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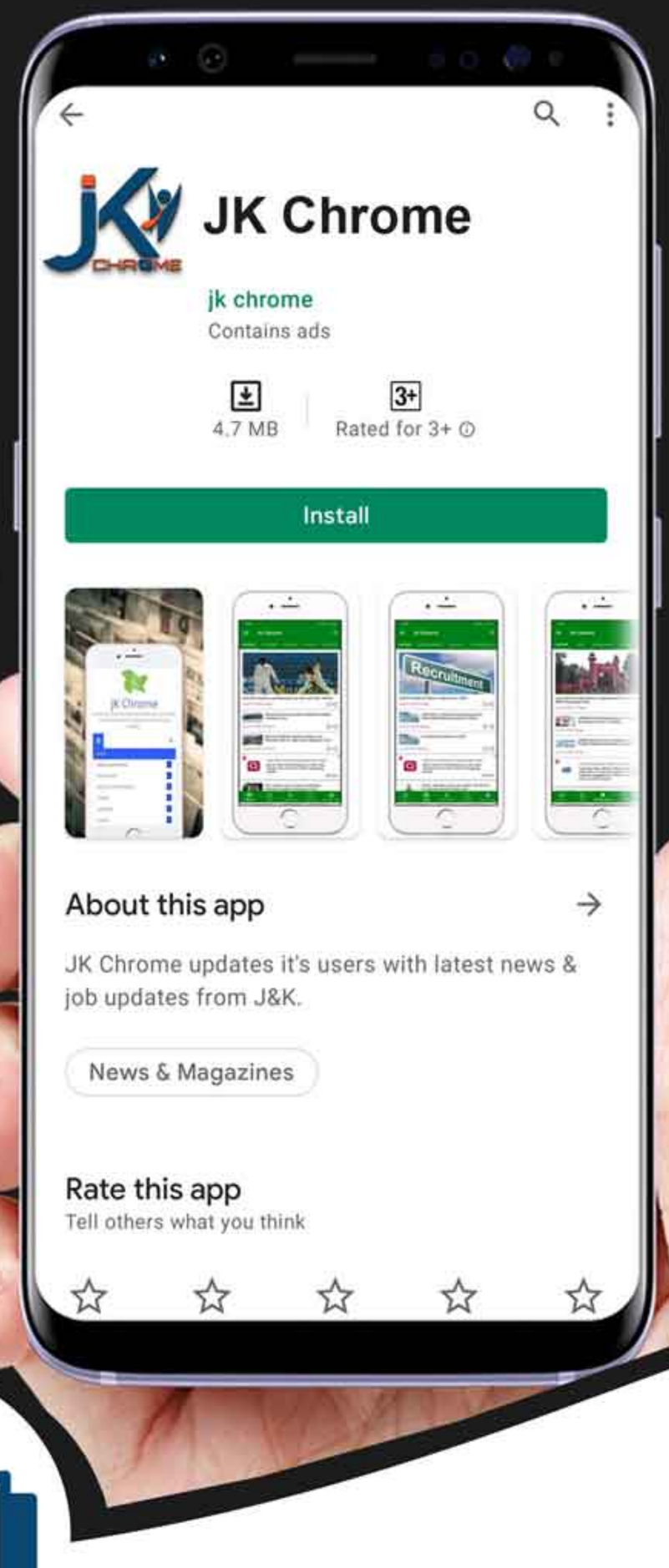

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TRIGONOMETRY

Importance : In almost every competitive exam 1-2 questions are always asked on Trigonometry and being simple questions, marks can be scored easily.

Scope of questions : Questions based on circular measurements (angle between clock hands, conversion between radian to degree and vice versa), trigonometrical formulae, equations or identities or questions based on height and distance [like height of Tree/Building/ Aeroplane, width of river, length of shadow at a particular time] are asked normally.

Way to success : Basic concepts of trigonometric ratio (sin, cos tan) and their values for different angles is must for height and distance questions. For equations and identities all formulae/rules are useful while in circular measurements relation between radian & degree and its practice is necessary.

Measurement of angles :

Systems of Measurement of Angles : There are three systems for measuring angles :

(i) Sexagesimal or English System

(ii) Centesimal or French System

(iii) Circular System

Measure of an angle : The measure of an angle is the amount of rotation from the initial side to the terminal side.

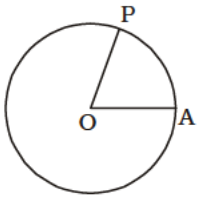
Right angle : If the revolving ray starting from its initial position to final position describes one quarter of a circle, then we say that the angle formed is a right angle.

Sexagesimal System : In this system a right angle is divided into 90 equal parts, called degrees. The symbol 1° is used to denote one degree. Thus, one degree is one–ninetieth part of a right angle. Each degree is divided into 60 equal parts, called minutes. The symbol 1' is used to denote one minute. And each minute is divided into 60 equal parts, called seconds. The symbol 1" is used to denote one second. Thus, one right angle = 90 degree (90°), 1° = 60 minutes (60'), 1' = 60 seconds (60")

Centesimal System : In this system a right angle is divided into 100 equal parts, called grades, each grade is subdivided into 100 minutes, and each minute into 100 seconds.

The symbol 1^g, 1' and 1" are used to denote a grade, a minute and a second respectively. Thus, one right angle = 100 grades = (100^g), 1 grade = 100 minutes = (100'), 1 minute = 100 seconds = (100")

Circular System : One radian, written as 1^c, is the measure of an angle subtended at the centre of a circle by an arc of length equal to the radius of the circle. Radian is a constant angle.

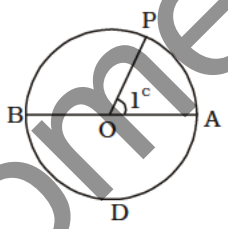


arc AP = radius r (OA) of the circle

$\therefore \angle AOP = 1$ radian ($= 1^c$)

Theorem : Radian is a constant angle.

Proof : Consider a circle with centre O and radius r.



Arc AP = radius r. $\therefore \angle AOP = 1^c$.

Produce AO to meet the circle at B so that $\angle AOB$ = a straight angle = 2 right angles.

Since the angles at the centre of a circle are proportional to the arcs subtending them. Therefore,

$$\frac{\angle AOP}{\angle AOB} = \frac{arc\ AP}{arc\ APB}$$

$$\Rightarrow \frac{\angle AOP}{\angle AOB} = \frac{r}{\pi r} \Rightarrow \angle AOP = \frac{1}{\pi}\angle AOB$$

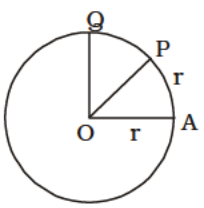
$$\Rightarrow 1^c = \frac{\text{a straight angle}}{\pi} = \frac{180°}{\pi}$$

$$\therefore\ 1^c = \frac{180°}{\pi} \qquad \Rightarrow \pi^c = 180°$$

- The number of radians in an angle subtended by an arc of a circle at the centre is equal to $\frac{arc}{radius}$

i.e. $\theta = \frac{s}{r}$

Proof : Consider a circle with centre O and radius r. Let $\angle AOQ = \theta^c$ and let arc AQ = s. Let P be a point on the arc AQ such that arc AP = r.



Then, $\angle AOP = 1^c$ Since angles at the centre of a circle are proportional to the arcs subtending them. Therefore,

$$\frac{\angle AOQ}{\angle AOP} = \frac{arc\ AQ}{arc\ AP}$$

$$\Rightarrow \angle AOQ = \left(\frac{arc\ AQ}{arc\ AP} \times 1\right)^c \qquad \left[\because \angle AOP = 1^c\right]$$

$$\Rightarrow \theta = \frac{s}{r} \text{ radians.}$$

Remarks :

Since $180° = \pi$ radians

Therefore, $1° = \frac{\pi}{180}$ radians

Hence, $30° = \frac{\pi}{180} \times 30 = \frac{\pi}{6}$ radians

$45° = \frac{\pi}{180} \times 45 = \frac{\pi}{4}$ radians

$60° = \frac{\pi}{180} \times 60 = \frac{\pi}{3}$ radians

$90° = \frac{\pi}{180} \times 90 = \frac{\pi}{2}$ radians

Degree	30	45	60	90	120	135	150	180	270	360
Radian	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	$\frac{2\pi}{3}$	$\frac{3\pi}{4}$	$\frac{5\pi}{6}$	π	$\frac{3\pi}{2}$	2π

- We have,
  π radians $= 180°$

  $\therefore$ 1 radian $= \frac{180°}{\pi} = \left(\frac{180}{22} \times 7\right)^\circ$

  $= 57° 16' 22''$ (approx).
- We have,
  $180° = \pi$ radians

  $\therefore 1^0 = \frac{\pi}{180}$ radians

  $= \left(\frac{22}{7 \times 180}\right)$ radian $= 0.01746$ radian.

Some Useful Points

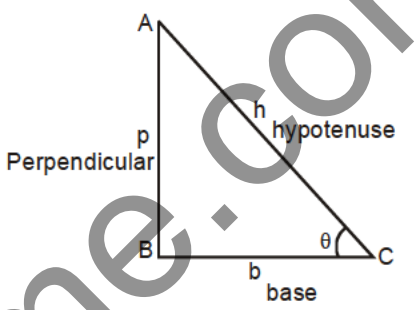
- The angle between two consecutive digits in a clock is $30° \left(= \frac{\pi}{6} \text{ radians}\right)$.
- The hour hand rotates through an angle of $30°$ in one hour i.e. $\left(\frac{1}{2}\right)^\circ$ in one minute.
- The minute hand rotates through an angle of $6°$ in one minute.

RULE 1 : $200^g = 180° = \pi^c$ It is the relation among angles.

RULE 2 : The number of radians in an angle subtended by an arc of a circle at the centre is equal to $\frac{\text{arc}}{\text{radius}}$

or, $\theta = \left(\frac{l}{r}\right)^c$ (l is arc length and r is radius)

Trigonometric function :



$\sin\theta = \frac{p}{h}$, $\cos\theta = \frac{b}{h}$, $\tan\theta = \frac{p}{b}$, $\cot\theta = \frac{b}{p}$

$\sec\theta = \frac{h}{b}$ and $\text{cosec}\,\theta = \frac{h}{p}$

$-1 \le \sin\theta$ or $\cos\theta \le 1$

$-\infty \le \tan\theta$ or $\cot\theta \le \infty$

$\sec\theta$ or $\text{cosec}\ \theta \ge 1$ or $\sec\theta$ or $\text{cosec}\,\theta \le -1$

$\sin\theta \,.\, \text{cosec}\,\theta = 1$

$\cos\theta \,.\, \sec\theta = 1$

$\tan\theta \,.\, \cot\theta = 1$

$\sin\theta = \frac{1}{\text{cosec}\,\theta}$ or, $\text{cosec}\,\theta = \frac{1}{\sin\theta}$

$\cos\theta = \frac{1}{\sec\theta}$ or, $\sec\theta = \frac{1}{\cos\theta}$

$\tan\theta = \frac{1}{\cot\theta}$ or, $\cot\theta = \frac{1}{\tan\theta}$

$\tan\theta = \frac{\sin\theta}{\cos\theta}$ and $\cot\theta = \frac{\cos\theta}{\sin\theta}$

Trigonometric Identities :

$\sin^2\theta + \cos^2\theta = 1$ or $\sin^2\theta = 1 - \cos^2\theta$

or, $\cos^2\theta = 1 - \sin^2\theta$

$\sec^2\theta - \tan^2\theta = 1$ or, $\sec^2\theta = 1 + \tan^2\theta$

or, $\tan^2\theta = \sec^2\theta - 1$

$\text{cosec}^2\theta - \cot^2\theta = 1$ or, $\text{cosec}^2\theta = 1 + \cot^2\theta$

or, $\cot^2\theta = \text{cosec}^2\theta - 1$

TRIGONOMETRY

Some special formulae :

i. $\sin(-\theta) = -\sin\theta$ $\quad$ $\operatorname{cosec}(-\theta) = -\operatorname{cosec}\theta$

$\cos(-\theta) = \cos\theta$ $\quad$ $\sec(-\theta) = \sec\theta$

$\tan(-\theta) = -\tan\theta$ $\quad$ $\cot(-\theta) = -\cot\theta$

ii. $\sin(90° - \theta) = \cos\theta$ $\quad$ $\cos(90° - \theta) = \sin\theta$

$\tan(90° - \theta) = \cot\theta$ $\quad$ $\cot(90° - \theta) = \tan\theta$

$\sec(90° - \theta) = \operatorname{cosec}\theta$ $\quad$ $\operatorname{cosec}(90° - \theta) = \sec\theta$

iii. $\sin(90°+\theta) = \cos\theta$ $\quad$ $\cos(90°+\theta) = -\sin\theta$

$\tan(90° + \theta) = -\cot\theta$ $\quad$ $\cot(90°+\theta) = -\tan\theta$

$\sec(90°+\theta) = -\operatorname{cosec}\theta$ $\quad$ $\operatorname{cosec}(90°+\theta) = \sec\theta$

iv. $\sin(180°-\theta) = \sin\theta$ $\quad$ $\cos(180°-\theta) = -\cos\theta$

$\tan(180°-\theta) = -\tan\theta$ $\quad$ $\cot(180°-\theta) = -\cot\theta$

$\sec(180°-\theta) = -\sec\theta$ $\quad$ $\operatorname{cosec}(180°-\theta) = \operatorname{cosec}\theta$

v. $\sin(180° + \theta) = -\sin\theta$

$\cos(180° + \theta) = -\cos\theta$

$\sec(180° + \theta) = -\sec\theta$

$\operatorname{cosec}(180° + \theta) = -\operatorname{cosec}\theta$

$\cot(180° + \theta) = \cot\theta$

$\tan(180° + \theta) = \tan\theta$

vi. $\sin(270°-\theta) = -\cos\theta$ $\quad$ $\cos(270°-\theta) = -\sin\theta$

$\tan(270°-\theta) = \cot\theta$ $\quad$ $\cot(270°-\theta) = +\tan\theta$

$\operatorname{cosec}(270°-\theta) = -\sec\theta$ $\quad$ $\sec(270°-\theta) = -\operatorname{cosec}\theta$

vii. $\sin(270°+\theta) = -\cos\theta$ $\quad$ $\cos(270°+\theta) = \sin\theta$

$\tan(270°+\theta) = -\cot\theta$ $\quad$ $\cot(270°+\theta) = -\tan\theta$

$\operatorname{cosec}(270°+\theta) = -\sec\theta$ $\quad$ $\sec(270°+\theta) = \operatorname{cosec}\theta$

viii. $\sin(360°-\theta) = -\sin\theta$ $\quad$ $\cos(360°-\theta) = \cos\theta$

$\tan(360°-\theta) = -\tan\theta$ $\quad$ $\operatorname{cosec}(360°-\theta) = -\operatorname{cosec}\theta$

$\sec(360°-\theta) = \sec\theta$ $\quad$ $\cot(360°-\theta) = -\cot\theta$

ix. $\sin(360°+\theta) = \sin\theta$ $\quad$ $\cos(360°+\theta) = \cos\theta$

$\tan(360°+\theta) = \tan\theta$ $\quad$ $\cot(360°+\theta) = \cot\theta$

$\sec(360°+\theta) = \sec\theta$ $\quad$ $\operatorname{cosec}(360°+\theta) = \operatorname{cosec}\theta$

To Calculate the maximum values:

(i) maximum value of $m\sin\theta \pm n\cos\theta$

$$= \sqrt{m^2+n^2}$$

(ii) maximum value of $m\sin\theta \pm n\sin\theta$

$$= \sqrt{m^2+n^2}$$

(iii) maximum value of $m\cos\theta \pm n\cos\theta = \sqrt{m^2+n^2}$

To calculate minimum values take $\left(-\sqrt{m^2+n^2}\right)$

Few Results :

$\tan 1°.\ \tan 2°,\ .\ .\ .\ .\ .\ .\ .\ .,\ \tan 89° = 1$

$\cot 1°.\cot 2°,\ .\ .\ .\ .\ .\ .\ .\ .\ ,\ \cot 89° = 1$

$\cos 1°.\ \cos 2°,\ .\ .\ .\ .\ .\ .\ .\ .\ ,\ \cos 90° = 0\ \ [\because\ \cos 90° = 0]$

$\cos 1°.\ \cos 2°,\ .\ .\ .\ .\ .\ .\ .\ .\ ,\ \cos(\text{more than } 90°) = 0$

$\sin 1°.\sin 2°.\ \sin 3°,\ .\ .\ .\ .\ .\ .\ .\ .\ ,\ [\because\ \sin 180° = 0]$

$\sin 1°.\sin 2°.\ \sin 3°,\ .\ .\ .\ .\ ,\ [\because \sin(\text{more than } 180° = 0]$

RULE 3 : If $\sec\theta + \tan\theta = x$ then $\sec\theta = \dfrac{x^2+1}{2x}$,

$\tan\theta = \dfrac{x^2-1}{2x}$ and $\sin\theta = \dfrac{x^2-1}{x^2+1}$

RULE 4 : If $\sec\theta - \tan\theta = x$ then $\sec\theta = \dfrac{x^2+1}{2x}$,

$\tan\theta = \dfrac{1-x^2}{2x}$ and $\sin\theta = \dfrac{1-x^2}{1+x^2}$

RULE 5 : If $\sin\theta + \cos\theta = x$, then $\sin\theta - \cos\theta = \sqrt{2-x^2}$

RULE 6 : If $\sin x + \operatorname{cosec} x = 2$

then $\sin^n x + \operatorname{cosec}^n x = 2$

If $\cos x + \sec x = 2$ then $\cos^n x + \sec^n x = 2$

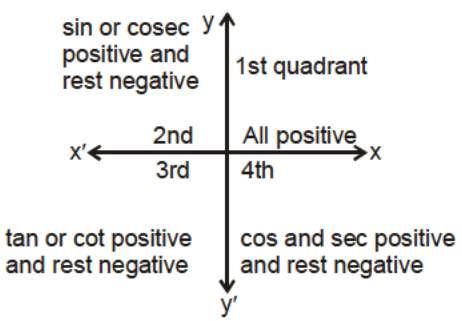
If $\tan x + \cot x = 2$

then $\tan^n x + \cot^n x = 2$ where $n \in N$.

RULE 7 : If $A + B = 90°$ then,

$\tan A.\tan B = 1$, $\sin A.\ \sec B = 1$, $\cos A.\ \operatorname{cosec} B = 1$

Angle and its measurement :



Nature of θ from 0 to 90°

$0 \to \theta \to 90$ $\sin\theta$ increases i.e. $\sin 68° > \sin 63°$

or $\sin 71° > \sin 54°$ $\cos\theta$ Decreases, $\tan\theta$ Increases $\cot\theta$ Decreases, $\sec\theta$ Increases $\operatorname{cosec}\theta$ Decreases. At $(90° \pm \theta)$ and $(270° \pm \theta)$ trigo functions will change as $\sin\theta \to \cos$, $\cos \to \sin\theta$, $\tan \to \cot$, $\cot \to \tan$, $\operatorname{cosec} \to \sec$, $\sec \to \operatorname{cosec}$. And at $(180° \pm \theta)$ and $(360° \pm \theta)$ trigo identitics remain same i.e. $\sin \to \sin$, $\cos \to \cos$, $\tan \to \tan$ and so on.

TRIGONOMETRY

θ	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞
cot	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0
sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞
cosec	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1

Angle Sum formulae :

$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$

$\cos(A \pm B) = \cos A.\cos B \pm \sin A .\sin B$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\cot(A \pm B) = \frac{\cot A.\cot B \mp 1}{\cot B \pm \cot A}$$

$2 \sin A \cos B = \sin(A + B) + \sin(A - B)$,

$2 \cos A. \sin B = \sin(A + B) - \sin(A - B)$,

$2 \cos A.\cos B = \cos(A + B) + \cos(A - B)$,

$2 \sin A \sin B = \cos(A - B) - \cos(A + B)$,

$\sin(A + B) \sin(A - B = \sin^2 A - \sin^2 B = \cos^2 B - \cos^2 A$

$\cos(A + B) \cos(A - B) = \cos^2 A - \sin^2 B = \cos^2 B - \sin^2 A$,

$\sin(A + B + C) = \sin A \cos B \cos C + \cos A \sin B \cos C + \cos A \cos B \sin C - \sin A \sin B \sin C$,

$\cos(A + B + C) = \cos A \cos B \cos C - \cos A \sin B \sin C - \sin A \cos B \sin C - \sin A \sin B \cos C$,

$$\tan(A + B + C) = \frac{\tan A + \tan B + \tan C - \tan A.\tan B.\tan c}{1 - \tan A.\tan B - \tan B.\tan C - \tan C.\tan A}$$

If $A + B = \pi$, then $\sin A = \sin B$, $\cos A = -\cos B$ and $\tan A = -\tan B$

If $A + B = 2\pi$, then $\sin A = -\sin B$, $\cos A = \cos B$ and $\tan A = -\tan B$

RULE 8 : $\sin\theta .\sin 2\theta .\sin 4\theta$

$$= \frac{1}{4} \sin 3\theta, \cos\theta .\cos 2\theta .\cos 4\theta$$

$$= \frac{1}{4} \cos 3\theta, \tan\theta .\tan 2\theta .\tan 4\theta = \tan 3\theta$$

Some values to be remembered :

$$\sin 18° = \frac{\sqrt{5}-1}{4}, \sin 36° = \frac{\sqrt{10-2\sqrt{5}}}{4}$$

$$\cos 18° = \sin 72° = \frac{\sqrt{10+2\sqrt{5}}}{4} \quad \cos 36° = \frac{\sqrt{5}+1}{4}$$

RULE 9 : If $(1 + \tan A)(1 + \tan B) = 2$ then $A + B = 45°$.

Function Sum Formulae :

$$\sin C + \sin D = 2\sin \frac{C+D}{2} \cos \frac{C-D}{2},$$

$$\sin C - \sin D = 2 \sin \frac{C-D}{2} . \cos \frac{C+D}{2}.$$

$$\cos C + \cos D = 2 \cos \frac{C+D}{2} .\cos \frac{C-D}{2},$$

$$\cos C - \cos D = -2 \sin \frac{C+D}{2} \sin \frac{C-D}{2}$$

Double angle formulae : (Multiple angles)

$$\sin 2A = 2 \sin A.\cos A = \frac{2\tan A}{1+\tan^2 A}.$$

$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1$

$$= 1 - 2\sin^2 A = \frac{1-\tan^2 A}{1+\tan^2 A},$$

$$2\cos^2 A = 1 + \cos 2A \quad \tan^2 A = \frac{1-\cos 2A}{1+\cos 2A},$$

$2\sin^2 A = 1 - \cos 2A$,

$$\tan 2A = \frac{2\tan A}{1-\tan^2 A}$$

Thrice angle formulae :

$\sin 3A = 3 \sin A - 4 \sin^3 A$,

$\cos 3A = 4 \cos^3 A - 3 \cos A$,

$$\tan 3A = \frac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$$

Half-angle-formulae : (Sub-multiple angles)

$$\sin A = 2\sin\left(\frac{A}{2}\right).\cos\left(\frac{A}{2}\right) = \frac{2\tan\left(\frac{A}{2}\right)}{1+\tan^2\left(\frac{A}{2}\right)},$$

$$\cos A = \cos^2\left(\frac{A}{2}\right) - \sin^2\left(\frac{A}{2}\right)$$

$$= 2\cos^2\left(\frac{A}{2}\right) - 1$$

$$= 1 - 2\sin^2\left(\frac{A}{2}\right)$$

$$= \frac{1-\tan^2\left(\frac{A}{2}\right)}{1+\tan^2\left(\frac{A}{2}\right)},$$

$$2\cos^2\left(\frac{A}{2}\right) = 1 + \cos A,$$

$$2\sin^2\left(\frac{A}{2}\right) = 1 - \cos A$$

$$\tan^2\left(\frac{A}{2}\right) = \frac{1-\cos A}{1+\cos A},$$

$$\tan A = \frac{2\tan\left(\frac{A}{2}\right)}{1-\tan^2\left(\frac{A}{2}\right)}$$

One-third angle formulae :

$$\sin A = 3\sin\left(\frac{A}{3}\right) - 4\sin^3\left(\frac{A}{3}\right),$$

$$\cos A = 4\cos^3\left(\frac{A}{3}\right) - 3\cos\left(\frac{A}{3}\right)$$

$$\tan A = \frac{3\tan\left(\frac{A}{3}\right) - \tan^3\left(\frac{A}{3}\right)}{1-3\tan^2\left(\frac{A}{3}\right)},$$

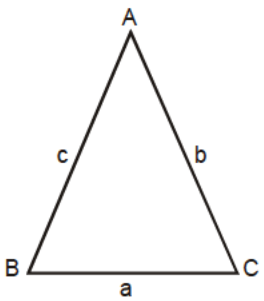
$\cos A.\cos 2A.\cos 2^2 A.\cos 2^3 A. \ldots\ldots \cos 2^{n-1} A$

$$= \frac{\sin 2^n A}{2^n \sin A},$$

$$\sin\theta.\sin(60^\circ - \theta)\sin(60^\circ + \theta) = \frac{1}{4}\sin 3\theta,$$

$$\cos\theta\cos(60^\circ - \theta).(60^\circ + \theta) = \frac{1}{4}\cos 3\theta$$

Some formulae related to triangle : Sine formulae



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

this may also be expressed as

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} = K$$

In a Δ ABC :

$\sin(B + C) = \sin A$, $\sin(C + A) = \sin B$, $\sin(A + B) = \sin C$, $\cos(B + C) = -\cos A$, $\cos(C + A) = -\cos B$, $\cos(A + B) = -\cos C$, $\tan(B + C) = -\tan A$, $\tan(C + A) = -\tan B$,

$$\tan(A + B) = -\tan C = \sin\left(\frac{B-C}{2}\right) = \left(\frac{b-c}{a}\right)\cos\frac{A}{2}$$

$$\Rightarrow \cos\left(\frac{B-C}{2}\right) = \left(\frac{b+c}{a}\right)\sin\frac{A}{2} \Rightarrow \frac{b-c}{b+c} = \frac{\tan\left(\frac{B-C}{2}\right)}{\tan\left(\frac{B+C}{2}\right)}$$

Cosine formulae :

In any Δ ABC,

(i) $a^2 = b^2 + c^2 - 2bc\cos A$ or, $\cos A = \frac{b^2+c^2-a^2}{2bc}$

(ii) $b^2 = c^2 + a^2 - 2ca\cos B$ or, $\cos B = \frac{a^2+c^2-b^2}{2ca}$

(iii) $c^2 = a^2 + b^2 - 2ab\cos C$ or, $\cos C = \frac{a^2+b^2-c^2}{2ab}$

Projection Formulae :

In any Δ ABC,

(i) $a = b\cos C + c\cos B$

(ii) $b = c\cos A + a\cos C$

(iii) $c = a\cos B + b\cos A$

i.e. any side of a triangle is equal to the sum of the projections of other two sides on it.

Napier's Analogy (Law of Tangents):

In any Δ ABC,

(i) $\tan\left(\frac{B-C}{2}\right) = \left(\frac{b-c}{b+c}\right)\cot\frac{A}{2}$

(ii) $\tan\left(\frac{A-B}{2}\right) = \left(\frac{a-b}{a+b}\right)\cot\frac{C}{2}$

(iii) $\tan\left(\frac{C-A}{2}\right) = \left(\frac{c-a}{c+a}\right)\cot\frac{B}{2}$

Area of a triangle :

In any Δ ABC, Area of $\Delta = \frac{1}{2}bc\sin A = \frac{1}{2}ca\sin B$

$$= \frac{1}{2}ab\sin C$$

RULE 10. The equation $a\cos\theta + b\sin\theta = c$ is solvable for $|c| < \sqrt{a^2+b^2}$.

❑❑❑

QUESTIONS ASKED IN PREVIOUS SSC EXAMS

TYPE–I

1. In circular measure, the value of the angle 11°15' is

(1) $\frac{\pi^c}{16}$ (2) $\frac{\pi^c}{8}$

(3) $\frac{\pi^c}{4}$ (4) $\frac{\pi^c}{12}$

(SSC CHSL DEO & LDC Exam. 28.10.2012, Ist Sitting)

2. In a triangle ABC, $\angle ABC = 75°$ and $\angle ACB = \frac{\pi^c}{4}$. The circular measure of $\angle BAC$ is

(1) $\frac{5\pi}{12}$ radian (2) $\frac{\pi}{3}$ radian

(3) $\frac{\pi}{6}$ radian (4) $\frac{\pi}{2}$ radian

(SSC Graduate Level Tier-I Exam. 11.11.2012, Ist Sitting)

3. The circular measure of an angle of an isosceles triangle is $\frac{5\pi}{9}$. Circular measure of one of the other angles must be

(1) $\frac{5\pi}{18}$ (2) $\frac{5\pi}{9}$

(3) $\frac{2\pi}{9}$ (4) $\frac{4\pi}{9}$

(SSC FCI Assistant Grade-III Main Exam. 07.04.2013)

4. The degree measure of 1 radian (taking $\pi = \frac{22}{7}$) is

(1) 57°61'22" (approx.)
(2) 57°16'22" (approx.)
(3) 57°22'16" (approx.)
(4) 57°32'16" (approx.)

(SSC Graduate Level Tier-I Exam. 21.04.2013, Ist Sitting)

5. $\left(\frac{3\pi}{5}\right)$ radians is equal to

(1) 100° (2) 120°
(3) 108° (4) 180°

(SSC Graduate Level Tier-I Exam. 19.05.2013)

6. If the sum of two angles is 135° and their difference is $\frac{\pi}{12}$, then the circular measure of the greater angle is

(1) $\frac{2\pi}{3}$ (2) $\frac{3\pi}{5}$

(3) $\frac{5\pi}{12}$ (4) $\frac{\pi}{3}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

7. If $0 \le \theta \le \frac{\pi}{2}$ and $\sec^2\theta + \tan^2\theta = 7$, then θ is

(1) $\frac{5\pi}{12}$ radian (2) $\frac{\pi}{3}$ radian

(3) $\frac{\pi}{5}$ radian (4) $\frac{\pi}{6}$ radian

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014 TF No. 999 KP0)

8. If the sum and difference of two angles are $\frac{22}{9}$ radian and 36° respectively, then the value of smaller angle in degree taking the value of π as $\frac{22}{7}$ is :

(1) 52° (2) 60°
(3) 56° (4) 48°

(SSC CGL Tier-I Exam, 16.08.2015 (Ist Sitting) TF No. 3196279)

9. The circular measure of the included angle formed by the hour hand and minute hand of a clock at 3 p.m. will be

(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{3}$

(3) $\frac{5\pi}{12}$ (4) $\frac{\pi}{2}$

(SSC CHSL (10+2) Tier-I (CBE) Exam. 08.09.2016) (Ist Sitting)

10. Which of the following relations is correct for $0 < \theta < 90°$?

(1) $\sin\theta = \sin^2\theta$
(2) $\sin\theta < \sin^2\theta$
(3) $\sin\theta > \sin^2\theta$
(4) $\sin\theta = \text{cosec}\,\theta$

(SSC CGL Tier-I (CBE) Exam. 28.08.2016 (Ist Sitting)

11. If θ is an acute angle and $\sin(\theta + 18°) = \frac{1}{2}$, then the value of θ in circular measure is :

(1) $\frac{\pi}{12}$ radians

(2) $\frac{\pi}{15}$ radians

(3) $\frac{2\pi}{5}$ radians

(4) $\frac{3\pi}{13}$ radians

(SSC CGL Tier-I (CBE) Exam. 08.09.2016 (IIIrd Sitting)

12. What is the measure of central angle of the arc whose length is 11 cm and radius of the circle is 14 cm ?

(1) 45° (2) 60°
(3) 75° (4) 90°

(SSC CHSL (10+2) Tier-I (CBE) Exam. 16.01.2017) (IInd Sitting)

TYPE–II

1. The minimum value of $2\sin^2\theta + 3\cos^2\theta$ is

(1) 0 (2) 3
(3) 2 (4) 1

(SSC CPO (SI, ASI & Intelligence Officer) Exam 28.08.2011 (Paper-I)

2. If $\text{cosec}\,39° = x$, the value of

$$\frac{1}{\text{cosec}^2 51} + \sin^2 39° + \tan^2 51° - \frac{1}{\sin^2 51° \sec^2 39°}$$ is

(1) $\sqrt{x^2 - 1}$ (2) $\sqrt{1 - x^2}$

(3) $x^2 - 1$ (4) $1 - x^2$

(SSC CPO (SI, ASI & Intelligence Officer) Exam. 28.08.2011 (Paper-I)

3. The value of $\tan 4°.\tan 43°.\tan 47°.\tan 86°$ is

(1) 2 (2) 3
(3) 1 (4) 4

(SSC CPO (SI, ASI & Intelligence Officer) Exam. 28.08.2011 (Paper-I) & (SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting) (North Zone)

TRIGONOMETRY

4. If $\frac{\tan\theta+\cot\theta}{\tan\theta-\cot\theta} = 2$, $(0 \le \theta \le 90°)$, then the value of $\sin\theta$ is

(1) $\frac{2}{\sqrt{3}}$ (2) $\frac{\sqrt{3}}{2}$

(3) $\frac{1}{2}$ (4) 1

(SSC CPO (SI, ASI & Intelligence Officer) Exam. 28.08.2011 (Paper-I)

5. If $\cos x + \cos y = 2$, the value of $\sin x + \sin y$ is

(1) 0 (2) 1

(3) 2 (4) –1

FCI Assistant Grade-III Exam. 25.02.2012 (Paper-I) North Zone (Ist Sitting)

6. The value of $\tan1°\tan2°\tan3°\ldots\ldots\tan89°$ is :

(1) 1 (2) 0

(3) $\sqrt{3}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CHSL DEO & LDC Exam. 11.12.2011) (Ist Sitting) (Delhi) & (FCI Assistant Grade-III Exam. 05.02.2012 (Paper-I) East Zone (IInd Sitting) & (SSC GL Tier-I Exam. 21.04.2013) (Ist Sitting) & (SSC CAPFs SI & CISF ASI Exam. 23.06.2013)

7. The measure of the angles of a triangle are in the ratio 2 : 7 : 11. Measures of angles are

(1) 16°, 56°, 88°

(2) 18°, 63°, 99°

(3) 20°, 70°, 90°

(4) 25°, 175°, 105°

(SSC CPO S.I. Exam. 07.09.2003)

8. The angles of a triangle are $(x + 5)°$, $(2x – 3)°$ and $(3x + 4)°$. The value of x is

(1) 30 (2) 31

(3) 29 (4) 28

(FCI Assistant Grade-III Exam. 25.02.2012 (Paper-I) North Zone (Ist Sitting)

9. The value of $\cot 10° \cdot \cot 20° \cdot \cot 60° \cdot \cot 70° \cdot \cot 80°$ is

(1) 1 (2) –1

(3) $\sqrt{3}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (North Zone)

10. If θ be an acute angle and $7\sin^2\theta + 3\cos^2\theta = 4$, then the value of $\tan\theta$ is

(1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{3}}$

(3) 1 (4) 0

(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (East Zone)

11. The value of $\sin^2 1° + \sin^2 5° + \sin^2 9° + \ldots. + \sin^2 89°$ is

(1) $11\frac{1}{2}$ (2) $11\sqrt{2}$

(3) 11 (4) $\frac{11}{\sqrt{2}}$

(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (East Zone)

12. The numerical value of $\cot 18° \left(\cot 72 \cos^2 22 + \frac{1}{\tan 72 \sec^2 68}\right)$ is

(1) 1 (2) $\sqrt{2}$

(3) 3 (4) $\frac{1}{\sqrt{3}}$

(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (East Zone)

13. If $\tan 15° = 2 - \sqrt{3}$, the value of $\tan 15° \cot 75° + \tan 75° \cot 15°$ is

(1) 14 (2) 12

(3) 10 (4) 8

(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (East Zone)

14. If x, y are acute angles, $0 < x + y < 90°$ and $\sin(2x – 20°) = \cos(2y + 20°)$, then the value of $\tan(x + y)$ is :

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{\sqrt{3}}{2}$

(3) $\sqrt{3}$ (4) 1

(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (Delhi Zone)

15. If $\angle A$ and $\angle B$ are complementary to each other, then the value of $\sec^2 A + \sec^2 B – \sec^2 A \cdot \sec^2 B$ is

(1) 1 (2) –1

(3) 2 (4) 0

(SSC Assistant Grade-III Exam. 11.11.2012 (IInd Sitting)

16. $\sin^2 5° + \sin^2 6° + \ldots + \sin^2 84° + \sin^2 85° = ?$

(1) $39\frac{1}{2}$ (2) $40\frac{1}{2}$

(3) 40 (4) $39\frac{1}{\sqrt{2}}$

(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (Delhi Zone)

17. $\sin^2 5° + \sin^2 10° + \sin^2 15° + \ldots. + \sin^2 85° + \sin^2 90°$ is equal to

(1) $7\frac{1}{2}$ (2) $8\frac{1}{2}$

(3) 9 (4) $9\frac{1}{2}$

(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (East Zone) & (SSC CHSL DEO & LDC Exam. 21.10.2012) (IInd Sitting)

18. The value of $\frac{\sin 39°}{\cos 51°} + 2\tan 11° \tan 31° \tan 45° \tan 59° \tan 79° – 3(\sin^2 21° + \sin^2 69°)$ is :

(1) 2 (2) –1

(3) 1 (4) 0

(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (East Zone)

19. If $\frac{\cos^2\theta}{\cot^2\theta – \cos^2\theta} = 3$ and $0° < \theta < 90°$, then the value of θ is :

(1) 30° (2) 45°

(3) 60° (4) None of these

(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (East Zone)

20. If $A = \tan 11° \tan 29°$, $B = 2\cot 61° \cot 79°$, then :

(1) A = 2B (2) A = – 2B

(3) 2A = B (4) 2A = – B

(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (East Zone)

21. If $\sin 17° = \frac{x}{y}$, then the value of $(\sec 17° – \sin 73°)$ is

(1) $\frac{y^2}{x\sqrt{y^2 – x^2}}$

(2) $\frac{x^2}{y\sqrt{y^2 – x^2}}$

(3) $\frac{x^2}{y\sqrt{x^2 – y^2}}$

(4) $\frac{y^2}{x\sqrt{x^2 – y^2}}$

(FCI Assistant Grade-III Exam. 05.02.2012 (Paper-I) East Zone (IInd Sitting) & (SSC Graduate Level Tier-II Exam. 16.09.2012)

TRIGONOMETRY

22. If $0° < \theta < 90°$, the value of $\sin\theta + \cos\theta$ is
(1) equal to 1
(2) greater than 1
(3) less than 1
(4) equal to 2
(SSC Graduate Level Tier-II Exam. 16.09.2012)

23. The expression $\frac{\tan 57° + \cot 37°}{\tan 33° + \cot 53°}$ is equal to
(1) $\tan 33° \cot 57°$
(2) $\tan 57° \cot 37°$
(3) $\tan 33° \cot 53°$
(4) $\tan 53° \cot 37°$
(SSC Graduate Level Tier-II Exam. 16.09.2012)

24. The value of $\frac{\cot 30° - \cot 75°}{\tan 15° - \tan 60°}$ is :
(1) 0 (2) 1
(3) $\sqrt{3} - 1$ (4) -1
(SSC CHSL DEO & LDC Exam. 21.10.2012 (IInd Sitting)

25. The value of
$\cot\theta.\tan(90° - \theta) - \sec(90° - \theta)\operatorname{cosec}\theta + (\sin^2 25° + \sin^2 65°) + \sqrt{3}(\tan 5° \tan 15°. \tan 30°. \tan 75°. \tan 85°)$ is :
(1) 1 (2) -1
(3) 2 (4) 0
(SSC CHSL DEO & LDC Exam. 21.10.2012 (IInd Sitting)

26. If $\sin(3x - 20°) = \cos(3y + 20°)$, then the value of $(x + y)$ is
(1) 20° (2) 30°
(3) 40° (4) 45°
(SSC CHSL DEO & LDC Exam. 28.10.2012 (Ist Sitting)

27. If $\cos\theta \operatorname{cosec} 23° = 1$, the value of θ is
(1) 23° (2) 37°
(3) 63° (4) 67°
(SSC CHSL DEO & LDC Exam. 04.11.2012 (IInd Sitting)

28. If $2(\cos^2\theta - \sin^2\theta) = 1$, θ is a positive acute angle, then the value of θ is
(1) 60° (2) 30°
(3) 45° (4) $22\frac{1}{2}°$
(SSC Assistant Grade-III Exam. 11.11.2012 (IInd Sitting)

29. The value of $(\tan 35° \tan 45° \tan 55°)$ is
(1) $\frac{1}{2}$ (2) 2
(3) 0 (4) 1
(SSC Delhi Police S.I. (SI) Exam. 19.08.2012)

30. If $\sec(7\theta + 28°) = \operatorname{cosec}(30° - 3\theta)$ then the value of θ is
(1) 8° (2) 5°
(3) 60° (4) 9°
(SSC Delhi Police S.I. (SI) Exam. 19.08.2012)

31. If $\tan\left(\frac{\pi}{2} - \frac{\theta}{2}\right) = \sqrt{3}$, the value of $\cos\theta$ is :
(1) 0 (2) $\frac{1}{\sqrt{2}}$
(3) $\frac{1}{2}$ (4) 1
(SSC CHSL DEO & LDC Exam. 04.11.2012, Ist Sitting)

32. If $7\sin^2\theta + 3\cos^2\theta = 4$ $(0° \le \theta \le 90°)$, then value of θ is
(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{3}$
(3) $\frac{\pi}{6}$ (4) $\frac{\pi}{4}$
(SSC Graduate Level Tier-I Exam. 11.11.2012, Ist Sitting)

33. If $\sec\theta = x + \frac{1}{4x}$ $(0° < \theta < 90°)$, then $\sec\theta + \tan\theta$ is equal to
(1) $\frac{x}{2}$ (2) $2x$
(3) x (4) $\frac{1}{2x}$
(SSC FCI Assistant Grade-III Main Exam. 07.04.2013)

34. The value of
$\cos 1° \cos 2° \cos 3°.....$
$\cos 177° \cos 178° \cos 179°$ is :
(1) 0 (2) $\frac{1}{2}$
(3) 1 (4) $\frac{1}{\sqrt{2}}$
(SSC Graduate Level Tier-I Exam. 21.04.2013, Ist Sitting)

35. The value of $(\sin^2 25° + \sin^2 65°)$ is :
(1) $\frac{\sqrt{3}}{2}$ (2) 1
(3) 0 (4) $\frac{2}{\sqrt{3}}$
(SSC Graduate Level Tier-I Exam. 21.04.2013, Ist Sitting)

36. If $\sec\theta + \tan\theta = \sqrt{3}$ $(0° \le \theta \le 90°)$, then $\tan 3\theta$ is
(1) undefined (2) $\frac{1}{\sqrt{3}}$
(3) $\frac{1}{\sqrt{2}}$ (4) $\sqrt{3}$
(SSC Graduate Level Tier-I Exam. 21.04.2013 IInd Sitting)

37. If $\sin(60° - \theta) = \cos(\psi - 30°)$, then the value of $\tan(\psi - \theta)$ is (assume that θ and ψ are both positive acute angles with $\theta < 60°$ and $\psi > 30°$).
(1) $\frac{1}{\sqrt{3}}$ (2) 0
(3) $\sqrt{3}$ (4) 1
(SSC Graduate Level Tier-I Exam. 21.04.2013 IInd Sitting)

38. If $a\sin\theta + b\cos\theta = c$ then the value of $a\cos\theta - b\sin\theta$ is :
(1) $\pm\sqrt{-a^2 + b^2 + c^2}$
(2) $\pm\sqrt{a^2 + b^2 - c^2}$
(3) $\pm\sqrt{a^2 - b^2 - c^2}$
(4) $\pm\sqrt{a^2 - b^2 + c^2}$
(SSC Graduate Level Tier-I Exam. 21.04.2013)

39. If $\sin(A - B) = \frac{1}{2}$ and $\cos(A + B) = \frac{1}{2}$ where $A > B > 0$ and $A + B$ is an acute angle, then the value B is
(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{12}$
(3) $\frac{\pi}{4}$ (4) $\frac{\pi}{2}$
(SSC Graduate Level Tier-I Exam. 21.04.2013)

TRIGONOMETRY

40. Maximum value of $(2 \sin \theta + 3 \cos \theta)$ is

(1) 2 (2) $\sqrt{13}$

(3) $\sqrt{15}$ (4) 1

(SSC Graduate Level Tier-I Exam. 21.04.2013)

41. The value of $152 (\sin 30° + 2 \cos^2 45° + 3 \sin 30° + 4 \cos^2 45° + ... + 17 \sin 30° + 18 \cos^2 45°)$ is

(1) an integer but not a perfect square

(2) a rational number but not an integer

(3) a perfect square of an integer

(4) irrational

(SSC Graduate Level Tier-I Exam. 21.04.2013)

42. Evaluate : $3 \cos 80° \operatorname{cosec} 10° + 2 \cos 59° \operatorname{cosec} 31°$

(1) 1 (2) 3

(3) 2 (4) 5

(SSC Graduate Level Tier-I Exam. 19.05.2013)

43. $\sin^2 \theta - 3 \sin \theta + 2 = 0$ will be true if

(1) $0 \le \theta < 90$ (2) $0 < \theta < 90$

(3) $\theta = 0°$ (4) $\theta = 90°$

(SSC Graduate Level Tier-I Exam. 19.05.2013)

44. If $\tan \alpha = n \tan \beta$ and $\sin \alpha = m \sin \beta$, then $\cos^2 \alpha$ is

(1) $\frac{m^2}{n^2+1}$ (2) $\frac{m^2}{n^2}$

(3) $\frac{m^2-1}{n^2-1}$ (4) $\frac{m^2+1}{n^2+1}$

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

45. If $\tan \theta = \frac{3}{4}$ and θ is acute, then $\operatorname{cosec} \theta$

(1) $\frac{4}{5}$ (2) $\frac{5}{3}$

(3) 2 (4) $\frac{1}{2}$

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

46. If $\operatorname{cosec} \theta - \cot \theta = \frac{7}{2}$, the value of $\operatorname{cosec} \theta$ is :

(1) $\frac{47}{28}$ (2) $\frac{51}{28}$

(3) $\frac{53}{28}$ (4) $\frac{49}{28}$

(SSC CAPFs SI & CISF ASI Exam. 23.06.2013

47. If $x \sin 45° = y \operatorname{cosec} 30°$, then $\frac{x^4}{y^4}$ is equal to

(1) 4^3 (2) 6^3

(3) 2^3 (4) 8^3

(SSC Graduate Level Tier-II Exam. 29.09.2013

48. If $5 \tan \theta = 4$, then $\frac{5 \sin \theta - 3 \cos \theta}{5 \sin \theta + 2 \cos \theta}$ is equal to

(1) $\frac{2}{3}$ (2) $\frac{1}{4}$

(3) $\frac{1}{6}$ (4) $\frac{1}{3}$

(SSC CHSL DEO & LDC Exam. 20.10.2013)

49. $2 \operatorname{cosec}^2 23° \cot^2 67° - \sin^2 23° - \sin^2 67° - \cot^2 67°$ is equal to

(1) 1 (2) $\sec^2 23°$

(3) $\tan^2 23°$ (4) 0

(SSC CHSL DEO & LDC Exam. 20.10.2013)

50. The equation $\cos^2 \theta = \frac{(x+y)^2}{4xy}$ is only possible when

(1) $x = -y$ (2) $x > y$

(3) $x = y$ (4) $x < y$

(SSC CHSL DEO & LDC Exam. 20.10.2013)

51. The value of $\operatorname{cosec}^2 18° - \frac{1}{\cot^2 72°}$ is

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{\sqrt{2}}{3}$

(3) $\frac{1}{2}$ (4) 1

(SSC CHSL DEO & LDC Exam. 27.10.2013 IInd Sitting)

52. If $\alpha + \beta = 90°$, then the value of $(1 - \sin^2 \alpha)(1 - \cos^2 \alpha) \times (1 + \cot^2 \beta)(1 + \tan^2 \beta)$ is

(1) 1 (2) –1

(3) 0 (4) 2

(SSC CHSL DEO & LDC Exam. 27.10.2013 IInd Sitting)

53. $\frac{2 \sin 68°}{\cos 22°} - \frac{2 \cot 15°}{5 \tan 75°} - \frac{3 \tan 45 \cdot \tan 20 \cdot \tan 40 \cdot \tan 50 \cdot \tan 70}{5}$ is equal to

(1) –1 (2) 0

(3) 1 (4) 2

(SSC CHSL DEO & LDC Exam. 27.10.2013 IInd Sitting)

54. The value of $\tan 10° \tan 15° \tan 75° \tan 80°$ is

(1) 0 (2) 1

(3) –1 (4) 2

(SSC CHSL DEO & LDC Exam. 10.11.2013, Ist Sitting)

55. The minimum value of $4 \tan^2 \theta + 9 \cot^2 \theta$ is equal to

(1) 0 (2) 5

(3) 12 (4) 13

(SSC CHSL DEO & LDC Exam. 10.11.2013, Ist Sitting)

56. If $\sin 7x = \cos 11x$, then the value of $\tan 9x + \cot 9x$ is

(1) 1 (2) 2

(3) 3 (4) 4

(SSC CHSL DEO & LDC Exam. 10.11.2013, Ist Sitting)

57. If $\tan^2 \alpha = 1 + 2 \tan^2 \beta$ (α, β are positive acute angles), then $\sqrt{2} \cos \alpha - \cos \beta$ is equal to

(1) 0 (2) $\sqrt{2}$

(3) 1 (4) –1

(SSC CHSL DEO & LDC Exam. 10.11.2013, Ist Sitting)

58. The product $\cos 1° \cos 2° \cos 3° \cos 4° .... \cos 100°$ is equal to

(1) –1 (2) $\frac{1}{4}$

(3) 1 (4) 0

(SSC CHSL DEO & LDC Exam. 10.11.2013, IInd Sitting)

59. If $2 (\cos^2 \theta - \sin^2 \theta) = 1$ (θ is a positive acute angle), then $\cot \theta$ is equal to

(1) $-\sqrt{3}$ (2) $\frac{1}{\sqrt{3}}$

(3) 1 (4) $\sqrt{3}$

(SSC CHSL DEO & LDC Exam. 20.10.2013)

TRIGONOMETRY

60. If $\tan(2\theta + 45°) = \cot 3\theta$ where $(2\theta + 45°)$ and 3θ are acute angles, then the value of θ is
(1) 5° (2) 9°
(3) 12° (4) 15°
FCI Assistant Grade-III Exam. 25.02.2012 (Paper-I) North Zone (Ist Sitting)

61. If θ be acute angle and $\cos\theta = \frac{15}{17}$, then the value of $\cot(90° - \theta)$ is
(1) $\frac{2\sqrt{8}}{15}$ (2) $\frac{8}{15}$
(3) $\frac{\sqrt{2}}{17}$ (4) $\frac{8\sqrt{2}}{17}$
FCI Assistant Grade-III Exam. 25.02.2012 (Paper-I) North Zone (Ist Sitting)

62. If $\sec^2\theta + \tan^2\theta = \frac{7}{12}$, then $\sec^4\theta - \tan^4\theta =$
(1) $\frac{7}{12}$ (2) $\frac{1}{2}$
(3) $\frac{5}{12}$ (4) 1
FCI Assistant Grade-III Exam. 25.02.2012 (Paper-I) North Zone (Ist Sitting)

63. If $0 < x < \frac{\pi}{2}$ and $\sec x = \operatorname{cosec} y$, then the value of $\sin(x + y)$ is :
(1) 0 (2) 1
(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{3}}$
FCI Assistant Grade-III Exam. 05.02.2012 (Paper-I) East Zone (IInd Sitting)

64. If A, B and C be the angles of a triangle, then out of the following, the incorrect relation is :
(1) $\sin\frac{A+B}{2} = \cos\frac{C}{2}$
(2) $\cos\left(\frac{A+B}{2}\right) = \sin\frac{C}{2}$
(3) $\tan\left(\frac{A+B}{2}\right) = \sec\frac{C}{2}$
(4) $\cot\left(\frac{A+B}{2}\right) = \tan\frac{C}{2}$
FCI Assistant Grade-III. Exam. 05.02.2012 (Paper-I) East Zone (IInd Sitting)

65. If $\sin\alpha + \cos\beta = 2$ $(0° \le \beta < \alpha \le 90°)$, then $\sin\left(\frac{2\alpha+\beta}{3}\right) =$
(1) $\sin\frac{\alpha}{2}$ (2) $\cos\frac{\alpha}{3}$
(3) $\sin\frac{\alpha}{3}$ (4) $\cos\frac{2\alpha}{3}$
(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (North Zone)

66. If $\cos^4\theta - \sin^4\theta = \frac{2}{3}$, then the value of $2\cos^2\theta - 1$ is
(1) 0 (2) 1
(3) $\frac{2}{3}$ (4) $\frac{3}{2}$
(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (North Zone)

67. If $\sin\alpha \sec(30° + \alpha) = 1$ $(0 < \alpha < 60°)$, then the value of $\sin\alpha + \cos 2\alpha$ is
(1) 1 (2) $\frac{2+\sqrt{3}}{2\sqrt{3}}$
(3) 0 (4) $\sqrt{2}$
(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (North Zone)

68. If $\tan\theta = 1$, then the value of $\frac{8\sin\theta + 5\cos\theta}{\sin^3\theta - 2\cos^3\theta + 7\cos\theta}$ is
(1) 2 (2) $2\frac{1}{2}$
(3) 3 (4) $\frac{4}{5}$
(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (North Zone)

69. If θ be a positive acute angle satisfying $\cos^2\theta + \cos^4\theta = 1$, then the value of $\tan^2\theta + \tan^4\theta$ is
(1) $\frac{3}{2}$ (2) 1
(3) $\frac{1}{2}$ (4) 0
(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (North Zone)

70. If $\tan\theta = \frac{4}{3}$, then the value of $\frac{3\sin\theta + 2\cos\theta}{3\sin\theta - 2\cos\theta}$ is
(1) 0.5 (2) –0.5
(3) 3.0 (4) –3.0
(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (North Zone)

71. The simplified value of $(\sec A - \cos A)^2 + (\operatorname{cosec} A - \sin A)^2 - (\cot A - \tan A)^2$ is
(1) 0 (2) $\frac{1}{2}$
(3) 1 (4) 2
(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (East Zone)

72. If θ be acute and $\tan\theta + \cot\theta = 2$, then the value of $\tan^5\theta + \cot^{10}\theta$ is
(1) 1 (2) 2
(3) 3 (4) 4
(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (East Zone)

73. If $\sin\theta - \cos\theta = \frac{7}{13}$ and $0 < \theta < 90°$, then the value of $\sin\theta + \cos\theta$ is
(1) $\frac{17}{13}$ (2) $\frac{13}{17}$
(3) $\frac{1}{13}$ (4) $\frac{1}{17}$
(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (East Zone)

74. If $2\cos\theta - \sin\theta = \frac{1}{\sqrt{2}}$, $(0° < \theta < 90°)$ the value of $2\sin\theta + \cos\theta$ is
(1) $\frac{1}{\sqrt{2}}$ (2) $\sqrt{2}$
(3) $\frac{3}{\sqrt{2}}$ (4) $\frac{\sqrt{2}}{3}$
(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (Delhi Zone)

75. If $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$, then the value of $\sin^4\theta - \cos^4\theta$ is
(1) $\frac{1}{5}$ (2) $\frac{2}{5}$
(3) $\frac{3}{5}$ (4) $\frac{4}{5}$
(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (Delhi Zone)

TRIGONOMETRY

76. If $\sec^2\theta + \tan^2\theta = 7$, then the value of θ when $0° \le \theta \le 90°$, is
(1) 60° (2) 30°
(3) 0° (4) 90°
(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (Delhi Zone)

77. The simplified value of $(\sec x \sec y + \tan x \tan y)^2 - (\sec x \tan y + \tan x \sec y)^2$ is :
(1) -1 (2) 0
(3) $\sec^2 x$ (4) 1
(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (Delhi Zone)

78. If $\sin\theta + \operatorname{cosec}\theta = 2$, then value of $\sin^{100}\theta + \operatorname{cosec}^{100}\theta$ is equal to :
(1) 1 (2) 2
(3) 3 (4) 100
(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (Delhi Zone)

79. If $A = \sin^2\theta + \cos^4\theta$, for any value of θ, then the value of A is
(1) $1 \le A \le 2$ (2) $\frac{3}{4} \le A \le 1$
(3) $\frac{13}{16} \le A \le 1$ (4) $\frac{3}{4} \le A \le \frac{13}{16}$
(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (East Zone)

80. If $\sin\theta + \operatorname{cosec}\theta = 2$, then the value of $\sin^5\theta + \operatorname{cosec}^5\theta$ when $0° \le \theta \le 90°$, is
(1) 0 (2) 1
(3) 10 (4) 2
(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (East Zone) & (SSC GL Tier-I 19.05.2013) (Ist Sitting)

81. If $\tan2\theta \cdot \tan 4\theta = 1$, then the value of $\tan 3\theta$ is
(1) $\sqrt{3}$ (2) 0
(3) 1 (4) $\frac{1}{\sqrt{3}}$
(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (East Zone)

82. If $\cos^2\alpha + \cos^2\beta = 2$, then the value of $\tan^3\alpha + \sin^5\beta$ is :
(1) -1 (2) 0
(3) 1 (4) $\frac{1}{\sqrt{3}}$
(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (East Zone)

83. If θ is a positive acute angle and $\tan 2\theta \tan 3\theta = 1$, then the value of $(2\cos^2\frac{5\theta}{2} - 1)$ is
(1) $-\frac{1}{2}$ (2) 1
(3) 0 (4) $\frac{1}{2}$
(SSC Graduate Level Tier-II Exam. 16.09.2012)

84. In a right-angled triangle XYZ, right-angled at Y, if $XY = 2\sqrt{6}$ and $XZ - YZ = 2$, then $\sec X + \tan X$ is
(1) $\frac{1}{\sqrt{6}}$ (2) $\sqrt{6}$
(3) $2\sqrt{6}$ (4) $\frac{\sqrt{6}}{2}$
(SSC Graduate Level Tier-II Exam. 16.09.2012)

85. The minimum value of $\sin^2\theta + \cos^2\theta + \sec^2\theta + \operatorname{cosec}^2\theta + \tan^2\theta + \cot^2\theta$ is
(1) 1 (2) 3
(3) 5 (4) 7
(SSC Graduate Level Tier-II Exam. 16.09.2012)

86. If $2\sin\left(\frac{\pi x}{2}\right) = x^2 + \frac{1}{x^2}$, then the value of $\left(x - \frac{1}{x}\right)$ is
(1) -1 (2) 2
(3) 1 (4) 0
(SSC Graduate Level Tier-II Exam. 16.09.2012)

87. If $\cos\theta + \sec\theta = 2$, the value of $\cos^6\theta + \sec^6\theta$ is
(1) 4 (2) 8
(3) 1 (4) 2
(SSC CHSL DEO & LDC Exam. 21.10.2012 (Ist Sitting)

88. The numerical value of
$\frac{5}{\sec^2\theta} + \frac{2}{1+\cot^2\theta} + 3\sin^2\theta$ is :
(1) 5 (2) 2
(3) 3 (4) 4
(SSC CHSL DEO & LDC Exam. 21.10.2012 (IInd Sitting)

89. The numerical value of
$\left(\frac{1}{\cos\theta} + \frac{1}{\cot\theta}\right)\left(\frac{1}{\cos\theta} - \frac{1}{\cot\theta}\right)$
is
(1) 0 (2) -1
(3) $+1$ (4) 2
(SSC CHSL DEO & LDC Exam. 28.10.2012 (Ist Sitting)

90. If $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = \frac{5}{4}$, the value of $\frac{\tan^2\theta + 1}{\tan^2\theta - 1}$ is
(1) $\frac{25}{16}$ (2) $\frac{41}{9}$
(3) $\frac{41}{40}$ (4) $\frac{40}{41}$
(SSC CHSL DEO & LDC Exam. 28.10.2012 (Ist Sitting)

91. If $\tan 7\theta \tan 2\theta = 1$, then the value of $\tan 3\theta$ is
(1) $\sqrt{3}$ (2) $-\frac{1}{\sqrt{3}}$
(3) $\frac{1}{\sqrt{3}}$ (4) $-\sqrt{3}$
(SSC Graduate Level Tier-I Exam. 11.11.2012 (Ist Sitting)

92. The value of
$\left(2\cos^2\theta - 1\right)\left(\frac{1+\tan\theta}{1-\tan\theta} + \frac{1-\tan\theta}{1+\tan\theta}\right)$ is
(1) 4 (2) 1
(3) 3 (4) 2
(SSC Assistant Grade-III Exam. 11.11.2012 (IInd Sitting)

93. If $\sec\theta + \tan\theta = 2$, then the value of $\sec\theta$ is
(1) $\frac{4}{5}$ (2) 5
(3) $\frac{5}{4}$ (4) $\sqrt{2}$
(SSC Delhi Police S.I. (SI) Exam. 19.08.2012)

94. If $\operatorname{cosec}\theta - \sin\theta = l$ and $\sec\theta - \cos\theta = m$, then the value of $l^2m^2(l^2 + m^2 + 3)$ is
(1) -1 (2) 0
(3) 1 (4) 2
(SSC Delhi Police S.I. (SI) Exam. 19.08.2012)

95. If $\frac{2\sin\theta - \cos\theta}{\cos\theta + \sin\theta} = 1$, then value of $\cot\theta$ is :
(1) $\frac{1}{2}$ (2) $\frac{1}{3}$
(3) 3 (4) 2
(SSC CHSL DEO & LDC Exam. 04.11.2012, Ist Sitting)

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96. If $\tan\theta = 2$, then the value of $\frac{8\sin\theta + 5\cos\theta}{\sin^3\theta + 2\cos^3\theta + 3\cos\theta}$ is

(1) $\frac{21}{5}$ (2) $\frac{8}{5}$

(3) $\frac{7}{5}$ (4) $\frac{16}{5}$

(SSC Graduate Level Tier-I Exam. 11.11.2012, Ist Sitting)

97. If $\tan\theta + \cot\theta = 2$, then the value of $\tan^{100}\theta + \cot^{100}\theta$ is

(1) 2 (2) 0

(3) 1 (4) $\sqrt{3}$

(SSC FCI Assistant Grade-III Main Exam. 07.04.2013)

98. $\frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta}$ is equal to

(1) $1 - \tan\theta - \cot\theta$
(2) $1 + \tan\theta - \cot\theta$
(3) $1 - \tan\theta + \cot\theta$
(4) $1 + \tan\theta + \cot\theta$

(SSC FCI Assistant Grade-III Main Exam. 07.04.2013)

99. If $\sin\theta + \text{cosec}\,\theta = 2$, then the value of $\sin^9\theta + \text{cosec}^9\theta$ is :

(1) 3 (2) 2
(3) 4 (4) 1

(SSC Graduate Level Tier-I Exam. 21.04.2013, Ist Sitting)

100. If $\sec\theta + \tan\theta = 2 + \sqrt{5}$, then the value of $\sin\theta + \cos\theta$ is :

(1) $\frac{3}{\sqrt{5}}$ (2) $\sqrt{5}$

(3) $\frac{7}{\sqrt{5}}$ (4) $\frac{1}{\sqrt{5}}$

(SSC Graduate Level Tier-I Exam. 21.04.2013, Ist Sitting)

101. The value of $(1 + \cot\theta - \text{cosec}\,\theta)(1 + \tan\theta + \sec\theta)$ is equal to

(1) 1 (2) 2
(3) 0 (4) –1

(SSC Graduate Level Tier-I Exam. 21.04.2013 IInd Sitting)

102. If $\tan\theta + \cot\theta = 2$, then the value of $\tan^n\theta + \cot^n\theta$ ($0° < \theta < 90°$, n is an integer) is

(1) 2 (2) 2^n
(3) $2n$ (4) 2^{n+1}

(SSC Graduate Level Tier-I Exam. 21.04.2013 IInd Sitting)

103. If $\frac{\sin\theta}{x} = \frac{\cos\theta}{y}$, then $\sin\theta - \cos\theta$ is equal to

(1) $x - y$ (2) $x + y$

(3) $\frac{x-y}{\sqrt{x^2+y^2}}$ (4) $\frac{y-x}{\sqrt{x^2+y^2}}$

(SSC Graduate Level Tier-I Exam. 21.04.2013 IInd Sitting)

104. If $x = a\sec\theta\cos\phi$, $y = b\sec\theta\sin\phi$, $z = c\tan\theta$, then the value of $\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2}$ is :

(1) 1 (2) 4
(3) 9 (4) 0

(SSC Graduate Level Tier-I Exam. 21.04.2013)

105. If $\frac{\sec\theta + \tan\theta}{\sec\theta - \tan\theta} = \frac{5}{3}$, then $\sin\theta$ is equal to :

(1) $\frac{1}{4}$ (2) $\frac{1}{3}$

(3) $\frac{2}{3}$ (4) $\frac{3}{4}$

(SSC Graduate Level Tier-I Exam. 21.04.2013)

106. If $\cos x + \cos^2 x = 1$, the numerical value of $(\sin^{12}x + 3\sin^{10}x + 3\sin^8 x + \sin^6 x - 1)$ is :

(1) –1 (2) 2
(3) 0 (4) 1

(SSC Graduate Level Tier-I Exam. 21.04.2013)

107. If $(1 + \sin\alpha)(1 + \sin\beta)(1 + \sin\gamma) = (1 - \sin\alpha)(1 - \sin\beta)(1 - \sin\gamma)$, then each side is equal to

(1) $\pm\cos\alpha\cos\beta\cos\gamma$
(2) $\pm\sin\alpha\sin\beta\sin\gamma$
(3) $\pm\sin\alpha\cos\beta\cos\gamma$
(4) $\pm\sin\alpha\sin\beta\cos\gamma$

(SSC Graduate Level Tier-I Exam. 21.04.2013)

108. The numerical value of $\frac{1}{1+\cot^2\theta} + \frac{3}{1+\tan^2\theta} + 2\sin^2\theta$ will be

(1) 2 (2) 5
(3) 6 (4) 3

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

109. The value of $\frac{4}{1+\tan^2\alpha} + \frac{3}{1+\cot^2\alpha} + 3\sin^2\alpha$ is

(1) 4 (2) –1
(3) 2 (4) 3

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

110. The value of $3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x)$ is

(1) 14 (2) 11
(3) 12 (4) 13

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

111. The value of $\sec\theta\left(\frac{1+\sin\theta}{\cos\theta} + \frac{\cos\theta}{1+\sin\theta}\right) - 2\tan^2\theta$ is

(1) 4 (2) 1
(3) 2 (4) 0

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

112. If $\tan\theta + \cot\theta = 2$, then the value of $\tan^2\theta + \cot^2\theta$ is

(1) 2 (2) 1

(3) $\sqrt{2}$ (4) 0

(SSC Graduate Level Tier-I Exam. 19.05.2013)

113. The eliminant of θ from $x\cos\theta - y\sin\theta = 2$ and $x\sin\theta + y\cos\theta = 4$ will give

(1) $x^2 + y^2 = 20$

(2) $3x^2 + y^2 = 20$

(3) $x^2 - y^2 = 20$

(4) $3x^2 - y^2 = 10$

(SSC Graduate Level Tier-I Exam. 19.05.2013)

114. The value of

$$\left[\frac{\cos^2 A(\sin A + \cos A)}{\text{cosec}^2 A(\sin A - \cos A)} + \frac{\sin^2 A(\sin A - \cos A)}{\sec^2 A(\sin A + \cos A)}\right]$$

$(\sec^2 A - \text{cosec}^2 A)$

(1) 1 (2) 3
(3) 2 (4) 4

(SSC Graduate Level Tier-I Exam. 19.05.2013)

TRIGONOMETRY

115. The value of

$$\frac{1}{\text{cosec}\,\theta - \cot\theta} - \frac{1}{\sin\theta} \text{ is}$$

(1) 1 (2) $\cot\theta$
(3) $\text{cosec}\,\theta$ (4) $\tan\theta$

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

116. If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, then $\cos\theta - \sin\theta$ is

(1) $\sqrt{2}\tan\theta$ (2) $-\sqrt{2}\cos\theta$
(3) $-\sqrt{2}\sin\theta$ (4) $\sqrt{2}\sin\theta$

(SSC Graduate Level Tier-I Exam. 19.05.2013 (Ist Sitting) & (SSC GL Tier-II Exam. 29.09.2013)

117. If $\cos^4\theta - \sin^4\theta = \frac{2}{3}$, then the value of $1 - 2\sin^2\theta$ is

(1) $\frac{4}{3}$ (2) 0
(3) $\frac{2}{3}$ (4) $\frac{1}{3}$

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

118. The value of

$$\frac{1}{(1+\tan^2\theta)} + \frac{1}{(1+\cot^2\theta)} \text{ is}$$

(1) $\frac{1}{4}$ (2) 1
(3) $\frac{5}{4}$ (4) $\frac{4}{3}$

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

119. If $\sin\theta - \cos\theta = \frac{1}{2}$ then value of $\sin\theta + \cos\theta$ is :

(1) 2 (2) ± 2
(3) $\frac{\sqrt{7}}{2}$ (4) 2

(SSC CAPFs SI & CISF ASI Exam. 23.06.2013)

120. The value of $\frac{\sin A}{1+\cos A} + \frac{\sin A}{1-\cos A}$ is
$(0° < A < 90°)$

(1) 2 cosec A (2) 2 sec A
(3) 2 sin A (4) 2 cos A

(SSC Graduate Level Tier-II Exam. 29.09.2013)

121. If $r\sin\theta = 1$, $r\cos\theta = \sqrt{3}$, then the value of $\left(\sqrt{3}\tan\theta + 1\right)$ is

(1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{3}}$
(3) 1 (4) 2

(SSC Graduate Level Tier-II Exam. 29.09.2013)

122. If $x\cos\theta - y\sin\theta = \sqrt{x^2+y^2}$ and

$$\frac{\cos^2\theta}{a^2} + \frac{\sin^2\theta}{b^2} = \frac{1}{x^2+y^2},$$

then the correct relation is

(1) $\frac{x^2}{b^2} - \frac{y^2}{a^2} = 1$

(2) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

(3) $\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$

(4) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

(SSC CHSL DEO & LDC Exam. 20.10.2013)

123. If $\tan\theta - \cot\theta = 0$, find the value of $\sin\theta + \cos\theta$.

(1) 0 (2) 1
(3) $\sqrt{2}$ (4) 2

(SSC CHSL DEO & LDC Exam. 27.10.2013 IInd Sitting)

124. The greatest value of $\sin^4\theta + \cos^4\theta$ is

(1) 2 (2) 3
(3) $\frac{1}{2}$ (4) 1

(SSC CHSL DEO & LDC Exam. 10.11.2013, IInd Sitting)

125. If $3\sin\theta + 5\cos\theta = 5$, then $5\sin\theta - 3\cos\theta$ is equal to

(1) ± 3 (2) ± 5
(3) 1 (4) ± 2

(SSC CHSL DEO & LDC Exam. 10.11.2013, IInd Sitting)

126. If $\sin\theta + \sin^2\theta = 1$, then the value of $\cos^2\theta + \cos^4\theta$ is

(1) 2 (2) 4
(3) 0 (4) 1

(SSC CHSL DEO & LDC Exam. 10.11.2013, IInd Sitting)

127. If $\tan\theta + \cot\theta = 2$ then the value of θ is

(1) 45° (2) 60°
(3) 90° (4) 30°

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

128. If $\cos\pi x = x^2 - x + \frac{5}{4}$, the value of x will be

(1) 0 (2) 1
(3) –1 (4) None of the above

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

129. The numerical value of

$$1 + \frac{1}{\cot^2 63°} - \sec^2 27° + \frac{1}{\sin^2 63°} - \text{cosec}^2 27° \text{ is}$$

(1) 1 (2) 2
(3) –1 (4) 0

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

130. If $x = \frac{\cos\theta}{1-\sin\theta}$, then $\frac{\cos\theta}{1+\sin\theta}$ is equal to

(1) $x - 1$ (2) $\frac{1}{x}$
(3) $\frac{1}{x+1}$ (4) $\frac{1}{1-x}$

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

131. In Δ ABC, $\angle B = 90°$ and AB : BC = 2 : 1. The value of $\sin A + \cot C$ is

(1) $3 + \sqrt{5}$ (2) $\frac{2+\sqrt{5}}{2\sqrt{5}}$
(3) $2 + \sqrt{5}$ (4) $3\sqrt{5}$

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

132. If $\sin\frac{\pi x}{2} = x^2 - 2x + 2$, then the value of x is

(1) 0 (2) 1
(3) –1 (4) None of these

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

133. The value of

$$\frac{\sin 43°}{\cos 47°} + \frac{\cos 19°}{\sin 71°} - 8\cos^2 60° \text{ is}$$

(1) 0 (2) 1
(3) 2 (4) –1

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

TRIGONOMETRY

134. The value of

$$\left(\sin^2 7\frac{1^\circ}{2}+\sin^2 82\frac{1^\circ}{2}\right.$$
$$\left.+\tan^2 2^\circ.\tan^2 88^\circ\right)$$ is

(1) 1 (2) 2
(3) 0 (4) 4

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

135. Find the value of $1 - 2\sin^2\theta + \sin^4\theta$.

(1) $\sin^4\theta$ (2) $\cos^4\theta$
(3) $\text{cosec}^4\theta$ (4) $\sec^4\theta$

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

136. The simplest value of cot 9° cot 27° cot 63° cot 81° is

(1) 0 (2) 1
(3) –1 (4) $\sqrt{3}$

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

137. If

$(1 + \sin A)(1 + \sin B)(1 + \sin C) =$
$(1 - \sin A)$
$(1 - \sin B)(1 - \sin C)$, $0 < A, B, C < \frac{\pi}{2}$ then each side is equal to

(1) sin A sin B sin C
(2) cos A cos B cos C
(3) tan A tan B tan C
(4) 1

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

138. The value of θ, which satisfies the equation $\tan^2\theta + 3 = 3\sec\theta$, $0° \le \theta < 90°$ is

(1) 15° or 0° (2) 30° or 0°
(3) 45° or 0° (4) 60° or 0°

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

139. If $\sin\theta = 0.7$, then $\cos\theta$, $0 \le \theta < 90°$, is

(1) 0.3 (2) $\sqrt{0.49}$
(3) $\sqrt{0.51}$ (4) $\sqrt{0.9}$

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

140. The value of $\sin^2 65° + \sin^2 25° + \cos^2 35° + \cos^2 55°$ is

(1) 0 (2) 1
(3) 2 (4) $\frac{1}{2}$

(SSC CGL Tier-I Re-Exam. (2013) 27.04.2014

141. If $x \sin 60°.\tan 30° = \sec 60°.\cot 45°$, then the value of x is

(1) 2 (2) $2\sqrt{3}$
(3) 4 (4) $4\sqrt{3}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

142. If $\theta = 60°$, then

$$\frac{1}{2}\sqrt{1+\sin\theta}+\frac{1}{2}\sqrt{1-\sin\theta}$$ is equal to

(1) $\cot\frac{\theta}{2}$ (2) $\sec\frac{\theta}{2}$
(3) $\sin\frac{\theta}{2}$ (4) $\cos\frac{\theta}{2}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

143. If $\frac{2\tan^2 30°}{1-\tan^2 30°}+\sec^2 45°-\sec^2 0° = x\sec 60°$, then the value of x is

(1) 2 (2) 1
(3) 0 (4) –1

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

144. If $\tan\theta = \frac{\sin\alpha - \cos\alpha}{\sin\alpha + \cos\alpha}$, then $\sin\alpha + \cos\alpha$ is

(1) $\pm\sqrt{2}\sin\theta$ (2) $\pm\sqrt{2}\cos\theta$
(3) $\pm\frac{1}{\sqrt{2}}\sin\theta$ (4) $\pm\frac{1}{\sqrt{2}}\cos\theta$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

145. If $7\sin^2\theta + 3\cos^2\theta = 4$, $(0° < \theta < 90°)$, then the value of $\tan\theta$ is

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{1}{2}$
(3) 1 (4) $\sqrt{3}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

146. If $\tan 9° = \frac{p}{q}$, then the value of

$$\frac{\sec^2 81°}{1+\cot^2 81°}$$ is

(1) $\frac{q}{p}$ (2) 1
(3) $\frac{p^2}{q^2}$ (4) $\frac{q^2}{p^2}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (Ist Sitting)

147. If $\sec\theta + \tan\theta = 5$, then the value of $\frac{\tan\theta + 1}{\tan\theta - 1}$ is

(1) $\frac{11}{7}$ (2) $\frac{13}{7}$
(3) $\frac{15}{7}$ (4) $\frac{17}{7}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (IInd Sitting)

148. If $\tan^2\theta = 1 - e^2$, then the value of $\sec\theta + \tan^3\theta\,\text{cosec}\theta$ is

(1) $\left(2+e^2\right)^{\frac{3}{2}}$ (2) $\left(2-e^2\right)^{\frac{1}{2}}$
(3) $\left(2+e^2\right)^{\frac{1}{2}}$ (4) $\left(2-e^2\right)^{\frac{3}{2}}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (IInd Sitting)

149. Which one of the following is true for $0° < \theta < 90°$?

(1) $\cos\theta \le \cos^2\theta$ (2) $\cos\theta > \cos^2\theta$
(3) $\cos\theta < \cos^2\theta$ (4) $\cos\theta \ge \cos^2\theta$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (IInd Sitting)

150. If $x \sin 60° \tan 30° - \tan^2 45° = \text{cosec}\,60° \cot 30° - \sec^2 45°$, then $x =$

(1) 2 (2) –2
(3) 6 (4) –4

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (IInd Sitting)

151. If $x = a\sec\alpha\cos\beta$, $y = b\sec\alpha\sin\beta$, $z = c\tan\alpha$, then the value of $\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}$ is

(1) 2 (2) 0
(3) 1 (4) –1

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (IInd Sitting)

152. If $\frac{\cos\alpha}{\cos\beta} = a$ and $\frac{\sin\alpha}{\sin\beta} = b$, then the value of $\sin^2\beta$ in terms of a and b is

(1) $\frac{a^2+1}{a^2-b^2}$ (2) $\frac{a^2-b^2}{a^2+b^2}$
(3) $\frac{a^2-1}{a^2-b^2}$ (4) $\frac{a^2-1}{a^2+b^2}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (IInd Sitting)

TRIGONOMETRY

153. The value of

$$\frac{\cos^2 60 + 4\sec^2 30 - \tan^2 45}{\sin^2 30 + \cos^2 30}$$ is

(1) $\frac{64}{\sqrt{3}}$ (2) $\frac{55}{12}$

(3) $\frac{67}{12}$ (4) $\frac{67}{10}$

(SSC CGL Tier-I Re-Exam. (2013) 20.07.2014 (IInd Sitting)

154. The value of $\sin^2 30° \cos^2 45° + 5\tan^2 30° + \frac{3}{2}\sin^2 90° - 3\cos^2 90°$ is

(1) $3\frac{7}{24}$ (2) $3\frac{3}{24}$

(3) $3\frac{1}{24}$ (4) $3\frac{5}{24}$

(SSC CGL Tier-I Exam. 19.10.2014 (Ist Sitting)

155. If $\cos^2\theta - \sin^2\theta = \frac{1}{3}$, where $0 \le \theta \le \frac{\pi}{2}$, then the value of $\cos^4\theta - \sin^4\theta$ is

(1) $\frac{1}{3}$ (2) $\frac{2}{3}$

(3) $\frac{1}{9}$ (4) $\frac{2}{9}$

(SSC CGL Tier-I Exam. 19.10.2014 (Ist Sitting)

156. If $\tan\theta = \frac{1}{\sqrt{11}}$ and $0 < \theta < \frac{\pi}{2}$, then the value of $\frac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta}$ is

(1) $\frac{3}{4}$ (2) $\frac{4}{5}$

(3) $\frac{5}{6}$ (4) $\frac{6}{7}$

(SSC CGL Tier-I Exam. 19.10.2014 (Ist Sitting)

157. The value of

$$\frac{1}{\sqrt{2}}\sin\frac{\pi}{6}\cos\frac{\pi}{4} - \cot\frac{\pi}{3}\sec\frac{\pi}{6} + \frac{5\tan\frac{\pi}{4}}{12\sin\frac{\pi}{2}}$$

is equal to

(1) 0 (2) 1

(3) 2 (4) $\frac{3}{2}$

(SSC CGL Tier-I Exam. 19.10.2014 (Ist Sitting)

158. If $\sin\theta = \frac{3}{5}$, then the value of $\frac{\tan\theta + \cos\theta}{\cot\theta + \text{cosec}\,\theta}$ is equal to

(1) $\frac{29}{60}$ (2) $\frac{31}{60}$

(3) $\frac{34}{60}$ (4) $\frac{37}{60}$

(SSC CGL Tier-I Exam. 19.10.2014 (Ist Sitting)

159. If $a\cos\theta + b\sin\theta = p$ and $a\sin\theta - b\cos\theta = q$, then the relation between a, b, p and q is

(1) $a^2 - b^2 = p^2 - q^2$

(2) $a^2 + b^2 = p^2 + q^2$

(3) $a + b = p + q$

(4) $a - b = p - q$

(SSC CGL Tier-I Exam. 19.10.2014 (Ist Sitting)

160. If $(\sin\alpha + \text{cosec}\,\alpha)^2 + (\cos\alpha + \sec\alpha)^2 = k + \tan^2\alpha + \cot^2\alpha$, then the value of k is

(1) 1 (2) 7

(3) 3 (4) 5

(SSC CGL Tier-I Exam. 19.10.2014)

161. If $\sin 21° = \frac{x}{y}$, then $\sec 21° - \sin 69°$ is equal to

(1) $\frac{x^2}{y\sqrt{y^2 - x^2}}$ (2) $\frac{y^2}{x\sqrt{y^2 - x^2}}$

(3) $\frac{x^2}{y\sqrt{x^2 - y^2}}$ (4) $\frac{y^2}{x\sqrt{x^2 - y^2}}$

(SSC CGL Tier-I Exam. 19.10.2014)

162. If $\sec\alpha + \tan\alpha = 2$, then the value of $\sin\alpha$ is (assume that $0 < \alpha < 90°$)

(1) 0.4 (2) 0.5

(3) 0.6 (4) 0.8

(SSC CGL Tier-I Exam. 19.10.2014)

163. If $3\sin\theta + 5\cos\theta = 5$, then the value of $5\sin\theta - 3\cos\theta$ will be

(1) ± 3 (2) ± 5

(3) ± 2 (4) ± 1

(SSC CGL Tier-I Exam. 19.10.2014)

164. If θ is an acute angle and $\tan\theta + \cot\theta = 2$, then the value of $\tan^5\theta + \cot^5\theta$ is

(1) 1 (2) 2

(3) 3 (4) 4

(SSC CGL Tier-I Exam. 19.10.2014)

165. The simple value of $\tan 1°. \tan 2°. \tan 3°..... \tan 89°$ is

(1) $\frac{1}{2}$ (2) 0

(3) 1 (4) $\frac{2}{3}$

(SSC CGL Tier-I Exam. 19.10.2014)

166. If $x\sin^2 60° - \frac{3}{2}\sec 60° \tan^2 30° + \frac{4}{5}\sin^2 45° \tan^2 60° = 0$ then x is

(1) $-\frac{1}{15}$ (2) -4

(3) $-\frac{4}{15}$ (4) -2

(SSC CGL Tier-I Exam. 26.10.2014)

167. If $7\sin\alpha = 24\cos\alpha$; $0 < \alpha < \frac{\pi}{2}$, then the value of $14\tan\alpha - 75\cos\alpha - 7\sec\alpha$ is equal to

(1) 3 (2) 4

(3) 1 (4) 2

(SSC CGL Tier-I Exam. 26.10.2014)

168. The value of x which satisfies the equation $2\,\text{cosec}^2 30° + x\sin^2 60° - \frac{3}{4}\tan^2 30° = 10$ is

(1) 2 (2) 3

(3) 0 (4) 1

(SSC CGL Tier-I Exam. 26.10.2014)

169. If $2\sin\theta + \cos\theta = \frac{7}{3}$ then the value of $(\tan^2\theta - \sec^2\theta)$ is

(1) 0 (2) –1

(3) $\frac{3}{7}$ (4) $\frac{7}{3}$

(SSC CGL Tier-I Exam. 26.10.2014)

170. If $29\tan\theta = 31$, then the value of $\frac{1 + 2\sin\theta\cos\theta}{1 - 2\sin\theta\cos\theta}$ is equal to

(1) 810 (2) 900

(3) 540 (4) 490

(SSC CGL Tier-I Exam. 26.10.2014)

TRIGONOMETRY

171. ABCD is a rectangle of which AC is a diagonal. The value of $(\tan^2 \angle CAD + 1) \sin^2 \angle BAC$ is

(1) 2 (2) $\frac{1}{4}$

(3) 1 (4) 0

(SSC CGL Tier-II Exam. 21.09.2014)

172. If $\tan x = \sin 45°. \cos 45° + \sin 30°$ then the value of x is

(1) 30° (2) 45°

(3) 60° (4) 90°

(SSC CGL Tier-II Exam. 21.09.2014)

173. For any real values of θ, $\sqrt{\frac{\sec\theta - 1}{\sec\theta + 1}} = ?$

(1) $\cot\theta - \operatorname{cosec}\theta$

(2) $\sec\theta - \tan\theta$

(3) $\operatorname{cosec}\theta - \cot\theta$

(4) $\tan\theta - \sec\theta$

(SSC CGL Tier-II Exam. 21.09.2014)

174. If the sum and difference of two angles are 135° and $\frac{\pi}{12}$ respectively, then the value of the angles in degree measure are

(1) 70°, 65° (2) 75°, 60°

(3) 45°, 90° (4) 80°, 55°

(SSC CGL Tier-II Exam. 21.09.2014)

175. In a Δ ABC, $\angle B = \frac{\pi}{3}$, $\angle C = \frac{\pi}{4}$ and D divides BC internally in the ratio 1 : 3 then $\frac{\sin\angle BAD}{\sin\angle CAD}$ is equal to

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{\sqrt{3}}$

(3) $\frac{1}{\sqrt{6}}$ (4) $\sqrt{6}$

(SSC CGL Tier-II Exam. 21.09.2014)

176. If $\sin 3A = \cos(A - 26°)$, where 3A is an acute angle then the value of A is

(1) 29° (2) 26°

(3) 23° (4) 28°

(SSC CGL Tier-II Exam. 21.09.2014)

177. Value of $\sec^2\theta - \frac{\sin^2\theta - 2\sin^4\theta}{2\cos^4\theta - \cos^2\theta}$ is

(1) 1 (2) 2

(3) −1 (4) 0

(SSC CGL Tier-II Exam. 21.09.2014)

178. If $x = a(\sin\theta + \cos\theta)$, $y = b(\sin\theta - \cos\theta)$ then the value of $\frac{x^2}{a^2} + \frac{y^2}{b^2}$ is

(1) 0 (2) 1

(3) 2 (4) −2

(SSC CGL Tier-II Exam. 21.09.2014)

179. If $\sin 5\theta = \cos 20°$ ($0° < \theta < 90°$) then the value of θ is

(1) 4° (2) 22°

(3) 10° (4) 14°

(SSC CGL Tier-II Exam. 21.09.2014)

180. If $0° < \theta < 90°$ and $2\sec\theta = 3\operatorname{cosec}^2\theta$, then θ is

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{4}$

(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{5}$

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014)

181. $\sqrt{\frac{1+\sin\theta}{1-\sin\theta}} + \sqrt{\frac{1-\sin\theta}{1+\sin\theta}}$ is equal to

(1) 2 cos θ (2) 2 sin θ

(3) 2 cot θ (4) 2 sec θ

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014)

182. If $\cos\theta = \frac{3}{5}$, then the value of $\sin\theta \cdot \sec\theta \cdot \tan\theta$ is

(1) $\frac{9}{16}$ (2) $\frac{16}{9}$

(3) $\frac{3}{4}$ (4) $\frac{4}{3}$

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014)

183. If $0° < A < 90°$, then the value of $\tan^2 A + \cot^2 A - \sec^2 A \operatorname{cosec}^2 A$ is

(1) 0 (2) 1

(3) 2 (4) −2

(SSC CHSL DEO & LDC Exam. 02.11.2014 (IInd Sitting)

184. If α and β are positive acute angles, $\sin(4\alpha - \beta) = 1$ and $\cos(2\alpha + \beta) = \frac{1}{2}$, then the value of $\sin(\alpha + 2\beta)$ is

(1) 0 (2) 1

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{\sqrt{2}}$

(SSC CHSL DEO & LDC Exam. 02.11.2014 (IInd Sitting)

185. If θ is a positive acute angle and $\operatorname{cosec}\theta = \sqrt{3}$, then the value of $\cot\theta - \operatorname{cosec}\theta$ is

(1) $\frac{3\sqrt{2} - \sqrt{3}}{3}$ (2) $\frac{\sqrt{2}(3+\sqrt{3})}{3}$

(3) $\frac{\sqrt{2}(3-\sqrt{3})}{3}$ (4) $\frac{3\sqrt{2} + \sqrt{3}}{3}$

(SSC CHSL DEO & LDC Exam. 02.11.2014 (IInd Sitting)

186. If θ is a positive acute angle and $4\cos^2\theta - 4\cos\theta + 1 = 0$, then the value of $\tan(\theta - 15°)$ is equal to

(1) 0 (2) 1

(3) $\sqrt{3}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CHSL DEO & LDC Exam. 9.11.2014)

187. If $(r\cos\theta - \sqrt{3})^2 + (r\sin\theta - 1)^2 = 0$ then the value of $\frac{r\tan\theta + \sec\theta}{r\sec\theta + \tan\theta}$ is equal to

(1) $\frac{4}{5}$ (2) $\frac{5}{4}$

(3) $\frac{\sqrt{3}}{4}$ (4) $\frac{\sqrt{5}}{4}$

(SSC CHSL DEO & LDC Exam. 9.11.2014)

188. The value of $\frac{\sin 25 \cos 65 + \cos 25 \sin 65}{\tan^2 70 - \operatorname{cosec}^2 20}$

(1) − 1 (2) 0

(3) 1 (4) 2

(SSC CHSL DEO & LDC Exam. 9.11.2014)

189. If $\sin(\theta + 18°) = \cos 60°$ ($0 < \theta < 90°$), then the value of $\cos 5\theta$ is

(1) $\frac{1}{2}$ (2) 0

(3) $\frac{1}{\sqrt{2}}$ (4) 1

(SSC CHSL DEO & LDC Exam. 16.11.2014)

TRIGONOMETRY

190. If $\tan\theta = \frac{3}{4}$, then the value of $\frac{4\sin^2\theta - 2\cos^2\theta}{4\sin^2\theta + 3\cos^2\theta}$ is equal to

(1) $\frac{1}{21}$ (2) $\frac{2}{21}$

(3) $\frac{4}{21}$ (4) $\frac{8}{21}$

(SSC CHSL DEO & LDC Exam. 16.11.2014)

191. If $\frac{\cos\alpha}{\cos\beta} = a$, $\frac{\sin\alpha}{\sin\beta} = b$, then $\sin^2\beta$ is equal to

(1) $\frac{a^2-1}{a^2+b^2}$ (2) $\frac{a^2+1}{a^2-b^2}$

(3) $\frac{a^2-1}{a^2-b^2}$ (4) $\frac{a^2+1}{a^2+b^2}$

(SSC CHSL DEO & LDC Exam. 16.11.2014)

192. Let A, B, C, D be the angles of a quadrilateral. If they are concyclic, then the value of cos A + cos B + cos C + cos D is

(1) 0 (2) 1

(3) –1 (4) 2

(SSC CHSL DEO & LDC Exam. 16.11.2014)

193. If $\sqrt{3}\tan\theta = 3\sin\theta$, then the value of $(\sin^2\theta - \cos^2\theta)$ is

(1) 1 (2) 3

(3) $\frac{1}{3}$ (4) None

(SSC CHSL DEO Exam. 02.11.2014 (Ist Sitting)

194. If sin(A + B) = sin A cos B + cos A sin B, then the value of sin75° is

(1) $\frac{\sqrt{3}+1}{\sqrt{2}}$ (2) $\frac{\sqrt{2}+1}{2\sqrt{2}}$

(3) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (4) $\frac{\sqrt{3}+1}{2}$

(SSC CHSL DEO Exam. 02.11.2014 (Ist Sitting)

195. ABC is a right angled triangle, right angled at B and ∠A = 60° and AB = 20 cm, then the ratio of sides BC and CA is

(1) $\sqrt{3}$: 1 (2) 1 : $\sqrt{3}$

(3) $\sqrt{3}$: $\sqrt{2}$ (4) $\sqrt{3}$: 2

(SSC CHSL DEO Exam. 02.11.2014 (Ist Sitting)

196. If tan 2θ . tan 3θ = 1, where 0° < θ < 90° then the value of θ is

(1) $22\frac{1}{2}°$ (2) 18°

(3) 24° (4) 30°

197. If $\cos^2\alpha - \sin^2\alpha = \tan^2\beta$, then the value of $\cos^2\beta - \sin^2\beta$ is

(1) $\cot^2\alpha$ (2) $\cot^2\beta$

(3) $\tan^2\alpha$ (4) $\tan^2\beta$

(SSC CHSL DEO Exam. 02.11.2014 (Ist Sitting)

198. If $\tan(A + B) = \sqrt{3}$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, ∠A + ∠B) < 90°, A ≥ B, then ∠A is

(1) 90° (2) 30°

(3) 45° (4) 60°

(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

199. The value of $\frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta}$ is equal to

(1) sin θ (2) cos θ

(3) tan θ (4) cot θ

(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

200. If $r\sin\theta = \frac{7}{2}$ and $r\cos\theta = \frac{7\sqrt{3}}{2}$, then value of r is

(1) 4 (2) 3

(3) 5 (4) 7

(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

201. If $\theta + \phi = \frac{\pi}{2}$ and $\sin\theta = \frac{1}{2}$, then the value of sin ϕ is

(1) 1 (2) $\frac{1}{\sqrt{2}}$

(3) $\frac{1}{2}$ (4) $\frac{\sqrt{3}}{2}$

(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

202. If 0° < θ < 90° and $2\sin^2\theta + 3\cos\theta = 3$, then the value of θ is

(1) 30° (2) 60°

(3) 45° (4) 75°

(SSC CHSL (10+2) DEO & LDC Exam. 16.11.2014, IInd Sitting TF No. 545 QP 6)

203. The value of θ ($0 \le \theta \le 90°$) satisfying $2\sin^2\theta = 3\cos\theta$ is

(1) 60° (2) 30°

(3) 90° (4) 45°

(SSC CGL Tier-II Exam. 12.04.2015 TF No. 567 TL 9)

204. If $a(\tan\theta + \cot\theta) = 1$, $\sin\theta + \cos\theta = b$ with $0° < \theta < 90°$, then a relation between a and b is

(1) $b^2 = 2(a + 1)$

(2) $b^2 = 2(a - 1)$

(3) $2a = b^2 - 1$

(4) $2a = b^2 + 1$

(SSC CGL Tier-II Exam. 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

205. If A is an acute angle and cot A + cosec A = 3, then the value of sin A is

(1) 1 (2) $\frac{3}{5}$

(3) $\frac{4}{5}$ (4) 0

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 IInd Sitting)

206. The simplest value of $\sin^2x + 2\tan^2x - 2\sec^2x + \cos^2x$ is

(1) 1 (2) 0

(3) –1 (4) 2

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014 TF No. 999 KP0)

207. If $x = a\sec\theta$ and $y = b\tan\theta$ then $\frac{a^2}{x^2} - \frac{b^2}{y^2} = ?$

(1) 1 (2) 2

(3) 3 (4) 4

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014 TF No. 999 KP0)

208. The value of $\sin^21° + \sin^22° + \sin^23° + \ldots + \sin^289°$ is

(1) 22 (2) 44

(3) $22\frac{1}{2}$ (4) $44\frac{1}{2}$

(SSC CGL Tier-I Exam. 19.10.2014 TF No. 022 MH 3)

209. The value of $\frac{\cos^3\theta + \sin^3\theta}{\cos\theta + \sin\theta} + \frac{\cos^3\theta - \sin^3\theta}{\cos\theta - \sin\theta}$ is equal to

(1) -1 (2) 1

(3) 2 (4) 0

(SSC CGL Tier-I Exam. 19.10.2014 TF No. 022 MH 3)

210. If $\sin 17° = \frac{x}{y}$, then

$\sec 17° - \sin 73°$ is equal to

(1) $\frac{y}{\sqrt{y^2 - x^2}}$ (2) $\frac{y^2}{(x\sqrt{y^2 - x^2})}$

(3) $\frac{x}{(y\sqrt{y^2 - x^2})}$ (4) $\frac{x^2}{(y\sqrt{y^2 - x^2})}$

(SSC CGL Tier-I Exam. 19.10.2014
TF No. 022 MH 3)

211. If θ is a positive acute angle and $\text{cosec}\ \theta + \cot\ \theta = \sqrt{3}$, then the value of $\text{cosec}\ \theta$ is

(1) $\frac{1}{\sqrt{3}}$ (2) $\sqrt{3}$

(3) $\frac{2}{\sqrt{3}}$ (4) 1

(SSC CGL Tier-I Exam. 19.10.2014
TF No. 022 MH 3)

212. If $\cos \alpha + \sec \alpha = \sqrt{3}$, then the value of $\cos^3 \alpha + \sec^3 \alpha$ is

(1) 2 (2) 1
(3) 0 (4) 4

(SSC CGL Tier-I Exam. 19.10.2014
TF No. 022 MH 3)

213. If $\sin \theta + \cos \theta = \sqrt{2} \cos \theta$, then the value of $\cot \theta$ is

(1) $\sqrt{2} + 1$ (2) $\sqrt{2} - 1$

(3) $\sqrt{3} - 1$ (4) $\sqrt{3} + 1$

(SSC CGL Tier-I Exam. 19.10.2014
TF No. 022 MH 3)

214. If $\cos^4 \theta - \sin^4 \theta = \frac{2}{3}$, then the value of $1 - 2 \sin^2 \theta$ is

(1) $\frac{2}{3}$ (2) $\frac{3}{2}$

(3) 1 (4) 0

(SSC CHSL (10+2) DEO & LDC
Exam. 16.11.2014 , Ist Sitting
TF No. 333 LO 2)

215. The value of $\frac{\cot 30° - \cot 75°}{\tan 15° - \tan 60°}$ is equal to

(1) – 1 (2) 0
(3) 1 (4) 2

(SSC CHSL (10+2) DEO & LDC
Exam. 16.11.2014 , Ist Sitting
TF No. 333 LO 2)

216. If $\sin \theta + \cos \theta = p$ and $\sec \theta + \text{cosec}\ \theta = q$, then the value of $q(p^2 - 1)$ is

(1) 1 (2) p
(3) $2p$ (4) 2

(SSC CHSL (10+2) DEO & LDC
Exam. 16.11.2014 , Ist Sitting
TF No. 333 LO 2)

217. If $\sin (3\alpha - \beta) = 1$ and $\cos (2\alpha + \beta) = \frac{1}{2}$, then the value of $\tan \alpha$ is

(1) 0 (2) $\frac{1}{\sqrt{3}}$

(3) 1 (4) $\sqrt{3}$

(SSC CHSL (10+2) DEO & LDC
Exam. 16.11.2014 , Ist Sitting
TF No. 333 LO 2)

218. If $\sin (60° - x) = \cos (y + 60°)$, then the value of $\sin (x - y)$ is

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{2}$

(3) $\frac{\sqrt{3}}{2}$ (4) 1

(SSC CHSL (10+2) DEO & LDC
Exam. 16.11.2014, IInd Sitting
TF No. 545 QP 6)

219. If $x = a \sec\theta$, $y = b \tan\theta$, then $\frac{x^2}{a^2} - \frac{y^2}{b^2}$ is

(1) –1 (2) 0
(3) 1 (4) 2

(SSC CHSL (10+2) DEO & LDC
Exam. 16.11.2014, IInd Sitting
TF No. 545 QP 6)

220. a, b, c are the lengths of three sides of a triangle ABC. If a, b, c are related by the relation $a^2 + b^2 + c^2 = ab + bc + ca$, then the value of $\sin^2 A + \sin^2 B + \sin^2 C$ is

(1) $\frac{3}{4}$ (2) $\frac{3\sqrt{3}}{2}$

(3) $\frac{3}{2}$ (4) $\frac{9}{4}$

(SSC CGL Tier-II Exam. 12.04.2015
TF No. 567 TL 9)

221. If $a \sin \theta + b \cos \theta = c$, then $a \cos \theta - b \sin \theta$ is equal to

(1) $\pm\sqrt{a + b - c}$

(2) $\pm\sqrt{a^2 + b^2 + c^2}$

(3) $\pm\sqrt{a^2 + b^2 - c^2}$

(4) $\pm\sqrt{c^2 + a^2 - b^2}$

(SSC CGL Tier-II Exam. 12.04.2015
TF No. 567 TL 9)

222. If $\sin \theta + \cos \theta = \sqrt{2} \sin (90° - \theta)$, then the value of $\cot \theta$ is

(1) $-\sqrt{2} - 1$ (2) $\sqrt{2} - 1$

(3) $\sqrt{2} + 1$ (4) $-\sqrt{2} + 1$

(SSC CGL Tier-II Exam. 12.04.2015
TF No. 567 TL 9)

223. If θ is a positive acute angle and $3(\sec^2\theta + \tan^2\theta) = 5$, then the value of $\cos 2\theta$ is

(1) $\frac{1}{2}$ (2) $\frac{1}{\sqrt{2}}$

(3) $\frac{\sqrt{3}}{2}$ (4) 1

(SSC CGL Tier-II Exam. 12.04.2015
TF No. 567 TL 9)

224. If $x \cos^2 30°. \sin 60° = \frac{\tan^2 45°. \sec 60°}{\text{cosec}\ 60°}$ then the value of x is

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{1}{\sqrt{2}}$

(3) $2\frac{2}{3}$ (4) $\frac{1}{2}$

(SSC CGL Tier-II Exam. 12.04.2015
TF No. 567 TL 9)

225. If $\tan \alpha = 2$, then the value of $\frac{\text{cosec}^2\alpha - \sec^2\alpha}{\text{cosec}^2\alpha + \sec^2\alpha}$ is

(1) $-\frac{15}{9}$ (2) $-\frac{3}{5}$

(3) $\frac{3}{5}$ (4) $\frac{17}{5}$

(SSC CGL Tier-II Exam. 12.04.2015
TF No. 567 TL 9)

226. If $\sin (\theta + 30°) = \frac{3}{\sqrt{12}}$, then the value of $\cos^2\theta$ is

(1) $\frac{1}{4}$ (2) $\frac{\sqrt{3}}{2}$

(3) $\frac{3}{4}$ (4) $\frac{1}{2}$

(SSC CGL Tier-II Exam. 12.04.2015
TF No. 567 TL 9)

TRIGONOMETRY

227. If $0 \le \theta \le 90°$ and $4\cos^2\theta - 4\sqrt{3}\cos\theta + 3 = 0$ then the value of θ is
(1) 30° (2) 45°
(3) 90° (4) 60°
(SSC CGL Tier-II Exam. 12.04.2015 TF No. 567 TL 9)

228. If $\sec\theta - \cos\theta = \frac{3}{2}$ where θ is a positive acute angle, then the value of $\sec\theta$ is
(1) $-\frac{1}{2}$ (2) 1
(3) 2 (4) 0
(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

229. If $\tan(5x - 10°) = \cot(5y + 20°)$, the value of $(x + y)$ is
(1) 15° (2) 16°
(3) 24° (4) 20°
(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

230. If $\sin\theta + \sin^2\theta = 1$, then the value of $\cos^{12}\theta + 3\cos^{10}\theta + 3\cos^8\theta + \cos^6\theta - 1$ is
(1) 1 (2) 2
(3) 3 (4) 0
(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

231. The value of $\tan 11° \tan 17° \tan 79° \tan 73°$ is
(1) $\frac{1}{2}$ (2) 0
(3) 1 (4) $\frac{1}{\sqrt{2}}$
(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

232. If for any acute angle A, $\sin A + \sin^2 A = 1$, then the value of $\cos^2 A + \cos^4 A$ is
(1) –1 (2) 1
(3) 2 (4) 0
(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

233. The value of $(1 + \sec 20° + \cot 70°)(1 - \operatorname{cosec} 20° + \tan 70°)$ is equal to
(1) 0 (2) 1
(3) 2 (4) – 1
(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

234. If $0° < A < 90°$, the value of $\frac{\tan A - \sec A - 1}{\tan A + \sec A + 1}$ is
(1) $\frac{\sin A - 1}{\cos A}$ (2) $\frac{1 - \sin A}{\cos A}$
(3) $\frac{1 - \cos A}{\sin A}$ (4) $\frac{\sin A + 1}{\cos A}$
(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

235. If α is an cute angle and $2\sin\alpha + 15\cos^2\alpha = 7$ then the value of $\cot\alpha$ is
(1) $\frac{4}{3}$ (2) $\frac{4}{5}$
(3) $\frac{5}{4}$ (4) $\frac{3}{4}$
(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 (Ist Sitting) TF No. 8037731)

236. If $\sin(A - B) = \sin A \cos B - \cos A \sin B$, then sin 15° will be
(1) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (2) $\frac{\sqrt{3}}{2\sqrt{2}}$
(3) $\frac{\sqrt{3}-1}{\sqrt{2}}$ (4) $\frac{\sqrt{3}-1}{2\sqrt{2}}$
(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 (Ist Sitting) TF No. 8037731)

237. If $\sec x + \cos x = 2$, then the value of $\sec^{16} x + \cos^{16} x$ will be
(1) $\sqrt{3}$ (2) 2
(3) 1 (4) 0
(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 IInd Sitting)

238. If $\sin^4\theta + \cos^4\theta = 2\sin^2\theta\cos^2\theta$, θ is an acute angle, then the value of $\tan\theta$ is
(1) 1 (2) 2
(3) $\sqrt{2}$ (4) 0
(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 IInd Sitting)

239. The maximum value of $\sin^4\theta + \cos^4\theta$ is
(1) $\frac{1}{3}$ (2) 1
(3) 2 (4) 3
(SSC CGL Tier-I Exam, 09.08.2015 (Ist Sitting) TF No. 1443088)

240. Find the value of $\tan 4° \tan 43° \tan 47° \tan 86°$
(1) $\frac{2}{3}$ (2) 1
(3) $\frac{1}{2}$ (4) 2
(SSC CGL Tier-I Exam, 09.08.2015 (Ist Sitting) TF No. 1443088)

241. If $x\cos\theta - \sin\theta = 1$, then $x^2 + (1 + x^2)\sin\theta$ equals
(1) 2 (2) 1
(3) – 1 (4) 0
(SSC CGL Tier-I Exam, 09.08.2015 (Ist Sitting) TF No. 1443088)

242. If $\sin\theta + \sin^2\theta = 1$ then $\cos^2\theta + \cos^4\theta$ is equal to
(1) None (2) 1
(3) $\frac{\sin\theta}{\cos^2\theta}$ (4) $\frac{\cos^2\theta}{\sin\theta}$
(SSC CGL Tier-I Exam, 09.08.2015 (Ist Sitting) TF No. 1443088)

243. The numerical value of $\frac{\cos^2 45°}{\sin^2 60°} + \frac{\cos^2 60°}{\sin^2 45°} - \frac{\tan^2 30°}{\cot^2 45°} - \frac{\sin^2 30°}{\cot^2 30°}$ is
(1) $1\frac{1}{4}$ (2) $\frac{3}{4}$
(3) $\frac{1}{4}$ (4) $\frac{1}{2}$
(SSC CGL Tier-I Exam, 09.08.2015 (Ist Sitting) TF No. 1443088)

244. The value of $\tan 1° \tan 2° \tan 3° \ldots\ldots \tan 89°$ is
(1) 1 (2) –1
(3) 0
(4) None of the options
(SSC CGL Tier-I Exam, 09.08.2015 (IInd Sitting) TF No. 4239378)

245. If $\frac{\cos\alpha}{\sin\beta} = n$ and $\frac{\cos\alpha}{\cos\beta} = m$, then the vlaue of $\cos^2\beta$ is
(1) $\frac{m^2}{m^2+n^2}$ (2) $\frac{1}{m^2+n^2}$
(3) $\frac{n^2}{m^2+n^2}$ (4) 0
(SSC CGL Tier-I Exam, 09.08.2015 (IInd Sitting) TF No. 4239378)

TRIGONOMETRY

246. If $0° \leq A \leq 90°$, the simplified form of the given expression sin A cos A (tan A – cot A) is
(1) 1 (2) $1 - 2\sin^2 A$
(3) $2\sin^2 A - 1$ (4) $1 - \cos^2 A$
(SSC CGL Tier-I Exam, 09.08.2015 (IInd Sitting) TF No. 4239378)

247. If θ is an acute angle and $\tan^2\theta + \frac{1}{\tan^2\theta} = 2$, then the value of θ is :
(1) 60° (2) 45°
(3) 15° (4) 30°
(SSC CGL Tier-I Exam, 09.08.2015 (IInd Sitting) TF No. 4239378)

248. If $\tan\theta + \cot\theta = 5$, then $\tan^2\theta + \cot^2\theta$ is
(1) 23 (2) 25
(3) 26 (4) 24
(SSC CGL Tier-I Exam, 09.08.2015 (IInd Sitting) TF No. 4239378)

249. The value of $\sin^2 22° + \sin^2 68° + \cot^2 30°$ is
(1) 4 (2) 3
(3) $\frac{3}{4}$ (4) $\frac{5}{4}$
(SSC CGL Tier-I Exam, 16.08.2015 (Ist Sitting) TF No. 3196279)

250. The minimum value of $2\sin^2\theta + 3\cos^2\theta$ is
(1) 3 (2) 4
(3) 2 (4) 1
(SSC CGL Tier-I Exam, 16.08.2015 (Ist Sitting) TF No. 3196279)

251. If θ be acute angle and $\tan(4\theta - 50°) = \cot(50° - \theta)$, then the value of θ in degrees is :
(1) 20 (2) 50
(3) 40 (4) 30
(SSC CGL Tier-I Exam, 16.08.2015 (Ist Sitting) TF No. 3196279)

252. If $5\sin\theta = 3$, the numerical velue of $\frac{\sec\theta - \tan\theta}{\sec\theta + \tan\theta}$ is
(1) $\frac{1}{2}$ (2) $\frac{1}{5}$
(3) $\frac{1}{3}$ (4) $\frac{1}{4}$
(SSC CGL Tier-I Exam, 16.08.2015 (Ist Sitting) TF No. 3196279)

253. If $\sec\theta + \tan\theta = p$, $(p \neq 0)$ then $\sec\theta$ is equal to
(1) $\left(p - \frac{1}{p}\right), p \neq 0$
(2) $2\left(p - \frac{1}{p}\right), p \neq 0$
(3) $\left(p + \frac{1}{p}\right), p \neq 0$
(4) $\frac{1}{2}\left(p + \frac{1}{p}\right), p \neq 0$
(SSC CGL Tier-I Exam, 16.08.2015 (Ist Sitting) TF No. 3196279)

254. If $1 + \cos^2\theta = 3\sin\theta\cos\theta$, then the integral value of $\cot\theta \left(0 < \theta < \frac{\pi}{2}\right)$ is
(1) 1 (2) 2
(3) 0 (4) 3
(SSC CGL Tier-I Exam, 16.08.2015 (IInd Sitting) TF No. 2176783)

255. The value of the following is : $3(\sin^4\theta + \cos^4\theta) + 2(\sin^6\theta + \cos^6\theta) + 12\sin^2\theta\cos^2\theta$
(1) 0 (2) 3
(3) 2 (4) 5
(SSC CGL Tier-I Exam, 16.08.2015 (IInd Sitting) TF No. 2176783)

256. If $\sec\theta + \tan\theta = 2 + \sqrt{5}$, then the value of $\sin\theta$ is $(0° \leq \theta \leq 90°)$
(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{2}{\sqrt{5}}$
(3) $\frac{1}{\sqrt{5}}$ (4) $\frac{4}{5}$
(SSC CGL Tier-I Exam, 16.08.2015 (IInd Sitting) TF No. 2176783)

257. If $\frac{\sec\theta + \tan\theta}{\sec\theta - \tan\theta} = 2\frac{51}{79}$ then the value of $\sin\theta$ is
(1) $\frac{39}{72}$ (2) $\frac{65}{144}$
(3) $\frac{35}{72}$ (4) $\frac{91}{144}$
(SSC CGL Tier-I Exam, 16.08.2015 (IInd Sitting) TF No. 2176783)

258. If $\tan A + \cot A = 2$, then the value of $\tan^{10}A + \cot^{10}A$ is
(1) 4 (2) 2
(3) 2^{10} (4) 1
(SSC CGL Tier-I Exam, 16.08.2015 (IInd Sitting) TF No. 2176783)

259. The value of $\cos^2 30° + \sin^2 60° + \tan^2 45° + \sec^2 60° + \cos 0°$ is
(1) $4\frac{1}{2}$ (2) $5\frac{1}{2}$
(3) $6\frac{1}{2}$ (4) $7\frac{1}{2}$
(SSC CGL Tier-I Re-Exam, 30.08.2015)

260. If $\cos x + \cos^2 x = 1$, then $\sin^8 x + 2\sin^6 x + \sin^4 x$ is equal to
(1) 0 (2) 3
(3) 2 (4) 1
(SSC CGL Tier-I Re-Exam, 30.08.2015)

261. In ΔABC, $\angle C = 90°$ and $AB = c$, $BC = a$, $CA = b$; then the value of (cosec B – cos A) is
(1) $\frac{c^2}{ab}$ (2) $\frac{b^2}{ca}$
(3) $\frac{a^2}{bc}$ (4) $\frac{bc}{a^2}$
(SSC CGL Tier-I Re-Exam, 30.08.2015)

262. If $\tan\theta - \cot\theta = 0$ and θ is positive acute angle, then the value of $\frac{\tan(\theta + 15°)}{\tan(\theta - 15°)}$ is
(1) 3 (2) $\frac{1}{\sqrt{3}}$
(3) $\frac{1}{3}$ (4) $\sqrt{3}$
(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

263. The value of
$\cot 41°.\cot 42°.\cot 43°.\cot 44°.\cot 45°.\cot 46°.\cot 47°.\cot 48°.\cot 49°$
(1) 1 (2) 0
(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{\sqrt{2}}$
(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

TRIGONOMETRY

264. If $x = a \sin\theta - b\cos\theta$, $y = a\cos\theta + b\sin\theta$, then which of the following is true?

(1) $\frac{x^2}{y^2} + \frac{a^2}{b^2} = 1$

(2) $x^2 + y^2 = a^2 - b^2$

(3) $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

(4) $x^2 + y^2 = a^2 + b^2$

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

265. If $\sec\theta - \tan\theta = \frac{1}{\sqrt{3}}$, the value of $\sec\theta \cdot \tan\theta$ is

(1) $\frac{2}{3}$ (2) $\frac{2}{\sqrt{3}}$

(3) $\frac{4}{\sqrt{3}}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

266. If $5\cos\theta + 12\sin\theta = 13$, $0° < \theta < 90°$, then the value of $\sin\theta$ is

(1) $\frac{5}{13}$ (2) $-\frac{12}{13}$

(3) $\frac{6}{13}$ (4) $\frac{12}{13}$

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

267. If $7\sin^2\theta + 3\cos^2\theta = 4$, then the value of $\tan\theta$ is (θ is acute)

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{1}{\sqrt{2}}$

(3) $\sqrt{3}$ (4) 1

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

268. The value of $(\text{cosec}\,a - \sin a)(\sec a - \cos a)(\tan a + \cot a)$ is

(1) 1 (2) 6

(3) 2 (4) 4

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

269. If $\sin A + \sin^2 A = 1$, then the value of $\cos^2 A + \cos^4 A$ is

(1) 2 (2) $1\frac{2}{3}$

(3) $1\frac{1}{2}$ (4) 1

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

270. If $\tan A = n\tan B$ and $\sin A = m\sin B$, then the value of $\cos^2 A$ is

(1) $\frac{m^2-1}{n^2+1}$ (2) $\frac{m^2+1}{n^2-1}$

(3) $\frac{m^2+1}{n^2+1}$ (4) $\frac{m^2-1}{n^2-1}$

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

271. If $\sin\theta + \cos\theta = \sqrt{2}\sin(90° - \theta)$ then $\cot\theta$ is equal to :

(1) $\sqrt{2}$ (2) 0

(3) $\sqrt{2} - 1$ (4) $\sqrt{2} + 1$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 01.11.2015, IInd Sitting)

272. The value of the following is :

$$\frac{(\tan 20°)^2}{(\text{cosec}\ 70°)^2} + \frac{(\cot 20°)^2}{(\sec 70°)^2} + 2\tan 15°.\tan 45°.\tan 75°$$

(1) 1 (2) 4

(3) 3 (4) 2

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 01.11.2015, IInd Sitting)

273. The value of the following is

$$\left(\frac{\sin 47°}{\cos 43°}\right)^2 + \left(\frac{\cos 43°}{\sin 47°}\right)^2 - 4\cos^2 45°$$

(1) –1 (2) 0

(3) 1 (4) $\frac{1}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 01.11.2015, IInd Sitting)

274. If $0° < \theta < 90°$ and $\text{cosec}\theta = \cot^2\theta$, then the value of the expression $\text{cosec}^4\theta - 2\text{cosec}^3\theta + \cot^2\theta$ is equal to:

(1) 2 (2) 0

(3) 1 (4) 3

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (Ist Sitting) TF No. 6636838)

275. If $4\sin^2\theta - 1 = 0$ and angle θ is less than 90°, the value of $\cos^2\theta + \tan^2\theta$ is :

(Take $0° < \theta < 90°$)

(1) $\frac{17}{15}$ (2) $\frac{13}{12}$

(3) $\frac{11}{9}$ (4) $\frac{12}{11}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (Ist Sitting) TF No. 6636838)

276. Find numerical value of

$$\frac{9}{\text{cosec}^2\theta} + 4\cos^2\theta + \frac{5}{1+\tan^2\theta}.$$

(1) 5 (2) 7

(3) 9 (4) 4

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (IInd Sitting) TF No. 7203752)

277. If $\tan\theta + \sec\theta = 3$, θ being acute, the value of $5\sin\theta$ is :

(1) $\frac{5}{2}$ (2) $\frac{\sqrt{3}}{5}$

(3) $\frac{5}{\sqrt{3}}$ (4) 4

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (IInd Sitting) TF No. 7203752)

278. If $\cos\theta = \frac{p}{\sqrt{p^2+q^2}}$, then the value of $\tan\theta$ is :

(1) $\frac{q}{\sqrt{p^2-q^2}}$ (2) $\frac{q}{p}$

(3) $\frac{p}{p^2+q^2}$ (4) $\frac{q}{\sqrt{p^2+q^2}}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (IInd Sitting) TF No. 7203752)

279. If A, B, and C be the angles of a triangle, then out of the following, the incorrect relation is :

(1) $\cos\left(\frac{A+B}{2}\right) = \sin\frac{C}{2}$

(2) $\tan\left(\frac{A+B}{2}\right) = \cot\frac{C}{2}$

(3) $\cot\left(\frac{A+B}{2}\right) = \tan\frac{C}{2}$

(4) $\sin\frac{A+B}{2} = \cos\frac{C}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (IInd Sitting) TF No. 7203752)

TRIGONOMETRY

280. The value of the expression $\sin^2 1° + \sin^2 11° + \sin^2 21° + \sin^2 31° + \sin^2 41° + \sin^2 45° + \sin^2 49° + \sin^2 59° + \sin^2 69° + \sin^2 79° + \sin^2 89°$ is :

(1) 0 (2) $5\frac{1}{2}$

(3) 5 (4) $4\frac{1}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (Ist Sitting) TF No. 1375232)

281. If $x = a(\sin\theta + \cos\theta)$ and $y = b(\sin\theta - \cos\theta)$, then the value of $\frac{x^2}{a^2} + \frac{y^2}{b^2}$ is :

(1) 4 (2) 3

(3) 1 (4) 2

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (Ist Sitting) TF No. 1375232)

282. If $\cos\theta + \sin\theta = m$ and $\sec\theta + \text{cosec}\,\theta = n$ then the value of $n(m^2 - 1)$ is equal to :

(1) 2m (2) mn

(3) 4mn (4) 2n

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (Ist Sitting) TF No. 1375232)

283. If $\frac{x - x\tan^2 30°}{1 + \tan^2 30°} = \sin^2 30° + 4\cot^2 45° - \sec^2 60°$, then the value of x is :

(1) $\frac{1}{4}$ (2) $\frac{1}{5}$

(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (Ist Sitting) TF No. 1375232)

284. If $\cos A + \sin A = \sqrt{2}\cos A$ then $\cos A - \sin A$ is equal to : (where $0° < A < 90°$)

(1) $\sqrt{2}\sin A$ (2) $2\sin A$

(3) $2\sqrt{\sin A}$ (4) $\sqrt{2\sin A}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (Ist Sitting) TF No. 1375232)

285. If $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$ then the value of $\sin^4\theta$ is :

(1) $\frac{2}{5}$ (2) $\frac{1}{5}$

(3) $\frac{4}{5}$ (4) $\frac{3}{5}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (IInd Sitting) TF No. 3441135)

286. If $\sin 2\theta = \frac{\sqrt{3}}{2}$ then the value of $\sin 3\theta$ is equal to (Take $0° \le \theta \le 90°$)

(1) $\frac{1}{2}$ (2) 1

(3) 0 (4) $\frac{\sqrt{3}}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (IInd Sitting) TF No. 3441135)

287. Value of the expression :

$$\frac{1 + 2\sin 60°\cos 60°}{\sin 60° + \cos 60°} + \frac{1 - 2\sin 60°\cos 60°}{\sin 60° - \cos 60°}$$ is

(1) $2\sqrt{3}$ (2) 0

(3) $\sqrt{3}$ (4) 2

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (IInd Sitting) TF No. 3441135)

288. If $\alpha + \beta = 90°$, then the expression $\frac{\tan\alpha}{\tan\beta} + \sin^2\alpha + \sin^2\beta$ is equal to :

(1) $\sec^2\beta$ (2) $\tan^2\alpha$

(3) $\tan^2\beta$ (4) $\sec^2\alpha$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (IInd Sitting) TF No. 3441135)

289. The value of x in the equation

$\tan^2\frac{\pi}{4} - \cos^2\frac{\pi}{3} = x\sin\frac{\pi}{4}\cos\frac{\pi}{4}\tan\frac{\pi}{3}$ is :

(1) $\frac{2}{\sqrt{3}}$ (2) $\frac{3\sqrt{3}}{4}$

(3) $\frac{1}{\sqrt{3}}$ (4) $\frac{\sqrt{3}}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 06.12.2015 (IInd Sitting) TF No. 3441135)

290. If $\sin A - \cos A = \frac{\sqrt{3}-1}{2}$, then the value of $\sin A \cdot \cos A$ is

(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{3}{2}$

(3) $\frac{\sqrt{3}}{4}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 20.12.2015 (Ist Sitting) TF No. 9692918)

291. If $\sin(90° - \theta) + \cos\theta = \sqrt{2}\cos(90° - \theta)$, then the value of $\text{cosec}\,\theta$ is

(1) $\frac{2}{3}$ (2) $\sqrt{\frac{3}{2}}$

(3) $\frac{1}{\sqrt{2}}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 20.12.2015 (Ist Sitting) TF No. 9692918)

292. If $\tan\left(\frac{\pi}{2} - \frac{\alpha}{2}\right) = \sqrt{3}$, then the value of $\cos\alpha$ is

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{2}$

(3) 0 (4) $\frac{\sqrt{3}}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 20.12.2015 (Ist Sitting) TF No. 9692918)

293. The value of $\cos 1° \cos 2° \cos 3° \ldots \cos 180°$ is

(1) 0 (2) 1

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 20.12.2015 (Ist Sitting) TF No. 9692918)

TRIGONOMETRY

294. If $\cos 20° = m$ and $\cos 70° = n$, then the value of $m^2 + n^2$ is

(1) 1 (2) $\frac{3}{2}$

(3) $\frac{1}{\sqrt{2}}$ (4) $\frac{1}{2}$

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 20.12.2015 (Ist Sitting) TF No. 9692918)

295. If $\tan(5x - 10°) = \cot(5y + 20°)$, then the value of $(x + y)$ is

(1) 15° (2) 16°

(3) $22\frac{1}{2}°$ (4) 24°

(SSC CGL Tier-I (CBE) Exam.10.09.2016)

296. If $\cos 27° = x$, the value of $\tan 63°$ is

(1) $\frac{x}{\sqrt{1-x^2}}$ (2) $\frac{x}{\sqrt{1+x^2}}$

(3) $\frac{\sqrt{1-x^2}}{x}$ (4) $\frac{\sqrt{1+x^2}}{x}$

(SSC CGL Tier-I (CBE) Exam.11.09.2016) (Ist Sitting)

297. If $\cos^2 x + \cos^4 x = 1$, then $\tan^2 x + \tan^4 x = ?$

(1) 0 (2) 1

(3) $2\tan^2 x$ (4) $2\tan^4 x$

(SSC CGL Tier-I (CBE) Exam.11.09.2016) (Ist Sitting)

298. The value of the expression $(1 + \sec 22° + \cot 68°)(1 - \operatorname{cosec} 22° + \tan 68°)$ is

(1) 0 (2) 1

(3) –1 (4) 2

(SSC CGL Tier-II Online Exam.01.12.2016)

299. If $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$ and $x\sin\theta - y\cos\theta = 0$, then the value of $(x^2 + y^2)$ equals

(1) 1 (2) $\frac{1}{2}$

(3) $\frac{3}{2}$ (4) 2

(SSC CGL Tier-II Online Exam.01.12.2016)

300. If $\sec\theta + \tan\theta = m$ (>1), then the value of $\sin\theta$ is $(0° < \theta < 90°)$

(1) $\frac{1-m^2}{1+m^2}$ (2) $\frac{m^2-1}{m^2+1}$

(3) $\frac{m^2+1}{m^2-1}$ (4) $\frac{1+m^2}{1-m^2}$

(SSC CGL Tier-II Online Exam.01.12.2016)

301. If $(a^2 - b^2)\sin\theta + 2ab\cos\theta = a^2 + b^2$, then $\tan\theta = ?$

(1) $\frac{2ab}{a^2-b^2}$ (2) $\frac{a^2-b^2}{2ab}$

(3) $\frac{ab}{a^2-b^2}$ (4) $\frac{a^2-b^2}{ab}$

(SSC CGL Tier-II Online Exam.01.12.2016)

302. If $2y\cos\theta = x\sin\theta$ and $2x\sec\theta - y\operatorname{cosec}\theta = 3$, then the value of $(x^2 + 4y^2)$ is

(1) 1 (2) 2

(3) 3 (4) 4

(SSC CGL Tier-II Online Exam.01.12.2016)

303. The expression of $\frac{\cot\theta + \operatorname{cosec}\theta - 1}{\cot\theta + \operatorname{cosec}\theta + 1}$ is equal to

(1) $\frac{1+\cos\theta}{\sin\theta}$ (2) $\frac{1-\cos\theta}{\sin\theta}$

(3) $\frac{\cot\theta + 1}{\operatorname{cosec}\theta}$ (4) $\frac{\cot\theta - 1}{\operatorname{cosec}\theta}$

(SSC CGL Tier-II Online Exam.01.12.2016)

304. If $\sin\theta = \frac{5}{13}$ and θ is acute, what is the value of $\sqrt{(\cot\theta + \tan\theta)}$?

(1) $\frac{2}{\sqrt{5}}$ (2) $\frac{13}{2\sqrt{15}}$

(3) $\frac{-2}{\sqrt{5}}$

(4) Cannot be determined

(SSC CPO SI, ASI Online Exam.05.06.2016) (IInd Sitting)

305. $\frac{2\sin\theta}{\cos\theta(1 + \tan^2\theta)}$ simplifies to:

(1) $\cos\theta$ (2) $\cos 2\theta$

(3) $\sin 2\theta$ (4) $\sin\theta$

(SSC CPO SI, ASI Online Exam.05.06.2016) (IInd Sitting)

306. If $\tan\theta_1 = 1$, $\sin\theta_2 = \frac{1}{\sqrt{2}}$, then the value of $\sin(\theta_1 + \theta_2)$ equal to

(1) –1 (2) 0

(3) 1 (4) $\frac{1}{2}$

(SSC CPO SI, ASI Online Exam.05.06.2016) (IInd Sitting)

307. Find the value of $\tan\theta(1 + \sec 2\theta)(1 + \sec 4\theta)(1 + \sec 8\theta)$.

(1) $\tan 10\theta$ (2) $\tan 8\theta$

(3) $\tan 12\theta$ (4) 1

(SSC CPO SI, ASI Online Exam.05.06.2016) (IInd Sitting)

308. If $\frac{\sin x}{1 + \cos x} + \frac{\sin x}{1 - \cos x} = 4$; and $0° < x < 90°$, then find the vlaue of x.

(1) 10° (2) 15°

(3) 45° (4) 30°

(SSC CPO Exam. 06.06.2016) (Ist Sitting)

309. The value of $\frac{\sin 65°}{\cos 25°}$ is

(1) 0 (2) 1

(3) 2

(4) Not defined

(SSC CPO Exam. 06.06.2016) (Ist Sitting)

310. If $\sin\theta + \operatorname{cosec}\theta = 2$, the value of $\sin^{100}\theta + \operatorname{cosec}^{100}\theta$ is :

(1) 1 (2) 2

(3) 3 (4) 4

(SSC CPO Exam. 06.06.2016) (Ist Sitting)

311. If $\sin 31° = \frac{x}{y}$ The value of $\sec 31° - \sin 59°$ is

(1) $\frac{x^2}{y\sqrt{y^2-x^2}}$

(2) $-\frac{x^2}{y\sqrt{y^2-x^2}}$

(3) $-\frac{y^2}{\sqrt{y^2-x^2}}$

(4) $-\frac{x^2}{\sqrt{y^2-x^2}}$

(SSC CHSL (10+2) Tier-I (CBE) Exam. 08.09.2016) (Ist Sitting)

312. The value of $(\sec^2 45° - \cot^2 45°) - (\sin^2 30° + \sin^2 60°)$ is

(1) 1 (2) $2\sqrt{3}$

(3) 0 (4) $\frac{1}{\sqrt{2}}$

(SSC CGL Tier-I (CBE) Exam. 09.09.2016) (Ist Sitting)

TRIGONOMETRY

313. The value of the following is :

$$\frac{\sin\theta \cos ec\theta \tan\theta \cot\theta}{\sin^2\theta + \cos^2\theta}$$

(1) 1 (2) tanθ
(3) 0 (4) 2

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 20.03.2016) (IInd Sitting)

314. If $\cos\theta + \sec\theta = \sqrt{3}$, then the value of $(\cos^3\theta + \sec^3\theta)$ is :

(1) 1 (2) $\frac{1}{\sqrt{2}}$
(3) 0 (4) $\sqrt{2}$

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 20.03.2016) (IInd Sitting)

315. If $\alpha + \theta = \frac{7\pi}{12}$ and $\tan\theta = \sqrt{3}$, then the value of tanα is :

(1) $\sqrt{3}$ (2) 1
(3) 0 (4) $\frac{1}{\sqrt{3}}$

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 20.03.2016) (IInd Sitting)

316. ∠Y is the right angle of the trianlge XYZ. If XY = $2\sqrt{6}$ cm and XZ–YZ = 2cm, then the value of (secX + tanX) is :

(1) $\frac{1}{\sqrt{6}}$ (2) $\frac{1}{2\sqrt{3}}$
(3) $2\sqrt{6}$ (4) $\sqrt{6}$

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 20.03.2016) (IInd Sitting)

317. If $\sec\theta + \tan\theta = 2$, then the value of sinθ is :

(1) $\frac{4}{5}$ (2) $\frac{\sqrt{3}}{5}$
(3) $\frac{2}{5}$ (4) $\frac{3}{5}$

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 20.03.2016) (IInd Sitting)

318. Find the value of 8 cos 10° cos 20° cos 40°.

(1) tan80° (2) cot10°
(3) tan80° or cot 10°
(4) None of these

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 05.06.2016) (Ist Sitting)

319. What is the value of $\frac{(\cot\theta + \text{cosec}\,\theta - 1)}{(\cot\theta - \text{cosec}\,\theta + 1)}$?

(1) cot θ + cosec θ
(2) 1
(3) –1 (4) 0

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 05.06.2016) (Ist Sitting)

320. A vertical pole AB is standing at the centre B of a square PQRS. If PR subtends an angle of 90° at the top, A of the pole, then the angle subtended by a side of the square at A is :

(1) 30° (2) 45°
(3) 60°
(4) None of these

321. For how many integral values of 'x', $\sin\phi = \frac{(3x-2)}{4}$, where $0° \le \phi \le 90°$

(1) 2 (2) 3
(3) 0 (4) 1

(SSC CPO SI & ASI, Online Exam. 06.06.2016) (IInd Sitting)

322. Find the value of $\cot\frac{\pi}{32} - \tan\frac{\pi}{32} - 2\tan\frac{\pi}{16}$

(1) $4\cot\frac{\pi}{8}$ (2) 0
(3) $2\cot\frac{\pi}{8}$ (4) $\cot\frac{\pi}{8}$

(SSC CPO SI & ASI, Online Exam. 06.06.2016) (IInd Sitting)

323. If $\sin\theta = a\cos\phi$ and $\cos\theta = b\sin\phi$, then the value of $(a^2-1)\cot^2\phi + (1-b^2)\cot^2\theta$ is equal to :

(1) $\frac{a^2+b^2}{a^2}$ (2) $\frac{a^2+b^2}{b^2}$
(3) $\frac{a^2-b^2}{b^2}$ (4) $\frac{a^2-b^2}{a^2}$

(SSC CPO SI & ASI, Online Exam. 06.06.2016) (IInd Sitting)

324. If $\sec^2\theta + \tan^2\theta = \sqrt{3}$, then the value of $(\sec^4\theta - \tan^4\theta)$ is

(1) $\frac{1}{\sqrt{3}}$ (2) 1
(3) $\sqrt{3}$ (4) 0

(SSC CGL Tier-I (CBE) Exam. 27.08.2016) (Ist Sitting)

325. If $\pi\sin\theta = 1$, $\pi\cos\theta = 1$, then the value of $\left\{\sqrt{3}\tan\left(\frac{2}{3}\theta\right)+1\right\}$ is

(1) 1 (2) $\sqrt{3}$
(3) 2 (4) $\frac{1}{\sqrt{3}}$

(SSC CGL Tier-I (CBE) Exam. 27.08.2016) (Ist Sitting)

326. Find the value of

$$\frac{1}{1+\tan^2\theta} + \frac{1}{1+\cot^2\theta}.$$

(1) $\frac{1}{4}$ (2) 1
(3) $\frac{1}{2}$ (4) 2

(SSC CGL Tier-I (CBE) Exam. 27.08.2016) (IInd Sitting)

327. If $\tan\theta + \frac{1}{\tan\theta} = 2$, then the value of $\tan^2\theta + \frac{1}{\tan^2\theta}$ is equal to :

(1) 6 (2) 4
(3) 2 (4) 3

(SSC CGL Tier-I (CBE) Exam. 27.08.2016) (IInd Sitting)

328. If in a triangle ABC, sin A = cos B, then the value of cos C is

(1) $\frac{\sqrt{3}}{2}$ (2) 0
(3) 1 (4) $\frac{1}{\sqrt{2}}$

(SSC CGL Tier-I (CBE) Exam. 28.08.2016) (IInd Sitting)

329. If $\sin\theta \times \cos\theta = \frac{1}{2}$. The value of $\sin\theta - \cos\theta$ is where $0° < \theta < 90°$

(1) 0 (2) $\sqrt{2}$
(3) 2 (4) 1

(SSC CGL Tier-I (CBE) Exam. 28.08.2016) (IInd Sitting)

330. If $\frac{\cos\theta}{1-\sin\theta} + \frac{\cos\theta}{1+\sin\theta} = 4$, then the value of $\theta(0° < \theta < 90°)$ is

(1) 60° (2) 45°
(3) 30° (4) 35°

(SSC CGL Tier-I (CBE) Exam. 29.08.2016) (IInd Sitting)

331. If $x^2 = \sin^2 30° + 4\cot^2 45° - \sec^2 60°$, then the value of $x\,(x > 0)$ is

(1) $-\frac{1}{2}$ (2) 1
(3) 0 (4) $\frac{1}{2}$

(SSC CGL Tier-I (CBE) Exam. 30.08.2016) (Ist Sitting)

TRIGONOMETRY

332. If $7\sin^2\theta + 3\cos^2\theta = 4$ then the value of $\sec\theta + \operatorname{cosec}\theta$ is

(1) $\frac{2}{\sqrt{3}} - 2$ (2) $\frac{2}{\sqrt{3}} + 2$

(3) $\frac{2}{\sqrt{3}}$ (4) None of these

(SSC CGL Tier-I (CBE) Exam. 30.08.2016) (Ist Sitting)

333. If $\tan\theta + \cot\theta = 5$, then the value of $\tan^2\theta + \cot^2\theta$ is

(1) 22 (2) 25
(3) 23 (4) 27

(SSC CGL Tier-I (CBE) Exam. 31.08.2016) (Ist Sitting)

334. If θ be positive acute angle and $5\cos\theta + 12\sin\theta = 13$, then the value of $\cos\theta$ is

(1) $\frac{12}{13}$ (2) $\frac{5}{13}$

(3) $\frac{5}{12}$ (4) $\frac{1}{5}$

(SSC CGL Tier-I (CBE) Exam. 31.08.2016) (Ist Sitting)

335. If $\tan 45° = \cot\theta$, then the value of θ, in radians is

(1) π (2) $\frac{\pi}{9}$

(3) $\frac{\pi}{2}$ (4) $\frac{\pi}{12}$

(SSC CGL Tier-I (CBE) Exam. 01.09.2016) (Ist Sitting)

336. ABC is a triangle. If $\sin\left(\frac{A+B}{2}\right) = \frac{\sqrt{3}}{2}$, then the value of $\sin\frac{C}{2}$ is

(1) $\frac{1}{\sqrt{2}}$ (2) 0

(3) $\frac{1}{2}$ (4) $\frac{\sqrt{3}}{2}$

(SSC CGL Tier-I (CBE) Exam. 01.09.2016) (Ist Sitting)

337. If $\cos^4\theta - \sin^4\theta = \frac{1}{3}$, then the value of $\tan^2\theta$ is

(1) $\frac{1}{2}$ (2) $\frac{1}{3}$

(3) $\frac{1}{4}$ (4) $\frac{1}{5}$

(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (Ist Sitting)

338. The value of $\tan 80° \tan 10° + \sin^2 70° + \sin^2 20°$ is

(1) 0 (2) 1

(3) 2 (4) $\frac{\sqrt{3}}{2}$

(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (Ist Sitting)

339. Find the value of

$$\left(\frac{\sin 27°}{\cos 63°}\right)^2 + \left(\frac{\cos 63°}{\sin 27°}\right)^2.$$

(1) 0 (2) 2
(3) 3 (4) 1

(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (IInd Sitting)

340. If $\sqrt{2}\tan 2\theta = \sqrt{6}$ and $0° < \theta < 45°$, then the value of $\sin\theta + \sqrt{3}\cos\theta - 2\tan^2\theta$ is

(1) $\frac{2}{3}$ (2) $\frac{4}{3}$

(3) 2 (4) $\frac{8}{3}$

(SSC CGL Tier-I (CBE) Exam. 03.09.2016) (IInd Sitting)

341. If $\tan\alpha = 2$, then the value of $\frac{\sin\alpha}{\sin^3\alpha + \cos^3\alpha}$ is

(1) $\frac{2}{9}$ (2) $\frac{\sqrt{5}}{9}$

(3) $\frac{10}{9}$ (4) $\frac{5\sqrt{5}}{9}$

(SSC CGL Tier-I (CBE) Exam. 03.09.2016) (IInd Sitting)

342. If $\sin\theta + \cos\theta = 1$, then $\sin\theta . \cos\theta$. is equal to

(1) 0 (2) 1

(3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

(SSC CGL Tier-I (CBE) Exam. 04.09.2016) (Ist Sitting)

343. If $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$ then the value of $\sin^4\theta - \cos^4\theta$ is

(1) $\frac{4}{3}$ (2) $\frac{3}{4}$

(3) $\frac{5}{3}$ (4) $\frac{3}{5}$

(SSC CGL Tier-I (CBE) Exam. 04.09.2016) (Ist Sitting)

344. If $\sin C - \sin D = x$, then the value of x is

(1) $2\sin\left[\frac{(C+D)}{2}\right]\cos\left[\frac{(C-D)}{2}\right]$

(2) $2\cos\left[\frac{(C+D)}{2}\right]\cos\left[\frac{(C-D)}{2}\right]$

(3) $2\cos\left[\frac{(C+D)}{2}\right]\sin\left[\frac{(C-D)}{2}\right]$

(4) $2\sin\left[\frac{(C+D)}{2}\right]\sin\left[\frac{(D-C)}{2}\right]$

(SSC CHSL (10+2) Tier-I (CBE) Exam. 16.01.2017) (IInd Sitting)

345. If $\sin A + \sin^2 A = 1$, then what is the value of $\cos^2 A + \cos^4 A$?

(1) 1 (2) 2

(3) $\frac{1}{2}$ (4) $\frac{1}{4}$

(SSC CGL Tier-I (CBE) Exam. 06.09.2016) (Ist Sitting)

346. Which one of the following is true for $0°<\theta<90°$

(1) $\cos\theta > \cos^2\theta$ (2) $\cos\theta < \cos^2\theta$
(3) $\cos\theta \geq \cos^2\theta$ (4) $\cos\theta \leq \cos^2\theta$

(SSC CGL Tier-I (CBE) Exam. 06.09.2016) (Ist Sitting)

347. If $5\sin^2\theta + 4\cos^2\theta = \frac{9}{2}$ and $0 < \theta < \frac{\pi}{2}$ then $\tan\theta$ is equal to

(1) 1 (2) 0

(3) -1 (4) $\frac{1}{4}$

(SSC CGL Tier-I (CBE) Exam. 06.09.2016) (Ist Sitting)

348. The value of $\sec 2\ 17° - \frac{1}{\tan^2 73°} - \sin 17° \sec 73°$ is

(1) 1 (2) 0
(3) -1 (4) 2

(SSC CGL Tier-I (CBE) Exam. 07.09.2016) (Ist Sitting)

349. If $x = a\cos\theta\cos\theta$, $y = a\cos\theta\sin\theta$ and $z = a\sin\theta$, then the value of $(x^2 + y^2 + z^2)$ is

(1) $2a^2$ (2) $4a^2$
(3) $9a^2$ (4) a^2

(SSC CGL Tier-I (CBE) Exam. 07.09.2016) (Ist Sitting)

350. If $\sec 15\theta = \operatorname{cosec} 15\theta$ $(0° < \theta < 10°)$ then value of θ is

(1) 9° (2) 5°
(3) 8° (4) 3°

(SSC CGL Tier-I (CBE) Exam. 30.08.2016) (IInd Sitting)

351. If $\tan\theta = \tan 30° . \tan 60°$ and θ is an acute angle, then 2θ is equal to

(1) 30° (2) 45°
(3) 90° (4) 0°

(SSC CGL Tier-I (CBE) Exam. 30.08.2016) (IInd Sitting)

TRIGONOMETRY

352. The value of $(1 + \tan^2\theta)(1 - \sin^2\theta)$ is
(1) 2 (2) 1
(3) −1 (4) −2
(SSC CGL Tier-I (CBE) Exam. 31.08.2016) (IInd Sitting)

353. If $r\sin\theta = 1$, $r\cos\theta = \sqrt{3}$ then the value of $(r^2\tan\theta)$ is
(1) 4 (2) $\frac{1}{\sqrt{3}}$
(3) $\frac{4}{\sqrt{3}}$ (4) $4\sqrt{3}$
(SSC CGL Tier-I (CBE) Exam. 31.08.2016) (IInd Sitting)

354. If $\sin\theta = \frac{\sqrt{3}}{2}$ and $0° < \theta < 90°$, then the value of $\tan(\theta - 15°)$ is
(1) 1 (2) $\sqrt{3}$
(3) $\frac{1}{\sqrt{3}}$ (4) $\sqrt{2}$
(SSC CGL Tier-I (CBE) Exam. 01.09.2016) (IInd Sitting)

355. If $\frac{\text{cosec}\,\theta + \sin\theta}{\text{cosec}\,\theta - \sin\theta} = \frac{5}{3}$ then the value of $\sin\theta$ is equal to
(1) $\frac{1}{2}$ (2) $\frac{1}{\sqrt{2}}$
(3) $\frac{\sqrt{3}}{2}$ (4) 1
(SSC CGL Tier-I (CBE) Exam. 01.09.2016) (IInd Sitting)

356. If $y = 2\sec\theta$ and $x = 3\tan\theta$ then $\frac{x^2}{9} - \frac{y^2}{4}$ is
(1) 0 (2) −1
(3) 2 (4) 1
(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (IInd Sitting)

357. If $r\sin\theta = \sqrt{3}$ and $r\cos\theta = 1$, rhen values of r and θ are : $(0° \le \theta \le 90°)$
(1) $r = 1$, $\theta = 30°$
(2) $r = \frac{1}{2}$, $\theta = 30°$
(3) $r = \sqrt{3}$, $\theta = 30°$
(4) $r = 2$, $\theta = 60°$
(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (IInd Sitting)

358. If $x\tan 60° + \cos 45° = \sec 45°$ then the value of $(x^2 + 1)$ is
(1) $\frac{6}{7}$ (2) $\frac{7}{6}$
(3) $\frac{5}{6}$ (4) $\frac{6}{5}$
(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

359. x, y be two acute angles, $x + y < 90°$ and $\sin(2x - 20°) = \cos(2y + 20°)$, the value of $\tan(x + y)$ is
(1) $\sqrt{3}$ (2) $\frac{1}{\sqrt{3}}$
(3) 1 (4) $2 + \sqrt{2}$
(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

360. If $a^2\sec^2x - b^2\tan^2x = c^2$ then the value of $(\sec^2x + \tan^2x)$ is equal to (assume $b^2 \ne a^2$)
(1) $\frac{b^2 - a^2 + 2c^2}{b^2 + a^2}$
(2) $\frac{b^2 + a^2 - 2c^2}{b^2 - a^2}$
(3) $\frac{b^2 - a^2 - 2c^2}{b^2 + a^2}$
(4) $\frac{b^2 - a^2}{b^2 + a^2 + 2c^2}$
(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

361. $(1 + \sec 20° + \cot 70°)(1 - \text{cosec}\,20° + \tan 70°)$ is equal to
(1) 0 (2) 1
(3) 2 (4) 3
(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

362. If $\tan^4\theta + \tan^2\theta = 1$ then the value of $\cos^4\theta + \cos^2\theta$ is
(1) 2 (2) 0
(3) 1 (4) −1
(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

363. The value of $8(\sin^6\theta + \cos^6\theta) - 12(\sin^4\theta + \cos^4\theta)$ is equal to
(1) 20 (2) − 20
(3) − 4 (4) 4
(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

364. If $\tan 3\theta \cdot \tan 7\theta = 1$, then the value of $\tan(\theta + 36°)$ is :
(1) $\frac{1}{\sqrt{3}}$ (2) 0
(3) 1 (4) $\sqrt{3}$
(SSC CGL Tier-I (CBE) Exam. 28.08.2016 (Ist Sitting)

365. The value of $\frac{\sin\theta}{1 + \cos\theta} + \frac{\sin\theta}{1 - \cos\theta}$ is :
(1) $2\sin\theta$ (2) $2\cos\theta$
(3) $2\sec\theta$ (4) $2\text{cosec}\,\theta$
(SSC CGL Tier-I (CBE) Exam. 29.08.2016 (Ist Sitting)

366. If $\tan\theta = \frac{8}{15}$, the value of $\frac{\sqrt{1 - \sin\theta}}{\sqrt{1 + \sin\theta}}$ is :
(1) $\frac{1}{5}$ (2) $\frac{2}{5}$
(3) $\frac{3}{5}$ (4) 0
(SSC CGL Tier-I (CBE) Exam. 29.08.2016 (Ist Sitting)

367. The value of $\left(\frac{\sin\theta + \sin\phi}{\cos\theta + \cos\phi} + \frac{\cos\theta - \cos\phi}{\sin\theta - \sin\phi}\right)$ is :
(1) 1 (2) 2
(3) $\frac{1}{2}$ (4) 0
(SSC CGL Tier-I (CBE) Exam. 30.08.2016 (IIIrd Sitting)

368. If $\cot\theta = 4$, then the value of $\frac{5\sin\theta + 3\cos\theta}{5\sin\theta - 3\cos\theta}$ is
(1) $\frac{1}{9}$ (2) $\frac{1}{3}$
(3) 3 (4) 9
(SSC CGL Tier-I (CBE) Exam. 30.08.2016 (IIIrd Sitting)

369. The value of $\cos^2 20° + \cos^2 70°$ is :
(1) $\sqrt{2}$ (2) 2
(3) $\frac{1}{\sqrt{2}}$ (4) 1
(SSC CGL Tier-I (CBE) Exam. 31.08.2016 (IIIrd Sitting)

370. If $\cos A + \cos^2 A = 1$, then the value of $(\sin^2 A + \sin^4 A)$ is :
(1) $\frac{1}{2}$ (2) $\frac{1}{4}$
(3) $\frac{1}{3}$ (4) 1
(SSC CGL Tier-I (CBE) Exam. 31.08.2016 (IIIrd Sitting)

371. If $\sin\theta + \text{cosec}\,\theta = 2$, then the value of $(\sin^{-7}\theta + \text{cosec}^7\theta)$ is
(1) 2^7 (2) 2^{-7}
(3) 2 (4) 2^{-1}
(SSC CGL Tier-I (CBE) Exam. 01.09.2016 (IIIrd Sitting)

372. If $2y\cos\theta = x\sin\theta$ and $2x\sec\theta - y\,\text{cosec}\,\theta = 3$ then what is the value of $(x^2 + 4y^2)$?
(1) 4 (2) 1
(3) 2 (4) 5
(SSC CGL Tier-I (CBE) Exam. 01.09.2016 (IIIrd Sitting)

TRIGONOMETRY

373. If $\sin^2\theta - \cos^2\theta = \frac{1}{4}$, then the value of $(\sin^4\theta - \cos^4\theta)$ is :

(1) $\frac{3}{4}$ (2) $\frac{1}{4}$

(3) $\frac{1}{16}$ (4) $\frac{1}{2}$

(SSC CGL Tier-I (CBE) Exam. 02.09.2016 (IInd Sitting)

374. The value of

$$\frac{\sin^2 63° + \sin^2 27°}{\cos^2 17° + \cos^2 73°}$$ is :

(1) 0 (2) 1

(3) 2 (4) –1

(SSC CGL Tier-I (CBE) Exam. 02.09.2016 (IInd Sitting)

375. The value of $\cos^2 20° + \cos^2 70°$ is :

(1) 0 (2) 1

(3) $\frac{1}{2}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CGL Tier-I (CBE) Exam. 03.09.2016 (IInd Sitting)

376. If $a.\sin 45°. \cos 45°. \tan 60° = \tan^2 45° - \cos 60°$, then find the value of a.

(1) $\frac{1}{\sqrt{3}}$ (2) $\sqrt{3}$

(3) 1 (4) $\frac{\sqrt{3}}{2}$

(SSC CGL Tier-I (CBE) Exam. 03.09.2016 (IIIrd Sitting)

377. If $3\sin\theta + 4\cos\theta = 5$, $(0 < \theta < 90°)$ then the value of $\sin\theta$ is :

(1) $\frac{1}{5}$ (2) $\frac{2}{5}$

(3) $\frac{3}{5}$ (4) $\frac{4}{5}$

(SSC CGL Tier-I (CBE) Exam. 03.09.2016 (IIIrd Sitting)

378. If $\sin x - \cos x = 1$, where 'x' is an acute angle, the value of $(\sin x + \cos x)$ is :

(1) 0 (2) 1

(3) $\frac{1}{2}$ (4) 2

(SSC CGL Tier-I (CBE) Exam. 04.09.2016 (IInd Sitting)

379. If $\sin(3x - 20°) = \cos(3y + 20°)$, then find the value of $(x + y)$.

(1) 90° (2) 60°

(3) 120° (4) 30°

(SSC CGL Tier-I (CBE) Exam. 04.09.2016 (IIIrd Sitting)

380. If $\frac{\cos\alpha}{\cos\beta} = m$ and $\frac{\cos\alpha}{\sin\beta} = n$, then the value of $(m^2 + n^2)\cos^2\beta$ is :

(1) n^2 (2) m^2

(3) mn (4) 1

(SSC CGL Tier-I (CBE) Exam. 04.09.2016 (IIIrd Sitting)

381. The value of $\tan 315° \cot(-405°)$ is equal to

(1) –1 (2) 1

(3) 0 (4) 2

(SSC CGL Tier-I (CBE) Exam. 06.09.2016 (IInd Sitting)

382. If $\tan(\alpha - \beta) = 1$, $\sec(\alpha + \beta) = \frac{2}{\sqrt{3}}$ and α, β are positive, then the smallest value of α is :

(1) $142\frac{1°}{2}$ (2) $187\frac{1°}{2}$

(3) $7\frac{1°}{2}$ (4) $37\frac{1°}{2}$

(SSC CGL Tier-I (CBE) Exam. 06.09.2016 (IInd Sitting)

383. If $\tan\theta + \cot\theta = 2$, then the value of $(\tan^n\theta + \cot^n\theta)$ is :

(1) 2^n (2) $2^{\frac{n}{2}}$

(3) $2^{\frac{1}{2}}$ (4) 2

(SSC CGL Tier-I (CBE) Exam. 06.09.2016 (IIIrd Sitting)

384. If $\cos x = \sin y$ and $\cot(x - 40°) = \tan(50° - y)$, then the values of x and y are :

(1) $x = 70°, y = 20°$

(2) $x = 75°, y = 15°$

(3) $x = 85°, y = 5°$

(4) $x = 80°, y = 10°$

(SSC CGL Tier-I (CBE) Exam. 06.09.2016 (IIIrd Sitting)

385. The value of $\text{cosec}^2 60° + \sec^2 60° - \cot^2 60° + \tan^2 30°$ will be

(1) 5 (2) $5\frac{1}{2}$

(3) $5\frac{1}{3}$ (4) $5\frac{2}{3}$

(SSC CGL Tier-I (CBE) Exam. 07.09.2016 (IInd Sitting)

386. If $\sin\theta + \text{cosec}\theta = 2$, the value of $\sin^n\theta + \text{cosec}^n\theta$ is :

(1) 2^n (2) $2^{\frac{1}{n}}$

(3) 2 (4) 0

(SSC CGL Tier-I (CBE) Exam. 07.09.2016 (IInd Sitting)

387. If $\sin A + \sin^2 A = 1$ then what is the value of $\cos^2 A + \cos^4 A$?

(1) $\frac{1}{2}$ (2) 1

(3) 2 (4) 3

(SSC CGL Tier-I (CBE) Exam. 07.09.2016 (IIIrd Sitting)

388. ABC is a right angled triangle with $\angle A = 90°$. Then the value of $\cos^2 A + \cos^2 B + \cos^2 C$ is :

(1) 2 (2) 1

(3) 0 (4) 3

(SSC CGL Tier-I (CBE) Exam. 07.09.2016 (IIIrd Sitting)

389. If $r\sin\theta = \frac{7}{2}$ and $r\cos\theta = \frac{7\sqrt{3}}{2}$ then the value of θ is :

(1) 30° (2) 45°

(3) 60° (4) 75°

(SSC CGL Tier-I (CBE) Exam. 08.09.2016 (IInd Sitting)

390. If $\tan\theta = 1$, then the value of

$$\frac{8\sin\theta + 5\cos\theta}{\sin^2\theta - 2\cos^2\theta + 7\cos\theta}$$ is :

(1) 1 (2) 3

(3) 2 (4) $\frac{1}{2}$

(SSC CGL Tier-I (CBE) Exam. 08.09.2016 (IInd Sitting)

391. If θ is positive acute angle and $4\sin^2\theta = 3$, then the value of $\left(\tan\theta - \cot\frac{\theta}{2}\right)$ is :

(1) 1 (2) 0

(3) $\sqrt{3}$ (4) $\frac{1}{\sqrt{3}}$

(SSC CGL Tier-I (CBE) Exam. 08.09.2016 (IIIrd Sitting)

392. If $\theta > 0$, be an acute angle, then the value of θ in degrees stisfying $\frac{\cos^2\theta - 3\cos\theta + 2}{\sin^2\theta} = 1$ is

(1) 90° (2) 30°

(3) 45° (4) 60°

(SSC CGL Tier-I (CBE) Exam. 09.09.2016 (IInd Sitting)

393. The value of $\cot 17°$

$$\left(\cot 73° \cos^2 22° + \frac{1}{\cot 17° \sec^2 68°}\right)$$ is

(1) 0 (2) 1

(3) 2 (4) $\sqrt{3}$

(SSC CGL Tier-I (CBE) Exam. 09.09.2016 (IInd Sitting)

TRIGONOMETRY

394. θ is a positive acute angle and sinθ – cosθ = 0, then the value of (secθ + cosecθ) is :
(1) 2 (2) $\sqrt{2}$
(3) $2\sqrt{2}$ (4) $3\sqrt{2}$
(SSC CGL Tier-I (CBE) Exam. 09.09.2016 (IIIrd Sitting)

395. The value of $\frac{2\tan 53^\circ}{\cot 37^\circ} - \frac{\cot 80^\circ}{\tan 10^\circ}$ is :
(1) 3 (2) 2
(3) 1 (4) 0
(SSC CGL Tier-I (CBE) Exam. 09.09.2016 (IIIrd Sitting)

396. The least value of $\tan^2 x + \cot^2 x$ is :
(1) 3 (2) 2
(3) 0 (4) 1
(SSC CGL Tier-I (CBE) Exam. 10.09.2016 (IInd Sitting)

397. If $\cos 21^\circ = \frac{x}{y}$, then (cosec 21° – cos 69°) is equal to
(1) $\frac{x^2}{y\sqrt{y^2 - x^2}}$ (2) $\frac{y^2}{x\sqrt{y^2 - x^2}}$
(3) $\frac{y^2}{x\sqrt{x^2 - y^2}}$ (4) $\frac{x^2}{y\sqrt{x^2 - y^2}}$
(SSC CGL Tier-I (CBE) Exam. 10.09.2016 (IInd Sitting)

298. If α + β = 90° and α : β = 2 : 1, then the ratio of cosα to cosβ is :
(1) 1 : $\sqrt{3}$ (2) 1 : 3
(3) 1 : $\sqrt{2}$ (4) 1 : 2
(SSC CGL Tier-I (CBE) Exam. 10.09.2016 (IIIrd Sitting)

399. If θ is positive acute angle and 7 $\cos^2\theta$ + 3 $\sin^2\theta$ = 4, then the value of θ is :
(1) 60° (2) 30°
(3) 45° (4) 90°
(SSC CGL Tier-I (CBE) Exam. 10.09.2016 (IIIrd Sitting)

400. If $\tan\theta = \frac{4}{3}$, then the value of $\frac{3\sin\theta + 2\cos\theta}{3\sin\theta - 2\cos\theta}$ is
(1) $\frac{1}{2}$ (2) $1\frac{1}{2}$
(3) 3 (4) –3
(SSC CGL Tier-I (CBE) Exam. 11.09.2016 (IInd Sitting)

401. If sec (4x – 50°) = cosec (50° – x), then the value of x is
(1) 45° (2) 90°
(3) 30° (4) 60°
(SSC CGL Tier-I (CBE) Exam. 11.09.2016 (IInd Sitting)

402. The value of (cos 53° – sin 37°) is
(1) 0 (2) 1
(3) 2 sin 37° (4) 2 cos 53°
(SSC CGL Tier-I (CBE) Exam. 11.09.2016 (IIIrd Sitting)

403. If cosecθ + sinθ = $\frac{5}{2}$, then the value of (cosecθ – sinθ) is :
(1) $-\frac{3}{2}$ (2) $\frac{3}{2}$
(3) $-\frac{\sqrt{3}}{2}$ (4) $\frac{\sqrt{3}}{2}$
(SSC CGL Tier-I (CBE) Exam. 11.09.2016 (IIIrd Sitting)

404. If sin (2a + 45°) = cos (30° – a), where 0° < a < 90°, then the value of a is :
(1) 0° (2) 15°
(3) 45° (4) 60°
(SSC CGL Tier-I (CBE) Exam. 27.10.2016 (Ist Sitting)

405. The value of cot 10°. cot 20°. cot 60°. cot 70°. cot 80° is :
(1) 1 (2) –1
(3) $\sqrt{3}$ (4) $\frac{1}{\sqrt{3}}$
(SSC CGL Tier-I (CBE) Exam. 27.10.2016 (Ist Sitting)

406. If 7$\sin^2\theta$ + 3$\cos^2\theta$ = 4, and 0° < θ < 90°, then the value of tan θ is :
(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{\sqrt{3}}$
(3) $\sqrt{\frac{3}{2}}$ (4) 1
(SSC CGL Tier-I (CBE) Exam. 27.10.2016 (Ist Sitting)

407. $\frac{\left(1 + \tan^2 A\right)\cot A}{\text{cosec}^2 A}$ is equal to
(1) cot A (2) tan A
(3) sin A (4) cos A
(SSC CHSL (10+2) Tier-I (CBE) Exam. 15.01.2017) (IInd Sitting)

408. If tan (A – B) = x, then the value of x is
(1) $\frac{(\tan A + \tan B)}{(1 - \tan A \tan B)}$
(2) $\frac{(\tan A + \tan B)}{(1 + \tan A \tan B)}$
(3) $\frac{(\tan A - \tan B)}{(1 - \tan A \tan B)}$
(4) $\frac{(\tan A - \tan B)}{(1 + \tan A \tan B)}$
(SSC CHSL (10+2) Tier-I (CBE) Exam. 15.01.2017) (IInd Sitting)

409. What is the value of sec 330°?
(1) 2 (2) $\frac{-2}{\sqrt{3}}$
(3) –2 (4) $\frac{2}{\sqrt{3}}$
(SSC CHSL (10+2) Tier-I (CBE) Exam. 15.01.2017) (IInd Sitting)

410. If $\frac{1}{(\tan A + \cot A)} = x$, then the value of x is
(1) cosAsinA (2) $\cos^2 A \sin^2 A$
(3) cosecAsecA (4) $\text{cosec}^2 A \sec^2 A$
(SSC CHSL (10+2) Tier-I (CBE) Exam. 16.01.2017) (IInd Sitting)

411. What is the value of $\sin\left(\frac{11\pi}{6}\right)$?
(1) $\frac{2}{\sqrt{3}}$ (2) $\frac{-2}{\sqrt{3}}$
(3) $\frac{-1}{2}$ (4) $\frac{1}{2}$
(SSC CHSL (10+2) Tier-I (CBE) Exam. 16.01.2017) (IInd Sitting)

412. If secA + tanA = a, then the value of cosA is
(1) $\frac{a^2 + 1}{2a}$ (2) $\frac{2a}{a^2 + 1}$
(3) $\frac{a^2 - 1}{2a}$ (4) $\frac{2a}{a^2 - 1}$
(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

413. If sin P + cosec P = 2, then the value of $\sin^7 P + \text{cosec}^7 P$ is
(1) 1 (2) 2
(3) 3 (4) 0
(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

414. If cos$x$. cos$y$ + sin$x$. sin$y$ = –1 then cos$x$ + cos$y$ is
(1) –2 (2) 1
(3) 0 (4) 2
(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

415. The value of the expression 2 ($\sin^6\theta + \cos^6\theta$) –3 ($\sin^4\theta + \cos^4\theta$) + 1 is
(1) –1 (2) 0
(3) 1 (4) 2
(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

416. If $\cos\theta = \frac{x^2 - y^2}{x^2 + y^2}$ then the value of $\cot\theta$ is equal to [If $0 \le \theta \le 90°$]

(1) $\frac{2xy}{x^2 - y^2}$ (2) $\frac{2xy}{x^2 + y^2}$

(3) $\frac{x^2 + y^2}{2xy}$ (4) $\frac{x^2 - y^2}{2xy}$

(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

417. If $x = \text{cosec}\theta - \sin\theta$ and $y = \sec\theta - \cos\theta$, then the relation between x and y is

(1) $x^2 + y^2 + 3 = 1$
(2) $x^2y^2(x^2 + y^2 + 3) = 1$
(3) $x^2(x^2 + y^2 - 5) = 1$
(4) $y^2(x^2 + y^2 - 5) = 1$

(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

TYPE–III

1. If the angle of elevation of the Sun changes from 30° to 45°, the length of the shadow of a pillar decreases by 20 metres. The height of the pillar is

(1) $20(\sqrt{3} - 1)$ m

(2) $20(\sqrt{3} + 1)$ m

(3) $10(\sqrt{3} - 1)$ m

(4) $10(\sqrt{3} + 1)$ m

(SSC CPO (SI, ASI & Intelligence Officer) Exam. 28.08.2011 (Paper-I)

2. One flies a kite with a thread 150 metre long. If the thread of the kite makes an angle of 60° with the horizontal line, then the height of the kite from the ground (assuming the thread to be in a straight line) is

(1) 50 metre (2) $75\sqrt{3}$ metre

(3) $25\sqrt{3}$ metre (4) 80 metre

FCI Assistant Grade-III Exam. 25.02.2012 (Paper-I) North Zone (Ist Sitting)

3. The angle of elevation of the top of a tower from two points A and B lying on the horizontal through the foot of the tower are respectively 15° and 30°. If A and B are on the same side of the tower and AB = 48 metre, then the height of the tower is :

(1) $24\sqrt{3}$ metre (2) 24 metre

(3) $24\sqrt{2}$ metre (4) 96 metre

FCI Assistant Grade-III Exam. 05.02.2012 (Paper-I) East Zone (IInd Sitting)

4. At a point on a horizontal line through the base of a monument, the angle of elevation of the top of the monument is found to be such that its tangent is $\frac{1}{5}$. On walking 138 metres towards the monument the secant of the angle of elevation is found to be $\frac{\sqrt{193}}{12}$. The height of the monument (in metre) is

(1) 35 (2) 49
(3) 42 (4) 56

(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (North Zone)

5. The distance between two pillars of length 16 metres and 9 metres is x metres. If two angles of elevation of their respective top from the bottom of the other are complementary to each other, then the value of x (in metres) is

(1) 15 (2) 16
(3) 12 (4) 9

(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (North Zone)

6. The angle of elevation of the top of a building from the top and bottom of a tree are x and y respectively. If the height of the tree is h metre, then (in metre) the height of the building is

(1) $\frac{h\cot x}{\cot x + \cot y}$

(2) $\frac{h\cot y}{\cot x + \cot y}$

(3) $\frac{h\cot x}{\cot x - \cot y}$

(4) $\frac{h\cot y}{\cot x - \cot y}$

(SSC CHSL DEO & LDC Exam. 04.12.2011 (Ist Sitting (East Zone)

7. The angle of elevation of the top of a tower from a point A on the ground is 30°. On moving a distance of 20 metres towards the foot of the tower to a point B, the angle of elevation increases to 60°. The height of the tower is

(1) $\sqrt{3}$ m (2) $5\sqrt{3}$ m

(3) $10\sqrt{3}$ m (4) $20\sqrt{3}$ m

(SSC CHSL DEO & LDC Exam. 04.12.2011 (IInd Sitting (East Zone)

8. Two poles of equal height are standing opposite to each other on either side of a road which is 100m wide. From a point between them on road, angle of elevation of their tops are 30° and 60°. The height of each pole (in metre) is

(1) $25\sqrt{3}$ (2) $20\sqrt{3}$

(3) $28\sqrt{3}$ (4) $30\sqrt{3}$

(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (Delhi Zone)

9. A telegraph post is bent at a point above the ground due to storm. Its top just meets the ground at a distance of $8\sqrt{3}$ metres from its foot and makes an angle of 30°, then the height of the post is :

(1) 16 metres (2) 23 metres
(3) 24 metres (4) 10 metres

(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (Delhi Zone)

10. The angle of elevation of the top of a building and the top of the chimney on the roof of the building from a point on the ground are x and 45° respectively. The height of building is h metre. Then the height of the chimney, (in metre) is :

(1) $h\cot x + h$ (2) $h\cot x - h$

(3) $h\tan x - h$ (4) $h\tan x + h$

(SSC CHSL DEO & LDC Exam. 11.12.2011 (IInd Sitting (East Zone)

11. Two posts are x metres apart and the height of one is double that of the other. If from the mid-point of the line joining their feet, an observer finds the angular elevations of their tops to be complementary, then the height (in metres) of the shorter post is

(1) $\frac{x}{2\sqrt{2}}$ (2) $\frac{x}{4}$

(3) $x\sqrt{2}$ (4) $\frac{x}{\sqrt{2}}$

(SSC Graduate Level Tier-II Exam. 16.09.2012)

12. An aeroplane when flying at a height of 5000m from the ground passes vertically above another aeroplane at an instant, when the angles of elevation of the two aeroplanes from the same point on the ground are 60° and 45° respectively. The vertical distance between the aeroplanes at that instant is

(1) $5000(\sqrt{3}-1)$ m

(2) $5000(3-\sqrt{3})$ m

(3) $5000\left(1-\frac{1}{\sqrt{3}}\right)$ m

(4) 4500 m

(SSC Graduate Level Tier-II Exam. 16.09.2012)

13. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of 30°. The man walks some distance towards the tower and then his angle of elevation of the top of the tower is 60°. If the height of the tower is 30 m, then the distance he moves is

(1) 22 m (2) $22\sqrt{3}$ m

(3) 20 m (4) $20\sqrt{3}$ m

(SSC CHSL DEO & LDC Exam. 21.10.2012 (Ist Sitting)

14. The distance between two vertical poles is 60 m. The height of one of the poles is double the height of the other. The angle of elevation of the top of the poles from the middle point of the line segment joining their feet are complementary to each other. The height of the poles are :

(1) 10 m and 20 m

(2) 20 m and 40 m

(3) 20.9 m and 41.8 m

(4) $15\sqrt{2}$ m and $30\sqrt{2}$ m

(SSC CHSL DEO & LDC Exam. 21.10.2012 (IInd Sitting)

15. An aeroplane when flying at a height of 3125m from the ground passes vertically below another plane at an instant when the angle of elevation of the two planes from the same point on the ground are 30° and 60° respectively. The distance between the two planes at that instant is

(1) 6520 m (2) 6000 m

(3) 5000 m (4) 6250 m

(SSC CHSL DEO & LDC Exam. 28.10.2012 (Ist Sitting)

16. The shadow of the tower becomes 60 metres longer when the altitude of the sun changes from 45° to 30°. Then the height of the tower is

(1) $20\left(\sqrt{3}+1\right)$ m (2) $24\left(\sqrt{3}+1\right)$ m

(3) $30\left(\sqrt{3}+1\right)$ m (4) $30\left(\sqrt{3}-1\right)$ m

(SSC CHSL DEO & LDC Exam. 28.10.2012 (Ist Sitting)

17. A vertical post 15 ft high is broken at a certain height and its upper part, not completely separated, meets the ground at an angle of 30°. Find the height at which the post is broken.

(1) 10ft (2) 5ft

(3) $15(2-\sqrt{3})$ ft (4) $5\sqrt{3}$ ft

(SSC CHSL DEO & LDC Exam. 04.11.2012 (IInd Sitting)

18. The shadow of a tower is $\sqrt{3}$ times its height. Then the angle of elevation of the top of the tower is

(1) 45° (2) 30°

(3) 60° (4) 90°

(SSC Graduate Level Tier-I Exam. 11.11.2012 (Ist Sitting)

19. A man 6 ft tall casts a shadow 4 ft long, at the same time when a flag pole casts a shadow 50 ft long. The height of the flag pole is

(1) 80 ft (2) 75 ft

(3) 60 ft (4) 70 ft

(SSC Assistant Grade-III Exam. 11.11.2012 (IInd Sitting)

20. The angle of elevation of an aeroplane from a point on the ground is 60°. After 15 seconds flight, the elevation changes to 30°. If the aeroplane is flying at a height of $1500\sqrt{3}$ m, find the speed of the plane

(1) 300 m/sec (2) 200 m/sec

(3) 100 m/sec (4) 150 m/sec

(SSC Delhi Police S.I. (SI) Exam. 19.08.2012)

21. The angle of elevation of the top of a tower from the point P and Q at distance of 'a' and 'b' respectively from the base of the tower and in the same straight line with it are complementary. The height of the tower is

(1) $\sqrt{ab}$ (2) $\frac{a}{b}$

(3) ab (4) a^2b^2

(SSC FCI Assistant Grade-III Main Exam. 07.04.2013)

22. The angle of elevation of a tower from a distance 100 m from its foot is 30°. Height of the tower is :

(1) $\frac{100}{\sqrt{3}}$ m (2) $50\sqrt{3}$ m

(3) $\frac{200}{\sqrt{3}}$ m (4) $100\sqrt{3}$ m

(SSC Graduate Level Tier-I Exam. 21.04.2013, Ist Sitting)

23. A kite is flying at a height of 50 metre. If the length of string is 100 metre then the inclination of string to the horizontal ground in degree measure is

(1) 90 (2) 60

(3) 45 (4) 30

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014 TF No. 999 KP0)

24. If the angle of elevation of a balloon from two consecutive kilometre-stones along a road are 30° and 60° respectively, then the height of the balloon above the ground will be

(1) $\frac{\sqrt{3}}{2}$ km (2) $\frac{1}{2}$ km

(3) $\frac{2}{\sqrt{3}}$ km (4) $3\sqrt{3}$ km

(SSC Graduate Level Tier-I Exam. 19.05.2013)

25. A vertical stick 12 cm long casts a shadow 8 cm long on the ground. At the same time, a tower casts a shadow 40 m long on the ground. The height of the tower is

(1) 72 m (2) 60 m

(3) 65 m (4) 70 m

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

TRIGONOMETRY

26. A tower standing on a horizontal plane subtends a certain angle at a point 160 m apart from the foot of the tower. On advancing 100 m towards it, the tower is found to subtend an angle twice as before. The height of the tower is
(1) 80 m (2) 100 m
(3) 160 m (4) 200 m
(SSC Graduate Level Tier-II Exam. 29.09.2013

27. The angle of elevation of a tower from a distance 50 m from its foot is 30°. The height of the tower is
(1) $50\sqrt{3}$ m (2) $\frac{50}{\sqrt{3}}$ m
(2) $75\sqrt{3}$ m (4) $\frac{75}{\sqrt{3}}$ m
(SSC Graduate Level Tier-II Exam. 29.09.2013

28. The length of the shadow of a vertical tower on level ground increases by 10 metres when the altitude of the sun changes from 45° to 30°. Then the height of the tower is
(1) $5\sqrt{3}$ metre
(2) $10\left(\sqrt{3}+1\right)$ metre
(3) $5\left(\sqrt{3}+1\right)$ metre
(4) $10\sqrt{3}$ metre
(SSC CHSL DEO & LDC Exam. 20.10.2013)

29. The elevation of the top of a tower from a point on the ground is 45°. On travelling 60m from the point towards the tower, the elevation of the top becomes 60°. The height of the tower (in metres) is
(1) 30 (2) $30\left(3-\sqrt{3}\right)$
(3) $30\left(3+\sqrt{3}\right)$ (4) $30\sqrt{3}$
(SSC 1CHSL DEO & LDC Exam. 27.10.2013 IInd Sitting)

30. From two points on the ground lying on a straight line through the foot of a pillar, the two angles of elevation of the top of the pillar are complementary to each other. If the distance of the two points from the foot of the pillar are 9 metres and 16 metres and the two points lie on the same side of the pillar, then the height of the pillar is
(1) 5 m (2) 10 m
(3) 7 m (4) 12 m
(SSC CHSL DEO & LDC Exam. 10.11.2013, IInd Sitting)

31. From a point P on the ground the angle of elevation of the top of a 10 m tall building is 30°. A flag is hoisted at the top of the building and the angle of elevation of the top of the flagstaff from P is 45°. Find the length of the flagstaff. (Take $\sqrt{3}$ = 1.732)
(1) $10\left(\sqrt{3}+2\right)$ m
(2) $10\left(\sqrt{3}+1\right)$ m
(3) $10\sqrt{3}$ m
(4) 7.32 m
(SSC CGL Tier-I Exam. 19.10.2014 (Ist Sitting)

32. The angle of elevation of the top of a vertical tower situated perpendicularly on a plane is observed as 60° from a point P on the same plane. From another point Q, 10m vertically above the point P, the angle of depression of the foot of the tower is 30°. The height of the tower is
(1) 15 m (2) 30 m
(3) 20 m (4) 25 m
(SSC CGL Tier-I Exam. 19.10.2014)

33. From a point 20 m away from the foot of a tower, the angle of elevation of the top of the tower is 30°. The height of the tower is
(1) 10 $\sqrt{3}$ m (2) 20 $\sqrt{3}$ m
(3) $\frac{10}{\sqrt{3}}$ m (4) $\frac{20}{\sqrt{3}}$ m
(SSC CGL Tier-I Exam. 26.10.2014)

34. The angle of elevation of a ladder leaning against a house is 60° and the foot of the ladder is 6.5 metres from the house. The length of the ladder is
(1) $\frac{13}{\sqrt{3}}$ metres (2) 13 metres
(3) 15 metres (4) 3.25 metres
(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014)

35. The angle of elevation of sun changes from 30° to 45°, the length of the shadow of a pole decreases by 4 metres, the height of the pole is
(Assume $\sqrt{3}$ = 1.732)
(1) 1.464 m (2) 9.464 m
(3) 3.648 cm (4) 5.464 m
(SSC CHSL DEO & LDC Exam. 02.11.2014 (IInd Sitting)

36. A vertical pole and a vertical tower are standing on the same level ground. Height of the pole is 10 metres. Fromthe top of the pole the angle of elevation of the top of the tower and angle of depression of the foot of the tower are 60° and 30° respectively. The height of the tower is
(1) 20 m (2) 30 m
(3) 40 m (4) 50 m
(SSC CHSL DEO & LDC Exam. 9.11.2014)

37. The length of the shadow of a vertical tower on level ground increases by 10 metres when the altitude of the sun changes from 45° to 30°. Then the height of the tower is
(1) 5 ($\sqrt{3}$ + 1) metres
(2) 5 ($\sqrt{3}$ – 1) metres
(3) $5\sqrt{3}$ metres
(4) $\frac{5}{\sqrt{3}}$ metres
(SSC CHSL DEO & LDC Exam. 9.11.2014)

38. If a pole of 12 m height casts a shadow of $4\sqrt{3}$ m long on the ground, then the sun's angle of elevation at that instant is
(1) 30° (2) 60°
(3) 45° (4) 90° 16 cm is
(SSC CHSL DEO & LDC Exam. 16.11.2014)

39. The angle of elevation of the top of a tower from a point on the ground is 30° and moving 70 metres towards the tower it becomes 60°. The height of the tower is
(1) 10 metre (2) $\frac{10}{\sqrt{3}}$ metre
(3) $10\sqrt{3}$ metre (4) $35\sqrt{3}$ metre
(SSC CHSL DEO Exam. 16.11.2014 (Ist Sitting)

40. The shadow of a tower standing on a level plane is found to be 30 metre longer when the Sun's altitude changes from 60° to 45°. The height of the tower is

(1) $15(3+\sqrt{3})$ metre

(2) $15(\sqrt{3}+1)$ metre

(3) $15(\sqrt{3}-1)$ metre

(4) $15(3-\sqrt{3})$ metre

(SSC CGL Tier-I Exam. 19.10.2014 TF No. 022 MH 3)

41. The angle of elevation of the top of a tower of height $100\sqrt{3}$ metre from a point at a distance of 100 metre from the foot of the tower on a horizontal plane is

(1) 45° (2) 60°

(3) 30° (4) $22\frac{1}{2}°$

(SSC CHSL (10+2) DEO & LDC Exam. 16.11.2014 , Ist Sitting TF No. 333 LO 2)

42. The shadow of a tower standing on a level plane is found to be 40m longer when the sun's altitude is 45°, than when it is 60°. The height of the tower is

(1) $30\left(3+\sqrt{3}\right)$ metre

(2) $40\left(3+\sqrt{3}\right)$ metre

(3) $20\left(3+\sqrt{3}\right)$ metre

(4) $10\left(3+\sqrt{3}\right)$ metre

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 (Ist Sitting) TF No. 8037731)

43. From two points on the ground and lying on a straight line through the foot of a pillar, the two angles of elevation of the top of the pillar are complementary to each other. If the distances of the two points from the foot of the pillar are 12 metres and 27 metres and the two points lie on the same side of the pillar, then the height (in metres) of the pillar is

(1) 12 (2) 18

(3) 15 (4) 16

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 (Ist Sitting) TF No. 8037731)

44. If the height of a pole is $2\sqrt{3}$ metre and the length of its shadow is 2 metre, then the angle of elevation of the sun is

(1) 90° (2) 45°

(3) 30° (4) 60°

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 IInd Sitting)

45. A 10 metre long ladder is placed against a wall. It is inclined at an angle of 30° to the ground. The distance (in m) of the foot of the ladder from the wall is (Given $\sqrt{3}$ = 1.732)

(1) 8.16 (2) 7.32

(3) 8.26 (4) 8.66

(SSC CGL Tier-I Exam, 09.08.2015 (Ist Sitting) TF No. 1443088)

46. The angle of elevation of a tower from a distance of 100 metre from its foot is 30°. Then the height of the tower is

(1) $50\sqrt{3}$ metre (2) $100\sqrt{3}$ metre

(3) $\frac{50}{\sqrt{3}}$ metre (4) $\frac{100}{\sqrt{3}}$ metre

(SSC CGL Tier-I Exam, 09.08.2015 (IInd Sitting) TF No. 4239378)

47. A kite is flying at the height of 75m from the ground. The string makes an angle θ (where $\cot\theta = \frac{8}{15}$) with the level ground. Assuming that there is no slack in the string the length of the string is equal to :

(1) 85 metre (2) 65 metre

(3) 75 metre (4) 40 metre

(SSC CGL Tier-I Exam, 16.08.2015 (Ist Sitting) TF No. 3196279)

48. Two towers A and B have lengths 45m and 15m respectively. The angle of elevation from the bottom of the tower B to the top of the tower A is 60°. If the angle of elevation from the bottom of tower A to the top of the tower B is θ then value of sinθ is :

(1) $\frac{1}{\sqrt{2}}$ (2) $\frac{1}{2}$

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{2}{\sqrt{3}}$

(SSC CGL Tier-I Exam, 16.08.2015 (IInd Sitting) TF No. 2176783)

49. If a 48 m tall building has a shadow of $48\sqrt{3}$ m., then the angle of elevation of the sun is

(1) 15° (2) 60°

(3) 45° (4) 30°

(SSC CGL Tier-I Re-Exam, 30.08.2015)

50. A telegraph post is bent at a point above the ground due to starm. Its top just touches the ground at a distance of $10\sqrt{3}$ metre from its foot and makes an angle of 30° with the horizontal. Then height (in metres) of the telegraph post is

(1) 30 (2) 24

(3) 20 (4) 25

(SSC CGL Tier-II Exam, 25.10.2015, TF No. 1099685)

51. TF is a tower with F on the ground. The angle of elevation of T from A is $x°$ such that $\tan x° = \frac{2}{5}$ and AF = 200m. The angle of elevation of T from a nearer point B is $y°$ with BF = 80m. The value of $y°$ is

(1) 60° (2) 30°

(3) 75° (4) 45°

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 01.11.2015, IInd Sitting)

52. If the angle of elevation of the sun changes from 45° to 60°, then the length of the shadow of a pillar decreases by 10 m. The height of the pillar is :

(1) $5\left(3-\sqrt{3}\right)$ metre

(2) $5\left(\sqrt{3}+1\right)$ metre

(3) $15\left(\sqrt{3}+1\right)$ metre

(4) $5\left(3+\sqrt{3}\right)$ metre

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (Ist Sitting) TF No. 6636838)

53. The ratio of the length of a rod and its shadow is $1 : \sqrt{3}$. The angle of elevation of the sun is :

(1) 90° (2) 30°

(3) 45° (4) 60°

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (Ist Sitting) TF No. 6636838)

54. A tower is 50 metre high. Its shadow is x metres shorter when the sun's altitude is 45° than when it is 30°. The value of x in metre is :

(1) $50\sqrt{3}$ (2) $50(\sqrt{3}-1)$

(3) $50(\sqrt{3}+1)$ (4) 50

(SSC CHSL (10+2) Tier-I (CBE) Exam. 08.09.2016) (Ist Sitting)

55. The angle of elevation of an aeroplane from a point on the ground is 45°. After flying for 15 seconds, the elevation changes to 30°. If the aeroplane is flying at a height of 2500 metres, then the speed of the aeroplane in km/hr. is

(1) 600 (2) $600(\sqrt{3}+1)$

(3) $600\sqrt{3}$ (4) $600(\sqrt{3}-1)$

(SSC CGL Tier-I (CBE) Exam.11.09.2016) (Ist Sitting)

56. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag staff of height h. At a point on the plane, the angle of elevation of the bottom of the flag staff is α and that of the top of the flag staff is β. Then the height of the tower is

(1) $h\tan\alpha$

(2) $\dfrac{h\tan\alpha}{\tan\beta-\tan\alpha}$

(3) $\dfrac{h\tan\alpha}{\tan\alpha-\tan\beta}$

(4) None of these

(SSC CGL Tier-II Online Exam.01.12.2016)

57. A person observes that the angle of elevation at the top of a pole of height 5 metre is 30°. Then the distance of the person from the pole is :

(1) $5\sqrt{3}$ metre (2) $\dfrac{5}{\sqrt{3}}$ metre

(3) $\sqrt{3}$ metre (4) $10\sqrt{3}$ metre

(SSC CPO Exam. 06.06.2016) (Ist Sitting)

58. The angle of elevation of a ladder leaning against a wall is 60° and the foot of the ladder is 4.6 metre away from the wall. The length of the ladder is

(1) 2.3 metre (2) 4.6 metre

(3) 9.2 metre (4) 7.8 metre

(SSC CGL Tier-I (CBE) Exam. 09.09.2016) (Ist Sitting)

59. A ladder is placed along a wall such that its upper end is touching the top of the wall. The foot of the ladder is 10 ft away from the wall and the ladder is making an angle of 60° with the ground. When a man starts climbing on it, it slips and now ladder makes an angle of 30° with ground. How much did the ladder slip from the top of the wall?

(1) 12 ft (2) 20 ft

(3) 7.32 ft (4) 18 ft

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 05.06.2016) (Ist Sitting)

60. The angle of elevation of the sun when the length of the shadow of a pole is equal to its height is :

(1) 30° (2) 45°

(3) 60° (4) 90°

(SSC CPO SI & ASI, Online Exam. 06.06.2016) (IInd Sitting)

61. The angles of elevation of top and bottom of a flag kept on a flagpost from 30 metres distance, are 45° and 30° respectively. Height of the flat is [taking $\sqrt{3}$ = 1.732]

(1) $12\sqrt{3}$ metre (2) 15 metre

(3) 14.32 metre (4) 12.68 metre

(SSC CGL Tier-I (CBE) Exam. 27.08.2016) (Ist Sitting)

62. From 40m away from the foot of a tower, the angle of elevation of the top of the tower is 60°. What is the height of the tower?

(1) $\dfrac{120}{\sqrt{3}}$ m. (2) $\dfrac{60}{\sqrt{3}}$ m.

(3) $\dfrac{50}{\sqrt{3}}$ m. (4) $\dfrac{130}{\sqrt{7}}$ m.

(SSC CGL Tier-I (CBE) Exam. 27.08.2016) (IInd Sitting)

63. A man standing on the bank of river observes that the angle subtended by a tree on the opposite bank is 60°. When he retires 36 m from the bank, he finds that the angle is 30°. The breadth of the river is

(1) 15 metre (2) 18 metre

(3) 16 metre (4) 11 metre

(SSC CGL Tier-I (CBE) Exam. 28.08.2016) (IInd Sitting)

64. Two ships are sailing in the sea on the two sides of a light house. The angles of elevation of the top of the light house as observed from the two ships are 30° and 45° respectively. If the light house is 100m high, the distance between the two ships is : (take $\sqrt{3}=1.73$)

(1) 173 metre (2) 200 metre

(3) 273 metre (4) 300 metre

(SSC CGL Tier-I (CBE) Exam. 29.08.2016) (IInd Sitting)

65. An observer on the top of a mountain, 500 m above the sea level, observes the angles of depression of the two boats in his same place of vision to be 45° and 30° respectively. Then the distance between the boats, if the boats are on the same side of the mountain, is

(1) 456 m (2) 584 m

(3) 366 m (4) 699 m

(SSC CGL Tier-I (CBE) Exam. 30.08.2016) (Ist Sitting)

66. The angle of elevation of the top of a pillar from the foot and the top of a building 20 m high, are 60° and 30° respectively. The height of the pillar is

(1) 10 m (2) $10\sqrt{3}$

(3) 60 m (4) 30 m

(SSC CGL Tier-I (CBE) Exam. 31.08.2016) (Ist Sitting)

67. The angles of elevation of the top of a temple, from the foot and the top of a building 30 m high, are 60° and 30° respectively. Then, the height of the temple is

(1) 50 metre (2) 43 metre

(3) 40 metre (4) 45 metre

(SSC CGL Tier-I (CBE) Exam. 01.09.2016) (Ist Sitting)

68. The height of a tower is $50\sqrt{3}$ metre. The angle of elevation of a tower from a distance 50 metre from its foot is

(1) 30° (2) 45°

(3) 60° (4) 90°

(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (Ist Sitting)

69. The respective ratio between the height of tower and the point at some distance from its foot is $5\sqrt{3}:5$. What will be the angle of elevation of the top of the tower?

(1) 30° (2) 60°

(3) 90° (4) 45°

(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (IInd Sitting)

70. The thread of a kite makes angle 60° with the horizontal plane. If the length of the thread be 80 m, then the vertical height of the kite will be

(1) $\frac{40}{\sqrt{3}}$ metre (2) $80\sqrt{3}$ metre

(3) 80 metre (4) $40\sqrt{3}$ metre

(SSC CGL Tier-I (CBE) Exam. 03.09.2016) (IInd Sitting)

71. The angle of elevation of the top of a tower from a point A on the ground is 30°. On moving a distance of 20 metres towards the foot of the tower to a point B, the angle of elevation increases to 60°. The height of the tower in metres is

(1) $\sqrt{3}$ (2) $5\sqrt{3}$

(3) $10\sqrt{3}$ (4) $20\sqrt{3}$

(SSC CGL Tier-I (CBE) Exam. 04.09.2016) (Ist Sitting)

72. A 1.6 m tall observer is 45 metres away from a tower. The angle of elevation from his eye to the top of the tower is 30°, then the height of the tower in metres is (Take $\sqrt{3}$ = 1.732)

(1) 25.98 (2) 26.58

(3) 27.58 (4) 27.98

(SSC CGL Tier-I (CBE) Exam. 07.09.2016) (Ist Sitting)

73. A straight tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle of 30° with the ground. The distance from the foot of the tree to the point, where the top touches the ground is 10 m. Find the total height of the tree?

(1) $10\sqrt{3}$ metre

(2) $\frac{10\sqrt{3}}{3}$ metre

(3) $10\left(\sqrt{3}+1\right)$ metre

(4) $10\left(\sqrt{3}-1\right)$ metre

(SSC CGL Tier-I (CBE) Exam. 30.08.2016) (IInd Sitting)

74. The top of a broken tree touches the ground at a distance of 15 metre from its base. If the tree is broken at a height of 8 metre from the ground, then the actual height of the tree is

(1) 17 metre (2) 20 metre

(3) 25 metre (4) 30 metre

(SSC CGL Tier-I (CBE) Exam. 31.08.2016) (IInd Sitting)

75. From two points, lying on the same horizontal line, the angles of elevation of the top of the pillar are θ and ϕ ($\theta < \phi$). If the height of the pillar is 'h' m and the two points lie on the same sides of the piller, then the distance between the two points is

(1) $h(\tan\theta - \tan\phi)$ metre

(2) $h(\cot\phi - \cot\theta)$ metre

(3) $h(\cot\theta - \cot\phi)$ metre

(4) $h\frac{\tan\theta\tan\phi}{\tan\phi - \tan\theta}$ metre

(SSC CGL Tier-I (CBE) Exam. 31.08.2016) (IInd Sitting)

76. The angle of elevation of the top of a tower from two horizontal points (in opposite sides) at distances of 25 metre and 64 metre from the base of tower are x and $90° - x$ respectively. The height of the tower will be

(1) 39 metre (2) 89 metre

(3) 1.6 metre (4) 40 metre

(SSC CGL Tier-I (CBE) Exam. 01.09.2016) (IInd Sitting)

77. If the length of the shadow of a vertical pole be $\sqrt{3}$ times the height of the pole, the angle of elevation of the sun is :

(1) 60° (2) 45°

(3) 30° (4) 90°

(SSC CGL Tier-I (CBE) Exam. 02.09.2016) (IInd Sitting)

78. An aeroplane flying horizontally at a height of 3 km. above the ground is observed at a certain point on earth to subtend an angle of 60°. After 15 seconds of flight, its angle of elevation is changed to 30°. The speed of the aeroplane (Take, $\sqrt{3}$ = 1.732) is

(1) 230.63 m./sec.

(2) 230.93 m./sec.

(3) 235.85 m./sec.

(4) 236.25 m./sec.

(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

79. If the angle of elevation of the sun decreases from 45° to 30°, then the length of the shadow of a pillar increases by 60m. The height of the pillar is

(1) $60\left(\sqrt{3}+1\right)$ metre

(2) $30\left(\sqrt{3}-1\right)$ metre

(3) $30\left(\sqrt{3}+1\right)$ metre

(4) $60\left(\sqrt{3}-1\right)$ metre

(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

80. The angle of elevation of the top of a tower, vertically erected in the middle of a paddy field, from two points on a horizontal line through the foot of the tower are given to be α and β ($\alpha > \beta$). The height of the tower is h unit. A possible distance (in the same unit) between the points is

(1) $\frac{h(\cot\beta - \cot\alpha)}{\cos(\alpha+\beta)}$

(2) $h(\cot\alpha - \cot\beta)$

(3) $\frac{h(\tan\beta - \tan\alpha)}{\tan\alpha\tan\beta}$

(4) $h(\cot\alpha + \cot\beta)$

(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

81. The angle of elevation of the top of an unfinished pillar at a point 150 metres from its base is 30°. The height (in metres) that the pillar must be raised so that its angle of elevation at the same point may be 45°, is (Take, $\sqrt{3}$ = 1.732)

(1) 63.4 (2) 86.6

(3) 126.8 (4) 173.2

(SSC CGL Tier-II (CBE) Exam. 30.11.2016)

82. If the angle of elevation of a cloud from a point 200m above a lake is 30° and the angle of depression of its reflection in the lake is 60°. Then the height of the cloud above the lake is :

(1) 100 m (2) 200 m

(3) 300 m (4) 400 m

(SSC CGL Tier-I (CBE) Exam. 28.08.2016 (Ist Sitting)

TRIGONOMETRY

83. At 129 metre away from the foot of a cliff on level of ground, the angle of elevation of the top of the cliff is 30°. The height of this cliff is :

(1) $50\sqrt{3}$ metre

(2) $45\sqrt{3}$ metre

(3) $43\sqrt{3}$ metre

(4) $47\sqrt{3}$ metre

(SSC CGL Tier-I (CBE) Exam. 29.08.2016 (Ist Sitting)

84. Find the angular elevation of the Sun when the shadow of a 15 metre long pole is $\frac{15}{\sqrt{3}}$ metre.

(1) 45° (2) 60°
(3) 30° (4) 90°

(SSC CGL Tier-I (CBE) Exam. 01.09.2016 (IIIrd Sitting)

85. If the angle of elevation of the top of a pillar from the ground level is raised from 30° to 60°, the length of the shadow of a pillar of height $50\sqrt{3}$ will be decreased by

(1) 60 metre (2) 75 metre
(3) 100 metre (4) 50 metre

(SSC CGL Tier-I (CBE) Exam. 02.09.2016 (IInd Sitting)

86. From a point P on a level ground, the angle of elevation to the top of the tower is 30°. If the tower is 100 metre high, the distance of point P from the foot of the tower is

$(\text{Take } \sqrt{3} = 1.73)$

(1) 149 metre (2) 156 metre
(3) 173 metre (4) 188 metre

(SSC CGL Tier-I (CBE) Exam. 03.09.2016 (IInd Sitting)

87. Two men standing on same side of a pillar 75 metre high, observe the angles of elevation of the top of the pillar to be 30° and 60° respectively. The distance between two men is :

(1) $100\sqrt{3}$ metre

(2) 100 metre

(3) $50\sqrt{3}$ metre

(4) $25\sqrt{3}$ metre

(SSC CGL Tier-I (CBE) Exam. 03.09.2016 (IIIrd Sitting)

88. The angles of elevation of an aeroplane flying vertically above the ground, as observed from the two consecutive stones, 1 km apart; are 45° and 60° aeroplane from the ground is :

(1) $\left(\sqrt{3}+1\right)$ km.

(2) $\left(\sqrt{3}+3\right)$ km.

(3) $\frac{1}{2}\left(\sqrt{3}+1\right)$ km.

(4) $\frac{1}{2}\left(\sqrt{3}+3\right)$ km.

(SSC CGL Tier-I (CBE) Exam. 04.09.2016 (IInd Sitting)

89. On a ground, there is a vertical tower with a flagpole on its top. At a point 9 metre away from the foot of the tower, the angles of elevation of the top and bottom of the flagpole are 60° and 30° respectively. The height of the flagpole is :

(1) $5\sqrt{3}$ metre (2) $6\sqrt{3}$ metre
(3) $6\sqrt{2}$ metre (4) $6\sqrt{5}$ metre

(SSC CGL Tier-I (CBE) Exam. 04.09.2016 (IIIrd Sitting)

90. If the elevation of the Sun changes from 30° to 60°, then the difference between the lengths of shadows of a pole 15 metre high, is

(1) 7.5 metre (2) 15 metre
(3) $10\sqrt{3}$ metre (4) $5\sqrt{3}$ metre

(SSC CGL Tier-I (CBE) Exam. 06.09.2016 (IInd Sitting)

91. Two persons are on either side of a temple, 75 m high, observe the angle of elevation of the top of the temple to be 30° and 60° respectively. The distance between the persons is :

(1) 173.2 metre (2) 100 metre
(3) 157.7 metre (4) 273.2 metre

(SSC CGL Tier-I (CBE) Exam. 07.09.2016 (IInd Sitting)

92. From the top of a 20 metre high building, the angle of elevation of the top of a tower is 60° and the angle of depression of its foot is at 45°, then the height of the tower is

$(\sqrt{3} = 1.732)$

(1) 45.46 metre (2) 45.64 metre
(3) 54.64 metre (4) 54.46 metre

(SSC CGL Tier-I (CBE) Exam. 07.09.2016 (IIIrd Sitting)

93. The length of shadow of a tower is $\sqrt{3}$ times that of its length. The angle of elevation of the sun is :

(1) 45° (2) 30°
(3) 60° (4) None

(SSC CGL Tier-I (CBE) Exam. 08.09.2016 (IInd Sitting)

94. The upper part of a tree broken at a certain height makes an angle of 60° with the ground at a distance of 10 metre from its foot. The original height of the tree was

(1) $20\sqrt{3}$ metre

(2) $10\sqrt{3}$ metre

(3) $10\left(2+\sqrt{3}\right)$ metre

(4) $10\left(2-\sqrt{3}\right)$ metre

(SSC CGL Tier-I (CBE) Exam. 09.09.2016 (IInd Sitting)

95. A telegraph post is bent at a point above the ground. Its top just touches the ground at a distance of $8\sqrt{3}$ metre from its foot and makes an angle of 30° with the horizontal. The height (in metre) of the post is :

(1) 12 (2) 16
(3) 18 (4) 24

(SSC CGL Tier-I (CBE) Exam. 10.09.2016 (IInd Sitting)

96. The angles of elevation of the top of a tower from two points at a distance of 4 m and 9 m from the base of the tower and in the same straight line with it are complementary. The height of the tower is :

(1) 4 metre (2) 7 metre
(3) 9 metre (4) 6 metre

(SSC CGL Tier-I (CBE) Exam. 10.09.2016 (IIIrd Sitting)

97. The shadow of a tower when the angle of elevation of the sun is 45°, is found to be 10 metre longer than when it was 60°. The height of the tower is

(1) $5\left(\sqrt{3}-1\right)$ metre

(2) $5\left(3+\sqrt{3}\right)$ metre

(3) $10\left(\sqrt{3}-1\right)$ metre

(4) $10\left(\sqrt{3}+1\right)$ metre

(SSC CGL Tier-I (CBE) Exam. 11.09.2016 (IInd Sitting)

98. Two men are on opposite sides of a tower. They measure the angles of elevation of the top of the tower as 30° and 45° respectively. If the height of the tower is 50 metre, the distance between the two men is (Take $\sqrt{3}$ = 1.73)

(1) 136.5 metre

(2) $50\sqrt{3}$ metre

(3) $100\sqrt{3}$ metre

(4) 135.5 metre

(SSC CGL Tier-I (CBE) Exam. 11.09.2016 (IIIrd Sitting)

99. The shadow of a vertical tower on ground level increases by 10 metre when the altitude of the sun changes form 45° to 30°. The height of the tower is :

(1) $5(\sqrt{3}+1)$ metre

(2) $10(\sqrt{3}-1)$ metre

(3) 9 metre

(4) 13 metre

(SSC CGL Tier-I (CBE) Exam. 27.10.2016 (Ist Sitting)

100. A man standing on the bank of a river observes that the angle of elevation of the top of a tree just on the opposite bank is 60°. But angle of elevation is 30° from a point which is at a distance $20\sqrt{3}$ ft away from the bank. Then the height of the tree is :

(1) 60 ft (2) 45 ft

(3) 30 ft (4) 15 ft

(SSC CGL Tier-I (CBE) Exam. 27.10.2016 (Ist Sitting)

101. The distance between two pillars is 120 metres. The height of one pillar is thrice the other. The angles of elevation of their tops from the mid point of the line connecting their feet are complementary to each other. The height (in metres) of the taller pillar is

(Use : $\sqrt{3}$ = 1.732)

(1) 34.64 (2) 51.96

(3) 69.28 (4) 103.92

(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

102. A hydrogen filled balloon ascending at the rate of 18 kmph was drifted by wind. Its angle of elevation at 10th and 15th minutes were found to be 60° and 45° respectively. The wind speed (in whole numbers) during the last five minutes, approximately, is equal to

(1) 7 km./hr. (2) 11 km./hr.

(3) 26 km./hr. (4) 33 km./hr.

(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

TYPE–IV

1. There are two vertical posts, one on each side of a road, just opposite to each other. One post is108 metre high. From the top of this post, the angle of depression of the top and foot of the other post are 30° and 60° respectively. The height of the other post (in metre) is

(1) 36 (2) 72

(3) 108 (4) 110

(SSC CHSL DEO & LDC Exam. 11.12.2011 (Ist Sitting (East Zone)

2. There are two temples, one on each bank of a river, just opposite to each other. One temple is 54m high. From the top of this temple, the angles of depression of the top and the foot of the other temple are 30° and 60° respectively. The length of the temple is :

(1) 18 m (2) 36 m

(3) $36\sqrt{3}$ m (4) $18\sqrt{3}$ m

(SSC & LDC Exam. 21.10.2012 (IInd Sitting)

3. The top of two poles of height 24 m and 36 m are connected by a wire. If the wire makes an angle of 60° with the horizontal, then the length of the wire is

(1) 6 m (2) $8\sqrt{3}$ m

(3) 8 m (4) $6\sqrt{3}$ m

(SSC Graduate Level Tier-I Exam. 19.05.2013 Ist Sitting)

4. From the top of a hill 200 m high, the angle of depression of the top and the bottom of a tower are observed to be 30° and 60°. The height of the tower is (in m) :

(1) $\frac{400\sqrt{3}}{3}$ (2) $166\frac{2}{3}$

(3) $133\frac{1}{3}$ (4) $200\sqrt{3}$

(SSC CAPFs SI & CISF ASI Exam. 23.06.2013)

5. From a tower 125 metres high, the angle of depression of two objects, which are in horizontal line through the base of the tower, are 45° and 30° and they are on the same side of the tower. The distance (in metres) between the objects is

(1) $125\sqrt{3}$

(2) $125(\sqrt{3}-1)$

(3) $125/(\sqrt{3}-1)$

(4) $125(\sqrt{3}+1)$

(SSC CHSL DEO & LDC Exam. 10.11.2013, Ist Sitting)

6. From the top of a tower of height 180 m the angles of depression of two objects on either sides of the tower are 30° and 45°. Then the distance between the objects are

(1) $180\left(3+\sqrt{3}\right)$m

(2) $180\left(3-\sqrt{3}\right)$ m

(3) $180\left(\sqrt{3}-1\right)$ m

(4) $180\left(\sqrt{3}+1\right)$ m

(SSC CGL Tier-II Exam. 21.09.2014)

7. From the peak of a hill which is 300 m high, the angle of depression of two sides of a bridge lying on a ground are 45° and 30° (both ends of the bridge are on the same side of the hill). Then the length of the bridge is

(1) $300(\sqrt{3}-1)$ m

(2) $300(\sqrt{3}+1)$ m

(3) $300\sqrt{3}$ m

(4) $\frac{300}{\sqrt{3}}$ m

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014

8. From an aeroplane just over a river, the angle of depression of two palm trees on the opposite bank of the river are found to be 60° and 30° respectively. If the breadth of the river is 400 metres, then the height of the aeroplane above the river at that instant is

(Assume $\sqrt{3}$ = 1.732)

(1) 173.2 metres

(2) 346.4 metres

(3) 519.6 metres

(4) 692.8 metres

(SSC CHSL DEO & LDC Exam. 02.11.2014 (IInd Sitting)

9. From the top of a light-house at a height 20 metres above sea-level, the angle of depression of a ship is 30°. The distance of the ship from the foot of the light house is

(1) 20 m (2) $20\sqrt{3}$ m

(3) 30 m (4) $30\sqrt{3}$ m

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam. 22.06.2014 TF No. 999 KP0)

TRIGONOMETRY

10. From an aeroplane just over a straight road, the angles of depression of two consecutive kilometre stones situated at opposite sides of the aeroplane were found to be 60° and 30° respectively. The height (in km) of the aeroplane from the road at that instant, is

(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{\sqrt{3}}{3}$

(3) $\frac{\sqrt{3}}{4}$ (4) $\sqrt{3}$

(SSC CGL Tier-II Exam, 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

11. From an aeroplane just over a straight road, the angles of depression of two consecutive kilometre stones situated at opposite sides of the aeroplane were found to be 60° and 30° respectively. The height (in km) of the aeroplane from the road at that instant was

(Given $\sqrt{3}$ = 1.732)

(1) 0.433 (2) 8.66

(3) 4.33 (4) 0.866

(SSC CGL Tier-I Re-Exam, 30.08.2015)

12. THe angle of depression of a point situated at a distance of 70 m from the base of a tower is 60°. The height of the tower is :

(1) $35\sqrt{3}$ m (2) $70\sqrt{3}$ m

(3) $\frac{70\sqrt{3}}{3}$ m (4) 70 m

(SSC CHSL (10+2) LDC, DEO & PA/SA Exam, 15.11.2015 (Ist Sitting) TF No. 6636838)

13. A pilot in an aeroplane at an altitude of 200 metre observes two points lying on either side of a river. If the angles of depression of the two points be 45° and 60°, then the width of the river is

(1) $\left(200+\frac{200}{\sqrt{3}}\right)$ metre

(2) $\left(200-\frac{200}{\sqrt{3}}\right)$ metre

(3) $400\sqrt{3}$ metre

(4) $\left(\frac{400}{\sqrt{3}}\right)$ metre

(SSC CGL Tier-I (CBE) Exam.10.09.2016)

14. A person from the top of a hill observes a vehicle moving towards him at a uniform speed. It takes 10 minutes for the angle of depression to change from 45° to 60°. After this the time required by the vehicle to reach the bottom of the hill is

(1) 12 minutes 20 seconds

(2) 13 minutes

(3) 13 minutes 40 seconds

(4) 14 minutes 24 seconds

(SSC CGL Tier-II Online Exam.01.12.2016)

15. From the top of a cliff 100 metre high, the angles of depression of the top and bottom of a tower are 45° and 60° respectively. The height of the tower is

(1) $\frac{100}{3}\left(3-\sqrt{3}\right)$ metre

(2) $\frac{100}{3}\left(\sqrt{3}-1\right)$ metre

(3) $\frac{100}{3}\left(2\sqrt{3}-1\right)$ metre

(4) $\frac{100}{3}\left(\sqrt{3}-\sqrt{2}\right)$ metre

(SSC CGL Tier-II Online Exam.01.12.2016)

16. A man on the top of a tower, standing on the sea shore, finds that a boat coming towards him takes 10 minutes for the angle of depression to change from 30° to 60°. How soon the boat reach the seashore ?

(1) 5 minutes (2) 7 minutes

(3) 10 minutes (4) 15 minutes

(SSC CGL Tier-II Online Exam.01.12.2016)

17. Two posts are 2 metres apart. Both posts are on same side of a tree. If the angles of depressions of these posts when observed from the top of the tree are 45° and 60° respectively, then the height of the tree is :

(1) $\left(3-\sqrt{3}\right)$ metre

(2) $\left(3+\sqrt{3}\right)$ metre

(3) $\left(-3+\sqrt{3}\right)$ metre

(4) $\left(3-\sqrt{2}\right)$ metre

(SSC CPO Exam. 06.06.2016) (Ist Sitting)

18. The cliff of a mountain is 180 m high and the angles of depression of two ships on the either side of cliff are 30° and 60°. What is the distance between the two ships?

(1) 400 metre

(2) $400\sqrt{3}$ metre

(3) 415.68 metre

(4) 398.6 metre

(SSC CAPFs (CPO) SI & ASI, Delhi Police Exam. 05.06.2016) (Ist Sitting)

19. From the top of a tower 60 metre high the angle of depression of the top and bottom of a pole are observed to be 45° and 60° respectively. If the pole and tower stand on the same plane, the height of the pole in metre is

(1) 60 $(\sqrt{3}-1)$ (2) 20 $(\sqrt{3}-1)$

(3) 20 $(3-\sqrt{3})$ (4) 20 $(\sqrt{3}+1)$

(SSC CGL Tier-I (CBE) Exam. 06.09.2016) (Ist Sitting)

20. A helicopter, at an altitude of 1500 metre, finds that two ships are sailing towards it, in the same direction. The angles of depression of the ships as observed from the helicopter are 60° and 30° respectively. Distance between the two ships, in metre is

(1) $1000\sqrt{3}$ (2) $\frac{1000}{\sqrt{3}}$

(3) $500\sqrt{3}$ (4) $\frac{500}{\sqrt{3}}$

(SSC CGL Tier-I (CBE) Exam. 30.08.2016 (IIIrd Sitting)

21. The angles of depression of two ships from the top of a light house are 45° and 30° toward east. If the ships are 200m apart, the height of the light house is (Take $\sqrt{3}$ =1.73)

(1) 273 metre (2) 270 metre

(3) 253 metre (4) 263 metre

(SSC CGL Tier-I (CBE) Exam. 31.08.2016 (IIIrd Sitting)

22. From the top of a building 60 metre high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60° respectively. The height of the tower in metre is :

(1) 40 (2) 45

(3) 50 (4) 55

(SSC CGL Tier-I (CBE) Exam. 06.09.2016 (IIIrd Sitting)

23. From a point on a bridge across the river, the angles of depression of the banks on opposite sides of the river are 30° and 45° respectively. If the bridge is at a height of 2.5 m from the banks, then the width of the river is

$\left(\text{Take } \sqrt{3} = 1.732\right)$

(1) 5.83 metre (2) 6.83 metre
(3) 5.76 metre (4) 6.87 metre

(SSC CGL Tier-I (CBE) Exam. 08.09.2016 (IIIrd Sitting)

24. A boat is moving away from an observation tower. It makes an angle of depression of 60° with an observer's eye when at a distance of 50 metre from the tower. After 8 seconds, the angle of depression becomes 30°. By assuming that it is running in still water, the approximate speed of the boat is :

(1) 33 km/hr (2) 42 km/hr
(3) 45 km/hr (4) 50 km/hr

(SSC CGL Tier-I (CBE) Exam. 09.09.2016 (IIIrd Sitting)

25. The angle of elevation of an aeroplane as observed from a point 30 metre above the transparent water-surface of a lake is 30° and the angle of depression of the image of the aeroplane in the water of the lake is 60°. The height of the aeroplane from the water-surface of the lake is

(1) 60 metre (2) 45 metre
(3) 50 metre (4) 75 metre

(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

26. The angles of depression of two ships from the top of a light house are 60° and 45° towards east. If the ships are 300 metre apart, the height of the light house is

(1) $200\left(3+\sqrt{3}\right)$ meter

(2) $250\left(3+\sqrt{3}\right)$ meter

(3) $150\left(3+\sqrt{3}\right)$ meter

(4) $160\left(3+\sqrt{3}\right)$ meter

(SSC CGL Tier-II (CBE) Exam. 12.01.2017)

TYPE–V

1. A pole stands vertically, inside a scalene triangular park ABC. If the angle of elevation of the top of the pole from each corner of the park is same, then in Δ ABC, the foot of the pole is at the

(1) centroid (2) circumcentre
(3) incentre (4) orthocentre

(SSC Graduate Level Tier-I Exam. 21.04.2013 IInd Sitting)

2. The base of a triangle is $12\sqrt{3}$ cm and two angles at the base are 30° and 60° respectively. The altitude of the triangle is

(1) 12 cm (2) 6 cm
(3) $10\sqrt{3}$ cm (4) 9 cm

(SSC CGL Tier-II Exam. 2014 12.04.2015 (Kolkata Region) TF No. 789 TH 7)

3. The two banks of a canal are straight and parallel. A, B, C are three persons of whom A stands on one bank and B and C on the opposite banks. B finds the angle ABC is 30°, while C finds that the angle ACB 60°. If B and C are 100 metres apart, the breadth of the canal is

(1) $\frac{25}{\sqrt{3}}$ metres

(2) $20\sqrt{3}$ metres

(3) $25\sqrt{3}$ metres

(4) $\frac{20}{\sqrt{3}}$ metres

(SSC CAPFs SI, CISF ASI & Delhi Police SI Exam, 21.06.2015 IInd Sitting)

4. A person of height 6ft. wants to pluck a fruit which is on a $\frac{26}{3}$ ft. high tree. If the person is standing $\frac{8}{\sqrt{3}}$ ft. away from the base of the tree, then at what angle should he throw a stone so that it hits the fruit ?

(1) 75° (2) 30°
(3) 45° (4) 60°

(SSC CGL Tier-I Exam, 09.08.2015 (IInd Sitting) TF No. 4239378)

5. If $x = a\cos\theta + b\sin\theta$ and $y = b\cos\theta - a\sin\theta$, then $x^2 + y^2$ is equal to

(1) ab (2) $a^2 + b^2$
(3) $a^2 - b^2$ (4) 1

(SSC CGL Tier-I (CBE) Exam. 29.08.2016) (IInd Sitting)

SHORT ANSWERS

TYPE-I

1. (1)	**2.** (2)	**3.** (3)	**4.** (2)
5. (3)	**6.** (3)	**7.** (2)	**8.** (1)
9. (4)	**10.** (3)	**11.** (2)	**12.** (1)

TYPE-II

1. (3)	**2.** (3)	**3.** (3)	**4.** (2)
5. (1)	**6.** (1)	**7.** (2)	**8.** (3)
9. (4)	**10.** (2)	**11.** (1)	**12.** (1)
13. (1)	**14.** (4)	**15.** (4)	**16.** (2)
17. (4)	**18.** (4)	**19.** (3)	**20.** (3)
21. (2)	**22.** (2)	**23.** (2)	**24.** (4)
25. (1)	**26.** (2)	**27.** (4)	**28.** (2)
29. (4)	**30.** (1)	**31.** (3)	**32.** (3)
33. (2)	**34.** (1)	**35.** (2)	**36.** (1)
37. (3)	**38.** (2)	**39.** (2)	**40.** (2)
41. (3)	**42.** (4)	**43.** (4)	**44.** (3)
45. (2)	**46.** (3)	**47.** (1)	**48.** (3)
49. (2)	**50.** (3)	**51.** (4)	**52.** (1)
53. (3)	**54.** (2)	**55.** (3)	**56.** (2)
57. (1)	**58.** (4)	**59.** (4)	**60.** (2)
61. (2)	**62.** (1)	**63.** (2)	**64.** (3)
65. (2)	**66.** (3)	**67.** (1)	**68.** (1)
69. (2)	**70.** (3)	**71.** (3)	**72.** (2)
73. (1)	**74.** (3)	**75.** (3)	**76.** (1)
77. (4)	**78.** (2)	**79.** (2)	**80.** (4)
81. (3)	**82.** (2)	**83.** (3)	**84.** (2)
85. (4)	**86.** (4)	**87.** (4)	**88.** (1)
89. (3)	**90.** (3)	**91.** (3)	**92.** (4)
93. (3)	**94.** (3)	**95.** (1)	**96.** (1)
97. (1)	**98.** (4)	**99.** (2)	**100.** (1)
101. (2)	**102.** (1)	**103.** (3)	**104.** (1)
105. (1)	**106.** (3)	**107.** (1)	**108.** (4)
109. (1)	**110.** (4)	**111.** (3)	**112.** (1)
113. (1)	**114.** (3)	**115.** (2)	**116.** (4)
117. (3)	**118.** (2)	**119.** (3)	**120.** (1)

TRIGONOMETRY

121. (4)	122. (2)	123. (3)	124. (4)
125. (1)	126. (4)	127. (1)	128. (4)
129. (4)	130. (2)	131. (2)	132. (2)
133. (1)	134. (2)	135. (2)	136. (2)
137. (2)	138. (4)	139. (3)	140. (3)
141. (3)	142. (4)	143. (2)	144. (2)
145. (1)	146. (4)	147. (4)	148. (4)
149. (2)	150. (1)	151. (3)	152. (3)
153. (2)	154. (1)	155. (1)	156. (3)
157. (1)	158. (2)	159. (2)	160. (2)
161. (1)	162. (3)	163. (1)	164. (2)
165. (3)	166. (3)	167. (4)	168. (2)
169. (2)	170. (2)	171. (3)	172. (2)
173. (3)	174. (2)	175. (3)	176. (1)
177. (1)	178. (3)	179. (4)	180. (3)
181. (4)	182. (2)	183. (4)	184. (4)
185. (*)	186. (2)	187. (1)	188. (1)
189. (1)	190. (1)	191. (3)	192. (1)
193. (3)	194. (3)	195. (4)	196. (2)
197. (3)	198. (3)	199. (3)	200. (4)
201. (4)	202. (2)	203. (1)	204. (3)
205. (2)	206. (1)	207. (1)	208. (4)
209. (3)	210. (4)	211. (3)	212. (3)
213. (1)	214. (1)	215. (1)	216. (3)
217. (2)	218. (2)	219. (3)	220. (4)
221. (3)	222. (3)	223. (1)	224. (3)
225. (2)	226. (3)	227. (1)	228. (3)
229. (2)	230. (4)	231. (3)	232. (2)
233. (3)	234. (1)	235. (4)	236. (4)
237. (2)	238. (1)	239. (2)	240. (2)
241. (2)	242. (2)	243. (2)	244. (1)
245. (3)	246. (3)	247. (2)	248. (1)
249. (1)	250. (3)	251. (4)	252. (4)
253. (4)	254. (1)	255. (4)	256. (2)
257. (2)	258. (2)	259. (4)	260. (4)
261. (3)	262. (1)	263. (1)	264. (4)
265. (1)	266. (4)	267. (1)	268. (1)

269. (4)	270. (4)	271. (4)	272. (3)
273. (2)	274. (2)	275. (2)	276. (3)
277. (4)	278. (2)	279. (2)	280. (2)
281. (4)	282. (1)	283. (3)	284. (1)
285. (*)	286. (2)	287. (3)	288. (4)
289. (4)	290. (3)	291. (2)	292. (2)
293. (1)	294. (1)	295. (2)	296. (1)
297. (2)	298. (4)	299. (1)	300. (2)
301. (2)	302. (4)	303. (*)	304. (2)
305. (3)	306. (3)	307. (2)	308. (4)
309. (2)	310 . (2)	311. (1)	312. (3)
313. (1)	314. (3)	315. (2)	316. (4)
317. (4)	318. (3)	319. (1)	320. (3)
321. (1)	322. (1)	323. (4)	324. (3)
325. (3)	326. (2)	327. (3)	328. (2)
329. (1)	330. (1)	331. (4)	332. (2)
333. (3)	334. (2)	335. (3)	336. (3)
337. (1)	338. (3)	339. (2)	340. (2)
341. (3)	342. (1)	343. (4)	344. (3)
345. (1)	346. (1)	347. (1)	348. (2)
349. (4)	350. (4)	351. (3)	352. (2)
353. (3)	354. (1)	355. (1)	356. (2)
357. (4)	358. (2)	359. (3)	360. (2)
361. (3)	362. (3)	363. (3)	364. (3)
365. (4)	366. (3)	367. (4)	368. (*)
369. (4)	370. (4)	371. (3)	372. (1)
373. (2)	374. (2)	375. (2)	376. (1)
377. (3)	378. (2)	379. (4)	380. (1)
381. (2)	382. (4)	383. (4)	384. (3)
385. (3)	386. (3)	387. (2)	388. (2)
389. (1)	290. (3)	391. (2)	392. (4)
393. (2)	294. (3)	395. (3)	396. (2)
397. (1)	398. (1)	399. (1)	400. (3)
401. (3)	402. (1)	403. (2)	404. (2)
405. (4)	406. (2)	407. (2)	408. (4)
409. (4)	410. (1)	411. (3)	412. (2)
413. (2)	414. (3)	415. (2)	416. (4)
417. (2)			

TYPE-III

1. (4)	2. (2)	3. (2)	4. (3)
5. (3)	6. (3)	7. (3)	8. (1)
9. (3)	10. (2)	11. (1)	12. (3)
13. (4)	14. (4)	15. (4)	16. (3)
17. (2)	18. (2)	19. (2)	20. (2)
21. (1)	22. (1)	23. (4)	24. (1)
25. (2)	26. (1)	27. (2)	28. (3)
29. (3)	30. (4)	31. (4)	32. (2)
33. (4)	34. (2)	35. (4)	36. (3)
37. (1)	38. (2)	39. (4)	40. (1)
41. (2)	42. (3)	43. (2)	44. (4)
45. (4)	46. (4)	47. (1)	48. (2)
49. (4)	50. (1)	51. (4)	52. (4)
53. (2)	54. (2)	55. (4)	56. (2)
57. (1)	58. (3)	59. (3)	60. (2)
61. (4)	62. (1)	63. (2)	64. (3)
65. (3)	66. (4)	67. (4)	68. (3)
69. (2)	70. (4)	71. (3)	72. (3)
73. (1)	74. (3)	75. (3)	76. (4)
77. (3)	78. (2)	79. (3)	80. (4)
81. (1)	82. (4)	83. (3)	84. (2)
85. (3)	86. (3)	87. (3)	88. (4)
89. (2)	90. (3)	91. (1)	92. (3)
93. (2)	94. (3)	95. (4)	96. (4)
97. (2)	98. (1)	99. (1)	100. (3)
101. (4)	102. (4)		

TYPE-IV

1. (2)	2. (2)	3. (2)	4. (3)
5. (2)	6. (4)	7. (1)	8. (1)
9. (2)	10. (3)	11. (4)	12. (2)
13. (1)	14. (3)	15. (1)	16. (1)
17. (2)	18. (3)	19. (3)	20. (1)
21. (1)	22. (1)	23. (2)	24. (3)
25. (1)	26. (3)		

TYPE-V

1. (2)	2. (4)	3. (3)	4. (2)
5. (2)			

EXPLANATIONS

TYPE-I

1. (1) Using Rule 1,

$11°15'$

$= 11° + \frac{15°}{60}$

$= 11° + \frac{1}{4} = \frac{45°}{4}$

$[\because 180° = \pi^c]$

$\therefore \frac{45°}{4} = \frac{\pi}{180} \times \frac{45}{4} = \frac{\pi^c}{16}$

2. (2) Using Rule 1,

$\angle ABC = 75°$

$[\because 180° = \pi \text{ radian or } \pi^c]$

$75° = \frac{\pi}{180} \times 75 = \frac{5\pi}{12}$ radian

$\therefore \angle BAC = \pi - \frac{\pi}{4} - \frac{5\pi}{12}$

$= \frac{12\pi - 3\pi - 5\pi}{12} = \frac{4\pi}{12}$

$= \frac{\pi}{3}$ radian

3. (3) Using Rule 1,

Sum of remaining two angles

$= \pi - \frac{5\pi}{9} = \frac{4\pi}{9}$

$\therefore$ Each angle $= \frac{1}{2} \times \frac{4\pi}{9} = \frac{2\pi}{9}$

$[\because \Delta$ is isosceles$]$

4. (2) Using Rule 1,

$\pi =$ radian $= 180°$

$\therefore 1$ radian $= \frac{180°}{\pi}$

$= \frac{180 \times 7°}{22}$

$= \frac{630}{11} = 57\frac{3}{11}°$

$= 57° \frac{3}{11} \times 60' = 57° \frac{180'}{11}$

$= 57°16' \frac{4}{11} \times 60'' = 57°16'22''$

5. (3) Using Rule 1,

$\because \pi$ radian $= 180°$

$\therefore \frac{3\pi}{5}$ radian $= \frac{180}{\pi} \times \frac{3\pi}{5}$

$= 108°$

6. (3) Using Rule 1,

Two angles = A and B where A > B.

$\therefore A + B = 135°$

$= \left(\frac{135 \times \pi}{180}\right)$ radian

$\Rightarrow A + B = \left(\frac{3\pi}{4}\right)$ radian ....(i)

$A - B = \frac{\pi}{12}$ ....(ii)

On adding these equations,

$2A = \frac{3\pi}{4} + \frac{\pi}{12}$

$= \frac{9\pi + \pi}{12} = \frac{10\pi}{12} = \frac{5\pi}{6}$

$\therefore A = \frac{5\pi}{12}$ radian

7. (2) Using Rule 1,

$\sec^2\theta + \tan^2\theta = 7$

$\Rightarrow 1 + \tan^2\theta + \tan^2\theta = 7$

$\Rightarrow 2\tan^2\theta = 7 - 1 = 6$

$\Rightarrow \tan^2\theta = 3$

$\Rightarrow \tan\theta = \sqrt{3}$

$= \tan 60°$

$\Rightarrow \theta = 60°$

$\because 180° = \pi$ radian

$\therefore 60° = \frac{\pi}{180} \times 60 = \frac{\pi}{3}$ radian

8. (1) Using Rule 1,

$\because \pi$ radian $= 180°$

$\therefore \frac{22}{9}$ radian $= \frac{180}{\pi} \times \frac{22}{9}$

$= \frac{180}{22} \times \frac{22 \times 7}{9} = 140°$ ....(i)

According to the question,

$A + B = 140°$

and, $A - B = 36°$ ....(ii)

On adding,

$2A = 176° \Rightarrow A = \frac{176}{2} = 88°$

From equation (i),

$\therefore 88° + B = 140°$

$\Rightarrow B = 140° - 88° = 52°$

9. (4) The hour hand of a watch traces an angle of 30° in an hour.

$\therefore$ Angle traced at 3 O'clock

$= 3 \times 30° = 90°$

$\because 180° = \pi$ radian

$\therefore 90° = \frac{\pi}{180} \times 90°$

$= \frac{\pi}{2}$ radian

10. (3) For $0 < \theta < 90°$,

$0 < \sin\theta < 1$

$\sin\theta > \sin^2\theta$

If $\theta = 30°$,

$\sin\theta = \sin 30° = \frac{1}{2}$

$\sin^2\theta = \sin^2 30° = \frac{1}{4}$

Clearly, $\frac{1}{2} > \frac{1}{4}$

11. (2) $\sin(\theta + 18°) = \frac{1}{2} = \sin 30°$

$\Rightarrow \theta + 18° = 30°$

$\Rightarrow \theta = 30° - 18° = 12°$

$\because 180° = \pi$ radian

$\therefore 12° = \frac{\pi}{180} \times 12$

$= \frac{\pi}{15}$ radians

12. (1) $\theta = \frac{l}{r}$ radian

$= \frac{11}{14}$ radian

$\because \pi$ radian $= 180°$

$\therefore 1$ radian $= \frac{180°}{\pi}$

$\therefore \frac{11}{14}$ radian $= \frac{180}{\frac{22}{7}} \times \frac{11}{14}$

$= \frac{180 \times 11 \times 7}{22 \times 14} = 45°$

TYPE-II

1. (3) $2\sin^2\theta + 3\cos^2\theta$
$= 2\sin^2\theta + 2\cos^2\theta + \cos^2\theta$
$= 2(\sin^2\theta + \cos^2\theta) + \cos^2\theta$
$= 2 + \cos^2\theta$ [$\because \sin^2\theta + \cos^2\theta = 1$]
$\because$ Minimum value of $\cos\theta = -1$
But $\cos^2\theta \geq 0$, when $\theta = 90°$
[$\because \cos 0° = 1, \cos 90° = 0$]
$\therefore$ Required minimum value
$= 2 + 0 = 2$

2. (3)

$$\frac{1}{\text{cosec}^2 51} + \sin^2 39 + \tan^2 51 - \frac{1}{\sin^2 51°.\sec^2 39°}$$

$= \sin^2 51° + \sin^2 39° + \tan^2(90° - 39°) - \dfrac{1}{\sin^2(90°-39°).\sec^2 39°}$
$= \cos^2 39° + \sin^2 39° + \cot^2 39° - \dfrac{1}{\cos^2 39°.\sec^2 39°}$
[$\because \sin(90° - \theta) = \cos\theta$
$\tan(90° - \theta) = \cot\theta$]
$= 1 + \cot^2 39° - 1$
$= \text{cosec}^2 39° - 1 = x^2 - 1$

3. (3) $\tan 4°.\tan 43°.\tan 47°.\tan 86°$
$= \tan 4°.\tan 43°.\tan(90° - 43°).\tan(90° - 4°)$
$= \tan 4° \times \tan 43° \times \cot 43° \times \cot 4° = 1$
[$\tan(90° - \theta) = \cot\theta$; $\tan\theta.\cot\theta = 1$]

4. (2) $\dfrac{\tan\theta + \cot\theta}{\tan\theta - \cot\theta} = \dfrac{2}{1}$
By componendo and dividendo,
$\dfrac{2\tan\theta}{2\cot\theta} = \dfrac{3}{1}$
$\Rightarrow \dfrac{\sin\theta}{\cos\theta}.\dfrac{\sin\theta}{\cos\theta} = 3$
$\Rightarrow \sin^2\theta = 3\cos^2\theta$
$\Rightarrow \sin^2\theta = 3(1 - \sin^2\theta)$
$\Rightarrow 4\sin^2\theta = 3$
$\Rightarrow \sin^2\theta = \dfrac{3}{4}$
$\Rightarrow \sin\theta = \dfrac{\sqrt{3}}{2}$

5. (1) $\cos x + \cos y = 2$
$\because \cos x \leq 1$
$\Rightarrow \cos x = 1; \cos y = 1$
$\Rightarrow x = y = 0°$ [$\because \text{Cos } 0° = 1$]
$\therefore \sin x + \sin y = 0$

6. (1) $\tan1°.\tan2°.\tan3°... \tan45°... \tan88°\tan89°$
$= (\tan1°.\tan89°)(\tan2°.\tan88°) ... \tan45°$
$= (\tan1°.\cot1°).(\tan2°.\cot2°) ... \tan45° = 1$
[$\because \tan(90° - \theta) = \cot\theta$, $\tan\theta.\cot\theta = 1$]

7. (2) Let the measure of three angles of triangle are 2x, 7x and 11x respectively.
$\therefore 2x + 7x + 11x = 180°$
$\Rightarrow 20x = 180°$
$\Rightarrow x = \dfrac{180}{20} = 9°$
$\therefore$ First angle $= 2x = 2 \times 9 = 18°$
Second angle $= 7x = 7 \times 9 = 63°$
Third angle $= 11x = 11 \times 9 = 99°$

8. (3) Sum of angles of a triangle $= 180°$
$\therefore x + 5 + 2x - 3 + 3x + 4 = 180°$
$\Rightarrow 6x + 6 = 180°$
$\Rightarrow 6x = 180 - 6 = 174°$
$\Rightarrow x = \dfrac{174}{6} = 29$

9. (4) $\cot10°.\cot80°.\cot20°.\cot70°.\cot60°$
$= \cot10°.\tan10° . \cot20°.\tan20°.\cot60°$
[$\because \tan(90 - \theta) = \cot\theta$ and $\tan\theta.\cot\theta = 1$]
$= 1 \times 1 \times \dfrac{1}{\sqrt{3}}$ [$\because \cot 60° = \dfrac{1}{\sqrt{3}}$]
$= \dfrac{1}{\sqrt{3}}$

10. (2) $7\sin^2\theta + 3\cos^2\theta = 4$
$\Rightarrow 7\dfrac{\sin^2\theta}{\cos^2\theta} + 3 = \dfrac{4}{\cos^2\theta}$
$= 4\sec^2\theta$
$\Rightarrow 7\tan^2\theta + 3 = 4(1 + \tan^2\theta)$
$\Rightarrow 7\tan^2\theta - 4\tan^2\theta = 4 - 3$
$\Rightarrow 3\tan^2\theta = 1$
$\Rightarrow \tan^2\theta = \dfrac{1}{3}$
$\Rightarrow \tan\theta = \dfrac{1}{\sqrt{3}}$

11. (1) No. of terms in $1 + 5 + 9 + ... + 89 = n$
$\therefore a + (n-1)d = t_n$
$\Rightarrow 1 + (n - 1)4 = 89$
$\Rightarrow (n - 1)4 = 89 - 1 = 88$
$\Rightarrow n - 1 = 22$
$\Rightarrow n = 23$
Now, $\sin^2 1° + \sin^2 89° + \sin^2 5° + \sin^2 85° + ... +$ to 22 terms $+ \sin^2 45°$
$= (\sin^2 1° + \cos^2 1°) + (\sin^2 5° + \cos^2 5°) + ... +$ to 11 terms $+ \left(\dfrac{1}{\sqrt{2}}\right)^2$
$= 11 \times 1 + \dfrac{1}{2}$
$= 11 + \dfrac{1}{2} = 11\dfrac{1}{2}$

[$\sin(90 - \theta) = \cos\theta$ and $\sin^2\theta + \cos^2\theta = 1$]

12. (1) $\cot 18°$
$\left(\cot 72°.\cos^2 22° + \dfrac{1}{\tan 72°.\sec^2 68°}\right)$
$= \cot 18°.\cot 72°.\cos^2 22° + \dfrac{\cot 18°}{\tan 72°.\sec^2 68°}$
$= \cot 18°.\tan 18°.\cos^2 22° + \dfrac{\cot 18}{\cot 18}.\cos^2 68°$
$= \cos^2 22° + \cos^2 68°$
$= \cos^2 22° + \sin^2 22° = 1$

[$\because \tan(90° - \theta) = \cot\theta$; $\sin(90° - \theta) = \cos\theta$; $\sin^2\theta + \cos^2\theta = 1$]

13. (1) $\tan 15°.\cot 75° + \tan 75°.\cot 15°$
$= \tan 15°.\cot(90° - 15°) + \tan(90° - 15°).\cot 15°$
$= \tan^2 15° + \cot^2 15°$ .....(i)
[$\because \tan(90 - \theta) = \cot\theta$, $\cot(90 - \theta) = \tan\theta$]
$\tan 15° = 2 - \sqrt{3}$
$\therefore \cot 15°$
$= \dfrac{1}{2 - \sqrt{3}} = \dfrac{2 + \sqrt{3}}{(2 - \sqrt{3})(2 + \sqrt{3})}$
$= 2 + \sqrt{3}$
$\therefore \tan^2 15° + \cot^2 15°$
$= (2 - \sqrt{3})^2 + (2 + \sqrt{3})^2$
$= 2(4 + 3) = 14$

14. (4) $\sin(2x - 20°) = \cos(2y + 20°)$
$\Rightarrow \sin(2x - 20°) = \sin(90° - 2y - 20°)$

$\Rightarrow$ $2x-20° = 70° - 2y$
$\Rightarrow$ $2x + 2y = 70 + 20 = 90°$
$\Rightarrow$ $x + y = 45°$
$\therefore$ $\tan(x + y) = \tan 45° = 1$

15. (4) $A + B = 90°$
$\Rightarrow B = 90° - A$
$\therefore \sec^2A + \sec^2B - \sec^2A \cdot \sec^2B$
$= \sec^2A + \text{cosec}^2A - \sec^2A \cdot \text{cosec}^2A$

$$= \frac{1}{\cos^2A} + \frac{1}{\sin^2A} - \frac{1}{\sin^2A.\cos^2A}$$

$$= \frac{\sin^2A + \cos^2A - 1}{\sin^2A.\cos^2A}$$

$$= \frac{1-1}{\sin^2A.\cos^2A} = 0.$$

16. (2) Let the number of terms be n, then
By $t_n = a + (n-1)d$
$85 = 5 + (n-1)$
$\Rightarrow n - 1 = 85 - 5 = 80$
$\Rightarrow n = 81$
$\therefore \sin^25° + \sin^26° + \ldots + \sin^245° + \ldots + \sin^284° + \sin^285°$
$= (\sin^25° + \sin^285°) + (\sin^26° + \ldots + \sin^284°) + \ldots.$ to (40 terms) $+ \sin^245°$
$= (\sin^25° + \cos^25°) + (\sin^26° + \ldots + \cos^26°) + \ldots.$ to 40 terms $+ \sin^245°$ $\quad \left[\begin{array}{l}\sin(90°-\theta) = \cos\theta \\ \sin^2\theta + \cos^2\theta = 1\end{array}\right]$

$$= 40 + \left(\frac{1}{\sqrt{2}}\right)^2 = 40 + \frac{1}{2} = 40\frac{1}{2}$$

17. (4) $\sin\theta = \cos(90° - \theta)$;
$\sin(90° - \theta) = \cos\theta$
$\therefore \sin 85° = \sin(90° - 5°) = \cos 5°$
$\therefore (\sin^25° + \sin^285°) + (\sin^210° + \sin^280°) + \ldots.$ to 8 terms $+ \sin^245° + \sin^290°$

$$= 8 \times 1 + \frac{1}{2} + 1 = 9\frac{1}{2}$$

18. (4) $\dfrac{\sin 39°}{\cos 51°} + 2\tan 11°.\tan 79°.\tan 31°.\tan 59°.\tan 45° - 3(\sin^221° + \sin^269°)$

$$= \frac{\sin 39°}{\cos(90°-39°)} + 2\tan 11°.\tan(90° - 11°).\tan 31°.\tan(90° - 59°).1 - 3(\sin^221° + \sin^2(90° - 21°)$$

$$= \frac{\sin 39°}{\sin 39°} + 2\tan 11°.\cot 11°.\tan 31°.\cot 31° - 3(\sin^221° + \cos^221°)$$
$= 1 + 2 - 3 = 0$

$[\tan\theta.\cot\theta = 1,\ \sin^2\theta + \cos^2\theta = 1]$

19. (3) $\dfrac{\cos^2\theta}{\cot^2\theta - \cos^2\theta} = 3$

$\Rightarrow \cos^2\theta = 3\cot^2\theta - 3\cos^2\theta$

$$\Rightarrow 4\cos^2\theta = 3\cot^2\theta = 3\frac{\cos^2\theta}{\sin^2\theta}$$

$$\Rightarrow 4\cos^2\theta - \frac{3\cos^2\theta}{\sin^2\theta} = 0$$

$$\Rightarrow \cos^2\theta\left(4 - \frac{3}{\sin^2\theta}\right) = 0$$

$$\therefore 4 - \frac{3}{\sin^2\theta} = 0 \ \&\ \text{Cos}^2\theta = 0$$
$\Rightarrow 4\sin^2\theta = 3$

$$\Rightarrow \sin\theta = \frac{\sqrt{3}}{2} = \sin 60°$$
$\Rightarrow \theta = 60°$
$\cos^2\theta = 0 \Rightarrow \theta = 90°$

20. (3) $A = \tan 11° \cdot \tan 29°$
$B = 2\cot 61° \cdot \cot 79°$
$= 2\cot(90° - 29°)\cot(90° - 11°)$
$= 2\tan 29° \cdot \tan 11°$
$[\because \cot(90° - \theta) = \tan\theta]$
$= 2A$

21. (2) $\sin 17° = \dfrac{x}{y}$

$$\cos 17° = \sqrt{1 - \sin^217°}$$

$$= \sqrt{1 - \frac{x^2}{y^2}} = \sqrt{\frac{y^2 - x^2}{y^2}}$$

$$= \frac{\sqrt{y^2 - x^2}}{y}$$

$$\therefore \sec 17° = \frac{y}{\sqrt{y^2 - x^2}}$$

$\sin 73° = \sin(90° - 17°)$
$= \cos 17°$
$\therefore \sec 17° - \sin 73°$

$$= \frac{y}{\sqrt{y^2 - x^2}} - \frac{\sqrt{y^2 - x^2}}{y}$$

$$= \frac{y^2 - y^2 + x^2}{y\sqrt{y^2 - x^2}} = \frac{x^2}{y\sqrt{y^2 - x^2}}$$

22. (2) $Z = \sin\theta + \cos\theta$
$\Rightarrow Z^2 = \sin^2\theta + \cos^2\theta + 2\sin\theta.\cos\theta$
$= 1 + 2\sin\theta.\cos\theta$
$\because 0 < \theta < 90°$
$\therefore \sin\theta < 1;\ \cos\theta < 1$
$\therefore 2\sin\theta \cdot \cos\theta < 1$
and $2\sin\theta\cos\theta > 1$
$\Rightarrow Z^2 < 2$
$\Rightarrow Z < \sqrt{2}$

23. (2) $\dfrac{\tan 57° + \cot 37°}{\tan 33° + \cot 53°}$

$$= \frac{\cot 33° + \tan 53°}{\tan 33° + \cot 53°}$$

$[\because \tan(90° - \theta) = \cot\theta,\ \cot(90° - \theta) = \tan\theta]$

$$= \frac{\frac{1}{\tan 33°} + \tan 53°}{\tan 33° + \frac{1}{\tan 53°}}$$

$$= \frac{1 + \tan 53°.\tan 33°}{\tan 33°.\tan 53° + 1} \times \frac{\tan 53°}{\tan 33°}$$
$= \tan 53° \cdot \cot 33°$
$= \cot 37° \cdot \tan 57°$

24. (4) $\cot 30° = \cot(90° - 60°)$
$= \tan 60°$
$\cot 75° = \cot(90° - 15°) = \tan 15°$

$$\therefore \frac{\cot 30° - \cot 75°}{\tan 15° - \tan 60°}$$

$$= \frac{\tan 60° - \tan 15°}{\tan 15° - \tan 60°} = -1$$

25. (1) $\cot\theta.\tan(90° - \theta) - \sec(90° - \theta).\text{cosec}\theta + (\sin^225° + \sin^265°) + \sqrt{3}(\tan 5°.\tan 15°.\tan 30°.\tan 75°.\tan 85°)$
$= \cot\theta.\cot\theta - \text{cosec}\theta.\text{cosec}\theta + (\sin^225° + \cos^225°) + \sqrt{3}(\tan 5°.\cot 5°.\tan 15°.\cot 15°.\tan 30°)$
$= (\cot^2\theta - \text{cosec}^2\theta) + (\sin^225° + \cos^225°) + \sqrt{3} \times \frac{1}{\sqrt{3}}$

$= -1 + 1 + 1 = 1$
$[\sin(90° - \theta) = \cos\theta;\ \text{cosec}^2\theta - \cot^2\theta = 1;\ \tan(90° - \theta) = \cot\theta;\ \sec(90° - \theta) = \text{cosec}\theta]$

TRIGONOMETRY

26. (2) $\sin(3x-20°)$
$= \cos(3y+20°)$
$\Rightarrow \sin(3x-20°)$
$= \sin(90°-3y-20°)$
$= \sin(70°-3y)$
$\Rightarrow 3x-20° = 70°-3y$
$\Rightarrow 3x+3y = 90°$
$\Rightarrow 3(x+y) = 90°$
$\Rightarrow x+y = 30°$

27. (4) $\cos\theta.\text{cosec}23° = 1$

$\Rightarrow \text{cosec}23° = \dfrac{1}{\cos\theta} = \sec\theta$

$\Rightarrow \text{cosec}23° = \text{cosec}(90°-\theta)$

$\Rightarrow 23° = 90°-\theta$

$\Rightarrow \theta = 90°-23° = 67°$

28. (2) $2(\cos^2\theta - \sin^2\theta) = 1$

$\Rightarrow \cos^2\theta - \sin^2\theta = \dfrac{1}{2}$

$\Rightarrow 1-2\sin^2\theta = \dfrac{1}{2}$

$\Rightarrow 2\sin^2\theta = 1-\dfrac{1}{2}$

$\Rightarrow 2\sin^2\theta = \dfrac{1}{2} \Rightarrow \sin^2\theta = \dfrac{1}{4}$

$\Rightarrow \sin\theta = \pm\dfrac{1}{2} = \sin 30°$

$\left[\because \theta \text{ is + ve angle}, \therefore \theta \neq \dfrac{-1}{2}\right]$

$\Rightarrow \theta = 30°$

29. (4) $\tan 35° \cdot \tan 45° \cdot \tan 55°$
$= \tan 35° \cdot 1 \cdot \tan(90°-35°)$
$= \tan 35° \cdot 1 \cdot \cot 35° = 1.1 = 1$
$[\tan(90°-\theta) = \cot\theta ; \tan\theta \cdot \cot\theta = 1]$

30. (1) $\sec(7\theta+28°)$
$= \text{cosec}(30°-3\theta)$
$\Rightarrow \sec(7\theta+28°)$
$= \sec(90°-(30°-3\theta))$
$\Rightarrow 7\theta+28° = 90°-30°+3\theta$
$\Rightarrow 4\theta = 90°-30°-28° = 32°$
$\Rightarrow \theta = \dfrac{32°}{4} = 8°$

31. (3) $\tan\left(\dfrac{\pi}{2}-\dfrac{\theta}{2}\right) = \sqrt{3}$

$\Rightarrow \cot\dfrac{\theta}{2} = \sqrt{3} = \cot 30°$

$\Rightarrow \dfrac{\theta}{2} = 30° \Rightarrow \theta = 60°$

$\therefore \cos\theta = \cos 60° = \dfrac{1}{2}$

32. (3) $7\sin^2\theta + 3\cos^2\theta = 4$
$\Rightarrow 7\sin^2\theta + 3(1-\sin^2\theta) = 4$
$\Rightarrow 7\sin^2\theta + 3 - 3\sin^2\theta = 4$
$\Rightarrow 4\sin^2\theta = 4-3 = 1$

$\Rightarrow \sin^2\theta = \dfrac{1}{4}$

$\Rightarrow \sin\theta = \dfrac{1}{2} = \sin\dfrac{\pi}{6}$

$\left[\text{Note: } \sin\theta \neq \dfrac{-1}{2}, \because 0 < \theta < 90\right]$

$\Rightarrow \theta = \dfrac{\pi}{6}$

33. (2) $\sec\theta = \dfrac{4x^2+1}{4x}$

$\tan\theta = \sqrt{\sec^2\theta - 1}$

$= \sqrt{\left(\dfrac{4x^2+1}{4x}\right)^2 - 1}$

$= \sqrt{\dfrac{(4x^2+1)^2 - (4x)^2}{(4x)^2}}$

$= \dfrac{(2x+1)(2x-1)}{4x} = \dfrac{4x^2-1}{4x}$

$\therefore \sec\theta + \tan\theta = \dfrac{4x^2+1}{4x} + \dfrac{4x^2-1}{4x}$

$= \dfrac{4x^2+1+4x^2-1}{4x}$

$= \dfrac{8x^2}{4x} = 2x$

34 (1) $\cos 90° = 0$
$\therefore \cos 1° . \cos 2° \ldots \cos 179° = 0$

35. (2) $\sin^2 25° + \sin^2 65°$

$= \sin^2 25° + \sin^2(90°-25°)$

$= \sin^2 25° + \cos^2 25° = 1$

36. (1) $\sec\theta + \tan\theta = \sqrt{3}$ .....(i)

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \dfrac{1}{\sqrt{3}}$ ....(ii)

By subtracting (ii) from (i)

$\sec\theta + \tan\theta - \sec\theta + \tan\theta$

$= \sqrt{3} - \dfrac{1}{\sqrt{3}}$

$\Rightarrow 2\tan\theta = \dfrac{3-1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \dfrac{1}{\sqrt{3}} = \tan 30°$

$\Rightarrow \theta = 30°$

$\therefore \tan 3\theta = \tan 90° = \text{undefined}$

37. (3) $\sin(60°-\theta) = \cos(\psi-30°)$

$= \sin(90°-\psi+30°)$

$= \sin(120°-\psi)$

$\Rightarrow 60°-\theta = 120°-\psi$

$\Rightarrow \psi-\theta = 60°$

$\therefore \tan(\psi-\theta) = \tan 60° = \sqrt{3}$

38. (2) $a\sin\theta + b\cos\theta = c$ ...(i)
$a\cos\theta - b\sin\theta = x$ ...(ii)
Squaring both the equations and adding,
$a^2\sin^2\theta + b^2\cos^2\theta + 2ab\sin\theta.\cos\theta + a^2\cos^2\theta + b^2\sin^2\theta - 2ab\sin\theta.\cos\theta = c^2 + x^2$
$\Rightarrow a^2\sin^2\theta + a^2\cos^2\theta + b^2\cos^2\theta + b^2\sin^2\theta = c^2 + x^2$
$\Rightarrow a^2(\sin^2\theta + \cos^2\theta) + b^2(\cos^2\theta + \sin^2\theta) = c^2 + x^2$
$\Rightarrow a^2 + b^2 = c^2 + x^2$
$\Rightarrow x^2 = a^2 + b^2 - c^2$

$\Rightarrow x = \pm\sqrt{a^2+b^2-c^2}$

39. (2) $\sin(A-B) = \dfrac{1}{2} = \sin 30°$

$\Rightarrow A-B = 30°$

Again, $\cos(A+B) = \dfrac{1}{2} = \cos 60°$

$\Rightarrow A+B = 60°$
$\therefore A+B+A-B = 30°+60° = 90°$
$\Rightarrow 2A = 90°$
$\Rightarrow A = 45°$
$\therefore A-B = 30°$
$\Rightarrow B = A-30° = 45°-30° = 15°$

$= \dfrac{15\times\pi}{180} = \dfrac{\pi}{12}$ radian

40. (2) Maximum value of $a\sin\theta + b\cos\theta = \sqrt{a^2+b^2}$

$\therefore$ Maximum value of $2\sin\theta + 3\cos\theta = \sqrt{2^2+3^2} = \sqrt{13}$

41. (3) $152(\sin 30° + 2\cos^2 45° + 3\sin 30° + 4\cos^2 45° + ... + 17\sin 30° + 18\cos^2 45°)$

$$= 152\left(\frac{1}{2} + 2\times\frac{1}{2} + 3\times\frac{1}{2} + 4\times\frac{1}{2} + ...+17\times\frac{1}{2} + 18\times\frac{1}{2}\right)$$

$$= 152\left(\frac{1}{2} + 1 + \frac{3}{2} + 2 + ...+ \frac{17}{2} + 9\right)$$

It is an A.P. whose $a = \frac{1}{2}$, $d = \frac{1}{2}$, $n = 18$

$$= 152\left[\frac{18}{2}\left(2\times\frac{1}{2} + (18-1)\frac{1}{2}\right)\right]$$

$$= 152\left[9\left(1 + \frac{17}{2}\right)\right]$$

$$= \frac{152\times 9\times 19}{2} = 12996$$ and

$\sqrt{12996} = 114$

i.e. a perfect square of an integer.

42. (4) $3\cos 80°.\operatorname{cosec} 10° + 2\cos 59°.\operatorname{cosec} 31°$
$= 3\cos(90°-10°).\operatorname{cosec} 10° + 2\cos(90°-31°).\operatorname{cosec} 31°$
$= 3\sin 10°.\operatorname{cosec} 10° + 2\sin 31°.\operatorname{cosec} 31°$
$= 3 + 2 = 5$
[$\because \cos(90°-\theta) = \sin\theta$; $\sin\theta.\operatorname{cosec}\theta = 1$]

43. (4) $\sin^2\theta - 3\sin\theta + 2 = 0$
$\Rightarrow \sin^2\theta - 2\sin\theta - \sin\theta + 2 = 0$
$\Rightarrow \sin\theta(\sin\theta - 2) - 1(\sin\theta - 2) = 0$
$\Rightarrow (\sin\theta - 1)(\sin\theta - 2) = 0$
$\Rightarrow \sin\theta = 1 = \sin 90°$
$\Rightarrow \theta = 90°$ and $\sin\theta \neq 2$

44. (3) $\tan\alpha = n\tan\beta$

$$\Rightarrow \tan\beta = \frac{1}{n}\tan\alpha$$

$$\Rightarrow \cot\beta = \frac{n}{\tan\alpha}$$ and

$$\sin\alpha = m\sin\beta \Rightarrow \sin\beta = \frac{1}{m}\sin\alpha$$

$$\Rightarrow \operatorname{cosec}\beta = \frac{m}{\sin\alpha}$$

[$\because \operatorname{cosec}^2\beta - \cot^2\beta = 1$]

$$\Rightarrow \frac{m^2}{\sin^2\alpha} - \frac{n^2}{\tan^2\alpha} = 1$$

$$\Rightarrow \frac{m^2}{\sin^2\alpha} - \frac{n^2\cos^2\alpha}{\sin^2\alpha} = 1$$

$$\Rightarrow \frac{m^2 - n^2\cos^2\alpha}{\sin^2\alpha} = 1$$

$\Rightarrow m^2 - n^2\cos^2\alpha = \sin^2\alpha$
$= 1 - \cos^2\alpha$
$\Rightarrow m^2 - 1 = n^2\cos^2\alpha - \cos^2\alpha$
$= (n^2-1)\cos^2\alpha$

$$\Rightarrow \cos^2\alpha = \frac{m^2-1}{n^2-1}$$

45. (2) $\tan\theta = \frac{3}{4}$

$$\therefore \cot\theta = \frac{4}{3}$$

$\because \operatorname{cosec}^2\theta - \cot^2\theta = 1$

$$\Rightarrow \operatorname{cosec}\theta = \sqrt{1+\cot^2\theta}$$

$$= \sqrt{1+\left(\frac{4}{3}\right)^2} = \sqrt{1+\frac{16}{9}} = \sqrt{\frac{25}{9}}$$

$$= \frac{5}{3}$$

46. (3) $\operatorname{cosec}\theta - \cot\theta = \frac{7}{2}$ .....(i)

$\operatorname{cosec}^2\theta - \cot^2\theta = 1$
$\Rightarrow (\operatorname{cosec}\theta + \cot\theta)(\operatorname{cosec}\theta - \cot\theta) = 1$

$$\Rightarrow \operatorname{cosec}\theta + \cot\theta = \frac{1}{\operatorname{cosec}\theta - \cot\theta} = \frac{2}{7}$$ .....(ii)

On adding both equations,

$$2\operatorname{cosec}\theta = \frac{7}{2} + \frac{2}{7}$$

$$= \frac{49+4}{14} = \frac{53}{14}$$

$$\Rightarrow \operatorname{cosec}\theta = \frac{53}{28}$$

47. (1) $x\sin 45° = y\operatorname{cosec} 30°$

$$\Rightarrow x\times\frac{1}{\sqrt{2}} = y\times 2$$

$$\Rightarrow \frac{x}{y} = 2\sqrt{2}$$

$$\Rightarrow \frac{x^4}{y^4} = \left(2\sqrt{2}\right)^4 = 2^4\times 2^2$$

$= 2^6 = 4^3$

48. (3) $5\tan\theta = 4 \Rightarrow \tan\theta = \frac{4}{5}$

$$\therefore \frac{5\sin\theta - 3\cos\theta}{5\sin\theta + 2\cos\theta}$$

Dividing numerator and denominator by $\cos\theta$,

$$= \frac{5.\frac{\sin\theta}{\cos\theta} - \frac{3\cos\theta}{\cos\theta}}{5\frac{\sin\theta}{\cos\theta} + \frac{2\cos\theta}{\cos\theta}}$$

$$= \frac{5\tan - 3}{5\tan\theta + 2} = \frac{5\times\frac{4}{5} - 3}{5\times\frac{4}{5} + 2}$$

$$= \frac{4-3}{4+2} = \frac{1}{6}$$

49. (2) $2\operatorname{cosec}^2 23°\times\cot^2 67° - \sin^2 23° - \sin^2 67° - \cot^2 67°$
$= 2.\operatorname{cosec}^2(90°-67°)\times\cot^2 67° - \sin^2 23° - \sin^2(90°-23°) - \cot^2 67°$
$= 2\sec^2 67°\times\cot^2 67° - \sin^2 23° - \cos^2 23° - \cot^2 67°$
$= 2\operatorname{cosec}^2 67° - 1 - \cot^2 67°$
$= \operatorname{cosec}^2 67° - 1 + \operatorname{cosec}^2 67° - \cot^2 67°$
$= \operatorname{cosec}^2 67° = \sec^2 23°$

[$\because \sec(90-\theta) = \operatorname{cosec}\theta$; $\sin(90-\theta) = \cos\theta$ & $\operatorname{cosec}^2(67) - 1 = \cot^2 67$]

50. (3) $\cos^2\theta \leq 1$

$$\therefore \frac{(x+y)^2}{4xy} \leq 1$$

$\Rightarrow (x+y)^2 - 4xy \leq 0$
$\Rightarrow (x-y)^2 \geq 0$
$\Rightarrow x = y$

51. (4) Expression

$$= \operatorname{cosec}^2 18° - \frac{1}{\cot^2 72°}$$

$= \operatorname{cosec}^2 18° - \tan^2 72°$

$[\because \tan\theta \cdot \cot\theta = 1]$

$= \text{cosec}^2 18° - \tan^2(90° - 18°)$

$= \text{cosec}^2\ 18° - \cot^2\ 18°$

$= 1$

$[\because \tan(90° - \theta = \cot\theta;$
$\text{cosec}^2\ \theta - \cot^2\ \theta = 1]$

52. (1) $(1 - \sin^2\alpha)\ (1 - \cos^2\alpha)\ (1 + \cot^2\beta)\ (1 + \tan^2\beta)$

$= \cos^2\alpha \cdot \sin^2\alpha \cdot \text{cosec}^2\beta\ \sec^2\beta$

$= (\cos^2\alpha \cdot \text{cosec}^2\ \beta)\ (\sin^2\alpha \cdot \sec^2\beta)$

$= (\cos^2\alpha \cdot \sec^2\alpha)\ (\sin^2\alpha \cdot \text{cosec}^2\ \alpha) = 1$

$[\alpha + \beta = 90° \Rightarrow \beta = 90° - \alpha$
$\text{cosec}\ \beta = \text{cosec}\ (90° - \alpha)$

$= \sec\alpha\ ;\ \sec\beta = \sec(90° - \alpha)$

$= \text{cosec}\ \alpha,\ \sin\alpha \cdot \text{cosec}\ \alpha$

$= \cos\alpha \cdot \sec\alpha = 1]$

53. (3) $\dfrac{2\sin 68°}{\cos 22°} - \dfrac{2\cot 15°}{5\tan 75°} -$

$\dfrac{3\tan 45° \cdot \tan 20° \cdot \tan 40°}{\tan 50° \tan 70°}$

5

$= 2\dfrac{\cos 22°}{\cos 22°} - \dfrac{2\tan 75°}{5\tan 75°} -$

$\dfrac{3 \cdot \tan 20° \cdot \cot 20° \tan 40° \cdot \cot 40°}{5}$

$= 2 - \dfrac{2}{5} - \dfrac{3}{5}$

$= \dfrac{10 - 2 - 3}{5} = 1$

$\left[\begin{array}{l}\sin(90° - \theta) = \cos\theta; \\ \cot(90° - \theta) = \tan\theta; \\ \tan(90° - \theta) = \cot\theta\end{array}\right]$

54. (2) $\tan 10° \cdot \tan 15° \cdot \tan 75° \cdot \tan 80°$

$= (\tan 10° \cdot \tan 80°)(\tan 15° \cdot \tan 75°)$

$= (\tan 10° \cdot \cot 10°)(\tan 15° \cdot \cot 15°)$

$= 1 \times 1 = 1$

$[\tan(90° - \theta) = \cot\theta;$
$\tan\theta \cdot \cot\theta = 1]$

55. (3) $4\tan^2\theta + 9\cot^2\theta$

$= (2\tan\theta - 3\cot\theta)^2 + 2 \times 3 \times 2$

$\therefore$ Minimum value $= 12$

$[\because (2\tan\theta - 3\cot\theta)^2 \geq 0]$

56. (2) $\sin 7x = \cos 11x$

$= \sin(90° - 11x)$

$\Rightarrow 7x = 90° - 11x$

$\Rightarrow 18x = 90°$

$\Rightarrow x = 5°$

$\therefore \tan 9x + \cot 9x$

$= \tan 45° + \cot 45°$

$= 1 + 1 = 2$

57. (1) $\tan^2\alpha = 1 + 2\tan^2\beta$

$\Rightarrow \sec^2\alpha - 1 = 1 + 2(\sec^2\beta - 1)$

$\Rightarrow \sec^2\alpha - 1 = 2\sec^2\beta - 1$

$\Rightarrow \dfrac{1}{\cos^2\alpha} = \dfrac{2}{\cos^2\beta}$

$\Rightarrow \sqrt{2}\cos\alpha = \cos\beta$

$\therefore \sqrt{2}\cos\alpha - \cos\beta = 0$

58. (4) $\cos 1° \cdot \cos 2° \cdot \cos 3° \ldots \cos 90° \ldots \cos 100°$

$= 0\ [\cos 90° = 0]$

59. (4) $2(\cos^2\theta - \sin^2\theta) = 1$

$\Rightarrow \cos^2\theta - (1 - \cos^2\theta) = \dfrac{1}{2}$

$\Rightarrow 2\cos^2\theta = 1 + \dfrac{1}{2} = \dfrac{3}{2}$

$\Rightarrow \cos^2\theta = \dfrac{3}{4}$

$\Rightarrow \sec^2\theta = \dfrac{4}{3}$

$\Rightarrow 1 + \tan^2\theta = \dfrac{4}{3}$

$\Rightarrow \tan^2\theta = \dfrac{4}{3} - 1 = \dfrac{1}{3}$

$\Rightarrow \tan\theta = \dfrac{1}{\sqrt{3}} \Rightarrow \cot\theta = \sqrt{3}$

60. (2) $\tan(2\theta + 45°) = \cot 3\theta$

$= \tan(90° - 3\theta)$

$\Rightarrow 2\theta + 45° = 90° - 3\theta$

$\Rightarrow 5\theta = 90° - 45° = 45°$

$\therefore \theta = 9°$

61. (2) $\cos\theta = \dfrac{15}{17}$

$\Rightarrow \sec\theta = \dfrac{1}{\cos\theta} = \dfrac{17}{15}$

$\therefore \cot(90° - \theta) = \tan\theta$

$= \sqrt{\sec^2\theta - 1}$

$= \sqrt{\left(\dfrac{17}{15}\right)^2 - 1} = \sqrt{\dfrac{289}{225} - 1}$

$= \sqrt{\dfrac{289 - 225}{225}} = \sqrt{\dfrac{64}{225}} = \dfrac{8}{15}$

62. (1) $\sec^2\theta - \tan^2\theta = 1$

$\sec^2\theta + \tan^2\theta = \dfrac{7}{12}$

$\therefore \sec^4\theta - \tan^4\theta$

$= (\sec^2\theta - \tan^2\theta)(\sec^2\theta + \tan^2\theta)$

$= 1 \times \dfrac{7}{12} = \dfrac{7}{12}$

63. (2) $\sec x = \text{cosec}\,y$

$\Rightarrow \cos x = \sin y$

$\Rightarrow \sin\left(\dfrac{\pi}{2} - x\right) = \sin y$

$\Rightarrow y = \dfrac{\pi}{2} - x$

$\Rightarrow x + y = \dfrac{\pi}{2}$

$\therefore \sin(x + y) = \sin\dfrac{\pi}{2} = 1$

64. (3) $A + B + C = \pi$

$\Rightarrow \dfrac{A + B}{2} = \dfrac{\pi}{2} - \dfrac{C}{2}$

$\Rightarrow \sin\left(\dfrac{A + B}{2}\right)$

$= \sin\left(\dfrac{\pi}{2} - \dfrac{C}{2}\right) = \cos\dfrac{C}{2}$

Similarly,

$\cos\left(\dfrac{A + B}{2}\right) = \sin\dfrac{C}{2}$

$\cot\left(\dfrac{A + B}{2}\right) = \tan\dfrac{C}{2}$

$\tan\left(\dfrac{A + B}{2}\right) = \cot\dfrac{C}{2}$

65. (2) $\sin\alpha + \cos\beta = 2$

$\sin\alpha \leq 1\ ;\ \cos\beta \leq 1$

$\Rightarrow \alpha = 90°\ ;\ \beta = 0°$

$\therefore \sin\left(\dfrac{2\alpha + \beta}{3}\right) = \sin\left(\dfrac{180°}{3}\right)$

$= \sin 60° = \dfrac{\sqrt{3}}{2}$

Also,

$\cos\dfrac{\alpha}{3} = \cos 30° = \dfrac{\sqrt{3}}{2}$

TRIGONOMETRY

66. (3) $\cos^4\theta - \sin^4\theta = \frac{2}{3}$

$\Rightarrow (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta)$

$= \frac{2}{3}$

$\Rightarrow \cos^2\theta - \sin^2\theta = \frac{2}{3}$

$\Rightarrow 2\cos^2\theta - 1 = \frac{2}{3}$

67. (1) $\frac{\sin\alpha}{\cos(30°+\alpha)} = 1$

$\Rightarrow \frac{\sin\alpha}{\sin(90°-30-\alpha)} = 1$

$\Rightarrow \frac{\sin\alpha}{\sin(60°-\alpha)} = 1$

$\Rightarrow \sin\alpha = \sin(60° - \alpha)$
$\Rightarrow 2\alpha = 60° \Rightarrow \alpha = 30°$
$\therefore \sin\alpha + \cos 2\alpha$
$= \sin 30° + \cos 60°$

$= \frac{1}{2} + \frac{1}{2} = 1$

68. (1) $\tan\theta = 1 \Rightarrow \theta = 45°$

$\therefore \frac{8\sin\theta + 5\cos\theta}{\sin^3\theta - 2\cos^3\theta + 7\cos\theta}$

$= \frac{8 \times \frac{1}{\sqrt{2}} + \frac{5}{\sqrt{2}}}{\frac{1}{2\sqrt{2}} - \frac{2}{2\sqrt{2}} + \frac{7}{\sqrt{2}}}$

$= \frac{\frac{13}{\sqrt{2}}}{\frac{13}{2\sqrt{2}}} = \frac{13}{\sqrt{2}} \times \frac{2\sqrt{2}}{13} = 2$

69. (2) $\cos^2\theta + \cos^4\theta = 1$
$\Rightarrow \cos^4\theta = 1 - \cos^2\theta = \sin^2\theta$
$\Rightarrow \tan^2\theta = \cos^2\theta$
$\therefore \tan^2\theta + \tan^4\theta = \cos^2\theta + \cos^4\theta$
$= 1$

70. (3) $\tan\theta = \frac{4}{3}$ (Given)

$\therefore \frac{3\sin\theta + 2\cos\theta}{3\sin\theta - 2\cos\theta} = \frac{3\tan\theta + 2}{3\tan\theta - 2}$

[Dividing N^r & D^r by $\cos\theta$]

$= \frac{3 \times \frac{4}{3} + 2}{3 \times \frac{4}{3} - 2} = \frac{4+2}{4-2} = 3$

71. (3) $(\sec A - \cos A)^2 + (\operatorname{cosec} A - \sin A)^2 - (\cot A - \tan A)^2$
$= \sec^2 A + \cos^2 A - 2\sec A \cos A + \operatorname{cosec}^2 A + \sin^2 A - 2\operatorname{cosec} A . \sin A - \cot^2 A - \tan^2 A + 2 \cot A . \tan A$
$= \sec^2 A - \tan^2 A + \cos^2 A + \sin^2 A + \operatorname{cosec}^2 A - \cot^2 A - 2$
$= 3 - 2 = 1$

$\left[\begin{array}{r} \because \sec A . \cos A = 1; \\ \sin A . \operatorname{cosec} A = 1; \\ \tan A . \cot A = 1 \\ \text{etc} \end{array}\right]$

72. (2) $\tan\theta + \cot\theta = 2$

$\Rightarrow \tan\theta + \frac{1}{\tan\theta} = 2$

$\Rightarrow \tan^2\theta + 1 = 2\tan\theta$
$\Rightarrow \tan^2\theta - 2\tan\theta + 1 = 0$
$\Rightarrow (\tan\theta - 1)^2 = 0$
$\Rightarrow \tan\theta = 1 \Rightarrow \cot\theta = 1$
$\therefore \tan^5\theta + \cot^{10}\theta = 1 + 1 = 2$

73. (1) $\sin\theta - \cos\theta = \frac{7}{13}$ .....(i)

$\sin\theta + \cos\theta = x$ .....(ii)
On squaring both equations and adding,

$2(\sin^2\theta + \cos^2\theta) = \frac{49}{169} + x^2$

$\Rightarrow x^2 = 2 - \frac{49}{169} = \frac{338 - 49}{169}$

$= \frac{289}{169} \Rightarrow x = \frac{17}{13}$

74. (3) $2\cos\theta - \sin\theta = \frac{1}{\sqrt{2}}$

$2\sin\theta + \cos\theta = x$ (Let)
On squaring and adding,
$4\cos^2\theta + \sin^2\theta - 4\sin\theta . \cos\theta + 4\sin^2\theta + \cos^2\theta + 4\sin\theta.\cos\theta$

$= \frac{1}{2} + x^2$

$\Rightarrow 4(\cos^2\theta + \sin^2\theta) + (\cos^2\theta + \sin^2\theta) = \frac{1}{2} + x^2$

$\Rightarrow \frac{1}{2} + x^2 = 5$

$\Rightarrow x^2 = 5 - \frac{1}{2} = \frac{9}{2} \Rightarrow x = \frac{3}{\sqrt{2}}$

75. (3) $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$

$\Rightarrow \sin\theta + \cos\theta = 3\sin\theta - 3\cos\theta$
$\Rightarrow 4\cos\theta = 2\sin\theta \Rightarrow \tan\theta = 2$
$\therefore \sin^4\theta - \cos^4\theta$
$= (\sin^2\theta + \cos^2\theta)(\sin^2\theta - \cos^2\theta)$
$= \sin^2\theta - \cos^2\theta$
$= \cos^2\theta(\tan^2\theta - 1)$

$= \frac{\tan^2\theta - 1}{\sec^2\theta}$

$= \frac{\tan^2\theta - 1}{1 + \tan^2\theta} = \frac{4-1}{1+4} = \frac{3}{5}$

76. (1) $\sec^2\theta + \tan^2\theta = 7$
$\Rightarrow 1 + \tan^2\theta + \tan^2\theta = 7$
$\Rightarrow 2\tan^2\theta = 7 - 1 = 6$

$\Rightarrow \tan^2\theta = 3 \Rightarrow \tan\theta = \sqrt{3}$

$\Rightarrow \theta = 60°$

77. (4) $(\sec x . \sec y + \tan x . \tan y)^2 - (\sec x . \tan y + \tan x . \sec y)^2$
$= \sec^2 x . \sec^2 y + \tan^2 x . \tan^2 y + 2 \sec x . \sec y . \tan x . \tan y - \sec^2 x . \tan^2 y - \tan^2 x . \sec^2 y - 2 \sec x . \sec y . \tan x . \tan y$
$= \sec^2 x . \sec^2 y + \tan^2 x . \tan^2 y - \sec^2 x . \tan^2 y - \tan^2 x . \sec^2 y$
$= \sec^2 x . \sec^2 y - \sec^2 x . \tan^2 y - \tan^2 x . \sec^2 y + \tan^2 x . \tan^2 y$
$= \sec^2 x (\sec^2 y - \tan^2 y) - \tan^2 x (\sec^2 y - \tan^2 y)$
$= \sec^2 x - \tan^2 x = 1$

78. (2) $\sin\theta + \operatorname{cosec}\theta = 2$

$\Rightarrow \sin\theta + \frac{1}{\sin\theta} = 2$

$\Rightarrow \sin^2\theta - 2\sin\theta + 1 = 0$
$\Rightarrow (\sin\theta - 1) = 0$
$\Rightarrow \sin\theta = 1 \quad \Rightarrow \operatorname{cosec}\theta = 1$
$\therefore \sin^{100}\theta + \operatorname{cosec}^{100}\theta$
$= 1 + 1 = 2$

79. (2) When $\theta = 0°$
$\sin^2\theta + \cos^4\theta = 1$
When $\theta = 45°$,

$\left[\sin 45° = \frac{1}{\sqrt{2}} \& \cos 45° = \frac{1}{\sqrt{5}}\right]$

$\sin^2\theta + \cos^4\theta = \frac{1}{2} + \frac{1}{4} = \frac{3}{4}$

When $\theta = 30°$,

$\left[\sin 30° = \frac{1}{2} \& \cos 30° = \frac{\sqrt{3}}{2}\right]$

$\sin^2\theta + \cos^4\theta = \frac{1}{4} + \frac{9}{16}$

$= \frac{4+9}{16} = \frac{13}{16}$

Hence, the value of

$A = \sin^2\theta + \cos^4\theta = \frac{13}{16}$

80. (4) $\sin\theta + \text{cosec}\,\theta = 2$

$\Rightarrow \sin\theta + \frac{1}{\sin\theta} = 2$

$\Rightarrow \sin^2\theta - 2\sin\theta + 1 = 0$

$\Rightarrow (\sin\theta - 1)^2 = 0 \Rightarrow \sin\theta = 1$

$\therefore \sin^5\theta + \text{cosec}^5\theta = 1 + 1 = 2$

81. (3) $\tan 2\theta = \frac{1}{\tan 4\theta} = \cot 4\theta$

$\Rightarrow \tan 2\theta = \tan(90° - 4\theta)$
$\Rightarrow 2\theta = 90° - 4\theta$
$\Rightarrow 6\theta = 90° \Rightarrow \theta = 15°$
$\therefore \tan 3\theta = \tan 45° = 1$

82. (2) $\cos^2\alpha + \cos^2\beta = 2$
$\Rightarrow 1 - \sin^2\alpha + 1 - \sin^2\beta = 2$
$\Rightarrow \sin^2\alpha + \sin^2\beta = 0$
$\Rightarrow \sin^2\alpha = 0$ & $\sin^2\beta = 0$
$\Rightarrow \sin\alpha = \sin\beta = 0$
$\Rightarrow \alpha = \beta = 0$
$\therefore \tan^3\alpha + \sin^5\beta = 0$

83. (3) $\tan 2\theta \cdot \tan 3\theta = 1$

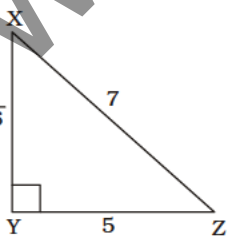
$\Rightarrow \tan 3\theta = \frac{1}{\tan 2\theta} = \cot 2\theta$

$\Rightarrow \tan 3\theta = \tan(90° - 2\theta)$
$\Rightarrow 3\theta = 90° - 2\theta \Rightarrow 5\theta = 90°$
$\Rightarrow \theta = 18°$

$\therefore 2\cos^2\frac{5\theta}{2} - 1 = 2\cos^2 45° - 1$

$= 2 \times \frac{1}{2} - 1 = 0$

84. (2)



$XZ - YZ = 2$ .... (I)
$\Rightarrow XY^2 + YZ^2 = XZ^2$

$\Rightarrow \left(2\sqrt{6}\right)^2 = XZ^2 - YZ^2$

$\Rightarrow 24 = (XZ - YZ)(XZ + YZ)$
$\Rightarrow XZ + YZ = 12$ ....(II)
Adding both the equations,

$2 \text{ X } Z = 14 \Rightarrow XZ = 7$
$\therefore YZ = 7 - 2 = 5$

$\therefore \sec X = \frac{7}{2\sqrt{6}}$

& $\tan X = \frac{5}{2\sqrt{6}}$

$\therefore \sec X + \tan X = \frac{7}{2\sqrt{6}} + \frac{5}{2\sqrt{6}}$

$= \frac{12}{2\sqrt{6}} = \sqrt{6}$

85. (4) $\sin^2\theta + \cos^2\theta + \sec^2\theta + \text{cosec}^2\theta + \tan^2\theta + \cot^2\theta$
$= 1 + \sec^2\theta - \tan^2\theta + \text{cosec}^2\theta - \cot^2\theta + 2(\tan^2\theta + \cot^2\theta)$
$= 3 + 2((\tan\theta - \cot\theta)^2 + 2) > 7$
$[(\tan\theta - \cot\theta)^2 > 0]$

86. (4) $x^2 + \frac{1}{x^2} = 2\sin\left(\frac{\pi x}{2}\right)$

$\Rightarrow \left(x - \frac{1}{x}\right)^2 + 2 = 2\sin\left(\frac{\pi x}{2}\right)$

$\Rightarrow x - \frac{1}{x} = 0$ $[\because \sin\theta \le 1]$

87. (4) $\cos\theta + \sec\theta = 2$

$\Rightarrow \cos\theta + \frac{1}{\cos\theta} = 2$

$\Rightarrow \cos^2\theta - 2\cos\theta + 1 = 0$
$\Rightarrow (\cos\theta - 1)^2 = 0$
$\Rightarrow \cos\theta = 1$
$\Rightarrow \sec\theta = 1$
$\therefore \cos^6\theta + \sec^6\theta = 1 + 1 = 2$

88. (1) Expression

$= \frac{5}{\sec^2\theta} + \frac{2}{1 + \cot^2\theta} + 3\sin^2\theta$

$= 5\cos^2\theta + \frac{2}{\text{cosec}^2\theta} + 3\sin^2\theta$

$= 5\cos^2\theta + 2\sin^2\theta + 3\sin^2\theta$
$= 5(\cos^2\theta + \sin^2\theta) = 5$

$\left[\because 1 + \cot^2\theta = \text{cosec}^2\theta, \frac{1}{\sec\theta} = \cos\theta; \& \frac{1}{\text{cosec}\,\theta} = \sin\theta\right]$

89. (3) Expression

$= \left(\frac{1}{\cos\theta} + \frac{1}{\cot\theta}\right)\left(\frac{1}{\cos\theta} - \frac{1}{\cot\theta}\right)$

$= \left(\frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}\right)\left(\frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta}\right)$

$= \frac{1+\sin\theta}{\cos\theta} \cdot \frac{1-\sin\theta}{\cos\theta}$

$= \frac{1 - \sin^2\theta}{\cos^2\theta} = \frac{\cos^2\theta}{\cos^2\theta} = 1$

90. (3) $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = \frac{5}{4}$

$\Rightarrow \frac{\cos\theta\left(\frac{\sin\theta}{\cos\theta} + 1\right)}{\cos\theta\left(\frac{\sin\theta}{\cos\theta} - 1\right)} = \frac{5}{4}$

$\Rightarrow \frac{\tan\theta + 1}{\tan\theta - 1} = \frac{5}{4}$

$\Rightarrow 4\tan\theta + 4 = 5\tan\theta - 5$
$\Rightarrow \tan\theta = 9$

$\Rightarrow \frac{2\tan\theta}{2} = \frac{5+4}{5-4}$

(By componendo and dividendo)

$\therefore \frac{\tan^2\theta + 1}{\tan^2\theta - 1} = \frac{(9)^2 + 1}{(9)^2 - 1} = \frac{81+1}{81-1}$

$= \frac{82}{80} = \frac{41}{40}$

91. (3) $\tan 7\theta \cdot \tan 2\theta = 1$

$\Rightarrow \tan 7\theta = \frac{1}{\tan 2\theta} = \cot 2\theta$

$\Rightarrow \tan 7\theta = \tan(90° - 2\theta)$
$\Rightarrow 7\theta = 90° - 2\theta$
$\Rightarrow 9\theta = 90° \Rightarrow \theta = 10°$

$\therefore \tan 3\theta = \tan 30° = \frac{1}{\sqrt{3}}$

92. (4) $(2\cos^2\theta - 1)$

$\left(\frac{1+\tan\theta}{1-\tan\theta} + \frac{1-\tan\theta}{1+\tan\theta}\right)$

$= (2\cos^2\theta - 1)$

$\left(\frac{(1+\tan\theta)^2 + (1-\tan\theta)^2}{1 - \tan^2\theta}\right)$

$= (2\cos^2\theta - 1)$

$$\left(2\left(\frac{1+\tan^2\theta}{1-\tan^2\theta}\right)\right)$$

$$= \frac{2\sec^2\theta(2\cos^2\theta-1)}{1-\frac{\sin^2\theta}{\cos^2\theta}}$$

$$= \frac{2\sec^2\theta(2\cos^2\theta-1)}{\frac{\cos^2\theta-\sin^2\theta}{\cos^2\theta}}$$

$$= \frac{2\sec^2\theta.\cos^2\theta(2\cos^2\theta-1)}{2\cos^2\theta-1}$$

$= 2$

93. (3) $\sec\theta + \tan\theta = 2$ .....(i)

$\therefore \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta+\tan\theta)(\sec\theta-\tan\theta) = 1$

$$\Rightarrow \sec\theta - \tan\theta = \frac{1}{2} \quad \text{.....(ii)}$$

By adding equations (i) and (ii),

$\therefore \sec\theta + \tan\theta + \sec\theta - \tan\theta$

$$= 2 + \frac{1}{2} = \frac{5}{2}$$

$$\Rightarrow 2\sec\theta = \frac{5}{2} \Rightarrow \sec\theta = \frac{5}{4}$$

94. (3) $(l^2.m^2)\ (l^2 + m^2 + 3)$

$= (\text{cosec}\,\theta - \sin\theta)^2$

$(\sec\theta - \cos\theta)^2$

$\{(\text{cosec}\,\theta - \sin\theta)^2 + (\sec\theta - \cos\theta)^2 + 3\}$

$$= \left(\frac{1}{\sin\theta}-\sin\theta\right)^2\left(\frac{1}{\cos\theta}-\cos\theta\right)^2$$

$$\left\{\left(\frac{1}{\sin\theta}-\sin\theta\right)^2+\left(\frac{1}{\cos\theta}-\cos\theta\right)^2+3\right\}$$

$$= \left(\frac{1-\sin^2\theta}{\sin\theta}\right)^2\left(\frac{1-\cos^2\theta}{\cos\theta}\right)^2$$

$$\left\{\left(\frac{1-\sin^2\theta}{\sin\theta}\right)^2+\left(\frac{1-\cos^2\theta}{\cos\theta}\right)^2+3\right\}$$

$$= \left(\frac{\cos^2\theta}{\sin\theta}\right)^2\left(\frac{\sin^2\theta}{\cos\theta}\right)^2$$

$$\left\{\left(\frac{\cos^2\theta}{\sin\theta}\right)^2+\left(\frac{\sin^2\theta}{\cos\theta}\right)^2+3\right\}$$

$$= \frac{\cos^4\theta}{\sin^2\theta}\times\frac{\sin^4\theta}{\cos^2\theta}$$

$$\left\{\frac{\cos^4\theta}{\sin^2\theta}+\frac{\sin^4\theta}{\cos^2\theta}+3\right\}$$

$= \cos^2\theta \times \sin^2\theta$

$$\left\{\frac{\cos^6\theta+\sin^6\theta+3\cos^2\theta.\sin^2\theta}{\cos^2\theta.\sin^2\theta}\right\}$$

$= \cos^6\theta + \sin^6\theta + 3\cos^2\theta\,.\,\sin^2\theta$

$= \{(\cos^2\theta + \sin^2\theta)^3 - 3\cos^2\theta\,.\,\sin^2\theta(\cos^2\theta + \sin^2\theta)\} + 3\cos^2\theta\,.\,\sin^2\theta$

$[\because\ a^3 + b^3 = (a+b)^3 - 3ab\,(a+b)]$

$= 1 - 3\cos^2\theta\,.\,\sin^2\theta + 3\cos^2\theta\,.\,\sin^2\theta = 1$

95. (1) $\dfrac{2\sin\theta-\cos\theta}{\cos\theta+\sin\theta} = 1$

Dividing numerator and denominator by $\sin\theta$,

$$\frac{2-\cot\theta}{\cot\theta+1} = 1$$

$\Rightarrow 2 - \cot\theta = \cot\theta + 1$

$\Rightarrow 2\cot\theta = 1$

$$\Rightarrow \cot\theta = \frac{1}{2}$$

96. (1) Expression

$$= \frac{8\sin\theta+5\cos\theta}{\sin^3\theta+2\cos^3\theta+3\cos\theta}$$

Dividing numerator and denominator by $\cos\theta$,

$$= \frac{8\tan\theta+5}{\tan\theta.\sin^2\theta+2\cos^2\theta+3}$$

$$= \frac{8\tan\theta+5}{2\sin^2\theta+2\cos^2\theta+3}$$

$$= \frac{8\tan\theta+5}{2(\sin^2\theta+\cos^2\theta)+3}$$

$$= \frac{8\times2+5}{5} = \frac{21}{5}$$

97. (1) $\tan\theta + \cot\theta = 2$

$$\Rightarrow \tan\theta + \frac{1}{\tan\theta} = 2$$

$\Rightarrow \tan^2\theta + 1 = 2\tan\theta$

$\Rightarrow \tan^2\theta - 2\tan\theta + 1 = 0$

$\Rightarrow (\tan\theta - 1)^2 = 0$

$\Rightarrow \tan\theta = 1$

$$\therefore \cot\theta = \frac{1}{\tan\theta} = 1$$

$\therefore\ \tan^{100}\theta + \cot^{100}\theta = 1 + 1 = 2$

98. (4) Expression

$$= \frac{\tan\theta}{1-\cot\theta} + \frac{\cot\theta}{1-\tan\theta}$$

$$= \frac{\tan\theta}{1-\frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1-\tan\theta}$$

$$= \frac{\tan^2\theta}{\tan\theta-1} + \frac{1}{\tan\theta(1-\tan\theta)}$$

$$= \frac{\tan^2\theta}{\tan\theta-1} - \frac{1}{\tan\theta(\tan\theta-1)}$$

$$= \frac{\tan^3\theta-1}{\tan\theta(\tan\theta-1)}$$

$$= \frac{(\tan\theta-1)(\tan^2\theta+\tan\theta+1)}{\tan\theta(\tan\theta-1)}$$

$$= \frac{\tan^2\theta+\tan\theta+1}{\tan\theta}$$

$= \tan\theta + \cot\theta + 1$

99. (2) $\sin\theta + \text{cosec}\,\theta = 2$

$$\Rightarrow \sin\theta + \frac{1}{\sin\theta} = 2$$

$\Rightarrow \sin^2\theta - 2\sin\theta + 1 = 0$

$\Rightarrow (\sin\theta - 1)^2 = 0$

$\Rightarrow \sin\theta = 1$

$\therefore\ \text{cosec}\,\theta = 1$

$\therefore\ \sin^9\theta + \text{cosec}^9\theta = 1 + 1 = 2$

100. (1) $\sec\theta + \tan\theta = 2 + \sqrt{5}$

$$\therefore \sec\theta - \tan\theta = \frac{1}{\sqrt{5}+2}$$

$\left[\because \sec^2\theta - \tan^2\theta = 1\right]$

$$= \frac{\sqrt{5}-2}{(\sqrt{5}+2)(\sqrt{5}-2)} = \sqrt{5}-2$$

On adding,

$2\sec\theta = 2 + \sqrt{5} + \sqrt{5} - 2 = 2\sqrt{5}$

$$\Rightarrow \sec\theta = \sqrt{5} \Rightarrow \cos\theta = \frac{1}{\sqrt{5}}$$

On subtracting,

$2\tan\theta = 2 + \sqrt{5} - \sqrt{5} + 2 = 4$

$\Rightarrow \tan\theta = 2$

$$\therefore \frac{\tan\theta}{\sec\theta} = \sin\theta = \frac{2}{\sqrt{5}}$$

$$\therefore \sin\theta + \cos\theta = \frac{2}{\sqrt{5}} + \frac{1}{\sqrt{5}}$$

$$= \frac{3}{\sqrt{5}}$$

101. (2) $(1+\cot\theta - \operatorname{cosec}\theta)$

$$(1+\tan\theta+\sec\theta)$$

$$= \left(1+\frac{\cos\theta}{\sin\theta}-\frac{1}{\sin\theta}\right)\left(1+\frac{\sin\theta}{\cos\theta}+\frac{1}{\cos\theta}\right)$$

$$= \frac{\sin\theta+\cos\theta-1}{\sin\theta} \times \frac{\cos\theta+\sin\theta+1}{\cos\theta}$$

$$= \frac{(\sin\theta+\cos\theta)^2-1}{\sin\theta.\cos\theta}$$

$$= \frac{\sin^2\theta+\cos^2\theta+2\sin\theta.\cos\theta-1}{\sin\theta.\cos\theta}$$

$$= \frac{2\sin\theta.\cos\theta}{\sin\theta.\cos\theta} = 2$$

102. (1) $\tan\theta+\cot\theta = 2$

$$\Rightarrow \tan\theta + \frac{1}{\tan\theta} = 2$$

$$\Rightarrow \tan^2\theta - 2\tan\theta + 1 = 0$$

$$\Rightarrow (\tan\theta - 1)^2 = 0$$

$$\Rightarrow \tan\theta = 1 = 0 \Rightarrow \tan\theta = 1$$

$$\therefore \cot\theta = 1 \Rightarrow \theta = 45°$$

$$\therefore \tan^n 45° + \cot^n 45° = 1 + 1 = 2$$

103. (3) $\frac{\sin\theta}{x} = \frac{\cos\theta}{y} = \frac{1}{k}$

$$\Rightarrow x = k\sin\theta;\ y = k\cos\theta$$

$$\therefore x^2 + y^2$$

$$= k^2(\sin^2\theta + \cos^2\theta) = k^2$$

$$\Rightarrow k = \sqrt{x^2+y^2}$$

$$\therefore \sin\theta - \cos\theta$$

$$= \frac{x}{k} - \frac{y}{k} = \frac{x-y}{k}$$

$$= \frac{x-y}{\sqrt{x^2+y^2}}$$

104. (1) $x = a\sec\theta.\cos\phi;\ y = b\sec\theta.\sin\phi,\ z = c\tan\theta$

$$\therefore \frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}$$

$$= \sec^2\theta.\cos^2\phi + \sec^2\theta.\sin^2\phi - \tan^2\theta$$

$$= \sec^2\theta(\cos^2\phi + \sin^2\phi) - \tan^2\theta$$

$$= \sec^2\theta - \tan^2\theta = 1$$

105. (1) $\frac{\sec\theta+\tan\theta}{\sec\theta-\tan\theta} = \frac{5}{3}$

$$\Rightarrow 5\sec\theta - 5\tan\theta$$

$$= 3\sec\theta + 3\tan\theta$$

$$\Rightarrow 2\sec\theta = 8\tan\theta$$

$$\Rightarrow \frac{\tan\theta}{\sec\theta} = \frac{2}{8} = \frac{1}{4}$$

$$\Rightarrow \frac{\sin\theta}{\cos\theta} \times \cos\theta = \frac{1}{4}$$

$$\Rightarrow \sin\theta = \frac{1}{4}$$

106. (3) $\cos x + \cos^2 x = 1$

$$\Rightarrow \cos x = 1 - \cos^2 x = \sin^2 x \ldots(1)$$

$$\therefore \sin^{12}x + 3\sin^{10}x + 3\sin^8 x + \sin^6 x - 1$$

$$= (\sin^4 x + \sin^2 x)^3 - 1$$

$$= (\cos^2 x + \sin^2 x)^3 - 1 \quad [\text{By (1)}]$$

$$= 1 - 1 = 0$$

107. (1) $(1+\sin\alpha)(1+\sin\beta)(1+\sin\gamma) = (1-\sin\alpha)(1-\sin\beta)(1-\sin\gamma) = x$

$$\therefore x.x = (1+\sin\alpha)(1-\sin\alpha)(1+\sin\beta)(1-\sin\beta)(1+\sin\gamma)(1-\sin\gamma)$$

$$= (1-\sin^2\alpha)(1-\sin^2\beta)(1-\sin^2\gamma)$$

$$= \cos^2\alpha.\cos^2\beta.\cos^2\gamma$$

$$\therefore x = \pm\cos\alpha.\cos\beta.\cos\gamma$$

108. (4)

$$\frac{1}{1+\cot^2\theta}+\frac{3}{1+\tan^2\theta}+2\sin^2\theta$$

$$= \frac{1}{\operatorname{cosec}^2\theta}+\frac{3}{\sec^2\theta}+2\sin^2\theta$$

$$= \sin^2\theta + 3\cos^2\theta + 2\sin^2\theta$$

$$= 3(\sin^2\theta+\cos^2\theta) = 3$$

109. (1)

$$\frac{4}{1+\tan^2\alpha}+\frac{1}{1+\cot^2\alpha}+3\sin^2\alpha$$

$$= \frac{4}{\sec^2\alpha}+\frac{1}{\operatorname{cosec}^2\alpha}+3\sin^2\alpha$$

$$= 4\cos^2\alpha + \sin^2\alpha + 3\sin^2\alpha$$

$$= 4(\cos^2\alpha+\sin^2\alpha) = 4$$

110. (4) $3(\sin x - \cos x)^4 + 6(\sin x + \cos x)^2 + 4(\sin^6 x + \cos^6 x)$

$$= 3(\sin^2 x + \cos^2 x - 2\sin x.\cos x)^2 + 6(\sin^2 x + \cos^2 x + 2\sin x.\cos x) + 4[(\sin^2 x + \cos^2 x)^3 - 3\sin^2 x.\cos^2 x(\sin^2 x + \cos^2 x)]$$

$$= 3(1 - 2\sin x\cos x)^2 + 6(1 + 2\sin x.\cos x) + 4(1 - 3\sin^2 x\cos^2 x)$$

$$= 3(1 + \sin^2 x.\cos^2 x - 4\sin x\cos x) + 6(1 + 2\sin x\cos x) + 4(1 - 3\sin^2 x\cos^2 x)$$

$$= 3 + 6 + 4 = 13$$

111. (3) Expression

$$= \sec\theta\left(\frac{1+\sin\theta}{\cos\theta}+\frac{\cos\theta}{1+\sin\theta}\right) - 2\tan^2\theta$$

$$= \frac{1+\sin^2\theta+2\sin\theta+\cos^2\theta}{\cos^2\theta(1+\sin\theta)} - 2\tan^2\theta$$

$$= \frac{2+2\sin\theta}{\cos^2\theta(1+\sin\theta)} - 2\tan^2\theta$$

$$= \frac{2}{\cos^2\theta} - 2\tan^2\theta$$

$$= 2\sec^2\theta - 2\tan^2\theta$$

$$= 2(\sec^2\theta - \tan^2\theta) = 2$$

112. (1) $\tan\theta + \cot\theta = 2$

On squaring both sides,

$$(\tan\theta+\cot\theta)^2 = 4$$

$$\Rightarrow \tan^2\theta + \cot^2\theta + 2\tan\theta.\cot\theta = 4$$

$$\Rightarrow \tan^2\theta + \cot^2\theta = 4 - 2 = 2$$

$$[\tan\theta.\cot\theta = 1]$$

113. (1) $x\cos\theta - y\sin\theta = 2$

$$x\sin\theta + y\cos\theta = 4$$

On squaring both the equations and adding

$$x^2\cos^2\theta + y^2\sin^2\theta - 2xy\sin\theta.\cos\theta + x^2\sin^2\theta + y^2\cos^2\theta + 2xy\sin\theta.\cos\theta = 4 + 16$$

$$\Rightarrow x^2(\cos^2\theta + \sin^2\theta) + y^2(\sin^2\theta + \cos^2\theta) = 20$$

$$\Rightarrow x^2 + y^2 = 20$$

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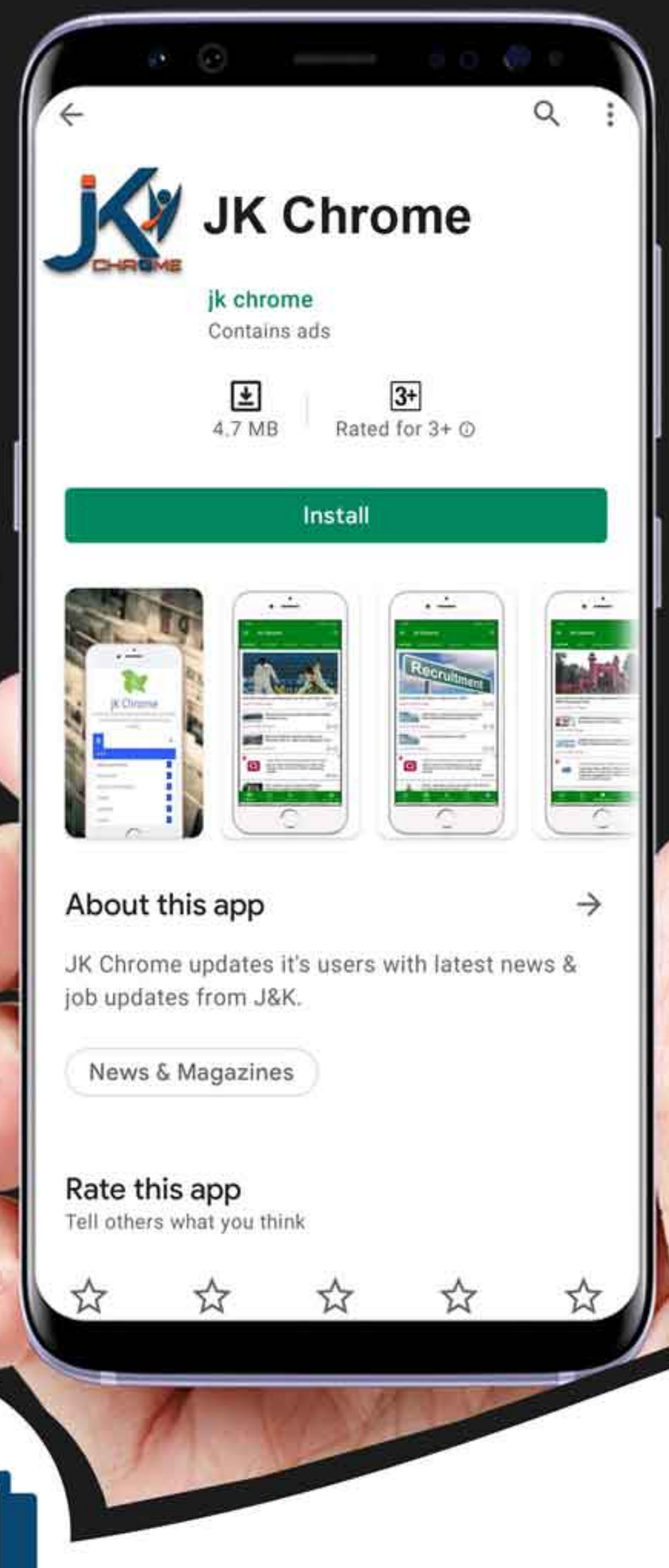

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114. (3) Expression

$$=\left[\frac{\cos^2 A(\sin A+\cos A)}{\operatorname{cosec}^2 A(\sin A-\cos A)}+\frac{\sin^2 A(\sin A-\cos A)}{\sec^2 A(\sin A+\cos A)}\right]\times\left(\frac{1}{\cos^2 A}-\frac{1}{\sin^2 A}\right)$$

$$=\left[\frac{\cos^2 A.\sin^2 A(\sin A+\cos A)}{\sin A-\cos A}+\frac{\sin^2 A.\cos^2 A(\sin A-\cos A)}{(\sin A+\cos A)}\right]\left(\frac{\sin^2 A-\cos^2 A}{\sin^2 A.\cos^2 A}\right)$$

$$=\left(\frac{\sin A+\cos A}{\sin A-\cos A}+\frac{\sin A-\cos A}{\sin A+\cos A}\right)(\sin^2 A-\cos^2 A)$$

$$=\left[\frac{(\sin A+\cos A)^2+(\sin A-\cos A)^2}{(\sin A-\cos A)(\sin A+\cos A)}\right](\sin^2 A-\cos^2 A)$$

$$=2(\sin^2 A+\cos^2 A)=2$$

115. (2) Expression

$$=\frac{1}{\operatorname{cosec}\theta-\cot\theta}-\frac{1}{\sin\theta}$$

$$=\frac{\operatorname{cosec}^2\theta-\cot^2\theta}{\operatorname{cosec}\theta-\cot\theta}-\operatorname{cosec}\theta$$

$= \operatorname{cosec}\theta+\cot\theta-\operatorname{cosec}\theta = \cot\theta$

$[\operatorname{cosec}^2\theta-\cot^2\theta=1 \;\&\; \frac{1}{\sin\theta}$

$=\operatorname{cosec}\theta]$

Method-2 :

$$\frac{1}{\frac{1}{\sin\theta}-\frac{\cos\theta}{\sin\theta}}-\frac{1}{\sin\theta}$$

$$=\frac{\sin\theta}{1-\cos\theta}-\frac{1}{\sin\theta}-\frac{\sin^2\theta-1+\cos\theta}{\sin\theta(1-\cos\theta)}$$

$$=\frac{1-\cos^2\theta-1+\cos\theta}{\sin\theta(1-\cos\theta)}$$

$$=\frac{\cos\theta(-\cos\theta+1)}{\sin\theta(1-\cos\theta)}=\frac{\cos\theta}{\sin\theta}=\cot\theta.$$

116. (4) $\cos\theta+\sin\theta=\sqrt{2}\cos\theta$

On squaring both sides,

$$\cos^2\theta+\sin^2\theta+2\cos\theta.\sin\theta$$

$$=2\cos^2\theta$$

$\Rightarrow \cos^2\theta-\sin^2\theta=2\sin\theta.\cos\theta$

$\Rightarrow (\cos\theta+\sin\theta)(\cos\theta-\sin\theta)$

$= 2\sin\theta.\cos\theta$

$\Rightarrow \sqrt{2}\cos\theta(\cos\theta-\sin\theta)$

$= 2\sin\theta.\cos\theta$

$\Rightarrow \cos\theta-\sin\theta$

$$=\frac{2\sin\theta.\cos\theta}{\sqrt{2}\cos\theta}=\sqrt{2}\sin\theta$$

117. (3) $\cos^4\theta-\sin^4\theta=\frac{2}{3}$

$$\Rightarrow(\cos^2\theta+\sin^2\theta)(\cos^2\theta-\sin^2\theta)=\frac{2}{3}$$

$$\Rightarrow\cos^2\theta-\sin^2\theta=\frac{2}{3}$$

$$\Rightarrow 1-\sin^2\theta-\sin^2\theta=\frac{2}{3}$$

$$\Rightarrow 1-2\sin^2\theta=\frac{2}{3}$$

118. (2) Expression

$$=\frac{1}{1+\tan^2\theta}+\frac{1}{1+\cot^2\theta}$$

$$=\frac{1}{\sec^2\theta}+\frac{1}{\operatorname{cosec}^2\theta}$$

$= \cos^2\theta+\sin^2\theta=1$

119. (3) $\sin\theta-\cos\theta=\frac{1}{2}$

$\sin\theta+\cos\theta=x$

On squaring and adding,

$$2(\sin^2\theta+\cos^2\theta)=\frac{1}{4}+x^2$$

$$\Rightarrow x^2=2-\frac{1}{4}=\frac{7}{4}$$

$$\Rightarrow x=\frac{\sqrt{7}}{2}$$

120. (1) $\frac{\sin A}{1+\cos A}+\frac{\sin A}{1-\cos A}$

$$=\frac{\sin A(1-\cos A)+\sin A(1+\cos A)}{(1+\cos A)(1-\cos A)}$$

$$=\frac{\sin A-\sin A\cos A+\sin A+\sin A.\cos A}{1-\cos^2 A}$$

$$=\frac{2\sin A}{\sin^2 A}=2\operatorname{cosec} A$$

121. (4) $r\sin\theta=1$

$r\cos\theta=\sqrt{3}$

$$\Rightarrow\frac{\sin\theta}{\cos\theta}=\tan\theta=\frac{1}{\sqrt{3}}$$

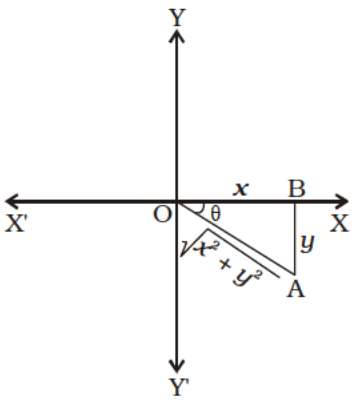
$\therefore \sqrt{3}\tan\theta+1$

$$=\sqrt{3}\times\frac{1}{\sqrt{3}}+1=1+1=2$$

122. (2) According to question,

$$x\cos\theta-y\sin\theta=\sqrt{x^2+y^2} \quad ...(i)$$

$$\frac{\cos^2\theta}{a^2}+\frac{\sin^2\theta}{b^2}=\frac{1}{x^2+y^2} \quad ...(ii)$$



$$\sin\theta=\frac{-y}{\sqrt{x^2+y^2}}$$

$$\cos\theta=\frac{x}{\sqrt{x^2+y^2}}$$

From equation (i)

$$\frac{x}{\sqrt{x^2+y^2}}\cos\theta-\frac{y}{\sqrt{x^2+y^2}}.\sin\theta=1$$

$$\therefore\frac{\cos^2\theta}{a^2}+\frac{\sin^2\theta}{b^2}=\frac{1}{x^2+y^2}$$

$$\Rightarrow\frac{x^2}{(x^2+y^2)a^2}+\frac{y^2}{(x^2+y^2).b^2}$$

$$=\frac{1}{x^2+y^2}$$

$$\Rightarrow\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

123. (3) $\tan\theta - \cot\theta = 0$

$\Rightarrow \tan\theta = \cot\theta = \tan(90° - \theta)$

$\Rightarrow \theta = 90° - \theta \Rightarrow 2\theta = 90° \Rightarrow \theta = 45°$

$\therefore \sin\theta + \cos\theta$

$= \sin 45° + \cos 45°$

$= \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$

124. (4) $\cos^4\theta + \sin^4\theta = (\cos^2\theta + \sin^2\theta)^2 - 2\cos^2\theta\sin^2\theta$

From maximum value,

$2\sin^2\theta.\cos^2\theta = 0$

Hence, $\sin^4\theta + \cos^4\theta$

$= (1)^2 - 0$

$= 1$

125. (1) $3\sin\theta + 5\cos\theta = 5$ ...(i)

$5\sin\theta - 3\cos\theta = x$ ...(ii)

On squaring and adding,

$9\sin^2\theta + 25\cos^2\theta + 25\sin^2\theta + 9\cos^2\theta = 25 + x^2$

$\Rightarrow 9(\sin^2\theta + \cos^2\theta) + 25(\cos^2\theta + \sin^2\theta) = 25 + x^2$

$\Rightarrow 9 + 25 = 25 + x^2$

$\Rightarrow x^2 = 9$

$\Rightarrow x = \pm 3$

126. (4) $\sin\theta + \sin^2\theta = 1$

$\Rightarrow \sin\theta = 1 - \sin^2\theta = \cos^2\theta$

$\therefore \cos^2\theta + \cos^4\theta$

$= \cos^2\theta + (\cos^2\theta)^2$

$= \cos^2\theta + \sin^2\theta = 1$

127. (1) $\tan\theta + \cot\theta = 2$

$\Rightarrow \tan\theta + \frac{1}{\tan\theta} = 2$

$\Rightarrow \frac{\tan^2\theta + 1}{\tan\theta} = 2$

$\Rightarrow \tan^2\theta + 1 = 2\tan\theta$

$\Rightarrow \tan^2\theta - 2\tan\theta + 1 = 0$

$\Rightarrow (\tan\theta - 1)^2 = 0$

$\Rightarrow \tan\theta - 1 = 0$

$\Rightarrow \tan\theta = 1 = \tan 45°$

$\Rightarrow \theta = 45°$

128. (4) $\cos\pi x = x^2 - x + \frac{5}{4}$

$= x^2 - 2.x.\frac{1}{2} + \frac{1}{4} - \frac{1}{4} + \frac{5}{4}$

$= \left(x - \frac{1}{2}\right)^2 + 1 > 1$

$-1 \le \cos x \le 1$

129. (4) $1 + \frac{1}{\cot^2 63°} - \sec^2 27° +$

$+ \frac{1}{\sin^2 63°} - \operatorname{cosec}^2 27°$

$= 1 + \tan^2 63° - \sec^2 27°$

$+ \operatorname{cosec}^2 63° - \operatorname{cosec}^2 27°$

$= 1 + \tan^2(90° - 27°) - \sec^2 27°$

$+ \operatorname{cosec}^2(90° - 27°) - \operatorname{cosec}^2 27°$

$= 1 + \cot^2 27° - \sec^2 27°$

$+ \sec^2 27° - \operatorname{cosec}^2 27°$

$= 1 + \cot^2 27° - \operatorname{cosec}^2 27°$

$= 1 - 1 = 0$

$[\because \operatorname{cosec}^2\theta - \cot^2\theta = 1]$

130. (2)

$x = \frac{\cos\theta}{1 - \sin\theta} = \frac{\cos\theta(1 + \sin\theta)}{(1 - \sin\theta)(1 + \sin\theta)}$

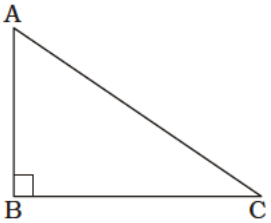
$= \frac{\cos\theta(1 + \sin\theta)}{1 - \sin^2\theta}$

$= \frac{\cos\theta(1 + \sin\theta)}{\cos^2\theta}$

$= \frac{1 + \sin\theta}{\cos\theta}$

$\therefore \frac{\cos\theta}{1 + \sin\theta} = \frac{1}{x}$

131. (2)



$\frac{AB}{BC} = \frac{2}{1}$

$\Rightarrow AB = 2k, BC = k$

$\therefore AC = \sqrt{(2k)^2 + k^2} = \sqrt{5k^2}$

$= \sqrt{5}k$

$\therefore \sin A + \cot C = \frac{BC}{AC} + \frac{BC}{AB}$

$= \frac{k}{\sqrt{5}k} + \frac{k}{2k}$

$= \frac{1}{\sqrt{5}} + \frac{1}{2} = \frac{2 + \sqrt{5}}{2\sqrt{5}}$

132. (2) $\sin\frac{\pi x}{2} = x^2 - 2x + 2$

Putting $x = 1$

$\sin\frac{\pi}{2} = 1 - 2 + 2 = 1$

133. (1) Expression

$= \frac{\sin 43°}{\cos 47°} + \frac{\cos 19°}{\sin 71°} - 8\cos^2 60°$

$= \frac{\sin 43}{\cos(90 - 43)} + \frac{\cos 19}{\sin(90 - 19)}$

$- 8 \times \left(\frac{1}{2}\right)^2$

$= \frac{\sin 43°}{\sin 43°} + \frac{\cos 19°}{\cos 19°} - 8 \times \frac{1}{4}$

$[\sin(90° - \theta) = \cos\theta;$
$\cos(90° - \theta) = \sin\theta]$

$= 1 + 1 - 2 = 0$

134. (2) $\sin^2 7\frac{1}{2}° + \sin^2 82\frac{1}{2}°$

$+ \tan^2 2° . \tan^2 88°$

$= \sin^2 7\frac{1}{2}° + \sin^2\left(90° - 7\frac{1}{2}°\right) +$

$\tan^2 2° . \tan^2(90° - 2°)$

$= \sin^2 7\frac{1}{2} + \cos^2 7\frac{1}{2} + \tan^2 2 .$

$. \cot^2 2°$

$[\because \sin(90° - \theta) = \cos\theta;$
$\tan(90° - \theta) = \cot\theta]$

$= 1 + 1 = 2$

135. (2) $1 - 2\sin^2\theta + \sin^4\theta$

$= (1 - \sin^2\theta)^2 = (\cos^2\theta)^2 = \cos^4\theta$

136. (2) Expression

$= \cot 9°. \cot 27°. \cot 63° . \cot 81°$

$= \cot 9°. \cot 27°. \cot(90° - 27°) .$

$\cot(90° - 9°)$

$= \cot 9° . \cot 27° . \tan 27° . \tan 9°$

$[\tan(90° - \theta)$

$= \cot\theta; \cot(90° - \theta) = \tan\theta]$

$= \cot 9° . \tan 9° . \cot 27° \tan 27°$

$= 1$ $[\tan\theta . \cot\theta = 1]$

137. (2) $(1 + \sin A)(1 + \sin B)(1 + \sin C) = (1 - \sin A) . (1 - \sin B)(1 - \sin C) = x$ (Let)

$\therefore x . x = (1 + \sin A)(1 + \sin B)(1 + \sin C)(1 - \sin A)(1 - \sin B)(1 - \sin C)$

$\Rightarrow x^2 = (1 - \sin^2 A)(1 - \sin^2 B)(1 - \sin^2 C)$

$\Rightarrow x^2 = \cos^2 A . \cos^2 B . \cos^2 C$

$\Rightarrow x = \pm \cos A \cdot \cos B \cdot \cos C$

$\because 0 < A, B, C < \frac{\pi}{2}$

$\therefore x = \cos A \cdot \cos B \cdot \cos C$

138. (4) $\tan^2\theta + 3 = 3 \sec\theta$

$\Rightarrow \sec^2\theta - 1 + 3 = 3 \sec\theta$

$\Rightarrow \sec^2\theta - 3 \sec\theta + 2 = 0$

$\Rightarrow \sec^2\theta - 2 \sec\theta - \sec\theta + 2 = 0$

$\Rightarrow \sec\theta (\sec\theta - 2) - 1 (\sec\theta - 2) = 0$

$\Rightarrow (\sec\theta - 2)(\sec\theta - 1) = 0$

$\Rightarrow \sec\theta = 2$ or 1

$\Rightarrow \theta = 60°$ or $0°$.

139. (3) $\sin\theta = 0.7$

$\therefore \cos\theta$

$= \sqrt{1 - \sin^2\theta} = \sqrt{1 - (0.7)^2}$

$= \sqrt{1 - 0.49} = \sqrt{0.51}$

140. (3) Expression $= \sin^2 65° + \sin^2 25° + \cos^2 35° + \cos^2 55°$

$= \sin^2 65° + \sin^2 (90° - 65°) + \cos^2 35° + \cos^2 (90° - 35°)$

$= \sin^2 65° + \cos^2 65° + \cos^2 35° + \sin^2 35°$

$= 1 + 1 = 2$

141. (3) $x.\sin 60°.\tan 30°$

$= \sec 60°.\cot 45°$

$\Rightarrow x \times \frac{\sqrt{3}}{2} \times \frac{1}{\sqrt{3}} = 2 \times 1$

$\Rightarrow x = 2 \times 2 = 4$

142. (4) $\frac{1}{2}\sqrt{1 + \sin\theta} + \frac{1}{2}\sqrt{1 - \sin\theta}$

$= \frac{1}{2}\left(\sqrt{1 + \sin 60°} + \sqrt{1 - \sin 60°}\right)$

$= \frac{1}{2}\left(\sqrt{1 + \frac{\sqrt{3}}{2}} + \sqrt{1 - \frac{\sqrt{3}}{2}}\right)$

$= \frac{1}{2\sqrt{2}}\left(\sqrt{2 + \sqrt{3}} + \sqrt{2 - \sqrt{3}}\right)$

$= \frac{1}{2\sqrt{2}} \times \frac{1}{2}\left(\sqrt{4 + 2\sqrt{3}} + \sqrt{4 - 2\sqrt{3}}\right)$

$= \frac{1}{4}\left(\sqrt{(\sqrt{3} + 1)^2} + \sqrt{(\sqrt{3} - 1)^2}\right)$

$= \frac{1}{4}\left(\sqrt{3} + 1 + \sqrt{3} - 1\right)$

$= \frac{2\sqrt{3}}{4} = \frac{\sqrt{3}}{2} = \cos 30°$

$= \cos\frac{\theta}{2}$

143. (2) $\frac{2\tan^2 30°}{1 - \tan^2 30°} + \sec^2 45° - \sec^2 0° = x \sec 60°$

$\Rightarrow \frac{2 \times \left(\frac{1}{\sqrt{3}}\right)^2}{1 - \left(\frac{1}{\sqrt{3}}\right)^2} + \left(\sqrt{2}\right)^2 - 1 = x \times 2$

$\Rightarrow \frac{\frac{2}{3}}{1 - \frac{1}{3}} + 2 - 1 = x \times 2$

$\Rightarrow \frac{2}{3} \times \frac{3}{2} + 1 = x \times 2$

$\Rightarrow 2 = x \times 2 \Rightarrow x = \frac{2}{2} = 1$

144. (2) $\tan\theta = \frac{\sin\alpha - \cos\alpha}{\sin\alpha + \cos\alpha}$

$\therefore 1 + \tan^2\theta$

$= 1 + \frac{(\sin\alpha - \cos\alpha)^2}{(\sin\alpha + \cos\alpha)^2}$

$\Rightarrow \sec^2\theta$

$= \frac{(\sin\alpha + \cos\alpha)^2 + (\sin\alpha - \cos\alpha)^2}{(\sin\alpha + \cos\alpha)^2}$

$\Rightarrow \sec^2\theta = \frac{2(\sin^2\alpha + \cos^2\alpha)}{(\sin\alpha + \cos\alpha)^2}$

$\Rightarrow \frac{1}{\cos^2\theta} = \frac{2}{(\sin\alpha + \cos\alpha)^2}$

$\Rightarrow \frac{1}{\cos\theta} = \frac{\pm\sqrt{2}}{\sin\alpha + \cos\alpha}$

$\Rightarrow \sin\alpha + \cos\alpha = \pm\sqrt{2}\cos\theta$

145. (1) $7\sin^2\theta + 3\cos^2\theta = 4$

On dividing both sides by $\cos^2\theta$

$7\tan^2\theta + 3 = 4\sec^2\theta$

$\Rightarrow 7\tan^2\theta + 3 = 4(1 + \tan^2\theta)$

$\Rightarrow 7\tan^2\theta + 3 = 4 + 4\tan^2\theta$

$\Rightarrow 7\tan^2\theta - 4\tan^2\theta = 4 - 3$

$\Rightarrow 3\tan^2\theta = 1$

$\Rightarrow \tan^2\theta = \frac{1}{3}$

$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$

146. (4) $\tan 9° = \frac{p}{q}$

$\therefore \frac{\sec^2 81°}{1 + \cot^2 81°} = \frac{\sec^2 81°}{\operatorname{cosec}^2 81°}$

$= \frac{1}{\cos^2 81°} \times \sin^2 81°$

$= \tan^2 81° = \tan^2(90° - 9°)$

$= \cot^2 9° = \frac{q^2}{p^2}$

147. (4) $\sec\theta + \tan\theta = 5$

$\therefore \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \frac{1}{5}$

$\therefore (\sec\theta + \tan\theta) - (\sec\theta - \tan\theta)$

$= 5 - \frac{1}{5} = \frac{25 - 1}{5}$

$\Rightarrow 2\tan\theta = \frac{24}{5} \Rightarrow \tan\theta = \frac{12}{5}$

$\therefore \frac{\tan\theta + 1}{\tan\theta - 1} = \frac{\frac{12}{5} + 1}{\frac{12}{5} - 1} = \frac{12 + 5}{12 - 5}$

$= \frac{17}{7}$

148. (4) $\tan^2\theta = 1 - e^2$

$\therefore \sec\theta + \tan^3\theta \cdot \operatorname{cosec}\theta$

$= \sec\theta + \tan^2\theta \cdot \tan\theta \cdot \operatorname{cosec}\theta$

$= \sec\theta + \tan^2\theta \cdot \frac{\sin\theta}{\cos\theta} \cdot \frac{1}{\sin\theta}$

$= \sec\theta + \tan^2\theta \cdot \sec\theta$

$= \sec\theta \cdot (1 + \tan^2\theta)$

$= \left(1 + \tan^2\theta\right)^{\frac{1}{2}} \cdot (1 + \tan^2\theta)$

$= \left(1 + \tan^2\theta\right)^{\frac{3}{2}} = \left(1 + 1 - e^2\right)^{\frac{3}{2}}$

$= \left(2 - e^2\right)^{\frac{3}{2}}$

149. (2) When $\theta = 60°$

$\cos\theta = \frac{1}{2}$, $\cos^2\theta = \frac{1}{4}$

$\therefore \cos\theta > \cos^2\theta$

150. (1) $x \sin 60° \tan 30° - \tan^2 45°$

$= \operatorname{cosec} 60°.\cot 30° - \sec^2 45°$

$\Rightarrow x \cdot \frac{\sqrt{3}}{2} \cdot \frac{1}{\sqrt{3}} - 1$

$= \frac{2}{\sqrt{3}} \times \sqrt{3} - \left(\sqrt{2}\right)^2$

$\Rightarrow \frac{x}{2} - 1 = 2 - 2 = 0$

$\Rightarrow \frac{x}{2} = 1 \Rightarrow x = 2$

151. (3) $x = a \sec\alpha \cdot \cos\beta$

$\Rightarrow \frac{x}{\alpha} = \sec\alpha \cdot \cos\beta$

Similarly,

$\frac{y}{b} = \sec\alpha \cdot \sin\beta, \ \frac{z}{c} = \tan\alpha$

$\therefore \frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2}$

$= \sec^2\alpha . \cos^2\beta + \sec^2\alpha \cdot \sin^2\beta - \tan^2\alpha$
$= \sec^2\alpha (\cos^2\beta + \sin^2\beta) - \tan^2\alpha$
$= \sec^2\alpha - \tan^2\alpha = 1$

152. (3) $\frac{\cos\alpha}{\cos\beta} = a \Rightarrow \cos\alpha = a\cos\beta$

On squaring both sides,
$\cos^2\alpha = a^2\cos^2\beta$
$\Rightarrow 1 - \sin^2\alpha = a^2(1 - \sin^2\beta)$ ...(i)
Again, $\sin\alpha = b\sin\beta$
$\Rightarrow \sin^2\alpha = b^2\sin^2\beta$
$\therefore$ From equation (i),
$1 - b^2\sin^2\beta = a^2 - a^2\sin^2\beta$
$\Rightarrow a^2\sin^2\beta - b^2\sin^2\beta = a^2 - 1$
$\Rightarrow \sin^2\beta (a^2 - b^2) = a^2 - 1$

$\Rightarrow \sin^2\beta = \frac{a^2 - 1}{a^2 - b^2}$

153. (2) Expression

$= \frac{\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \cos^2 30°}$

$= \left(\frac{1}{2}\right)^2 + 4\left(\frac{2}{\sqrt{3}}\right)^2 - 1$

[$\because \sin^2\theta + \cos^2\theta = 1$]

$= \frac{1}{4} + \frac{16}{3} - 1$

$= \frac{3 + 64 - 12}{12} = \frac{55}{12}$

154. (1)
$\sin^2 30° \cos^2 45° + 5\tan^2 30° + \frac{3}{2}\sin^2 90° - 3\cos^2 90°$

$= \left(\frac{1}{2}\right)^2 \times \left(\frac{1}{\sqrt{2}}\right)^2 + 5 \times \left(\frac{1}{\sqrt{3}}\right)^2 + \frac{3}{2} \times 1 - 3 \times 0$

$= \frac{1}{4} \times \frac{1}{2} + 5 \times \frac{1}{3} + \frac{3}{2}$

$= \frac{1}{8} + \frac{5}{3} + \frac{3}{2} = \frac{3 + 40 + 36}{24}$

$= \frac{79}{24} = 3\frac{7}{24}$

155. (1) $\cos^2\theta - \sin^2\theta = \frac{1}{3}$

$\cos^4\theta - \sin^4\theta$
$= (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta)$
$= 1 \times \frac{1}{3} = \frac{1}{3}$

156. (3) $\tan\theta = \frac{1}{\sqrt{11}}$; $\cot\theta = \sqrt{11}$

$\therefore \frac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta}$

$= \frac{1 + \cot^2\theta - (1 + \tan^2\theta)}{1 + \cot^2\theta + 1 + \tan^2\theta}$

$= \frac{\cot^2\theta - \tan^2\theta}{\cot^2\theta + \tan^2\theta + 2}$

$= \frac{(\sqrt{11})^2 - \left(\frac{1}{\sqrt{11}}\right)^2}{\left(\sqrt{11}\right)^2 + \left(\frac{1}{\sqrt{11}}\right)^2 + 2}$

$= \frac{11 - \frac{1}{11}}{11 + \frac{1}{11} + 2} = \frac{\frac{121 - 1}{11}}{\frac{121 + 1 + 22}{11}}$

$= \frac{120}{144} = \frac{5}{6}$

157. (1) Expression $= \frac{1}{\sqrt{2}} \sin\frac{\pi}{6} \cdot \cos\frac{\pi}{4} - \cot\frac{\pi}{3} \cdot \sec\frac{\pi}{6} + \frac{5\tan\frac{\pi}{4}}{12\sin\frac{\pi}{2}}$

$= \frac{1}{\sqrt{2}} \times \frac{1}{2} \times \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{3}} \times \frac{2}{\sqrt{3}} + \frac{5 \times 1}{12 \times 1}$

$= \frac{1}{4} - \frac{2}{3} + \frac{5}{12}$

$= \frac{3 - 8 + 5}{12} = 0$

158. (2) $\sin\theta = \frac{3}{5}$

$\therefore \cos\theta = \sqrt{1 - \sin^2\theta}$

$= \sqrt{1 - \left(\frac{3}{5}\right)^2} = \sqrt{1 - \frac{9}{25}}$

$= \sqrt{\frac{16}{25}} = \frac{4}{5}$

$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4}$

$\cot\theta = \frac{1}{\tan\theta} = \frac{4}{3}$

$\text{cosec}\,\theta = \frac{1}{\sin\theta} = \frac{5}{3}$

$\therefore \frac{\tan\theta + \cos\theta}{\cot\theta + \text{cosec}\theta} = \frac{\frac{3}{4} + \frac{4}{5}}{\frac{4}{3} + \frac{5}{3}}$

$= \frac{\frac{15 + 16}{20}}{\frac{4 + 5}{3}}$

$= \frac{31}{20} \times \frac{3}{9} = \frac{31}{60}$

159. (2) $a\cos\theta + b\sin\theta = p$
$a\sin\theta - b\cos\theta = q$
On squaring and adding,
$a^2\cos^2\theta + b^2\sin^2\theta + 2ab\sin\theta \cdot \cos\theta + a^2\sin^2\theta + b^2\cos^2\theta - 2ab\sin\theta \cdot \cos\theta$
$= p^2 + q^2$
$\Rightarrow a^2\cos^2\theta + a^2\sin^2\theta + b^2\sin^2\theta + b^2\cos^2\theta = p^2 + q^2$
$\Rightarrow a^2(\cos^2\theta + \sin^2\theta) + b^2(\sin^2\theta + \cos^2\theta) = p^2 + q^2$
$\Rightarrow a^2 + b^2 = p^2 + q^2$

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160. (2) $(\sin\alpha + \operatorname{cosec}\alpha)^2 + (\cos\alpha + \sec\alpha)^2 = k + \tan^2\alpha + \cot^2\alpha$

$\Rightarrow \sin^2\alpha + \operatorname{cosec}^2\alpha + 2\sin\alpha . \operatorname{cosec}\alpha + \cos^2\alpha + \sec^2\alpha + 2\cos\alpha.\sec\alpha = k + \tan^2\alpha + \cot^2\alpha$

$\Rightarrow \sin^2\alpha + \cos^2\alpha + 2 + \operatorname{cosec}^2\alpha + \sec^2\alpha + 2 = k + \tan^2\alpha + \cot^2\alpha$

$\Rightarrow 5 + \operatorname{cosec}^2\alpha + \sec^2\alpha = k + \tan^2\alpha + \cot^2\alpha$

$\Rightarrow 5 + 1 + \cot^2\alpha + 1 + \tan^2\alpha = k + \tan^2\alpha + \cot^2\alpha$

$\Rightarrow 7 + \cot^2\alpha + \tan^2\alpha = k + \tan^2\alpha + \cot^2\alpha$

$\Rightarrow k = 7$

161. (1) $\sin 21° = \frac{x}{y}$

$\cos 21° = \sqrt{1 - \sin^2 21°}$

$= \sqrt{1 - \frac{x^2}{y^2}} = \frac{\sqrt{y^2 - x^2}}{y}$

$\therefore \sec 21° = \frac{y}{\sqrt{y^2 - x^2}}$

$\therefore \sec 21° - \sin 69°$
$= \sec 21° - \sin(90° - 21°)$
$= \sec 21° - \cos 21°$

$= \frac{y}{\sqrt{y^2 - x^2}} - \frac{\sqrt{y^2 - x^2}}{y}$

$= \frac{y^2 - (y^2 - x^2)}{y\sqrt{y^2 - x^2}} = \frac{x^2}{y\sqrt{y^2 - x^2}}$

162. (3) $\sec\alpha + \tan\alpha = 2$

$\Rightarrow \frac{1}{\cos\alpha} + \frac{\sin\alpha}{\cos\alpha} = 2$

$\Rightarrow \frac{1 + \sin\alpha}{\cos\alpha} = 2$

$\Rightarrow 1 + \sin\alpha = 2\cos\alpha$
$\Rightarrow (1 + \sin\alpha)^2 = 4\cos^2\alpha$
$\Rightarrow 1 + \sin^2\alpha + 2\sin\alpha$
$= 4(1 - \sin^2\alpha)$
$\Rightarrow 1 + \sin^2\alpha + 2\sin\alpha$
$= 4 - 4\sin^2\alpha$
$\Rightarrow 5\sin^2\alpha + 2\sin\alpha + 1 - 4 = 0$
$\Rightarrow 5\sin^2\alpha + 2\sin\alpha - 3 = 0$
$\Rightarrow 5\sin^2\alpha + 5\sin\alpha - 3\sin\alpha - 3 = 0$
$\Rightarrow 5\sin\alpha(\sin\alpha + 1) - 3(\sin\alpha + 1) = 0$
$\Rightarrow (5\sin\alpha - 3)(\sin\alpha + 1) = 0$
$\because \alpha < 90°$,
$\therefore 5\sin\alpha - 3 = 0$
$\Rightarrow 5\sin\alpha = 3$

$\Rightarrow \sin\alpha = \frac{3}{5} = 0.6$

163. (1) $3\sin\theta + 5\cos\theta = 5$ --- (i)
$5\sin\theta - 3\cos\theta = x$ (let)-- (ii)
On squaring and adding both the equations,
$(3\sin\theta + 5\cos\theta)^2 + (5\sin\theta - 3\cos\theta)^2 = 5^2 + x^2$
$\Rightarrow 9\sin^2\theta + 25\cos^2\theta + 30\sin\theta.\cos\theta + 25\sin^2\theta + 9\cos^2\theta - 30\sin\theta.\cos\theta = 25 + x^2$
$\Rightarrow 9\sin^2\theta + 9\cos^2\theta + 25\cos^2\theta + 25\sin^2\theta = 25 + x^2$
$\Rightarrow 9(\sin^2\theta + \cos^2\theta) + 25(\cos^2\theta + \sin^2\theta) = 25 + x^2$
$\Rightarrow 9 + 25 = 25 + x^2$
$\Rightarrow x^2 = 9 \Rightarrow x = \pm 3$

164. (2) $\tan\theta + \cot\theta = 2$

$\Rightarrow \tan\theta + \frac{1}{\tan\theta} = 2$

$\Rightarrow \frac{\tan^2\theta + 1}{\tan\theta} = 2$

$\Rightarrow \tan^2\theta + 1 = 2\tan\theta$
$\Rightarrow \tan^2\theta - 2\tan\theta + 1 = 0$
$\Rightarrow (\tan\theta - 1)^2 = 0$
$\Rightarrow \tan\theta - 1 = 0 \Rightarrow \tan\theta = 1$

$\therefore \cot\theta = \frac{1}{\tan\theta} = 1$

$\therefore \tan^5\theta + \cot^5\theta = 1 + 1 = 2$

165. (3) $\tan 1° . \tan 2° . \tan 3° \ldots \tan 89°$
$= (\tan 1° . \tan 89°)$
$(\tan 2°. \tan 88°) \ldots \tan 45°$
$= (\tan 1°. \tan(90° - 1°))$
$(\tan 2° \tan(90° - 2°) .. \tan 45°$
$= (\tan 1° . \cot 1°)$
$(\tan 2°. \cot 2°) .. \tan 45°$
$= 1.1..1. = 1$
$[\tan(90° - \theta) = \cot\theta]$

166. (3) $x\sin^2 60° - \frac{3}{2}\sec 60° . \tan^2 30°$

$+ \frac{4}{5}\sin^2 45° . \tan^2 60° = 0$

$\Rightarrow x . \left(\frac{\sqrt{3}}{2}\right)^2 - \frac{3}{2} \times 2 . \left(\frac{1}{\sqrt{3}}\right)^2$

$+ \frac{4}{5} \times \left(\frac{1}{\sqrt{2}}\right)^2 \times (\sqrt{3})^2 = 0$

$\Rightarrow \frac{3x}{4} - \frac{3}{2} \times 2 \times \frac{1}{3} + \frac{4}{5} \times \frac{1}{2} \times 3 = 0$

$\Rightarrow \frac{3x}{4} - 1 + \frac{6}{5} = 0$

$\Rightarrow \frac{3x}{4} = 1 - \frac{6}{5} = \frac{5 - 6}{5} = \frac{-1}{5}$

$\Rightarrow x = -\frac{1}{5} \times \frac{4}{3} = \frac{-4}{15}$

167. (4) $7\sin\alpha = 24\cos\alpha$

$\Rightarrow \frac{\sin\alpha}{\cos\alpha} = \frac{24}{7} \Rightarrow \tan\alpha = \frac{24}{7}$

$\therefore \sec\alpha = \sqrt{1 + \tan^2\alpha} = \sqrt{1 + \left(\frac{24}{7}\right)^2}$

$= \sqrt{1 + \frac{576}{49}} = \sqrt{\frac{49 + 576}{49}}$

$= \sqrt{\frac{625}{49}} = \frac{25}{7}$

$\therefore \cos\alpha = \frac{1}{\sec\alpha} = \frac{7}{25}$

$\therefore 14\tan\alpha - 75\cos\alpha - 7\sec\alpha$
$= 14 \times \frac{24}{7} - 75 \times \frac{7}{25} - 7 \times \frac{25}{7}$
$= 48 - 21 - 25 = 2$

168. (2) $2\operatorname{cosec}^2 30° + x\sin^2 60° - \frac{3}{4}\tan^2 30° = 10$

$\Rightarrow 2 \times (2)^2 + x \times \left(\frac{\sqrt{3}}{2}\right)^2 - \frac{3}{4} \times \left(\frac{1}{\sqrt{3}}\right)^2 = 10$

$\Rightarrow 8 + \frac{3x}{4} - \frac{3}{4} \times \frac{1}{3} = 10$

$\Rightarrow \frac{3x}{4} = 10 + \frac{1}{4} - 8$

$\Rightarrow \frac{3x}{4} = \frac{9}{4} \Rightarrow 3x = 9$

$\Rightarrow x = \frac{9}{3} = 3$

169. (2) $\tan^2\theta - \sec^2\theta = -(\sec^2\theta - \tan^2\theta) = -1$.

170. (2) $29\tan\theta = 31 \Rightarrow \tan\theta = \frac{31}{29}$

$$\text{Expression} = \frac{1+2\sin\theta.\cos\theta}{1-2\sin\theta\cos\theta}$$

$$= \frac{\sin^2\theta+\cos^2\theta+2\sin\theta.\cos\theta}{\sin^2\theta+\cos^2\theta-2\sin.\cos\theta}$$

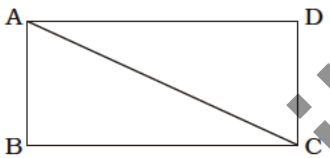
$$= \frac{(\sin\theta+\cos\theta)^2}{(\sin\theta-\cos\theta)^2}$$

$$= \left(\frac{\frac{\sin\theta}{\cos\theta}+\frac{\cos\theta}{\cos\theta}}{\frac{\sin\theta}{\cos\theta}-\frac{\cos\theta}{\cos\theta}}\right)^2 = \left(\frac{\tan\theta+1}{\tan\theta-1}\right)^2$$

$$= \left(\frac{\frac{31}{29}+1}{\frac{31}{29}-1}\right)^2 = \left(\frac{\frac{31+29}{29}}{\frac{31-29}{29}}\right)^2$$

$$= \left(\frac{60}{2}\right)^2 = (30)^2 = 900.$$

171. (3)



$\angle ACD = 45°$

$\angle BAC = 45°$

$\therefore (\tan^2\angle CAD + 1).\sin^2\angle BAC$

$= (\tan^2 45° + 1)\sin^2 45°$

$= (1+1)\times\left(\frac{1}{\sqrt{2}}\right)^2 = 2\times\frac{1}{2} = 1$

172. (2) $\tan x = \sin 45°.\cos 45° + \sin 30°$

$= \frac{1}{\sqrt{2}}.\frac{1}{\sqrt{2}} + \frac{1}{2} = \frac{1}{2}+\frac{1}{2} = 1$

$\therefore \tan x = \tan 45° \Rightarrow x = 45°$

173. (3) $\sqrt{\frac{\sec\theta-1}{\sec\theta+1}} = \sqrt{\frac{\frac{1}{\cos\theta}-1}{\frac{1}{\cos\theta}+1}}$

$$= \sqrt{\frac{\frac{1-\cos\theta}{\cos\theta}}{\frac{1+\cos\theta}{\cos\theta}}}$$

$$= \sqrt{\frac{1-\cos\theta}{1+\cos\theta}} = \sqrt{\frac{(1-\cos\theta)(1-\cos\theta)}{(1+\cos\theta)(1-\cos\theta)}}$$

(Rationalising the numerator and the denominator)

$$= \sqrt{\frac{(1-\cos\theta)^2}{1-\cos^2\theta}} = \sqrt{\frac{(1-\cos\theta)^2}{\sin^2\theta}}$$

$$= \frac{1-\cos\theta}{\sin\theta} = \frac{1}{\sin\theta}-\frac{\cos\theta}{\sin\theta}$$

$= \text{cosec}\theta - \cot\theta$.

174. (2) Let the angles be A and B where A > B

$\therefore A + B = 135°$

and, $A - B$

$= \frac{\pi}{12} = \frac{\pi}{12}\times\frac{180°}{\pi} = 15°$

On adding

$A + B + A - B$

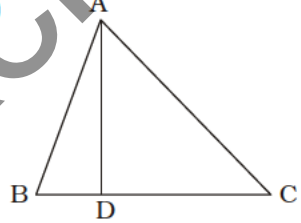
$= 135° + 15° = 150°$

$\Rightarrow 2A = 150° \Rightarrow A = \frac{150}{2} = 75°$

$\therefore A + B = 135°$

$\Rightarrow B = 135° - 75° = 60°$

175. (3)



$\angle B = \frac{\pi}{3}, \angle = \frac{\pi}{4}$

and $\frac{BD}{DC} = \frac{1}{3}$

From ΔABD,

$$\frac{BD}{\sin BAD} = \frac{AD}{\sin ABD}$$

$$\Rightarrow \frac{BD}{\sin BAD} = \frac{AD}{\sin\frac{\pi}{3}}$$

$$\Rightarrow \frac{BD}{\sin BAD} = \frac{AD}{\frac{\sqrt{3}}{2}}$$

$$\Rightarrow AD = \frac{\sqrt{3}}{2}.\frac{BD}{\sin BAD} \quad ...(i)$$

From ΔADC,

$$\frac{CD}{\sin DAC} = \frac{AD}{\sin ACD}$$

$$\Rightarrow \frac{CD}{\sin DAC} = \frac{AD}{\sin\frac{\pi}{4}}$$

$$\Rightarrow AD = \frac{1}{\sqrt{2}}.\frac{CD}{\sin DAC} \quad ...(ii)$$

From equations (i) and (ii),

$$\frac{\sqrt{3}}{2}.\frac{BD}{\sin BAD} = \frac{1}{\sqrt{2}}.\frac{CD}{\sin DAC}$$

$$\Rightarrow \frac{\sin BAD}{\sin DAC} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{\sqrt{2}}}\times\frac{BD}{CD}$$

$$\Rightarrow \frac{\sin BAD}{\sin DAC} = \frac{\sqrt{3}}{2}\times\sqrt{2}\times\frac{1}{3}$$

$$= \frac{1}{\sqrt{2}\times\sqrt{3}} = \frac{1}{\sqrt{6}}$$

176. (1) $\sin 3A = \cos(A - 26°)$

$\Rightarrow \cos(90° - 3A) = \cos(A - 26°)$

$\Rightarrow 90° - 3A = A - 26°$

$\Rightarrow 90° + 26° = 3A + A$

$\Rightarrow 4A = 116$

$\Rightarrow A = \frac{116}{4} = 29°$

177. (1) $\sec^2\theta - \frac{\sin^2\theta - 2\sin^4\theta}{2\cos^4\theta - \cos^2\theta}$

$$= \sec^2\theta - \frac{\sin^2\theta(1-2\sin^2\theta)}{\cos^2\theta(2\cos^2\theta-1)}$$

$$= \sec^2\theta - \frac{\sin^2\theta(1-2(1-\cos^2\theta))}{\cos^2\theta(2\cos^2\theta-1)}$$

$$= \sec^2\theta - \tan^2\theta\,\frac{(2\cos^2\theta-1)}{2\cos^2\theta-1}$$

$= \sec^2\theta - \tan^2\theta = 1$

178. (3) $x = a(\sin\theta + \cos\theta)$ and $y = b(\sin\theta - \cos\theta)$

$$\Rightarrow \frac{x}{a} = \sin\theta + \cos\theta \text{ and}$$

$$\frac{y}{b} = \sin\theta - \cos\theta$$

$$\therefore \frac{x^2}{a^2}+\frac{y^2}{b^2} = (\sin\theta + \cos\theta)^2 + (\sin\theta - \cos\theta)^2$$

$= \sin^2\theta + \cos^2\theta + 2\sin\theta.\cos\theta + \sin^2\theta + \cos^2\theta - 2\sin\theta.\cos\theta$

$= 2(\sin^2\theta + \cos^2\theta) = 2$

179. (4) $\sin 5\theta = \cos 20°$

$\Rightarrow \sin 5\theta = \sin(90 - 20)$

$= \sin 70°$

$\Rightarrow 5\theta = 70°$

$\Rightarrow \theta = \frac{70}{5} = 14°$

180. (3) $2\sec\theta = 3\text{cosec}^2\theta$

$\Rightarrow \frac{2}{\cos\theta} = \frac{3}{\sin^2\theta} = \frac{3}{1-\cos^2\theta}$

$\Rightarrow 2 - 2\cos^2\theta = 3\cos\theta$

$\Rightarrow 2\cos^2\theta + 3\cos\theta - 2 = 0$

$\Rightarrow 2\cos^2\theta + 4\cos\theta - \cos\theta - 2 = 0$

$\Rightarrow 2\cos\theta(\cos\theta + 2) - 1(\cos\theta + 2) = 0$

$\Rightarrow (2\cos\theta - 1)(\cos\theta + 2) = 0$

$\therefore 2\cos\theta - 1 = 0$ as $\cos\theta + 2 \neq 0$

$\Rightarrow \cos\theta = \frac{1}{2} = \cos 60° \text{ or } \cos\frac{\pi}{3}$

$\Rightarrow \theta = \frac{\pi}{3}$

181. (4) Expression

$= \sqrt{\frac{1+\sin\theta}{1-\sin\theta}} + \sqrt{\frac{1-\sin\theta}{1+\sin\theta}}$

$= \sqrt{\frac{(1+\sin\theta)(1+\sin\theta)}{(1-\sin\theta)(1+\sin\theta)}} +$

$\sqrt{\frac{(1-\sin\theta)(1-\sin\theta)}{(1+\sin\theta)(1-\sin\theta)}}$

$= \sqrt{\frac{(1+\sin\theta)^2}{1-\sin^2\theta}} + \sqrt{\frac{(1-\sin\theta)^2}{1-\sin^2\theta}}$

$= \sqrt{\frac{(1+\sin\theta)^2}{\cos^2\theta}} + \sqrt{\frac{(1-\sin\theta)^2}{\cos^2\theta}}$

$= \frac{1+\sin\theta}{\cos\theta} + \frac{1-\sin\theta}{\cos\theta}$

$= \frac{1+\sin\theta+1-\sin\theta}{\cos\theta} = \frac{2}{\cos\theta}$

$= 2\sec\theta$

182. (2) $\cos\theta = \frac{3}{5}$

$\therefore \sec\theta = \frac{5}{3}$

$\therefore \tan\theta = \sqrt{\sec^2\theta - 1}$

$= \sqrt{\left(\frac{5}{3}\right)^2 - 1}$

$= \sqrt{\frac{25}{9} - 1} = \sqrt{\frac{25-9}{9}} = \sqrt{\frac{16}{9}}$

$= \frac{4}{3}$

$\therefore \sin\theta \cdot \sec\theta \cdot \tan\theta = \frac{\sin\theta}{\cos\theta} \cdot \tan\theta$

$= \tan^2\theta = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$

183. (4) $\tan^2A + \cot^2A - \sec^2A \cdot \text{cosec}^2A$

$= \tan^2A + \cot^2A - (1 + \tan^2A)(1 + \cot^2A)$

$= \tan^2A + \cot^2A - (1 + \tan^2A + \cot^2A + \cot^2A.\tan^2A)$

$= \tan^2A + \cot^2A - 1 - \tan^2A - \cot^2A - \cot^2A \cdot \tan^2A$

$= -1 - 1 = -2$

[$\tan A \cdot \cot A = 1$]

184. (4) $\sin(4\alpha - \beta) = 1 = \sin 90°$

$\Rightarrow 4\alpha - \beta = 90°$ ...(i)

$\cos(2\alpha + \beta) = \frac{1}{2} = \cos 60°$

$\Rightarrow 2\alpha + \beta = 60°$ ...(ii)

On adding equations (i) and (ii),

$4\alpha - \beta + 2\alpha + \beta = 90° + 60°$

$\Rightarrow 6\alpha = 150° \Rightarrow \alpha = \frac{150}{6} = 25°$

From equation (ii),

$2 \times 25 + \beta = 60°$

$\Rightarrow \beta = 60° - 50° = 10°$

$\therefore \sin(\alpha + 2\beta)$

$= \sin(25 + 2 \times 10)$

$= \sin 45° = \frac{1}{\sqrt{2}}$

185. (*) $\text{cosec}\theta = \sqrt{3}$

$\cot\theta = \sqrt{\text{cosec}^2\theta - 1}$

$= \sqrt{(\sqrt{3})^2 - 1} = \sqrt{3-1} = \sqrt{2}$

$\therefore \cot\theta - \text{cosec}\theta = \sqrt{2} - \sqrt{3}$

$= \frac{3(\sqrt{2} - \sqrt{3})}{3} = (\sqrt{2} - \sqrt{3})$

186. (2) $4\cos^2\theta - 4\cos\theta + 1 = 0$

$\Rightarrow (2\cos\theta - 1)^2 = 0$

$\Rightarrow 2\cos\theta - 1 = 0$

$\Rightarrow 2\cos\theta = 1$

$\Rightarrow \cos\theta = \frac{1}{2} = \cos 60°$

$\Rightarrow \theta = 60°$

$\therefore \tan(\theta - 15°) = \tan(60° - 15°) = \tan 45° = 1$

187. (1) $(r\cos\theta - \sqrt{3})^2 + (r\sin\theta - 1)^2 = 0$

$\Rightarrow r\cos\theta - \sqrt{3} = 0$ and $r\sin\theta - 1 = 0$

$\Rightarrow r\cos\theta = \sqrt{3}$ and $r\sin\theta = 1$

$\therefore r^2\cos^2\theta + r^2\sin^2\theta = 3 + 1$

$\Rightarrow r^2(\sin^2\theta + \cos^2\theta) = 4$

$\Rightarrow r^2 = 4 \Rightarrow r = 2$

$\therefore \tan\theta = \frac{r\sin\theta}{r\cos\theta} = \frac{1}{\sqrt{3}}$

and $r\cos\theta = \sqrt{3} \Rightarrow \cos\theta = \frac{\sqrt{3}}{r}$

$\Rightarrow \sec\theta = \frac{r}{\sqrt{3}}$

$\therefore \frac{r\tan\theta + \sec\theta}{r\sec\theta + \tan\theta} = \frac{\frac{r}{\sqrt{3}} + \frac{r}{\sqrt{3}}}{\frac{r^2}{\sqrt{3}} + \frac{1}{\sqrt{3}}}$

$= \frac{r\left(\frac{2}{\sqrt{3}}\right)}{\frac{r^2+1}{\sqrt{3}}}$

$= \frac{2r}{r^2+1} = \frac{2\times 2}{4+1} = \frac{4}{5}$

188. (1)

$\frac{\sin 25°\cos 65° + \cos 25°\sin 65°}{\tan^2 70° - \text{cosec}^2 20°}$

$= \frac{\sin 25°\cos(90°-25°) + \cos 25°}{\sin(90°-25°)}$

$\tan^2 70° - \text{cosec}^2(90°-70°)$

$\left[\begin{array}{l}\because \sin(90°-\theta) = \cos\theta \\ \cos(90°-\theta) = \sin\theta \\ \text{cosec}(90°-\theta) = \sec\theta\end{array}\right]$

$= \frac{\sin 25°\sin 25° + \cos 25°.\cos 25°}{\tan^2 70° - \sec^2 70°}$

$= \frac{\sin^2 25° + \cos^2 25°}{\tan^2 70° - \sec^2 70°}$

$= \frac{1}{-1} = -1$

$\left[\because \sec^2\theta - \tan^2\theta = 1 \right.$
$\left. \sin^2\theta + \cos^2\theta = 1\right]$

TRIGONOMETRY

189. (1) $\sin(\theta + 18°) = \cos 60°$
$= \cos(90° - 30°) = \sin 30°$
$\Rightarrow \theta + 18° = 30°$
$\Rightarrow \theta = 30° - 18° = 12°$

$\therefore \cos 5\theta = \cos 60° = \frac{1}{2}$

190. (1) $\tan\theta = \frac{3}{4} \Rightarrow \tan^2\theta = \frac{9}{16}$

Expression

$$= \frac{4\sin^2\theta - 2\cos^2\theta}{4\sin^2\theta + 3\cos^2\theta}$$

$$= \frac{4\frac{\sin^2\theta}{\cos^2\theta} - 2\frac{\cos^2\theta}{\cos^2\theta}}{4\frac{\sin^2\theta}{\cos^2\theta} + 3\frac{\cos^2\theta}{\cos^2\theta}}$$

$$= \frac{4\tan^2\theta - 2}{4\tan^2\theta + 3}$$

$$= \frac{4 \times \frac{9}{16} - 2}{4 \times \frac{9}{16} + 3}$$

$$= \frac{\frac{9}{4} - 2}{\frac{9}{4} + 3} = \frac{9-8}{9+12} = \frac{1}{21}$$

191. (3) $\frac{\cos\alpha}{\cos\beta} = a$

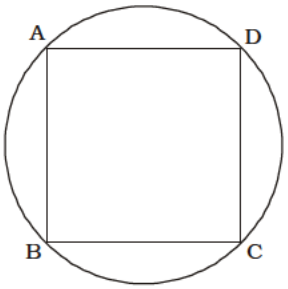
$$\Rightarrow \frac{\cos^2\alpha}{\cos^2\beta} = a^2$$

$$\Rightarrow \frac{1-\sin^2\alpha}{1-\sin^2\beta} = a^2$$

$\Rightarrow 1 - \sin^2\alpha = a^2(1 - \sin^2\beta)$
$\Rightarrow 1 - b^2\sin^2\beta = a^2 - a^2\sin^2\beta$
$\Rightarrow 1 - a^2 = b^2\sin^2\beta - a^2\sin^2\beta$
$\Rightarrow 1 - a^2 = (b^2 - a^2)\sin^2\beta$

$$\Rightarrow \sin^2\beta = \frac{1-a^2}{b^2-a^2} = \frac{a^2-1}{a^2-b^2}$$

192. (1)



ABCD is a concyclic quadrilateral.
$\angle A + \angle C = \angle B + \angle D = 180°$
$\therefore \angle A = 180° - \angle C$
$\therefore \cos A = \cos(180° - C)$
$= -\cos C$
and $\cos B = -\cos D$
$\therefore \cos A + \cos B + \cos C + \cos D$
$= \cos A + \cos B - \cos A - \cos B = 0$

193. (3) $\sqrt{3}\tan\theta = 3\sin\theta$

$$\Rightarrow \sqrt{3}\frac{\sin\theta}{\cos\theta} = 3\sin\theta$$

$$\Rightarrow \sqrt{3} = 3\cos\theta$$

$$\Rightarrow \cos\theta = \frac{\sqrt{3}}{3} = \frac{1}{\sqrt{3}}$$

$$\therefore \sin\theta = \sqrt{1-\cos^2\theta}$$

$$= \sqrt{1-\frac{1}{3}} = \sqrt{\frac{2}{3}}$$

$$\therefore \sin^2\theta - \cos^2\theta = \left(\sqrt{\frac{2}{3}}\right)^2 - \left(\frac{1}{\sqrt{3}}\right)^2$$

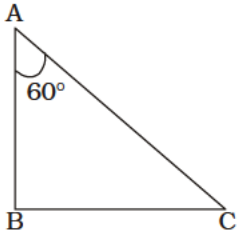
$$= \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$$

194. (3) A = 45°, B = 30° (let)
$\therefore \sin(A + B) = \sin A \cdot \cos B + \cos A \cdot \sin B$
$\Rightarrow \sin(45° + 30°)$
$= \sin 45° \cdot \cos 30° + \cos 45° \cdot \sin 30°$

$$= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \times \frac{1}{2}$$

$$= \frac{\sqrt{3}}{2\sqrt{2}} + \frac{1}{2\sqrt{2}} = \frac{\sqrt{3}+1}{2\sqrt{2}}$$

195. (4)



$\angle B = 90°$
$\angle A = 60°$
$\angle C = 180° - 90° - 60° = 30°$

$$\cos C = \frac{BC}{CA}$$

$$\Rightarrow \cos 30° = \frac{BC}{CA}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{BC}{CA} = \sqrt{3}:2$$

196. (2) $\tan 2\theta \cdot \tan 3\theta = 1$

$$\Rightarrow \tan 3\theta = \frac{1}{\tan 2\theta} = \cot 2\theta$$

$\Rightarrow \tan 3\theta = \tan(90° - 2\theta)$
$\Rightarrow 3\theta = 90° - 2\theta$
$\Rightarrow 3\theta + 2\theta = 5\theta = 90°$

$$\Rightarrow \theta = \frac{90°}{5} = 18°$$

197. (3) $\cos^2\alpha - \sin^2\alpha = \tan^2\beta$
$\Rightarrow \cos^2\alpha - (1 - \cos^2\alpha) = \tan^2\beta$
$\Rightarrow 2\cos^2\alpha - 1 = \tan^2\beta$
$\Rightarrow 2\cos^2\alpha = 1 + \tan^2\beta = \sec^2\beta$

$$\Rightarrow \cos^2\beta = \frac{1}{2\cos^2\alpha}$$

$\sin^2\beta = 1 - \cos^2\beta$

$$= 1 - \frac{1}{2\cos^2\alpha}$$

$$= \frac{2\cos^2\alpha - 1}{2\cos^2\alpha}$$

$\therefore \cos^2\beta - \sin^2\beta$

$$= \frac{1}{2\cos^2\alpha} - \frac{2\cos^2\alpha - 1}{2\cos^2\alpha}$$

$$= \frac{1 - 2\cos^2\alpha + 1}{2\cos^2\alpha}$$

$$= \frac{2(1-\cos^2\alpha)}{2\cos^2\alpha} = \frac{\sin^2\alpha}{\cos^2\alpha}$$

$= \tan^2\alpha$

Note : It is an identity.

198. (3) $\tan(A + B) = \sqrt{3} = \tan 60°$
$\Rightarrow A + B = 60°$ ...(i)

$$\tan(A - B) = \frac{1}{\sqrt{3}} = \tan 30°$$

$\Rightarrow A - B = 30°$ ...(ii)
$\therefore A + B + A - B = 60° + 30°$
$\Rightarrow 2A = 90°$

$$\Rightarrow A = \frac{90°}{2} = 45°$$

199. (3) Expression

$$= \frac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta}$$

$$= \frac{\sin\theta(1 - 2\sin^2\theta)}{\cos\theta(2\cos^2\theta - 1)}$$

$= \frac{\sin\theta}{\cos\theta} \cdot \frac{(1-2(1-\cos^2\theta))}{(2\cos^2\theta-1)}$

$= \tan\theta \frac{(1+2\cos^2\theta-2)}{(2\cos^2\theta-1)}$

$= \tan\theta \cdot \frac{2\cos^2\theta-1}{2\cos^2\theta-1} = \tan\theta$

200. (4) $r\sin\theta = \frac{7}{2}$ ...(i)

$r\cos\theta = \frac{7\sqrt{3}}{2}$ ...(ii)

On squaring both equations and adding,

$r^2\sin^2\theta + r^2\cos^2\theta = \left(\frac{7}{2}\right)^2 + \left(\frac{7\sqrt{3}}{2}\right)^2$

$\Rightarrow r^2(\sin^2\theta + \cos^2\theta) = \frac{47}{4} + \frac{147}{4}$

$\Rightarrow r^2 = \frac{49+147}{4} = \frac{196}{4} = 49$

$\therefore r = \sqrt{49} = 7$

201. (4) $\sin\theta = \frac{1}{2} = \sin 30° = \sin\frac{\pi}{6}$

$\Rightarrow \theta = \frac{\pi}{6}$

[$\because$ 180° = π radian]

$\therefore \theta + \phi = \frac{\pi}{2} \Rightarrow \frac{\pi}{6} + \phi = \frac{\pi}{2}$

$\Rightarrow \phi = \frac{\pi}{2} - \frac{\pi}{6} = \frac{3\pi-\pi}{6}$

$= \frac{2\pi}{6} = \frac{\pi}{3}$

$\therefore \sin\phi = \sin\frac{\pi}{3} = \frac{\sqrt{3}}{2}$

202. (2) $2\sin^2\theta + 3\cos\theta = 3$
$\Rightarrow 2(1-\cos^2\theta) + 3\cos\theta = 3$
$\Rightarrow 2 - 2\cos^2\theta + 3\cos\theta = 3$
$\Rightarrow 2\cos^2\theta - 3\cos\theta + 1 = 0$
$\Rightarrow 2\cos^2\theta - 2\cos\theta - \cos\theta + 1 = 0$
$\Rightarrow 2\cos\theta(\cos\theta - 1) - 1(\cos\theta - 1) = 0$
$\Rightarrow (2\cos\theta - 1)(\cos\theta - 1) = 0$
$\Rightarrow 2\cos\theta - 1 = 0 \Rightarrow 2\cos\theta = 1$

$\Rightarrow \cos\theta = \frac{1}{2} \Rightarrow \theta = 60°$

or, $\cos\theta - 1 = 0 \Rightarrow \cos\theta = 1$
$\Rightarrow \theta = 0°$

203. (1) $2\sin^2\theta = 3\cos\theta$
$\Rightarrow 2(1-\cos^2\theta) = 3\cos\theta$
$\Rightarrow 2 - 2\cos^2\theta = 3\cos\theta$
$\Rightarrow 2\cos^2\theta + 3\cos\theta - 2 = 0$
$\Rightarrow 2\cos^2\theta + 4\cos\theta - \cos\theta - 2 = 0$
$\Rightarrow 2\cos\theta(\cos\theta + 2) - 1(\cos\theta + 2) = 0$
$\Rightarrow (2\cos\theta - 1)(\cos\theta + 2) = 0$
$\Rightarrow 2\cos\theta - 1 = 0$ because $\cos\theta + 2 \neq 0$
$\Rightarrow 2\cos\theta = 1$

$\Rightarrow \cos\theta = \frac{1}{2} = \cos 60°$

$\Rightarrow \theta = 60°$

204. (3) $a(\tan\theta + \cot\theta) = 1$

$\Rightarrow a\left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right) = 1$

$\Rightarrow a\left(\frac{\sin^2\theta + \cos^2\theta}{\sin\theta.\cos\theta}\right) = 1$

$\Rightarrow \sin\theta \cdot \cos\theta = a$ ....(i)
$\sin\theta + \cos\theta = b$
On squaring both sides,
$\sin^2\theta + \cos^2\theta + 2\sin\theta \cdot \cos\theta = b^2$
$\Rightarrow 1 + 2a = b^2$
$\Rightarrow 2a = b^2 - 1$

205. (2) $\text{cosec}^2 A - \cot^2 A = 1$
$(\text{cosec } A + \cot A)(\text{cosec } A - \cot A) = 1$

$\text{cosec } A - \cot A = \frac{1}{3}$

$\text{cosec } A + \cot A = 3$
On adding,

$2\,\text{cosec } A = \frac{1}{3} + 3$

$= \frac{1+9}{3} = \frac{10}{3}$

$\Rightarrow \text{cosec } A = \frac{10}{3\times 2} = \frac{5}{3}$

$\therefore \sin A = \frac{3}{5}$

206. (1) $\sin^2 x + 2\tan^2 x - 2\sec^2 x + \cos^2 x$
$= \sin^2 x + \cos^2 x - 2\sec^2 x + 2\tan^2 x$
$= 1 - 2(\sec^2 x - \tan^2 x)$
$= 1 - 2 = -1$
[$\sec^2 x - \tan^2 x = 1$, $\sin^2 x + \cos^2 x = 1$]

207. (1) $x = a\sec\theta$

$\Rightarrow \frac{x}{a} = \sec\theta$

Again, $y = b\tan\theta$

$\Rightarrow \frac{y}{b} = \tan\theta$

$\therefore \frac{x^2}{a^2} - \frac{y^2}{b^2}$
$= \sec^2\theta - \tan^2\theta = 1$

208. (4) $\sin^2 1° + \sin^2 2° + \sin^2 3° + ... + \sin^2 89°$
$= (\sin^2 1° + \sin^2 89°) + (\sin^2 2° + \sin^2 88°) + ...$ to 44 terms $+ \sin^2 45°$
$= (\sin^2 1° + \sin^2(90° - 1°) + (\sin^2 2° + \sin^2(90° - 2°) + ...$to 44 terms $+ \left(\frac{1}{\sqrt{2}}\right)^2$
$= (\sin^2 1° + \cos^2 1°) + (\sin^2 2° + \cos^2 2°) + ...$to 44 terms $+ \frac{1}{2}$
[$\sin(90° - \theta) = \cos\theta$]
$= 1 + 1 + ...$to 44 terms $+ \frac{1}{2}$
[$\sin^2\theta + \cos^2\theta = 1$]
$= 44 + \frac{1}{2} = 44\frac{1}{2}$

209. (3) $\frac{\cos^3\theta + \sin^3\theta}{\cos\theta + \sin\theta} + \frac{\cos^3\theta - \sin^3\theta}{\cos\theta - \sin\theta}$

$= \frac{(\cos\theta + \sin\theta)(\cos^2\theta + \sin^2\theta - \cos\theta.\sin\theta)}{\cos\theta + \sin\theta}$

$+ \frac{(\cos\theta - \sin\theta)(\cos^2\theta + \sin^2\theta + \cos\theta.\sin\theta)}{(\cos\theta - \sin\theta)}$

$= \cos^2\theta + \sin^2\theta - \cos\theta \cdot \sin\theta + \cos^2\theta + \sin^2\theta + \cos\theta \cdot \sin\theta$
$= 1 + 1 = 2$

210. (4) $\sin 17° = \frac{x}{y}$
$\sin 73° = \sin(90° - 17°)$
$= \cos 17°$
$\therefore \cos 17° = \sqrt{1 - \sin^2 17°}$

$= \sqrt{1 - \frac{x^2}{y^2}} = \sqrt{\frac{y^2 - x^2}{y^2}}$

$= \frac{\sqrt{y^2 - x^2}}{y}$

$\therefore \sec 17° = \frac{y}{\sqrt{y^2 - x^2}}$

$\therefore \sec 17° - \sin 73°$
$= \sec 17° - \cos 17°$

$= \frac{y}{\sqrt{y^2 - x^2}} - \frac{\sqrt{y^2 - x^2}}{y}$

$= \frac{y^2 - (y^2 - x^2)}{y\sqrt{y^2 - x^2}}$

$= \frac{y^2 - y^2 + x^2}{y\sqrt{y^2 - x^2}}$

$= \frac{x^2}{y\sqrt{y^2 - x^2}}$

211. (3) $\operatorname{cosec}\theta + \cot\theta = \sqrt{3}$ ...(i)
$\operatorname{cosec}^2\theta - \cot^2\theta = 1$
$\Rightarrow (\operatorname{cosec}\theta + \cot\theta)(\operatorname{cosec}\theta - \cot\theta) = 1$

$\Rightarrow \operatorname{cosec}\theta - \cot\theta = \frac{1}{\sqrt{3}}$ ...(ii)

$\therefore \operatorname{cosec}\theta + \cot\theta + \operatorname{cosec}\theta - \cot\theta =$

$\sqrt{3} + \frac{1}{\sqrt{3}}$

$\Rightarrow 2\operatorname{cosec}\theta = \frac{3+1}{\sqrt{3}}$

$\Rightarrow \operatorname{cosec}\theta = \frac{4}{2\sqrt{3}} = \frac{2}{\sqrt{3}}$

212. (3) $\cos\alpha + \sec\alpha = \sqrt{3}$
$\therefore \cos^3\alpha + \sec^3\alpha = (\cos\alpha + \sec\alpha)^3$
$- 3\cos\alpha \cdot \sec\alpha (\cos\alpha + \sec\alpha)$

$= \left(\sqrt{3}\right)^3 - 3\times\sqrt{3}$

$= 3\sqrt{3} - 3\sqrt{3} = 0$

213. (1) $\sin\theta + \cos\theta = \sqrt{2}\cos\theta$

$\Rightarrow \sqrt{2}\cos\theta - \cos\theta = \sin\theta$

$\Rightarrow \cos\theta\left(\sqrt{2} - 1\right) = \sin\theta$

$\Rightarrow \frac{\cos\theta}{\sin\theta} = \frac{1}{\sqrt{2} - 1}$

$= \frac{\sqrt{2}+1}{(\sqrt{2}-1)(\sqrt{2}+1)} = \sqrt{2}+1$

$\cot\theta = \sqrt{2}+1$

214. (1) $\cos^4\theta - \sin^4\theta = \frac{2}{3}$

$\Rightarrow (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta)$

$= \frac{2}{3}$

$[\because \cos^2\theta + \sin^2\theta = 1]$

$\Rightarrow \cos^2\theta - \sin^2\theta = \frac{2}{3}$

$\Rightarrow 1 - \sin^2\theta - \sin^2\theta = \frac{2}{3}$

$\Rightarrow 1 - 2\sin^2\theta = \frac{2}{3}$

215. (1) $\frac{\cot 30° - \cot 75°}{\tan 15° - \tan 60°}$

$= \frac{\cot(90° - 60°) - \cot(90° - 15°)}{\tan 15° - \tan 60°}$

$= \frac{\tan 60° - \tan 15°}{\tan 15° - \tan 60°} = -1$

216. (3) $\sin\theta + \cos\theta = p$
$\sec\theta + \operatorname{cosec}\theta = q$

$\Rightarrow \frac{1}{\cos\theta} + \frac{1}{\sin\theta} = q$

$\Rightarrow \frac{\sin\theta + \cos\theta}{\sin\theta.\cos\theta} = q$

$\therefore q(p^2 - 1) = \left(\frac{\sin\theta + \cos\theta}{\sin\theta.\cos\theta}\right)$
$((\sin\theta + \cos\theta)^2 - 1)$

$= \frac{\sin\theta + \cos\theta}{\sin\theta.\cos\theta} \cdot (\sin^2\theta + \cos^2\theta +$
$2\sin\theta.\cos\theta - 1)$

$= \frac{\sin\theta + \cos\theta}{\sin\theta.\cos\theta} \cdot 2\sin\theta \cdot \cos\theta$
$= 2p$

217. (2) $\sin(3\alpha - \beta) = 1 = \sin 90°$
$\Rightarrow 3\alpha - \beta = 90°$ ... (i)

$\cos(2\alpha + \beta) = \frac{1}{2} = \cos 60°$

$\Rightarrow 2\alpha + \beta = 60°$ .... (ii)
By adding both equations,
$3\alpha + 2\alpha = 90° + 60°$
$\Rightarrow 5\alpha = 150$

$\Rightarrow \alpha = \frac{150}{5} = 30°$

$\therefore \tan\alpha = \tan 30° = \frac{1}{\sqrt{3}}$

218. (2) $\sin(60° - x) = \cos(y + 60°)$
$\Rightarrow \sin(60° - x) = \sin(90° - y - 60°)$
$[\because \sin(90° - \theta) = \cos\theta$
$\Rightarrow 60° - x$
$= 90° - y - 60° = 30° - y$
$\Rightarrow x - y = 60° - 30°$
$\Rightarrow x - y = 30°$

$\therefore \sin(x - y) = \sin 30° = \frac{1}{2}$

219. (3) $x = a\sec\theta \Rightarrow \frac{x}{a} = \sec\theta$

and, $y = b\tan\theta \Rightarrow \frac{y}{b} = \tan\theta$

$\therefore \frac{x^2}{a^2} - \frac{y^2}{b^2} = \sec^2\theta - \tan^2\theta = 1$

220. (4) $a^2 + b^2 + c^2 = ab + bc + ca$
$\Rightarrow 2a^2 + 2b^2 + 2c^2 = 2ab + 2bc$
$+ 2ca$
$\Rightarrow a^2 + b^2 + b^2 + c^2 + c^2 + a^2 -$
$2ab - 2bc - 2ca = 0$
$\Rightarrow a^2 + b^2 - 2ab + b^2 + c^2 - 2bc$
$+ c^2 + a^2 - 2ca = 0$
$\Rightarrow (a-b)^2 + (b-c)^2 + (c-a)^2 = 0$
$\Rightarrow a - b = 0 \Rightarrow a = b$
$b - c = 0 \Rightarrow b = c$
$c - a = 0 \Rightarrow c = a$
$\therefore \Delta ABC$ is an equilateral triangle.
$\therefore \angle A = \angle B = \angle C = 60°$
$\therefore \sin^2 A + \sin^2 B + \sin^2 C$
$= 3\sin^2 A = 3 \times \sin^2 60°$

$= 3 \times \left(\frac{\sqrt{3}}{2}\right)^2$

$= \frac{3\times 3}{4} = \frac{9}{4}$

221. (3) $a\sin\theta + b\cos\theta = c$ .... (i)
$a\cos\theta - b\sin\theta = x$ (let) ... (ii)
On squaring equations (i) and (ii) and adding,
$a^2\sin^2\theta + b^2\cos^2\theta + 2ab\sin\theta.$
$\cos\theta + a^2\cos^2\theta + b^2\sin^2\theta - 2ab\sin\theta.\cos\theta = c^2 + x^2$
$\Rightarrow a^2(\sin^2\theta + \cos^2\theta) + b^2(\cos^2\theta +$
$\sin^2\theta) = c^2 + x^2$
$\Rightarrow a^2 + b^2 = c^2 + x^2$
$\Rightarrow x^2 = a^2 + b^2 - c^2$

$\Rightarrow x = \pm\sqrt{a^2 + b^2 - c^2}$

222. (3) $\sin\theta + \cos\theta = \sqrt{2}\ \sin(90° - \theta)$

$\Rightarrow \sin\theta + \cos\theta = \sqrt{2}\ \cos\theta$

$\Rightarrow \sin\theta = \sqrt{2}\ \cos\theta - \cos\theta$

$\Rightarrow \sin\theta = \cos\theta\,(\sqrt{2} - 1)$

$\Rightarrow \dfrac{\cos\theta}{\sin\theta} = \dfrac{1}{\sqrt{2}-1}$

$\Rightarrow \cot\theta = \dfrac{1}{\sqrt{2}-1}$

$\Rightarrow \cot\theta = \dfrac{1}{\sqrt{2}-1} \times \dfrac{(\sqrt{2}+1)}{(\sqrt{2}+1)}$

$= \dfrac{\sqrt{2}+1}{2-1} = \sqrt{2} + 1$

223. (1) $3(\sec^2\theta + \tan^2\theta) = 5$

$\Rightarrow \sec^2\theta + \tan^2\theta = \dfrac{5}{3}$

$\Rightarrow \sec^2\theta + \sec^2\theta - 1 = \dfrac{5}{3}$

$\Rightarrow 2\sec^2\theta = \dfrac{5}{3} + 1 = \dfrac{8}{3}$

$\Rightarrow \sec^2\theta = \dfrac{4}{3} \Rightarrow \sec\theta = \dfrac{2}{\sqrt{3}}$

$\Rightarrow \cos\theta = \dfrac{\sqrt{3}}{2} = \cos 30°$

$\Rightarrow \theta = 30°$

$\therefore \cos 2\theta = \cos 60° = \dfrac{1}{2}$

224. (3) $x.\cos^2 30°\,.\sin 60°$

$= \dfrac{\tan^2 45°.\sec 60°}{\operatorname{cosec} 60°}$

$\Rightarrow x.\left(\dfrac{\sqrt{3}}{2}\right)^2 . \dfrac{\sqrt{3}}{2} = \dfrac{1\times 2}{\frac{2}{\sqrt{3}}}$

$\Rightarrow x \times \dfrac{3}{4} \times \dfrac{\sqrt{3}}{2} = \sqrt{3}$

$\Rightarrow x = \dfrac{\sqrt{3}\times 8}{3\sqrt{3}} = \dfrac{8}{3} = 2\dfrac{2}{3}$

225. (2) $\tan\alpha = 2$

$\therefore \dfrac{\operatorname{cosec}^2\alpha - \sec^2\alpha}{\operatorname{cosec}^2\alpha + \sec^2\alpha}$

$= \dfrac{1+\cot^2\alpha - 1 - \tan^2\alpha}{1+\cot^2\alpha + 1 + \tan^2\alpha}$

$= \dfrac{\cot^2\alpha - \tan^2\alpha}{\cot^2\alpha + \tan^2\alpha + 2}$

$= \dfrac{\frac{1}{4} - 4}{\frac{1}{4} + 4 + 2} = \dfrac{\frac{1-16}{4}}{\frac{1+16+8}{4}}$

$= \dfrac{-15}{25} = \dfrac{-3}{5}$

226. (3) $\sin(\theta + 30°) = \dfrac{3}{\sqrt{12}}$

$= \dfrac{3}{2\sqrt{3}} = \dfrac{\sqrt{3}}{2}$

$\Rightarrow \sin(\theta + 30°) = \sin 60°$

$\Rightarrow \theta + 30° = 60°$

$\Rightarrow \theta = 60 - 30 = 30°$

$\therefore \cos^2\theta = \cos^2 30°$

$= \left(\dfrac{\sqrt{3}}{2}\right)^2 = \dfrac{3}{4}$

227. (1) $4\cos^2\theta - 4\sqrt{3}\ \cos\theta + 3 = 0$

$\Rightarrow (2\cos\theta)^2 - 2.2\cos\theta.\sqrt{3} + (\sqrt{3})^2 = 0$

$\Rightarrow (2\cos\theta - \sqrt{3})^2 = 0$

$\Rightarrow 2\cos\theta - \sqrt{3} = 0$

$\Rightarrow 2\cos\theta = \sqrt{3}$

$\Rightarrow \cos\theta = \dfrac{\sqrt{3}}{2} = \cos 30°$

$\Rightarrow \theta = 30°$

228. (3) $\sec\theta - \cos\theta = \dfrac{3}{2}$

$\Rightarrow \sec\theta - \dfrac{1}{\sec\theta} = \dfrac{3}{2}$

$\Rightarrow \dfrac{\sec^2\theta - 1}{\sec\theta} = \dfrac{3}{2}$

$\Rightarrow 2\sec^2\theta - 2 = 3\sec\theta$

$\Rightarrow 2\sec^2\theta - 3\sec\theta - 2 = 0$

$\Rightarrow 2\sec^2\theta - 4\sec\theta + \sec\theta - 2 = 0$

$\Rightarrow 2\sec\theta(\sec\theta - 2) + 1(\sec\theta - 2) = 0$

$\Rightarrow (2\sec\theta + 1)(\sec\theta - 2) = 0$

$\Rightarrow \sec\theta = 2$ because $2\sec\theta + 1 \neq 0$

θ is positive acute angle.

229. (2) $\tan(5x - 10°) = \cot(5y + 20°)$

$\Rightarrow \tan(5x - 10°) = \tan(90° - (5y + 20°))$

$\Rightarrow 5x - 10° = 90° - 5y - 20°$

$\Rightarrow 5x + 5y = 70° + 10°$

$\Rightarrow 5(x + y) = 80°$

$\Rightarrow x + y = \dfrac{80°}{5} = 16°$

230. (4) $\sin\theta + \sin^2\theta = 1$

$\Rightarrow \sin\theta = 1 - \sin^2\theta = \cos^2\theta$

Now, $\cos^{12}\theta + 3\cos^{10}\theta + 3\cos^8\theta + \cos^6\theta - 1$

$= (\cos^4\theta + \cos^2\theta)^3 - 1$

$= (\sin^2\theta + \cos^2\theta)^3 - 1 = 1 - 1 = 0$

231. (3) $\tan 11°.\tan 17°.\tan 79°.\tan 73°$

$= \tan 11°.\tan 17°.\tan(90° - 11°).\tan(90° - 17°)$

$= \tan 11°.\tan 17°.\cot 11°.\cot 17°$

$= \tan 11°.\cot 11°.\tan 17°.\cot 17°$

$= 1 \times 1 = 1$

[$\because \tan(90° - \theta) = \cot\theta$; $\tan\theta\,.\,\cot\theta = 1$]

232. (2) $\sin A + \sin^2 A = 1$

$\Rightarrow \sin A = 1 - \sin^2 A = \cos^2 A$

$\therefore \cos^2 A + \cos^4 A$

$= \cos^2 A + (\cos^2 A)^2$

$= \cos^2 A + \sin^2 A = 1$

233. (3) $(1 + \sec 20° + \cot 70°)(1 - \operatorname{cosec} 20° + \tan 70°)$

$= (1 + \sec 20° + \tan 20°)(1 - \operatorname{cosec} 20° + \cot 20°)$

[$\because \tan(90° - \theta) = \cot\theta$; $\cot(90° - \theta) = \tan\theta$]

$= \left(1 + \dfrac{1}{\cos 20°} + \dfrac{\sin 20°}{\cos 20°}\right)$

$\left(1 - \dfrac{1}{\sin 20°} + \dfrac{\cos 20°}{\sin 20°}\right)$

$= \dfrac{\cos 20° + 1 + \sin 20°}{\cos 20°} .$

$\dfrac{\sin 20° - 1 + \cos 20°}{\sin 20°}$

$= \dfrac{(\cos 20° + \sin 20°)^2 - 1}{\sin 20°.\cos 20°}$

$= \dfrac{\cos^2 20 + \sin^2 20 + 2\sin 20\ .\cos 20 - 1}{\sin 20\ .\cos 20}$

$= \frac{1+2\sin 20°.\cos 20°-1}{\sin 20°.\cos 20°} = 2$

234. (1) $\frac{\tan A - \sec A - 1}{\tan A + \sec A + 1}$

$= \frac{\tan A - \sec A - (\sec^2 A - \tan^2 A)}{\tan A + \sec A + 1}$

$= \frac{(\tan A - \sec A) - (\sec A - \tan A)(\sec A + \tan A)}{\tan A + \sec A + 1}$

$= \frac{(\tan A - \sec A) + (\tan A - \sec A)(\sec A + \tan A)}{\tan A + \sec A + 1}$

$= \frac{(\tan A - \sec A)(1 + \sec A + \tan A)}{\tan A + \sec A + 1}$

$= \tan A - \sec A = \frac{\sin A}{\cos A} - \frac{1}{\cos A}$

$= \frac{\sin A - 1}{\cos A}$

235. (4) $2\sin\alpha + 15\cos^2\alpha = 7$

$\Rightarrow 2\sin\alpha + 15(1 - \sin^2\alpha) = 7$

$\Rightarrow 2\sin\alpha + 15 - 15\sin^2\alpha = 7$

$\Rightarrow 15\sin^2\alpha - 2\sin\alpha - 15 + 7 = 0$

$\Rightarrow 15\sin^2\alpha - 2\sin\alpha - 8 = 0$

$\Rightarrow 15\sin^2\alpha - 12\sin\alpha + 10\sin\alpha - 8 = 0$

$\Rightarrow 3\sin\alpha(5\sin\alpha - 4) + 2(5\sin\alpha - 4) = 0$

$\Rightarrow (3\sin\alpha + 2)(5\sin\alpha - 4) = 0$

$\Rightarrow 5\sin\alpha - 4 = 0 \Rightarrow \sin\alpha = \frac{4}{5}$

$\sin\alpha \neq -\frac{2}{3}$ because α is acute angle.

$\therefore \operatorname{cosec}\alpha = \frac{1}{\sin\alpha} = \frac{5}{4}$

$\therefore \cot\alpha = \sqrt{\operatorname{cosec}^2\alpha - 1}$

$= \sqrt{\left(\frac{5}{4}\right)^2 - 1} = \sqrt{\frac{25}{16} - 1}$

$= \sqrt{\frac{25-16}{16}} = \sqrt{\frac{9}{16}} = \frac{3}{4}$

236. (4) Let, $A = 45°$

$B = 30°$

$\sin(A - B)$

$= \sin A.\cos B - \cos A.\sin B$

$\Rightarrow \sin(45° - 30°)$

$= \sin 45°.\cos 30° - \cos 45°.\sin 30°$

$\Rightarrow \sin 15°$

$= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \times \frac{1}{2}$

$= \frac{\sqrt{3}}{2\sqrt{2}} - \frac{1}{2\sqrt{2}} = \frac{\sqrt{3}-1}{2\sqrt{2}}$

237. (2) $\sec x + \cos x = 2$

$\Rightarrow \frac{1}{\cos x} + \cos x = 2$

$\Rightarrow \frac{1 + \cos^2 x}{\cos x} = 2$

$\Rightarrow \cos^2 x + 1 = 2\cos x$

$\Rightarrow \cos^2 x - 2\cos x + 1 = 0$

$\Rightarrow (\cos x - 1)^2 = 0 \Rightarrow \cos - 1 = 0$

$\Rightarrow \cos = 1$

$\therefore \sec x = 1$

$\therefore \sec^{16} x + \cos^{16} x = 1 + 1 = 2$

238. (1) $\sin^4\theta + \cos^4\theta = 2\sin^2\theta.\cos^2\theta$

$\Rightarrow \sin^4\theta + \cos^4\theta - 2\sin^2\theta.\cos^2\theta = 0$

$\Rightarrow (\sin^2\theta - \cos^2\theta)^2 = 0$

$\Rightarrow \sin^2\theta - \cos^2\theta = 0$

$\Rightarrow \sin^2\theta = \cos^2\theta$

$= \tan^2\theta = 1 \Rightarrow \tan\theta = +1$

$\because \theta$ is acute angle.

239. (2) Expression

$= \sin^4\theta + \cos^4\theta$

$= (\sin^2\theta)^2 + (\cos^2\theta)^2$

$= (\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta.\cos^2\theta.$

$= 1 - 2\sin^2\theta.\cos^2\theta.$

$= 1 - \frac{4\sin^2\theta.\cos^2\theta}{2}$

$[\because \sin 2\theta = 2\sin\theta.\cos\theta]$

$= 1 - \frac{\sin^2 2\theta}{2}$

$= 1 - \frac{1 - \cos 4\theta}{4}$

$[\because 1 - \cos 2\theta = 2\cos^2\theta]$

$= 1 - \frac{1}{4} + \frac{\cos 4\theta}{4}$

$= 1 - \frac{1}{4} + \frac{1}{4} = 1$

$(\cos 4\theta \leq 1)$

OR

The value of $\sin^4\theta + \cos^4\theta$ will be maximum if $\theta = 0°$

$\therefore$ Required value $= (\sin 0)^4 + (\cos 0)^4 = 0 + 1 = 1$

240. (2) $\tan 86° = \cot(90° - 86°)$

$= \cot 4°.$

$\tan 47° = \cot(90° - 47°)$

$= \cot 43°$

$\therefore (\tan 4°.\tan 86°)(\tan 43°.\tan 47°)$

$= (\tan 4° : \cot 4°)(\tan 43°.\cot 43°)$

$= 1$ ($\because \tan\theta.\cot\theta = 1$)

241. (2) $x\cos\theta - \sin\theta = 1$

$\Rightarrow x\cos\theta = 1 + \sin\theta$

$\Rightarrow x = \frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}$

$\Rightarrow x = \sec\theta + \tan\theta$ --- (i)

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \frac{1}{x}$ (ii)

From equation (i) + (ii),

$2\sec\theta = x + \frac{1}{x} = \frac{x^2+1}{x}$

$\Rightarrow \sec\theta = \frac{x^2+1}{2x}$

From equation (i) – (ii),

$2\tan\theta = x - \frac{1}{x} = \frac{x^2-1}{x}$

$\therefore \tan\theta = \frac{x^2-1}{2x}$

$\therefore \sin\theta = \frac{\tan\theta}{\sec\theta}$

$= \frac{x^2-1}{2x} \times \frac{2x}{x^2+1} = \frac{x^2-1}{x^2+1}$

$\therefore$ Expression $= x^2 - (1 + x^2)\sin\theta$

$= x^2 - (1 + x^2) \times \frac{x^2-1}{x^2+1}$

$= x^2 - x^2 + 1 = 1$

Note : In the original equation $x^2 + (1 + x^2)\sin\theta$ has been given that seems incorrect.

242. (2) $\sin\theta + \sin^2\theta = 1$

$\Rightarrow \sin\theta = 1 - \sin^2\theta = \cos^2\theta$

$\therefore \cos^2\theta + \cos^4\theta$

$= \cos^2\theta + (\cos^2\theta)^2$

$= \cos^2\theta + \sin^2\theta = 1$

243. (2) $\frac{\cos^2 45°}{\sin^2 60°} + \frac{\cos^2 60°}{\sin^2 45°} - \frac{\tan^2 30°}{\cot^2 45°} - \frac{\sin^2 30°}{\cot^2 30°}$

$= \frac{\left(\frac{1}{\sqrt{2}}\right)^2}{\left(\frac{\sqrt{3}}{2}\right)^2} + \frac{\left(\frac{1}{2}\right)^2}{\left(\frac{1}{\sqrt{2}}\right)^2} - \frac{\left(\frac{1}{\sqrt{3}}\right)^2}{(1)^2} - \frac{\left(\frac{1}{2}\right)^2}{(\sqrt{3})^2}$

$= \frac{1}{2} \times \frac{4}{3} + \frac{1}{4} \times 2 - \frac{1}{3} \times 1 - \frac{1}{4 \times 3}$

$= \frac{2}{3} + \frac{1}{2} - \frac{1}{3} - \frac{1}{12}$

$= \frac{8+6-4-1}{12} = \frac{9}{12} = \frac{3}{4}$

244. (1) $\tan(90° - \theta) = \cot\theta$

$\tan\theta.\cot\theta = 1$

$\tan 89° = \tan(90° - 1°)$

$= \cot 1°.$

$\tan 88° = \tan(90° - 2°)$

$= \cot 2°.$

$\therefore$ Expression = $(\tan 1°.\tan 89°)$ $(\tan 2°.\tan 88°)$ ---- $\tan 45°$

$= (\tan 1°.\cot 1°).(\tan 2°.\cot 2°)$ --- $\tan 45°$

$= 1.1$ ----$1 = 1$

245. (3) $\frac{\cos\alpha}{\sin\beta} = n$ and $\frac{\cos\alpha}{\cos\beta} = m$

$\Rightarrow \cos\alpha = n\sin\beta$ and

$\cos\alpha = m\cos\beta.$

$\therefore n^2\sin^2\beta = m^2\cos^2\beta$

$\Rightarrow n^2(1 - \cos^2\beta) = m^2\cos^2\beta$

$\Rightarrow n^2 - n^2\cos^2\beta = m^2\cos^2\beta$

$\Rightarrow m^2\cos^2\beta + n^2\cos^2\beta = n^2$

$\Rightarrow \cos^2\beta(m^2 + n^2) = n^2$

$\Rightarrow \cos^2\beta = \frac{n^2}{m^2 + n^2}$

246. (3)

$\sin A.\cos A(\tan A - \cot A)$

$= \sin A.\cos A\left(\frac{\sin A}{\cos A} - \frac{\cos A}{\sin A}\right)$

$= \sin A.\cos A\left(\frac{\sin^2 A - \cos^2 A}{\sin A.\cos A}\right)$

$= \sin^2 A - \cos^2 A$

$= \sin^2 A - (1 - \sin^2 A)$

$= \sin^2 A - 1 + \sin^2 A$

$= 2\sin^2 A - 1$

247. (2) $\tan^2\theta + \frac{1}{\tan^2\theta} = 2$

$\Rightarrow \frac{\tan^4\theta + 1}{\tan^2\theta} = 2$

$\Rightarrow \tan^4\theta + 1 = 2\tan^2\theta$

$\Rightarrow \tan^4\theta - 2\tan^2\theta + 1 = 0$

$\Rightarrow (\tan^2\theta - 1)^2 = 0$

$\Rightarrow \tan^2\theta - 1 = 0$

$\Rightarrow \tan^2\theta = 1$

$\Rightarrow \tan\theta = 1 = \tan 45°$

$\Rightarrow \theta = 45°$ $\because$ θ is an acute angle

248. (1) $\tan\theta + \cot\theta = 5$

On squaring both sides,

$(\tan\theta + \cot\theta)^2 = 5^2$

$\Rightarrow \tan^2\theta + \cot^2\theta + 2\tan\theta.\cot\theta = 25$

$\Rightarrow \tan^2\theta + \cot^2\theta = 25 - 2 = 23$

[$\because \tan\theta.\cot\theta = 1$]

249. (1) $\sin^2 22° + \sin^2 68° + \cot^2 30°$

$= \sin^2 22° + \sin^2(90° - 22°) + (\sqrt{3})^2$

$= \sin^2 22° + \cos^2 22° + 3$

[$\because \sin^2\theta + \cos^2\theta = 1$]

$= 1 + 3 = 4$

250. (3) $2\sin^2\theta + 3\cos^2\theta$

$= 2\sin^2\theta + 2\cos^2\theta + \cos^2\theta$

$= 2(\sin^2\theta + \cos^2\theta) + \cos^2\theta$

$= 2 + \cos^2\theta$

$\therefore$ Minimum value = 2 + 0 = 2

because $\cos^2\theta \geq 0$

251. (4) $\tan(4\theta - 50°) = \cot(50° - \theta)$

$\Rightarrow \tan(4\theta - 50°)$

$= \tan(90° - (50° - \theta))$

$\Rightarrow 4\theta - 50° = 90° - (50° - \theta)$

$\Rightarrow 4\theta - 50° = 90° - 50° + \theta$

$\Rightarrow 4\theta - 50° = 40° + \theta$

$\Rightarrow 4\theta - \theta = 40° + 50°$

$\Rightarrow 3\theta = 90° \Rightarrow \theta = \frac{90°}{3} = 30°$

252. (4) $5\sin\theta = 3 \Rightarrow \sin\theta = \frac{3}{5}$

Expression = $\frac{\sec\theta - \tan\theta}{\sec\theta + \tan\theta}$

$= \frac{\frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta}}{\frac{1}{\cos\theta} + \frac{\sin\theta}{\cos\theta}} = \frac{\frac{1 - \sin\theta}{\cos\theta}}{\frac{1 + \sin\theta}{\cos\theta}}$

$= \frac{1 - \sin\theta}{1 + \sin\theta} = \frac{1 - \frac{3}{5}}{1 + \frac{3}{5}} = \frac{5 - 3}{5 + 3}$

$= \frac{2}{8} = \frac{1}{4}$

253. (4) $\sec\theta + \tan\theta = p$ .....(i)

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \frac{1}{p}$ .....(ii)

On adding both the equations,

$2\sec\theta = p + \frac{1}{p}$

$\Rightarrow \sec\theta = \frac{1}{2}\left(p + \frac{1}{p}\right)$

254. (1) $1 + \cos^2\theta = 3\sin\theta.\cos\theta$

Dividing both sides by $\sin^2\theta$,

$\frac{1}{\sin^2\theta} + \frac{\cos^2\theta}{\sin^2\theta} = \frac{3\sin\theta\cos\theta}{\sin^2\theta}$

$\Rightarrow \text{cosec}^2\theta + \cot^2\theta = 3\cot\theta$

$\Rightarrow 1 + \cot^2\theta + \cot^2\theta = 3\cot\theta$

$\Rightarrow 2\cot^2\theta - 3\cot\theta + 1 = 0$

$\Rightarrow 2\cot^2\theta - 2\cot\theta - \cot\theta + 1 = 0$

$\Rightarrow 2\cot^2\theta(\cot\theta - 1) - 1(\cot\theta - 1) = 0$

$\Rightarrow (2\cot\theta - 1)(\cot\theta - 1) = 0$

$\Rightarrow \cot\theta = \frac{1}{2}$ or 1

255. (4) Expression

$= 3(\sin^4\theta + \cos^4\theta) + 2(\sin^6\theta + \cos^6\theta) + 12\sin^2\theta.\cos^2\theta$

$= 3\{(\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta.\cos^2\theta\}$

$+ 2\{(\sin^2\theta + \cos^2\theta)^3 - 3\sin^2\theta.\cos^2\theta(\sin^2\theta + \cos^2\theta) + 12\sin^2\theta.\cos^2\theta$

[$\because a^2 + b^2 = (a + b)^2 - 2ab$; $a^3 + b^3 = (a + b)^3 - 3ab(a + b)$]

$= 3(1 - 2\sin^2\theta.\cos^2\theta) + 2(1 - 3\sin^2\theta.\cos^2\theta) + 12\sin^2\theta.\cos^2\theta = 3 - 6\sin^2\theta.\cos^2\theta + 2 - 6$

$\sin^2\theta\cos^2\theta + 12\sin^2\theta.\cos^2\theta = 5$

256. (2) $\sec\theta + \tan\theta = 2 + \sqrt{5}$

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$$\Rightarrow \sec\theta - \tan\theta = \frac{1}{\sqrt{5}+2}$$

$$= \frac{1}{\sqrt{5}+2} \times \frac{\sqrt{5}-2}{\sqrt{5}-2} = \frac{\sqrt{5}-2}{5-4}$$

$$= \sqrt{5}-2$$

$\therefore \sec\theta + \tan\theta + \sec\theta - \tan\theta$

$= 2 + \sqrt{5} + \sqrt{5} - 2$

$\Rightarrow 2\sec\theta = 2\sqrt{5}$

$\Rightarrow \sec\theta = \sqrt{5}$ ....(i)

Again,

$\sec\theta + \tan\theta - (\sec\theta - \tan\theta)$

$= 2 + \sqrt{5} - \sqrt{5} + 2$

$\Rightarrow 2\tan\theta = 4 \Rightarrow \tan\theta = 2$ ....(ii)

$$\therefore \sin\theta = \frac{\tan\theta}{\sec\theta} = \frac{2}{\sqrt{5}}$$

257. (2) $\dfrac{\sec\theta+\tan\theta}{\sec\theta-\tan\theta} = 2\dfrac{51}{79}$

$$= \frac{158+51}{79} = \frac{209}{79}$$

By componendo and dividendo,

$$\frac{\sec\theta+\tan\theta+\sec\theta-\tan\theta}{\sec\theta+\tan\theta-\sec\theta+\tan\theta}$$

$$= \frac{209+79}{209-79}$$

$$\Rightarrow \frac{2\sec\theta}{2\tan\theta} = \frac{288}{130}$$

$$\Rightarrow \frac{\sec\theta}{\tan\theta} = \frac{144}{65}$$

$$\therefore \sin\theta = \frac{\tan\theta}{\sec\theta} = \frac{65}{144}$$

258. (2) $\tan A + \cot A = 2$

$$\Rightarrow \tan A + \frac{1}{\tan A} = 2$$

$$\Rightarrow \frac{\tan^2 A + 1}{\tan A} = 2$$

$\Rightarrow \tan^2 A + 1 = 2\tan A$

$\Rightarrow \tan^2 A - 2\tan A + 1 = 0$

$\Rightarrow (\tan A - 1)^2 = 0$

$\Rightarrow \tan A - 1 = 0 \quad \Rightarrow \tan A = 1$

$\Rightarrow \cot A = 1$

$\therefore \tan^{10} A + \cot^{10} A = 1 + 1 = 2$

259. (4) $\cos^2 30° + \sin^2 60° + \tan^2 45° + \sec^2 60° + \cos 0°$

$$= \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{\sqrt{3}}{2}\right)^2 + (1)^2 + (2)^2 + 1$$

$$= \frac{3}{4} + \frac{3}{4} + 1 + 4 + 1$$

$$= 6 + \frac{3+3}{4}$$

$$= 6 + \frac{6}{4} = 6 + \frac{3}{2} = \frac{12+3}{2}$$

$$= \frac{15}{2} = 7\frac{1}{2}$$

260. (4) $\cos x + \cos^2 x = 1$

$\Rightarrow \cos x = 1 - \cos^2 x$

$= \sin^2 x$ ..... (i)

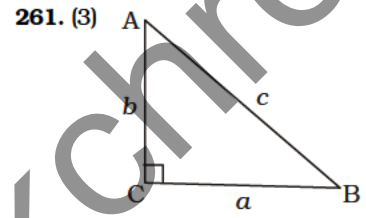
$\therefore \sin^8 x + 2\sin^6 x + \sin^4 x$

$= (\sin^4 x + \sin^2 x)^2$

$= ((\cos x)^2 + \sin^2 x)^2$

$= (\cos^2 x + \sin^2 x)^2 = 1$

261. (3)



In ΔABC,

$AB^2 = AC^2 + BC^2$

$\Rightarrow c^2 = a^2 + b^2$ ..... (i)

From ΔABC,

$$\text{cosec } B = \frac{AB}{AC} = \frac{c}{b} \quad \text{..... (ii)}$$

$$\cos A = \frac{AC}{AB} = \frac{b}{c}$$

$$\therefore \text{cosec } B - \cos A = \frac{c}{b} - \frac{b}{c}$$

$$= \frac{c^2 - b^2}{bc} = \frac{a^2}{bc}$$

262. (1) $\tan\theta - \cot\theta = 0$

$\Rightarrow \tan\theta = \cot\theta$

$\Rightarrow \tan\theta = \tan(90° - \theta)$

$\Rightarrow \theta = 90° - \theta$

$\Rightarrow 2\theta = 90°$

$\Rightarrow \theta = 45°$

$$\therefore \frac{\tan(\theta+15°)}{\tan(\theta-15°)}$$

$$= \frac{\tan(45°+15°)}{\tan(45°-15°)} = \frac{\tan 60°}{\tan 30°}$$

$$= \frac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = \sqrt{3} \times \sqrt{3} = 3$$

263. (1) Expression = $(\cot 41° . \cot 49°) . (\cot 42° . \cot 48°) (\cot 43° . \cot 47°) . (\cot 44° . \cot 46°) . \cot 45°$

$= \cot 41° . \tan(90° - 49°) . \cot 42° . \tan(90° - 48°) . \cot 43° . \tan(90° - 47°) . \cot 44° . \tan(90° - 46°).1$

$= (\cot 41° . \tan 41°)(\cot 42° . \tan 42°) . (\cot 43° . \tan 43°). (\cot 44° . \tan 44°) . 1 = 1$

[$\because \tan(90° - \theta) = \cot\theta$; $\tan\theta . \cot\theta = 1$]

264. (4) $x = a\sin\theta - b\cos\theta$ --- (i)

$y = a\cos\theta + b\sin\theta$ - (ii)

On squaring and adding both the equations,

$x^2 + y^2 = (a\sin\theta - b\cos\theta)^2 + (a\cos\theta + b\sin\theta)^2$

$= a^2\sin^2\theta + b^2\cos^2\theta - 2ab\sin\theta . \cos\theta + a^2\cos^2\theta + b^2\sin^2\theta + 2ab\sin\theta . \cos\theta$

$= a^2(\sin^2\theta + \cos^2\theta) + b^2(\cos^2\theta + \sin^2\theta)$

$= a^2 + b^2$

[$\because \sin^2\theta + \cos^2\theta = 1$]

265. (1) $\sec\theta - \tan\theta = \dfrac{1}{\sqrt{3}}$ ....(i)

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$\Rightarrow \sec\theta + \tan\theta = \sqrt{3}$ ....(ii)

On adding equations (i) and (ii),

$$2\sec\theta = \sqrt{3} + \frac{1}{\sqrt{3}}$$

$$= \frac{3+1}{\sqrt{3}} = \frac{4}{\sqrt{3}}$$

$$\Rightarrow \sec\theta = \frac{2}{\sqrt{3}}$$

Again, by equation (ii) – (i),

$$2\tan\theta = \sqrt{3} - \frac{1}{\sqrt{3}}$$

$$= \frac{3-1}{\sqrt{3}} = \frac{2}{\sqrt{3}}$$

$$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$$

$\therefore$ $\sec\theta \cdot \tan\theta$

$= \frac{2}{\sqrt{3}} \times \frac{1}{\sqrt{3}} = \frac{2}{3}$

266. (4) $5\cos\theta + 12\sin\theta = 13$

$\Rightarrow \frac{5}{13}\cos\theta + \frac{12}{13}\sin\theta = 1$

$\because \sin^2\theta + \cos^2\theta = 1$

$\therefore \sin\theta = \frac{12}{13}, \cos\theta = \frac{5}{13}$

267. (1) $7\sin^2\theta + 3\cos^2\theta = 4$

On dividing both sides by $\cos^2\theta$,

$7\frac{\sin^2\theta}{\cos^2\theta} + \frac{3\cos^2\theta}{\cos^2\theta} = \frac{4}{\cos^2\theta}$

$\Rightarrow 7\tan^2\theta + 3 = 4\sec^2\theta$

$\Rightarrow 7\tan^2\theta + 3 = 4(1 + \tan^2\theta)$

$\Rightarrow 7\tan^2\theta + 3 = 4 + 4\tan^2\theta$

$\Rightarrow 7\tan^2\theta - 4\tan^2\theta = 4 - 3$

$\Rightarrow 3\tan^2\theta = 1 \Rightarrow \tan^2\theta = \frac{1}{3}$

$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$

268. (1) Expression

$= (\text{cosec}\,a - \sin a)(\sec a - \cos a)(\tan a + \cot a)$

$= \left(\frac{1}{\sin a} - \sin a\right)\left(\frac{1}{\cos a} - \cos a\right)\left(\frac{\sin a}{\cos a} + \frac{\cos a}{\sin a}\right)$

$= \left(\frac{1-\sin^2 a}{\sin a}\right)\left(\frac{1-\cos^2 a}{\cos a}\right) \cdot \frac{\sin^2 a + \cos^2 a}{\cos a . \sin a}$

$= \frac{\cos^2 a}{\sin a} \times \frac{\sin^2 a}{\cos a} \times \frac{1}{\cos a . \sin a}$

$= 1$

269. (4) $\sin A + \sin^2 A = 1$

$\Rightarrow \sin A = 1 - \sin^2 A = \cos^2 A$

$\therefore \cos^2 A + \cos^4 A$

$= \cos^2 A + (\cos^2 A)^2$

$= \cos^2 A + \sin^2 A = 1$

270. (4) $\tan A = n \tan B$

$\Rightarrow \tan B = \frac{1}{n}\tan A$

$\Rightarrow \cot B = \frac{n}{\tan A}$

and, $\sin A = m \sin B$

$\Rightarrow \sin B = \frac{1}{m}\sin A$

$\Rightarrow \text{cosec}\, B = \frac{m}{\sin A}$

$\because \text{cosec}^2 B - \cot^2 B = 1$

$\Rightarrow \frac{m^2}{\sin^2 A} - \frac{n^2}{\tan^2 A} = 1$

$\Rightarrow \frac{m^2}{\sin^2 A} - \frac{n^2\cos^2 A}{\sin^2 A} = 1$

$\Rightarrow \frac{m^2 - n^2\cos^2 A}{\sin^2 A} = 1$

$\Rightarrow m^2 - n^2\cos^2 A = \sin^2 A$

$\Rightarrow m^2 - n^2\cos^2 A = 1 - \cos^2 A$

$\Rightarrow m^2 - 1 = n^2\cos^2 A - \cos^2 A$

$\Rightarrow m^2 - 1 = (n^2 - 1)\cos^2 A$

$\Rightarrow \cos^2 A = \frac{m^2 - 1}{n^2 - 1}$

271. (4) $\sin\theta + \cos\theta = \sqrt{2}\sin(90° - \theta)$

$\Rightarrow \sin\theta + \cos\theta = \sqrt{2}\cos\theta$

$\Rightarrow \sqrt{2}\cos\theta - \cos\theta = \sin\theta$

$\Rightarrow \cos\theta(\sqrt{2} - 1) = \sin\theta$

$\Rightarrow \frac{\cos\theta}{\sin\theta} = \frac{1}{\sqrt{2} - 1}$

$\Rightarrow \cot\theta = \frac{1}{\sqrt{2} - 1} \times \frac{\sqrt{2} + 1}{\sqrt{2} + 1}$

$= \frac{\sqrt{2} + 1}{2 - 1} = \sqrt{2} + 1$

272. (3) $\tan 20° = \tan(90° - 70°)$

$= \cot 70°$

$\therefore \cot 20° = \tan 70°$

$\tan 15° = \tan(90° - 75°)$

$= \cot 75°$

$\therefore$ Expression $= \cot^2 70° . \sin^2 70° + \tan^2 70° . \cos^2 70° + 2\cot 75° . \tan 75° . \tan 45°$

$= \frac{\cos^2 70°}{\sin^2 70°} . \sin^2 70° + \frac{\sin^2 70°}{\cos^2 70°} . \cos^2 70° + 2 \times 1 \times 1$

$= \cos^2 70° + \sin^2 70° + 2$

$= 1 + 2 = 3$

[$\because \sin\theta . \text{cosec}\,\theta = 1$; $\cos\theta . \sec\theta = 1$; $\tan\theta . \cot\theta = 1$]

273. (2) $\sin 47° = \sin(90° - 43°)$

$= \cos 43°$

$\therefore \left(\frac{\sin 47}{\cos 43}\right)^2 + \left(\frac{\cos 43}{\sin 47}\right)^2 - 4\cos^2 45$

$= \left(\frac{\cos 43}{\cos 43}\right)^2 + \left(\frac{\sin 47}{\sin 47}\right)^2 - 4 \times \left(\frac{1}{\sqrt{2}}\right)^2$

$[\because \sin(90° - \theta) = \cos\theta, \cos(90° - \theta) = \sin\theta]$

$= 1 + 1 - 4 \times \frac{1}{2} = 2 - 2 = 0$

274. (2) $\text{cosec}\theta = \cot^2\theta$

$\Rightarrow \text{cosec}\theta = \text{cosec}^2\theta - 1$

$\Rightarrow \text{cosec}^2\theta - \text{cosec}\theta = 1$ .....(i)

Expression

$= \text{cosec}^4\theta - 2\text{cosec}^3\theta + \cot^2\theta$

$= \text{cosec}^4\theta - \text{cosec}^3\theta - \text{cosec}^3\theta + \text{cosec}\theta$

$= \text{cosec}^2\theta(\text{cosec}^2\theta - \text{cosec}\theta) - \text{cosec}\theta(\text{cosec}^2\theta - 1)$

$= \text{cosec}^2\theta - \text{cosec}^2\theta = 0$

275. (2) $4\sin^2\theta - 1 = 0$

$\Rightarrow 4\sin^2\theta = 1$

$\Rightarrow \sin^2\theta = \frac{1}{4}$

$\Rightarrow \sin\theta = \frac{1}{2}$ $(\because \theta < 90°)$

$\therefore \sin\theta = \sin 30° \Rightarrow \theta = 30°$

$\therefore \cos^2\theta + \tan^2\theta$

$= \cos^2 30° + \tan^2 30°$

$= \left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{\sqrt{3}}\right)^2 = \frac{3}{4} + \frac{1}{3}$

$= \frac{9 + 4}{12} = \frac{13}{12}$

276. (3)

$\frac{9}{\text{cosec}^2\theta} + 4\cos^2\theta + \frac{5}{1 + \tan^2\theta}$

$= 9\sin^2\theta + 4\cos^2\theta + \frac{5}{\sec^2\theta}$

$= 9\sin^2\theta + 4\cos^2\theta + 5\cos^2\theta$

$= 9\sin^2\theta + 9\cos^2\theta$

$= 9(\sin^2\theta + \cos^2\theta) = 9 \times 1 = 9$

277. (4) $\tan\theta + \sec\theta = 3$ .....(i)

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \frac{1}{3}$ .... (ii)

On adding equations (i) and (ii),

$2\sec\theta = 3+\frac{1}{3}=\frac{10}{3}$

On subtracting equation (ii) from (i),

$2\tan\theta = 3-\frac{1}{3}$

$=\frac{9-1}{3}=\frac{8}{3}$

$\therefore \sin\theta = \frac{\tan\theta}{\sec\theta}$

$=\frac{8}{3}\times\frac{3}{10}=\frac{4}{5}$

$\therefore 5\sin\theta = 5\times\frac{4}{5}=4$

278. (2) $\cos\theta = \frac{p}{\sqrt{p^2+q^2}}$

$\therefore \sin\theta = \sqrt{1-\cos^2\theta}$

$=\sqrt{1-\frac{p^2}{p^2+q^2}}$

$=\sqrt{\frac{p^2+q^2-p^2}{p^2+q^2}}=\frac{q}{\sqrt{p^2+q^2}}$

$\therefore \tan\theta = \frac{\sin\theta}{\cos\theta}$

$=\frac{q}{\sqrt{p^2+q^2}}\times\frac{\sqrt{p^2+q^2}}{p}=\frac{q}{p}$

279. (2) In a triangle ABC,
$A + B + C = 180°$

$\Rightarrow \frac{A}{2}+\frac{B}{2}+\frac{C}{2}=90°$

$\Rightarrow \frac{A+B}{2}=90°-\frac{C}{2}$

$\Rightarrow \tan\left(\frac{A+B}{2}\right)$

$=\tan\left(90°-\frac{C}{2}\right)=\cot\frac{C}{2}$

280. (2) $\sin 89° = \sin(90°-1°)$
$= \cos 1°$
$\sin 79° = \sin(90°-11°)$
$= \cos 11°$
$\sin 69° = \sin(90°-21°)$
$= \cos 21°$
$\sin 59° = \sin(90°-31°)$
$= \cos 31°$
$\sin 49° = \sin(90°-41°)$
$= \cos 41°$
$\therefore$ Expression
$= (\sin^2 1° + \cos^2 1°) + (\sin^2 11° + \cos^2 11°) + (\sin^2 21° + \cos^2 21°) + (\sin^2 31° + \cos^2 31°) + (\sin^2 41° + \cos^2 41°) + \sin^2 45°$

$=5+\left(\frac{1}{\sqrt{2}}\right)^2=5+\frac{1}{2}=5\frac{1}{2}$

$[\because \sin^2\theta + \cos^2\theta = 1]$

281. (4) $x = a(\sin\theta + \cos\theta)$

$\Rightarrow \frac{x}{a} = \sin\theta + \cos\theta$

and, $y = b(\sin\theta - \cos\theta)$

$\Rightarrow \frac{y}{b} = \sin\theta - \cos\theta$

$\therefore \frac{x^2}{a^2}+\frac{y^2}{b^2}$

$= (\sin\theta + \cos\theta)^2 + (\sin\theta - \cos\theta)^2$

$= 2(\sin^2\theta + \cos^2\theta) = 2$

$[\because (a+b)^2 + (a-b)^2 = 2(a^2+b^2)]$

282. (1) $\cos\theta + \sin\theta = m$ --- (i)
$\sec\theta + \operatorname{cosec}\theta = n$

$\Rightarrow \frac{1}{\cos\theta}+\frac{1}{\sin\theta}=n$

$\Rightarrow \frac{\sin\theta+\cos\theta}{\sin\theta.\cos\theta}=n$ --- (ii)

$\therefore n(m^2-1)=\frac{\sin\theta+\cos\theta}{\sin\theta.\cos\theta}$

$[(\sin\theta+\cos\theta)^2-1]$

$=\frac{\sin\theta+\cos\theta}{\sin\theta.\cos\theta}(\sin^2\theta+\cos^2\theta + 2\sin\theta\cos\theta - 1)$

$=\frac{\sin\theta+\cos\theta}{\sin\theta.\cos\theta}\times 2\sin\theta.\cos\theta$

$[\because \sin^2\theta + \cos^2\theta = 1]$

$= 2(\sin\theta + \cos\theta) = 2m$

283. (3) $\frac{x-x\tan^2 30°}{1+\tan^2 30°}$

$= \sin^2 30° + 4\cot^2 45° - \sec^2 60°$

$\Rightarrow \frac{x-x\times\left(\frac{1}{\sqrt{3}}\right)^2}{1+\left(\frac{1}{\sqrt{3}}\right)^2}$

$=\left(\frac{1}{2}\right)^2+4\times(1)^2-(2)^2$

$\Rightarrow \frac{x-\frac{x}{3}}{1+\frac{1}{3}}=\frac{1}{4}+4-4$

$\Rightarrow \frac{3x-x}{3+1}=\frac{1}{4}$

$\Rightarrow 2x=\frac{1}{4}\times 4=1$

$\Rightarrow x=\frac{1}{2}$

284. (1) $\cos A + \sin A$

$=\sqrt{2}\cos A$ --- (i)

$\cos A - \sin A = x$ (let) --- (ii)

On squaring both equation and adding
$\cos^2 A + \sin^2 A + 2\sin A.\cos A + \cos^2 A + \sin^2 A - 2\sin A\cos A = 2$
$\cos^2 A + x^2$
$\Rightarrow 2(\cos^2 A + \sin^2 A)$
$= 2\cos^2 A + x^2$
$\Rightarrow x^2 + 2\cos^2 A = 2$
$\Rightarrow x^2 = 2 - 2\cos^2 A$
$= 2(1 - \cos^2 A) = 2\sin^2 A$

$\therefore x = \sqrt{2}\sin A$

285. (*) $\frac{\sin\theta+\cos\theta}{\sin\theta-\cos\theta}=\frac{3}{1}$

By componendo and dividendo,

$\frac{\sin\theta+\cos\theta+\sin\theta-\cos\theta}{\sin\theta+\cos\theta-\sin\theta+\cos\theta}$

$=\frac{3+1}{3-1}$

$\Rightarrow \frac{2\sin\theta}{2\cos\theta}=\frac{4}{2}$

$\Rightarrow \tan\theta = 2$

$\therefore \cot\theta = \frac{1}{2}$

$\therefore \operatorname{cosec}\theta = \sqrt{1+\cot^2\theta}$

$=\sqrt{1+\frac{1}{4}}=\sqrt{\frac{5}{4}}=\frac{\sqrt{5}}{2}$

$\therefore \sin\theta = \frac{2}{\sqrt{5}}$

$\sin^4\theta = \frac{16}{25}$

286. (2) $\sin 2\theta = \frac{\sqrt{3}}{2} = \sin 60°$

$\Rightarrow 2\theta = 60° \Rightarrow \theta = 30°$

$\therefore \sin 3\theta = \sin 90° = 1$

287. (3) Expression

$$= \frac{1+2\times\frac{\sqrt{3}}{2}\times\frac{1}{2}}{\frac{\sqrt{3}}{2}+\frac{1}{2}} + \frac{1-2\times\frac{\sqrt{3}}{2}\times\frac{1}{2}}{\frac{\sqrt{3}}{2}-\frac{1}{2}}$$

$$= \frac{1+\frac{\sqrt{3}}{2}}{\frac{\sqrt{3}+1}{2}} + \frac{1-\frac{\sqrt{3}}{2}}{\frac{\sqrt{3}-1}{2}}$$

$$= \frac{2+\sqrt{3}}{\sqrt{3}+1} + \frac{2-\sqrt{3}}{\sqrt{3}-1}$$

$$= \frac{(2+\sqrt{3})(\sqrt{3}-1)+(\sqrt{3}+1)(2-\sqrt{3})}{(\sqrt{3}+1)(\sqrt{3}-1)}$$

$$= \frac{2\sqrt{3}-2+3-\sqrt{3}+2\sqrt{3}-3+2-\sqrt{3}}{3-1}$$

$$= \frac{4\sqrt{3}-2\sqrt{3}}{2} = \frac{2\sqrt{3}}{2} = \sqrt{3}$$

288. (4) $\alpha + \beta = 90°$

$\Rightarrow \alpha = 90° - \beta$

$\Rightarrow \tan\alpha = \tan(90° - \beta) = \cot\beta.$

$\sin\alpha = \sin(90° - \beta) = \cos\beta$

$\therefore$ Expression

$$= \frac{\cot\beta}{\tan\beta} + \cos^2\beta + \sin^2\beta$$

$= \cot^2\beta + 1$

$= \operatorname{cosec}^2\beta = \operatorname{cosec}^2(90° - \alpha)$

$= \sec^2\alpha$

289. (4) $\tan^2\frac{\pi}{4} - \cos^2\frac{\pi}{3}$

$= x \sin\frac{\pi}{4} . \cos\frac{\pi}{4} . \tan\frac{\pi}{3}$

$\Rightarrow 1 - \left(\frac{1}{2}\right)^2 = x . \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} \times \sqrt{3}$

$\Rightarrow 1 - \frac{1}{4} = x \times \frac{\sqrt{3}}{2}$

$\Rightarrow \frac{4-1}{4} = x \times \frac{\sqrt{3}}{2}$

$\Rightarrow x = \frac{3}{4} \times \frac{2}{\sqrt{3}} = \frac{\sqrt{3}}{2}$

290. (3) $\sin A - \cos A = \frac{\sqrt{3}-1}{2}$

On squaring both sides,

$\sin^2 A + \cos^2 A - 2\sin A . \cos A$

$= \frac{1}{4}\left[\left(\sqrt{3}\right)^2 + (1)^2 - 2\sqrt{3}\right]$

$\Rightarrow 1 - 2\sin A\cos A$

$= \frac{1}{4}\left(4 - 2\sqrt{3}\right)$

$\Rightarrow 1 - 2\sin A\cos A = \frac{2-\sqrt{3}}{2}$

$\Rightarrow 2 - 4\sin A\cos A = 2 - \sqrt{3}$

$\Rightarrow 4\sin A . \cos A = 2 - 2 + \sqrt{3} = \sqrt{3}$

$\Rightarrow \sin A.\cos A = \frac{\sqrt{3}}{4}$

291. (2) $\sin(90° - \theta) + \cos\theta$

$= \sqrt{2}\cos(90° - \theta)$

$\Rightarrow \cos\theta + \cos\theta = \sqrt{2}\sin\theta$

$\Rightarrow 2\cos\theta = \sqrt{2}\sin\theta$

$\Rightarrow \frac{\cos\theta}{\sin\theta} = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$

$\Rightarrow \cot\theta = \frac{1}{\sqrt{2}}$

$\because \operatorname{cosec}^2\theta = 1 + \cot^2\theta$

$= 1 + \left(\frac{1}{\sqrt{2}}\right)^2 = 1 + \frac{1}{2}$

$\Rightarrow \operatorname{cosec}^2\theta = \frac{3}{2}$

$\Rightarrow \operatorname{cosec}\theta = \sqrt{\frac{3}{2}}$

292. (2) $\tan\left(\frac{\pi}{2} - \frac{\alpha}{2}\right) = \sqrt{3}$

$\Rightarrow \cot\frac{\alpha}{2} = \sqrt{3} = \cot 30°$

$\Rightarrow \frac{\alpha}{2} = 30° \Rightarrow \alpha = 60°$

$\therefore \cos\alpha = \cos 60° = \frac{1}{2}$

293. (1) $\because \cos 90° = 0$

$\therefore \cos 1°.\cos 2°.... \cos 180° = 0$

294. (1) $\cos 20° = m$ and $\cos 70° = n$

$\therefore m^2 + n^2 = \cos^2 20° + \cos^2 70°$

$= \cos^2(90° - 70°) + \cos^2 70°$

$\Rightarrow \sin^2 70° + \cos^2 70° = 1$

295. (2) $\tan(90° - \theta) = \cot\theta$

$\therefore \tan(5x - 10°) = \cot(5y + 20°)$

$\Rightarrow \tan(5x - 10°)$

$= \tan\{90° - (5y + 20°)\}$

$\Rightarrow 5x - 10° = 90° - (5y + 20°)$

$\Rightarrow 5x - 10° = 90° - 5y - 20°$

$\Rightarrow 5x + 5y = 70° + 10°$

$\Rightarrow 5(x + y) = 80°$

$\Rightarrow x + y = \frac{80°}{5} = 16°$

296. (1) $\cos 27° = x$

$\Rightarrow \cos(90° - 63°) = x$

$\Rightarrow \sin 63° = x$

$\therefore \cos 63° = \sqrt{1 - \sin^2 63°}$

$= \sqrt{1 - x^2}$

$\therefore \tan 63° = \frac{\sin 63°}{\cos 63°}$

$= \frac{x}{\sqrt{1 - x^2}}$

297. (2) $\cos^2 x + \cos^4 x = 1$

$\Rightarrow \cos^4 x = 1 - \cos^2 x = \sin^2 x$

$\therefore \tan^2 x + \tan^4 x$

$= \frac{\sin^2 x}{\cos^2 x} + \frac{\sin^4 x}{\cos^4 x}$

$= \frac{\cos^4 x}{\cos^2 x} + \frac{\sin^4 x}{\sin^2 x}$

$= \cos^2 x + \sin^2 x = 1$

298. (4) $(1 + \sec 22° + \cot 68°)(1 - \operatorname{cosec} 22° + \tan 68°)$
$= (1 + \sec 22° + \tan 22°)(1 - \operatorname{cosec} 22° + \cot 22°)$
$[\because \tan(90° - \theta) = \cot\theta;\ \cot(90° - \theta) = \tan\theta]$

$$= \left(1 + \frac{1}{\cos 22°} + \frac{\sin 22°}{\cos 22°}\right)\left(1 - \frac{1}{\sin 22°} + \frac{\cos 22°}{\sin 22°}\right)$$

$$= \left(\frac{\cos 22° + 1 + \sin 22°}{\cos 22°}\right)\left(\frac{\sin 22° - 1 + \cos 22°}{\sin 22°}\right)$$

$$= \frac{(\cos 22 + \sin 22 + 1)(\sin 22 + \cos 22 - 1)}{\sin 22 \cdot \cos 22}$$

$$= \frac{(\sin 22° + \cos 22°)^2 - 1}{\sin 22° \cdot \cos 22°}$$

$$= \frac{\sin^2 22 + \cos^2 22 + 2\sin 22 \cdot \cos 22 - 1}{\sin 22 \cdot \cos 22}$$

$$= \frac{1 - 1 + 2\sin 22° \cdot \cos 22°}{\sin 22° \cdot \cos 22°} = 2$$

299. (1) $\because x\sin\theta - y\cos\theta = 0$
$\Rightarrow x\sin\theta = y\cos\theta$ ..... (i)
$\therefore x\sin^3\theta + y\cos^3\theta$
$= \sin\theta \cdot \cos\theta$
$\Rightarrow y\cos\theta \cdot \sin^2\theta + y\cos^3\theta$
$= \sin\theta \cdot \cos\theta$
$\Rightarrow y\cos\theta(\sin^2\theta + \cos^2\theta)$
$= \sin\theta \cdot \cos\theta$
$\Rightarrow y\cos\theta = \sin\theta \cdot \cos\theta$
$\Rightarrow y = \sin\theta$
From equation (i),
$x\sin\theta = \sin\theta \cdot \cos\theta$
$\Rightarrow x = \cos\theta$
$\therefore x^2 + y^2 = \cos^2\theta + \sin^2\theta = 1$

300. (2) $\sec\theta + \tan\theta = m$. (Given) ...(i)
$\because \sec^2\theta - \tan^2\theta = 1$
$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$$\Rightarrow \sec\theta - \tan\theta = \frac{1}{m} \quad \text{....(ii)}$$

By equations (i) + (ii),

$$2\sec\theta = m + \frac{1}{m}$$

$$\Rightarrow \sec\theta = \frac{m^2 + 1}{2m}$$

By equation (i) – (ii),

$$2\tan\theta = m - \frac{1}{m}$$

$$\Rightarrow \tan\theta = \frac{m^2 - 1}{2m}$$

$$\therefore \sin\theta = \frac{\tan\theta}{\sec\theta}$$

$$= \frac{m^2 - 1}{2m} \times \frac{2m}{m^2 + 1} = \frac{m^2 - 1}{m^2 + 1}$$

301. (2) $(a^2 - b^2)\sin\theta + 2ab\cos\theta = (a^2 + b^2)$
On dividing by $\cos\theta$,
$(a^2 - b^2)\tan\theta + 2ab = (a^2 + b^2)\sec\theta$
On squaring both sides,
$(a^2 - b^2)^2\tan^2\theta + 4a^2b^2 + 4ab(a^2 - b^2)\tan\theta = (a^2 + b^2)^2\sec^2\theta$
$\Rightarrow (a^2 - b^2)^2\tan^2\theta + 4ab(a^2 - b^2)\tan\theta + 4a^2b^2 = (a^2 + b^2)^2(1 + \tan^2\theta)$
$\Rightarrow (a^2 + b^2)^2\tan^2\theta - (a^2 - b^2)^2\tan^2\theta\ 4ab(a^2 - b^2)^2\tan\theta + (a^2 + b^2) - 4a^2b^2 = 0$
$\Rightarrow \tan^2\theta\{(a^2 + b^2)^2 - (a^2 - b^2)^2\} - 4ab(a^2 - b^2)\tan\theta + (a^2 - b^2)^2 = 0$
$\Rightarrow 4a^2b^2\tan^2\theta - 4ab(a^2 - b^2)\tan\theta + (a^2 - b^2)^2 = 0$
$\Rightarrow \{2ab\tan\theta - (a^2 - b^2)\}^2 = 0$
$\Rightarrow 2ab\tan\theta - (a^2 - b^2) = 0$

$$\Rightarrow \tan\theta = \frac{a^2 - b^2}{2ab}$$

302. (4) $2y\cos\theta = x\sin\theta$ ..(i)
$2x\sec\theta - y\operatorname{cosec}\theta = 3$

$$\Rightarrow 2.\frac{2y\cos\theta}{\sin\theta} \cdot \sec\theta - y\operatorname{cosec}\theta = 3$$

$\Rightarrow 4y\operatorname{cosec}\theta - y\operatorname{cosec}\theta = 3$
$\Rightarrow 3y\operatorname{cosec}\theta = 3$

$$\Rightarrow y = \frac{3}{3\operatorname{cosec}\theta} = \sin\theta$$

From equation (i),
$2\sin\theta \cdot \cos\theta = x\sin\theta$
$\Rightarrow x = 2\cos\theta$
$\therefore x^2 + 4y^2 = 4\cos^2\theta + 4\sin^2\theta$
$= 4(\cos^2\theta + \sin^2\theta) = 4$

303. (*) $\dfrac{\cot\theta + \operatorname{cosec}\theta - 1}{\cot\theta - \operatorname{cosec}\theta + 1}$
(we have taken $(\cot\theta - \operatorname{cosec}\theta + 1)$ instead of $(\cot\theta + \operatorname{cosec}\theta + 1)$ as denominator)

$$= \frac{\cot\theta + \operatorname{cosec}\theta - (\operatorname{cosec}^2\theta - \cot^2\theta)}{\cot\theta - \operatorname{cosec}\theta + 1}$$

$$= \frac{(\cot\theta + \operatorname{cosec}\theta) - (\operatorname{cosec}\theta + \cot\theta)}{(\operatorname{cosec}\theta - \cot\theta)}$$

$$= \frac{(\cot\theta + \operatorname{cosec}\theta)(1 - \operatorname{cosec}\theta + \cot\theta)}{\cot\theta - \operatorname{cosec}\theta + 1}$$

$= \cot\theta + \operatorname{cosec}\theta$

$$= \frac{\cos\theta}{\sin\theta} + \frac{1}{\sin\theta}$$

$$= \frac{\cos\theta + 1}{\sin\theta}$$

304. (2) $\sin\theta = \dfrac{5}{13}$

$$\cos\theta = \sqrt{1 - \sin^2\theta}$$

$$= \sqrt{1 - \left(\frac{5}{13}\right)^2}$$

$$= \sqrt{1 - \frac{25}{169}} = \sqrt{\frac{169 - 25}{169}}$$

$$= \sqrt{\frac{144}{169}} = \frac{12}{13}$$

$$\therefore \tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{5}{12}$$

$$\cot\theta = \frac{12}{5}$$

$$\therefore \sqrt{\tan\theta + \cot\theta} = \sqrt{\frac{5}{12} + \frac{12}{5}}$$

$$= \sqrt{\frac{25 + 144}{60}} = \sqrt{\frac{169}{60}}$$

$$= \frac{13}{2\sqrt{15}}$$

305. (3) Expression

$$= \frac{2\sin\theta}{\cos\theta(1 + \tan^2\theta)}$$

$= \frac{2\sin\theta}{\cos\theta.\sec^2\theta} = \frac{2\sin\theta}{\sec\theta}$

$[\because \cos\theta \cdot \sec\theta = 1]$

$= 2\sin\theta \cdot \cos\theta = \sin2\theta$

306. (3) $\tan\theta_1 = 1 = \tan 45°$

$\Rightarrow \theta_1 = 45°$

Again, $\sin\theta_2 = \frac{1}{\sqrt{2}} = \sin 45°$

$\Rightarrow \theta_2 = 45°$

$\therefore \sin(\theta_1 + \theta_2) = \sin 90° = 1$

307. (2) $\tan\theta\ (1 + \sec2\theta)\ (1 + \sec4\theta)\ (1 + \sec 8\theta)$

$= \tan\theta \left(1+\frac{1}{\cos2\theta}\right)\left(1+\frac{1}{\cos4\theta}\right)\left(1+\frac{1}{\cos8\theta}\right)$

$= \tan\theta \left(\frac{\cos2\theta+1}{\cos2\theta}\right)\left(\frac{\cos4\theta+1}{\cos4\theta}\right)\left(\frac{\cos8\theta+1}{\cos8\theta}\right)$

$= \tan\theta \ \frac{2\cos^2\theta}{\cos2\theta} \cdot \frac{2\cos^2 2\theta}{\cos4\theta} \cdot \frac{2\cos^2 4\theta}{\cos8\theta}$

$[\because 1 + \cos2\theta = 2\cos^2\theta]$

$= 8.\frac{\tan\theta.\cos^2\theta.\cos2\theta.\cos4\theta}{\cos8\theta}$

$= 4.\frac{2\sin\theta\cos\theta.\cos2\theta.\cos4\theta}{\cos8\theta}$

$[2\sin\theta.\cos\theta = \sin2\theta]$

$= 4.\frac{\sin2\theta.\cos2\theta.\cos4\theta}{\cos8\theta}$

$= \frac{2\sin4\theta.\cos4\theta}{\cos8\theta} = \frac{\sin8\theta}{\cos8\theta}$

$= \tan8\theta.$

308. (4) $\frac{\sin x}{1+\cos x} + \frac{\sin x}{1-\cos x} = 4$

$\Rightarrow \frac{\sin x(1-\cos x)+\sin x(1+\cos x)}{(1+\cos x)(1-\cos x)} = 4$

$\Rightarrow \frac{\sin x - \sin x.\cos x + \sin x + \sin x.\cos x}{1-\cos^2 x} = 4$

$\Rightarrow \frac{2\sin x}{\sin^2 x} = 4$

$\Rightarrow 2\sin x = 1$

$\Rightarrow \sin x = \frac{1}{2} = \sin30°$

$\Rightarrow x = 30°$

309. (2) $\frac{\sin65°}{\cos25°} = \frac{\sin(90°-25°)}{\cos25°}$

$= \frac{\cos25°}{\cos25°} = 1$

310. (2) $\sin\theta + \operatorname{cosec}\theta = 2$

$\Rightarrow \sin\theta + \frac{1}{\sin\theta} = 2$

$\Rightarrow \sin^2\theta + 1 = 2\sin\theta$

$\Rightarrow \sin^2\theta - 2\sin\theta + 1 = 0$

$\Rightarrow (\sin\theta - 1)^2 = 0$

$\Rightarrow \sin\theta = 1$

$\therefore \operatorname{cosec}\theta = \frac{1}{\sin\theta} = 1$

$\therefore \sin^{100}\theta + \operatorname{cosec}^{100}\theta = 1 + 1 = 2$

311. (1) $\sin 31° = \frac{x}{y}$

$\therefore \cos31° = \sqrt{1-\sin^2 31°}$

$= \sqrt{1-\frac{x^2}{y^2}} = \sqrt{\frac{y^2-x^2}{y^2}}$

$= \frac{\sqrt{y^2-x^2}}{y}$

$\therefore \sec 31° = \frac{y}{\sqrt{y^2-x^2}}$

$\therefore \sec31° - \sin59°$

$= \sec 31° - \sin(90° - 31°)$

$= \sec 31° - \cos31°$

$= \frac{y}{\sqrt{y^2-x^2}} - \frac{\sqrt{y^2-x^2}}{y}$

$= \frac{y^2-(y^2-x^2)}{y\sqrt{(y^2-x^2)}}$

$= \frac{y^2-y^2+x^2}{y\sqrt{y^2-x^2}} = \frac{x^2}{y\sqrt{y^2-x^2}}$

312. (3) $\sec^2 45° - \cot^2 45° - \sin^2 30° - \sin^2 60°$

$= (\sqrt{2})^2 - 1 - \left(\frac{1}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2$

$= 2 - 1 - \frac{1}{4} - \frac{3}{4}$

$= 1 - \frac{1}{4} - \frac{3}{4} = \frac{3}{4} - \frac{3}{4} = 0$

313. (1) Expression

$= \frac{(\sin\theta.\operatorname{cosec}\theta)(\tan\theta.\cot\theta)}{\sin^2\theta+\cos^2\theta}$

$= \frac{1\times1}{1} = 1$

314. (3) $a^3 + b^3 = (a + b)^3 - 3ab(a + b)$.

$\therefore \cos^3\theta + \sec^3\theta = (\cos\theta + \sec\theta)^3 - 3\cos\theta.\sec\theta(\cos\theta + \sec\theta)$

$= (\sqrt{3})^3 - 3\times\sqrt{3}$

$[\because \cos\theta + \sec\theta = \sqrt{3}$

$= 3\sqrt{3} - 3\sqrt{3} = 0$

315. (2) $\tan\theta = \sqrt{3} = \tan\frac{\pi}{3}$

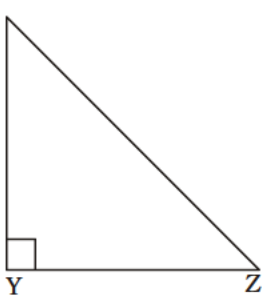
$\Rightarrow \theta = \frac{\pi}{3}$

$\therefore \alpha + \theta = \frac{7\pi}{12} \Rightarrow \alpha = \frac{7\pi}{12} - \frac{\pi}{3}$

$= \frac{7\pi-4\pi}{12} = \frac{\pi}{4}$

$\therefore \tan\alpha = \tan\frac{\pi}{4} = 1$

316. (4)



$XY = 2\sqrt{6}$ cm

$XY - YZ = 2$ cm. ...(1)

$\therefore XZ^2 = XY^2 + YZ^2$

$\Rightarrow XZ^2 - YZ^2 = \left(2\sqrt{6}\right)^2$

$\Rightarrow XZ^2 - YZ^2 = 24$

$\therefore \dfrac{XZ^2 - YZ^2}{XZ - YZ} = \dfrac{24}{2}$

$\Rightarrow XZ + YZ = 12$ ....(ii)

$\Rightarrow \sec X + \tan X = \dfrac{XZ}{XY} + \dfrac{YZ}{XY}$

$= \dfrac{XZ + YZ}{XY} = \dfrac{12}{2\sqrt{6}} = \sqrt{6}$

317. (4) $\sec\theta + \tan\theta = 2$

$\therefore \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \dfrac{1}{2}$

$\therefore \sec\theta + \tan\theta + \sec\theta - \tan\theta$

$= 2 + \dfrac{1}{2}$

$\Rightarrow 2\sec\theta = \dfrac{5}{2} \Rightarrow \sec\theta = \dfrac{5}{4}$

Again, $(\sec\theta + \tan\theta) - (\sec\theta - \tan\theta)$

$= 2 - \dfrac{1}{2}$

$\Rightarrow 2\tan\theta = \dfrac{3}{2} \Rightarrow \tan\theta = \dfrac{3}{4}$

$\Rightarrow \sin\theta = \dfrac{\tan\theta}{\sec\theta} = \dfrac{3}{4} \div \dfrac{5}{4} = \dfrac{3}{5}$

318. (3) Expression

$= 8 \cos 10^\circ . \cos 20^\circ . \cos 40^\circ$

$= 4\left(\dfrac{2\sin 10^\circ . \cos 10^\circ . \cos 20^\circ . \cos 40^\circ}{\sin 10^\circ}\right)$

$= 2\left(\dfrac{2\sin 20^\circ . \cos 20^\circ . \cos 40^\circ}{\sin 10^\circ}\right)$

$[\because 2\sin\theta . \cos\theta = \sin 2\theta]$

$= \left(\dfrac{2\sin 40^\circ . \cos 40^\circ}{\sin 10^\circ}\right)$

$= \dfrac{\sin 80^\circ}{\sin 10^\circ} = \dfrac{\sin 80^\circ}{\cos(90^\circ - 10^\circ)}$

$= \dfrac{\sin 80^\circ}{\cos 80^\circ}$ or, $\dfrac{\cos 10^\circ}{\sin 10^\circ}$

$[\because \sin(90^\circ - \theta) = \cos\theta;$
$\cos(90^\circ - \theta) = \sin\theta]$

$= \tan 80^\circ$ or $\cot 10^\circ$

319. (1) $\dfrac{\cot\theta + \operatorname{cosec}\theta - 1}{\cot\theta - \operatorname{cosec}\theta + 1}$

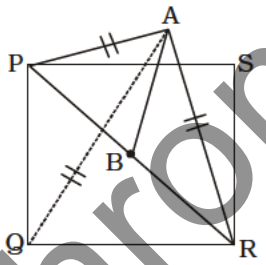
$= \dfrac{\cot\theta + \operatorname{cosec}\theta - \left(\operatorname{cosec}^2\theta - \cot^2\theta\right)}{\cot\theta - \operatorname{cosec}\theta + 1}$

$= \dfrac{(\cot\theta + \operatorname{cosec}\theta) - (\operatorname{cosec}\theta - \cot\theta)(\operatorname{cosec}\theta + \cot\theta)}{\cot\theta - \operatorname{cosec}\theta + 1}$

$= \dfrac{(\cot\theta + \operatorname{cosec}\theta)(1 - \operatorname{cosec}\theta + \cot\theta)}{\cot\theta - \operatorname{cosec}\theta + 1}$

$= \cot\theta + \operatorname{cosec}\theta$

320. (3)



PA = PR

$\angle APB = \angle ARB = 45^\circ$

If $PR = \sqrt{2}x$:

$PB = \dfrac{x}{\sqrt{2}}$

From Δ APB

$\tan 45^\circ = \dfrac{AB}{PB} \Rightarrow AB = PB = \dfrac{x}{\sqrt{2}}$

$\therefore PA = \sqrt{\dfrac{x^2}{2} + \dfrac{x^2}{2}} = \sqrt{x^2} = x$

$\therefore QA = PQ = PA = x$

$\therefore \angle PAQ = 60^\circ$

321. (1) $0 \le \phi \le 90^\circ$

$\therefore 0 \le \sin\phi \le 1$

$\because \sin\phi = \dfrac{3x - 2}{4}$

when, $x = 1$, $\sin\phi = \dfrac{1}{4}$

$x = 2 = \sin\phi = \dfrac{4}{4} = 1$

322. (1) $\cot\dfrac{\pi}{32} - \tan\dfrac{\pi}{32} - 2\tan\dfrac{\pi}{16}$

$= \dfrac{\cos\frac{\pi}{32}}{\sin\frac{\pi}{32}} - \dfrac{\sin\frac{\pi}{32}}{\cos\frac{\pi}{32}} - 2\tan\dfrac{\pi}{16}$

$= \dfrac{\cos^2\frac{\pi}{32} - \sin^2\frac{\pi}{32}}{\sin\frac{\pi}{32} \times \cos\frac{\pi}{32}} - 2\tan\dfrac{\pi}{16}$

$= \dfrac{2\cos\frac{\pi}{16}}{2\sin\frac{\pi}{32}.\cos\frac{\pi}{32}} - 2\tan\dfrac{\pi}{16}$

$[\cos^2\theta - \sin^2\theta = \cos 2\theta]$

$= \dfrac{2\cos\frac{\pi}{16}}{\sin\frac{\pi}{16}} - 2\tan\dfrac{\pi}{16}$

$[\because \sin 2\theta = 2\sin\theta.\cos\theta]$

$= 2\left(\dfrac{\cos\frac{\pi}{16}}{\sin\frac{\pi}{16}} - \dfrac{\sin\frac{\pi}{16}}{\cos\frac{\pi}{16}}\right)$

$= 2\left(\dfrac{\cos^2\frac{\pi}{16} - \sin^2\frac{\pi}{16}}{\sin\frac{\pi}{16}.\cos\frac{\pi}{16}}\right)$

$= \dfrac{4\cos\frac{\pi}{8}}{\sin\frac{\pi}{8}} = 4\cot\dfrac{\pi}{8}$

323. (4)

$$(a^2-1)\cot^2\phi+(1-b^2)\cot^2\theta$$

$$=(a^2-1)\frac{\cos^2\phi}{\sin^2\phi}+(1-b^2)\frac{\cos^2\theta}{\sin^2\theta}$$

$$=\frac{(a^2-1)\cos^2\phi.\sin^2\theta+(1-b^2)\cos^2\theta.\sin^2\phi}{\sin^2\phi.\sin^2\theta}$$

$$=\frac{a^2\cos^2\phi.\sin^2\theta-\cos^2\phi.\sin^2\theta+\cos^2\theta.\sin^2\phi-b^2\cos^2\theta.\sin^2\phi}{\sin^2\phi.\sin^2\theta}$$

$$=\frac{\sin^2\theta.\sin^2\theta-\cos^2\phi.\sin^2\theta+\cos^2\theta.\sin^2\phi-\cos^2\theta.\cos^2\phi}{\sin^2\phi.\sin^2\theta}$$

$[\because \sin\theta=b\cos\phi;\cos\theta=b\sin\phi]$

$$=\frac{\sin^4\theta-\cos^4\theta-\cos^2\phi.\sin^2\theta+\cos^2\theta.\sin^2\phi}{\sin^2\phi.\sin^2\theta}$$

$$=\frac{(\sin^2\theta-\cos^2\theta)(\sin^2\theta+\cos^2\theta)-\cos^2\phi.\sin^2\theta+\cos^2\theta.\sin^2\phi}{\sin^2\phi.\sin^2\theta}$$

$$=\frac{\sin^2\theta-\cos^2\phi.\sin^2\theta-\cos^2\theta+\cos^2\theta.\sin^2\phi}{\sin^2\phi.\sin^2\theta}$$

$$=\frac{\sin^2\theta(1-\cos^2\phi)-\cos^2\theta(1-\sin^2\phi)}{\sin^2\phi.\sin^2\theta}$$

$$=\frac{\sin^2\theta.\sin^2\phi-\cos^2\theta.\cos^2\phi}{\sin^2\phi.\sin^2\theta}$$

$$=1-\frac{\cos^2\theta}{\sin^2\theta}\cdot\frac{\cos^2\phi}{\sin^2\phi}=1-\frac{b^2}{a^2}=\frac{a^2-b^2}{a^2}$$

324. (3) $\sec^2\theta+\tan^2\theta=\sqrt{3}$

and $\sec^2\theta-\tan^2\theta=1$

$\therefore \sec^4\theta-\tan^4\theta$

$=(\sec^2\theta+\tan^2\theta)(\sec^2\theta-\tan^2\theta)$

$=\sqrt{3}\times 1=\sqrt{3}$

325. (3) $\pi\sin\theta=1$ and $\pi\cos\theta=1$

$$\therefore \frac{\pi\sin\theta}{\pi\cos\theta}=1$$

$\therefore \tan\theta=1=\tan 45°$

$\Rightarrow \theta=45°$

$\therefore \sqrt{3}\tan\left(\frac{2\theta}{3}\right)+1$

$=\sqrt{3}\tan\left(\frac{2\times 45°}{3}\right)+1$

$=\sqrt{3}\tan 30°+1$

$=\sqrt{3}\times\frac{1}{\sqrt{3}}+1=1+1=2$

326. (2) Expression,

$$=\frac{1}{1+\tan^2\theta}+\frac{1}{1+\cot^2\theta}$$

$$=\frac{1}{\sec^2\theta}+\frac{1}{\operatorname{cosec}^2\theta}$$

$[\because \sec^2\theta-\tan^2\theta=1;\ \operatorname{cosec}^2\theta-\cot^2\theta=1]$

$=\cos^2\theta+\sin^2\theta=1$

$[\because \cos\theta.\sec\theta=1;\ \sin\theta.\operatorname{cosec}\theta=1]$

327. (3) $\tan\theta+\frac{1}{\tan\theta}=2$

$\Rightarrow \tan^2\theta+1=2\tan\theta$

$\Rightarrow \tan^2\theta-2\tan\theta+1=0$

$\Rightarrow (\tan\theta-1)^2\Rightarrow \tan\theta-1=0$

$\Rightarrow \tan\theta=1$

$$\therefore \tan^2\theta+\frac{1}{\tan^2\theta}=1+1=2$$

328. (2) $\sin A=\cos B$

$\Rightarrow \sin A=\sin(90°-B)$

$\Rightarrow A=90°-B$

$\Rightarrow A+B=90°$

$\therefore \angle C=90°$

$\therefore \cos C=\cos 90°=0$

329. (1) $\sin\theta.\cos\theta=\frac{1}{2}$

$\Rightarrow 2\sin\theta.\cos\theta=1$

$\Rightarrow \sin 2\theta=1=\sin 90°$

$\Rightarrow 2\theta=90°$

$\Rightarrow \theta=45°$

$\therefore \sin\theta-\cos\theta$

$=\sin 45°-\cos 45°$

$$=\frac{1}{\sqrt{2}}-\frac{1}{\sqrt{2}}=0$$

330. (1) $\frac{\cos\theta}{1-\sin\theta}+\frac{\cos\theta}{1+\sin\theta}=4$

$$\Rightarrow \frac{\cos\theta(1+\sin\theta)+\cos\theta(1-\sin\theta)}{(1-\sin\theta)(1+\sin\theta)}=4$$

$$\Rightarrow \frac{\cos\theta+\cos\theta.\sin\theta+\cos\theta-\cos\theta.\sin\theta}{1-\sin^2\theta}=4$$

$$\Rightarrow \frac{2\cos\theta}{\cos^2\theta}=4$$

$$\Rightarrow \frac{1}{\cos\theta}=2\Rightarrow \cos\theta=\frac{1}{2}$$

$=\cos 60°$

$\Rightarrow \theta=60°$

331. (4) $x^2=\sin^2 30°+4\cot^2 45°-\sec^2 60°$

$$=\left(\frac{1}{2}\right)^2+4(1)^2-(2)^2$$

$$=\frac{1}{4}+4-4=\frac{1}{4}$$

$$\therefore x=\frac{1}{2}$$

332. (2) $7\sin^2\theta+3\cos^2\theta=4$

$\Rightarrow 4\sin^2\theta+3\sin^2\theta+3\cos^2\theta=4$

$\Rightarrow 4\sin^2\theta+3(\sin^2\theta+\cos^2\theta)=4$

$\Rightarrow 4\sin^2\theta=4-3$

$[\because \sin^2\theta+\cos^2\theta=1]$

$\Rightarrow 4\sin^2\theta=1$

$$\Rightarrow \sin^2\theta=\frac{1}{4}$$

$\Rightarrow \sin\theta = \frac{1}{2} = \sin 30°$

$\Rightarrow \theta = 30°$

$\therefore \sec\theta + \operatorname{cosec}\theta$

$= \sec 30° + \operatorname{cosec} 30°$

$= \frac{2}{\sqrt{3}} + 2$

333. (3) $\tan\theta + \cot\theta = 5$

On squaring both sides,

$(\tan\theta + \cot\theta)^2 = 25$

$\Rightarrow \tan^2\theta + \cot^2\theta + 2\tan\theta . \cot\theta = 25$

$\Rightarrow \tan^2\theta + \cot^2\theta + 2 = 25$

$\Rightarrow \tan^2\theta + \cot^2\theta = 25 - 2 = 23$

334. (2) $5\cos\theta + 12\sin\theta = 13$

$\Rightarrow 5\cos\theta - 13 = 12\sin\theta$

On squaring both sides,

$25\cos^2\theta + 169 - 130\cos\theta = 144(1 - \cos^2\theta)$

$\Rightarrow 25\cos^2\theta - 130\cos\theta + 169 = 144 - 144\cos^2\theta$

$\Rightarrow 144\cos^2\theta + 25\cos^2\theta - 130\cos\theta + 169 - 144 = 0$

$\Rightarrow 169\cos^2\theta - 130\cos\theta + 25 = 0$

$\Rightarrow (13\cos\theta - 5)^2 = 0$

$\Rightarrow 13\cos\theta - 5 = 0$

$\Rightarrow 13\cos\theta = 5$

$\Rightarrow \cos\theta = \frac{5}{13}$

OR

$5\cos\theta + 12\sin\theta = 13$

$\Rightarrow \frac{5}{13}\cos\theta + \frac{12}{13}\sin\theta = 1$

$\because \cos^2\theta + \sin^2\theta = 1$

$\therefore \cos\theta = \frac{5}{13}$

335. (3) $\tan 45° = \cot\theta$

$\Rightarrow \tan 45° = \tan(90° - \theta)$

$\Rightarrow 45° = 90° - \theta$

$\Rightarrow \theta = 90° - 45° = 45°$

$\because 180° = \pi$ radian

$\therefore 45° = \frac{\pi}{180} \times 45°$

$= \frac{\pi}{4}$ radian

336. (3) $\sin\frac{A+B}{2} = \frac{\sqrt{3}}{2} = \sin 60°$

$\Rightarrow \frac{A+B}{2} = 60°$

$\Rightarrow A + B = 2 \times 60° = 120°$

$\therefore C = 180° - 120° = 60°$

$\therefore \sin\frac{C}{2} = \sin 30° = \frac{1}{2}$

337. (1) $\cos^2\theta + \sin^2\theta = 1$ ..... (i)

$\therefore \cos^4\theta - \sin^4\theta = \frac{1}{3}$

$\Rightarrow (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta) = \frac{1}{3}$

$\Rightarrow \cos^2\theta - \sin^2\theta = \frac{1}{3}$ ..... (ii)

By equations (i) + (ii),

$2\cos^2\theta = 1 + \frac{1}{3} = \frac{4}{3}$

$\Rightarrow \cos^2\theta = \frac{2}{3}$

From equation (i),

$\frac{2}{3} + \sin^2\theta = 1$

$\Rightarrow \sin^2\theta = 1 - \frac{2}{3} = \frac{1}{3}$

$\therefore \tan^2\theta = \frac{\frac{1}{3}}{\frac{2}{3}} = \frac{1}{2}$

338. (3) $\tan 80° . \tan 10° + \sin^2 70° + \sin^2 20°$

$= \tan(90° - 10°) . \tan 10° + \sin^2(90° - 20°) + \sin^2 20°$

$= \cot 10° . \tan 10° + \cos^2 20° + \sin^2 20°$

$= 1 + 1 = 2$

[$\because \sin(90° - \theta) = \cos\theta$; $\tan(90° - \theta) = \cot\theta$; $\tan\theta . \cot\theta = 1$]

339. (2) $\sin 27° = \sin(90° - 63°)$

$= \cos 63°$

[$\because \sin(90° - \theta) = \cos\theta$]

$\therefore \left(\frac{\sin 27°}{\cos 63°}\right)^2 + \left(\frac{\cos 63°}{\sin 27°}\right)^2$

$= \left(\frac{\sin 27°}{\sin 27°}\right)^2 + \left(\frac{\sin 27°}{\sin 27°}\right)^2$

$= 1 + 1 = 2$

340. (2) $\sqrt{2}\tan 2\theta = \sqrt{6}$

$\Rightarrow \tan 2\theta = \frac{\sqrt{6}}{\sqrt{2}} = \sqrt{3}$

$\Rightarrow \tan 2\theta = \tan 60°$

$\Rightarrow 2\theta = 60° \Rightarrow \theta = 30°$

$\therefore \sin\theta + \sqrt{3}\cos\theta - 2\tan 2\theta$

$= \sin 30° + \sqrt{3}\cos 30° - 2\tan^2 30°$

$= \frac{1}{2} + \sqrt{3} \times \frac{\sqrt{3}}{2} - 2\left(\frac{1}{\sqrt{3}}\right)^2$

$= \frac{1}{2} + \frac{3}{2} - \frac{2}{3}$

$= \frac{3+9-4}{6} = \frac{8}{6} = \frac{4}{3}$

341. (3) $\tan\alpha = 2$

$\therefore \sec^2\alpha = 1 + \tan^2\alpha = 1 + 2^2$

$= 1 + 4 = 5$

Expression $= \frac{\sin\alpha}{\sin^3\alpha + \cos^3\alpha}$

$= \frac{\sin\alpha}{\cos^3\alpha\left(\frac{\sin^3\alpha}{\cos^3\alpha} + \frac{\cos^3\alpha}{\cos^3\alpha}\right)}$

$= \frac{\sin\alpha}{\cos\alpha} \cdot \frac{1}{\cos^2\alpha} \cdot \frac{1}{(\tan^3\alpha + 1)}$

$= \tan\alpha . \sec^2\alpha . \frac{1}{(\tan^3\alpha + 1)}$

$= 2 \times 5 \times \frac{1}{(2^3 + 1)} = \frac{10}{9}$

342. (1) $\sin\theta + \cos\theta = 1$

On squaring,

$(\sin\theta + \cos\theta)^2 = 1$

$\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta . \cos\theta = 1$

$\Rightarrow 1 + 2\sin\theta . \cos\theta = 1$

$\Rightarrow 2\sin\theta . \cos\theta = 1 - 1 = 0$

$\Rightarrow \sin\theta . \cos\theta = 0$

343. (4) $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$

$\Rightarrow 3\sin\theta - 3\cos\theta = \sin\theta + \cos\theta$

$\Rightarrow 3\sin\theta - \sin\theta = 3\cos\theta + \cos\theta$

$\Rightarrow 2\sin\theta = 4\cos\theta$

$\Rightarrow \sin\theta = 2\cos\theta$

$\Rightarrow \tan\theta = 2$

$\therefore \sec^2\theta = 1 + \tan^2\theta$

$= 1 + 4 = 5$

$\therefore \cos^2\theta = \frac{1}{5}$

$\therefore \sin^2\theta = 1 - \cos^2\theta$

$= 1 - \frac{1}{5} = \frac{4}{5}$

$\therefore \sin^4\theta - \cos^4\theta$

$= (\sin^2\theta + \cos^2\theta)(\sin^2\theta - \cos^2\theta)$

$= \sin^2\theta - \cos^2\theta$

$= \frac{4}{5} - \frac{1}{5} = \frac{3}{5}$

344. (3) $\sin C - \sin D = 2\cos\frac{C+D}{2} . \sin\frac{C-D}{2} = x$

Illustration

sin (A + B)
= sinA . cosB + cosA . sinB
sin (A – B)
= sinA . cosB – cosA . sinB
∴ sin (A + B) – sin (A – B)
= 2 cosA . sinB
Let, A + B = C ; A – B = D
∴ On adding,

$$A = \frac{C+D}{2}$$

On subtracting,

$$B = \frac{C-D}{2}$$

$$\therefore \sin C - \sin D = 2\cos\frac{C+D}{2}\cdot\sin\frac{C-D}{2}$$

345. (1) $\sin A + \sin^2 A = 1$
$\Rightarrow \sin A = 1 - \sin^2 A = \cos^2 A$
$\therefore \cos^2 A + \cos^4 A$
$= \cos^2 A + (\cos^2 A)^2$
$= \cos^2 A + \sin^2 A = 1$

346. (1) For $0° < \theta < 90°$
$\cos\theta > \cos^2\theta$ because $\cos\theta° = 1$ and $\cos 90° = 0$

347. (1) $5\sin^2\theta + 4\cos^2\theta = \frac{9}{2}$

$\Rightarrow 10\sin^2\theta + 8\cos^2\theta = 9$
On dividing by $\cos^2\theta$,

$$\frac{10\sin^2\theta}{\cos^2\theta} + \frac{8\cos^2\theta}{\cos^2\theta} = \frac{9}{\cos^2\theta}$$

$= 9\sec^2\theta$
$\Rightarrow 10\tan^2\theta + 8 = 9(1 + \tan^2\theta)$
$\Rightarrow 10\tan^2\theta + 8 = 9 + 9\tan^2\theta$
$\Rightarrow 10\tan^2\theta - 9\tan^2\theta = 9 - 8$
$\Rightarrow \tan^2\theta = 1 \Rightarrow \tan\theta = \pm 1$

$\because 0 < \theta < \frac{\pi}{2}$ $\therefore \tan\theta = 1$

348. (2) $\sec^2 17° - \frac{1}{\tan^2 73°} - \sin 17°\sec 73°$
$= \sec^2 17° - \cot^2 73° - \sin 17°\cdot\sec 73°$
$= \sec^2 17° - \cot^2(90° - 17°) - \sin 17°\cdot\sec(90° - 17°)$
$= \sec^2 17^2 - \tan^2 17° - \sin 17°\cdot\operatorname{cosec} 17°$
$= 1 - 1 = 0$
[$\because \cot(90° - \theta) = \tan\theta$; $\sec(90° - \theta) = \operatorname{cosec}\theta$; $\sec^2\theta - \tan^2\theta = 1$; $\sin\theta\cdot\operatorname{cosec}\theta = 1$]

349. (4) $x = a\cos\theta.\cos\phi$
$y = a\cos\theta.\sin\phi$
$z = a\sin\theta$
$\therefore x^2 + y^2 + z^2$
$= a^2\cos^2\phi.\cos^2\theta + a^2\cos^2\theta.\sin^2\phi + a^2\sin^2\theta$
$= a^2\cos^2\theta(\cos^2\phi + \sin^2\phi) + a^2\sin^2\theta$
$= a^2\cos^2\theta + a^2\sin^2\theta$
$= a^2(\cos^2\theta + \sin^2\theta) = a^2$

350. (4) $\sec 15\theta = \operatorname{cosec} 15\theta$
$\Rightarrow \sec 15\theta = \sec(90° - 15\theta)$
$\Rightarrow 15\theta = 90° - 15\theta$
$\Rightarrow 15\theta = 90° - 15\theta$
$\Rightarrow 15\theta + 15\theta = 90°$
$\Rightarrow 30\theta = 90°$

$$\Rightarrow \theta = \frac{90°}{30} = 3°$$

351. (3) $\tan\theta = \tan 30°\cdot\tan 60°$

$$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}} \times \sqrt{3} = 1$$

$\Rightarrow \tan\theta = \tan 45°$
$\Rightarrow \theta = 45°$
$\therefore 2\theta = 2 \times 45° = 90°$

352. (2) Expression
$= (1 + \tan^2\theta)\cdot(1 - \sin^2\theta)$
$= \sec^2\theta\cdot\cos^2\theta = 1$
[$\because \sec^2\theta - \tan^2\theta = 1 = \sin^2\theta + \cos^2\theta$; $\sec\theta\cdot\cos\theta = 1$]

353. (3) $r\sin\theta = 1$ ..... (i)
$r\cos\theta = \sqrt{3}$ ..... (ii)
On squaring and adding both equations,
$r^2\sin^2\theta + r^2\cos^2\theta = 1 + 3$
$\Rightarrow r^2(\sin^2\theta + \cos^2\theta) = 4$
$\Rightarrow r^2 = 4$

$$\text{Again, } \frac{r\sin\theta}{r\cos\theta} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$$

$$\therefore r^2\tan\theta = \frac{4}{\sqrt{3}}$$

354. (1) $\sin\theta = \frac{\sqrt{3}}{2} = \sin 60°$
$\Rightarrow \theta = 60°$
$\therefore \tan(\theta - 15°)$
$= \tan(60° - 15°) = \tan 45° = 1$

355. (1) $\frac{\operatorname{cosec}\theta + \sin\theta}{\operatorname{cosec}\theta - \sin\theta} = \frac{5}{3}$
$\Rightarrow 5\operatorname{cosec}\theta - 5\sin\theta$
$= 3\operatorname{cosec}\theta + 3\sin\theta$
$\Rightarrow 5\operatorname{cosec}\theta - 3\operatorname{cosec}\theta$
$= 5\sin\theta + 3\sin\theta$
$\Rightarrow 2\operatorname{cosec}\theta = 8\sin\theta$

$$\Rightarrow \frac{1}{\sin\theta} = 4\sin\theta$$

$\Rightarrow 4\sin^2\theta = 1 \Rightarrow 2\sin\theta = 1$

$$\Rightarrow \sin\theta = \frac{1}{2}$$

356. (2) $y = 2\sec\theta \Rightarrow \sec\theta = \frac{y}{2}$

and $x = 3\tan\theta \Rightarrow \tan\theta = \frac{x}{3}$
$\because \sec^2\theta - \tan^2\theta = 1$

$$\Rightarrow \frac{y^2}{4} - \frac{x^2}{9} = 1$$

$$\Rightarrow \frac{x^2}{9} - \frac{y^2}{4} = -1$$

357. (4) $r\sin\theta = \sqrt{3}$
$r\cos\theta = 1$
On squaring and adding,
$r^2\sin^2\theta + r^2\cos^2\theta = 3 + 1$
$\Rightarrow r^2(\sin^2\theta + \cos^2\theta) = 4$
$\Rightarrow r^2 = 4 \Rightarrow r = \sqrt{4} = 2$

$$\text{Again, } \frac{r\sin\theta}{r\cos\theta} = \sqrt{3}$$

$\Rightarrow \tan\theta = \sqrt{3} = \tan 60°$
$\Rightarrow \theta = 60°$

358. (2) $x\tan 60° + \cos 45°$
$= \sec 45°$

$$\Rightarrow \sqrt{3}x + \frac{1}{\sqrt{2}} = \sqrt{2}$$

$$\Rightarrow \sqrt{3}x = \sqrt{2} - \frac{1}{\sqrt{2}}$$

$$\Rightarrow \sqrt{3}x = \frac{2-1}{\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$\Rightarrow x = \frac{1}{\sqrt{6}}$$

$$\therefore x^2 + 1 = \left(\frac{1}{\sqrt{6}}\right)^2 + 1$$

$$= \frac{1}{6} + 1 = \frac{7}{6}$$

359. (3) $\sin(2x - 20°) = \cos(2y + 20°)$
$\Rightarrow \sin(2x - 20°)$
$= \sin\{90° - (2y + 20°)\}$
$\Rightarrow 2x - 20° = 90° - 2y - 20°$
$\Rightarrow 2x + 2y = 90°$
$\Rightarrow 2(x + y) = 90° \Rightarrow x + y = 45°$
$\therefore \tan(x + y) = \tan 45° = 1$

360. (2) $a^2\sec^2 x - b^2\tan^2 x = c^2$
$\Rightarrow a^2(1 + \tan^2 x) - b^2\tan^2 x = c^2$
$\Rightarrow a^2 + a^2\tan^2 x - b^2\tan^2 x = c^2$
$\Rightarrow a^2\tan^2 x - b^2\tan^2 x = c^2 - a^2$
$\Rightarrow \tan^2 x(a^2 - b^2) = c^2 - a^2$

$$\Rightarrow \tan^2 x = \frac{c^2 - a^2}{a^2 - b^2}$$

$\therefore \sec^2 x + \tan^2 x$
$= 1 + \tan^2 x + \tan^2 x$
$= 1 + 2\tan^2 x$

$= 1 + \dfrac{2(c^2 - a^2)}{a^2 - b^2}$

$= \dfrac{a^2 - b^2 + 2c^2 - 2a^2}{a^2 - b^2}$

$= \dfrac{-b^2 + 2c^2 - a^2}{a^2 - b^2}$

$= \dfrac{b^2 + a^2 - 2c^2}{b^2 - a^2}$

361. (3) (1 + sec 20° + cot 70°) (1 – cosec 20° + tan 70°)
= (1 + sec 20° + tan 20°) (1 – cosec 20° + cot 20°)
[$\because$ tan (90° – θ) = cotθ; cot (90° – θ) = tanθ]

$= \left(1 + \dfrac{1}{\cos 20°} + \dfrac{\sin 20°}{\cos 20°}\right)$

$\left(1 - \dfrac{1}{\sin 20°} + \dfrac{\cos 20°}{\sin 20°}\right)$

$= \left(\dfrac{\cos 20° + 1 + \sin 20°}{\cos 20°}\right)$

$\left(\dfrac{\sin 20° - 1 + \cos 20°}{\sin 20°}\right)$

$= \dfrac{(\sin 20 + \cos 20 + 1)(\sin 20 + \cos 20 - 1)}{\sin 20 \cdot \cos 20}$

$= \dfrac{(\sin 20° + \cos 20°)^2 - 1}{\sin 20° \cdot \cos 20°}$

$= \dfrac{\sin^2 20 + \cos^2 20 + 2\sin 20 \cdot \cos 20 - 1}{\sin 20 \cdot \cos 20}$

$= \dfrac{1 + 2\sin 20° \cdot \cos 20° - 1}{\sin 20° \cdot \cos 20°} = 2$

362. (3) $\tan^4\theta + \tan^2\theta = 1$
$\Rightarrow \tan^2\theta (\tan^2\theta + 1) = 1$
$\Rightarrow \tan^2\theta \cdot \sec^2\theta = 1$

$\Rightarrow \tan^2\theta = \dfrac{1}{\sec^2\theta} = \cos^2\theta.$

$\therefore \cos^4\theta + \cos^2\theta = \tan^4\theta + \tan^2\theta = 1$

363. (3) $8(\sin^6\theta + \cos^6\theta) - 12(\sin^4\theta + \cos^4\theta)$
$= 8\{(\sin^2\theta + \cos^2\theta)^3 - 3\sin^2\theta \cdot \cos^2\theta(\sin^2\theta + \cos^2\theta)\} - 12\{(\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta)\}$
$= 8(1 - 3\sin^2\theta \cdot \cos^2\theta) - 12(1 - 2\sin^2\theta \cdot \cos^2\theta)$
$= 8 - 24\sin^2\theta \cdot \cos^2\theta - 12 + 24\sin^2\theta\cos^2\theta = -4$

364. (3) $\tan 3\theta \cdot \tan 7\theta = 1$

$\Rightarrow \tan 3\theta = \dfrac{1}{\tan 7\theta} = \cot 7\theta$
$\Rightarrow \tan 3\theta = \tan(90° - 7\theta)$
$\Rightarrow 3\theta = 90° - 7\theta$
$\Rightarrow 3\theta + 7\theta = 90°$
$\Rightarrow 10\theta = 90° \Rightarrow \theta = 9°$
$\therefore \tan(\theta + 36°) = \tan(9° + 36°)$
$= \tan 45° = 1$

365. (4) Expression

$= \dfrac{\sin\theta}{1 + \cos\theta} + \dfrac{\sin\theta}{1 - \cos\theta}$

$= \dfrac{\sin\theta(1 - \cos\theta) + \sin\theta(1 + \cos\theta)}{(1 + \cos\theta)(1 - \cos\theta)}$

$= \dfrac{\sin\theta - \sin\theta.\cos\theta + \sin\theta + \sin\theta.\cos\theta}{1 - \cos^2\theta}$

$= \dfrac{2\sin\theta}{\sin^2\theta} = \dfrac{2}{\sin\theta} = 2\operatorname{cosec}\theta$

366. (3) $\tan\theta = \dfrac{8}{15}$
$\therefore \sec^2\theta - \tan^2\theta = 1$
$\Rightarrow \sec^2\theta = 1 + \tan^2\theta$

$= 1 + \left(\dfrac{8}{15}\right)^2$

$= 1 + \dfrac{64}{225} = \dfrac{225 + 64}{225} = \dfrac{289}{225}$

$\Rightarrow \sec\theta = \sqrt{\dfrac{289}{225}} = \dfrac{17}{15}$

$\therefore$ Expression

$= \sqrt{\dfrac{1 - \sin\theta}{1 + \sin\theta}}$

$= \sqrt{\dfrac{(1 - \sin\theta)(1 - \sin\theta)}{(1 + \sin\theta)(1 - \sin\theta)}}$

$= \sqrt{\dfrac{(1 - \sin\theta)^2}{1 - \sin^2\theta}}$

$= \sqrt{\dfrac{(1 - \sin\theta)^2}{\cos^2\theta}} = \dfrac{1 - \sin\theta}{\cos\theta}$

$= \dfrac{1}{\cos\theta} - \dfrac{\sin\theta}{\cos\theta} = \sec\theta - \tan\theta$

$= \dfrac{17}{15} - \dfrac{8}{15}$

$= \dfrac{17 - 8}{15} = \dfrac{9}{15} = \dfrac{3}{5}$

367. (4) Expression

$= \dfrac{\sin\theta + \sin\phi}{\cos\theta + \cos\phi} + \dfrac{\cos\theta - \cos\phi}{\sin\theta - \sin\phi}$

$= \dfrac{(\sin\theta + \sin\phi)(\sin\theta - \sin\phi) + (\cos\theta - \cos\phi)(\cos\theta + \cos\phi)}{(\cos\theta + \cos\phi)(\sin\theta - \sin\phi)}$

$= \dfrac{\sin^2\theta - \sin^2\phi + \cos^2\theta - \cos^2\phi}{(\cos\theta + \cos\phi)(\sin\theta - \sin\phi)}$

$= \dfrac{(\sin^2\theta + \cos^2\theta) - (\sin^2\phi + \cos^2\phi)}{(\cos\theta + \cos\phi)(\sin\theta - \sin\phi)}$

$= \dfrac{1 - 1}{(\cos\theta + \cos\phi)(\sin\theta - \sin\phi)} = 0$

368. (*) $\cot\theta = 4$ (Given)

Expression $= \dfrac{5\sin\theta + 3\cos\theta}{5\sin\theta - 3\cos\theta}$

$= \dfrac{5\dfrac{\sin\theta}{\sin\theta} + \dfrac{3\cos\theta}{\sin\theta}}{5\dfrac{\sin\theta}{\sin\theta} - \dfrac{3\cos\theta}{\sin\theta}}$

[On dividing numerator and denominator by sinθ]

$= \dfrac{5 + 3\cot\theta}{5 - 3\cot\theta}$

$= \dfrac{5 + 3 \times 4}{5 - 3 \times 4} = \dfrac{5 + 12}{5 - 12} = \dfrac{-17}{7}$

369. (4) $\cos^2 20° + \cos^2 70°$
$= \cos^2(90° - 70°) + \cos^2 70°$
$= \sin^2 70° + \cos^2 70° = 1$
[cos (90° – θ) = sinθ]

370. (4) $\cos A + \cos^2 A = 1$
$\Rightarrow \cos A = 1 - \cos^2 A = \sin^2 A$
$\therefore \sin^2 A + \sin^4 A$
$= \sin^2 A + (\sin^2 A)^2$
$= \sin^2 A + \cos^2 A = 1$

371. (3) $\sin\theta + \operatorname{cosec}\theta = 2$

$\Rightarrow \sin\theta + \dfrac{1}{\sin\theta} = 2$

$\Rightarrow \sin^2\theta + 1 = 2\sin\theta$
$\Rightarrow \sin^2\theta - 2\sin\theta + 1 = 0$
$\Rightarrow (\sin\theta - 1)^2 = 0$
$\Rightarrow \sin\theta - 1 = 0$
$\Rightarrow \sin\theta = 1$
$\therefore \operatorname{cosec}\theta = 1$
$\therefore \sin^{-7}\theta + \operatorname{cosec}^7\theta$
$= (1)^{-7} + (1)^7 = 2$

372. (1) $2y\cos\theta = x\sin\theta$

$\Rightarrow x = \dfrac{2y\cos\theta}{\sin\theta}$ ....(1)

$\therefore 2x\sec\theta - y\operatorname{cosec}\theta = 3$

$\Rightarrow \dfrac{2 \times 2 \times y\cos\theta.\sec\theta}{\sin\theta} - y\operatorname{cosec}\theta = 3$

$\Rightarrow 4y\operatorname{cosec}\theta - y\operatorname{cosec}\theta = 3$
$\Rightarrow 3y\operatorname{cosec}\theta = 3$

$\Rightarrow y = \dfrac{1}{\text{cosec}\theta} = \sin\theta$

From equation (i),

$x = \dfrac{2 \times \sin\theta.\cos\theta}{\sin\theta} = 2\cos\theta$

$\therefore\ x^2 + 4y^2 = (2\cos\theta)^2 + 4\sin^2\theta$
$= 4(\cos^2\theta + \sin^2\theta) = 4$

373. (2) $\sin^2\theta - \cos^2\theta = \dfrac{1}{4}$

$\therefore\ \sin^4\theta - \cos^4\theta = (\sin^2\theta + \cos^2\theta)$

$(\sin^2\theta - \cos^2\theta) = \dfrac{1}{4}$

374. (2) $\dfrac{\sin^2 63° + \sin^2 27°}{\cos^2 17° + \cos^2 73°}$

$= \dfrac{\sin^2 63° + \sin^2(90° - 63°)}{\cos^2 17° + \cos^2(90° - 17°)}$

$= \dfrac{\sin^2 63° + \cos^2 63°}{\cos^2 17° + \sin^2 17°}$

$= 1$

$\left[\because \sin(90°-\theta) = \cos\theta;\ \cos(90°-\theta) = \sin\theta;\ \sin^2\theta + \cos^2\theta = 1\right]$

375. (2) $\cos^2 20° + \cos^2 70°$
$= \cos^2 20° + \cos^2(90° - 20°)$
$= \cos^2 20° + \sin^2 20° = 1$
$[\because \cos(90° - \theta) = \sin\theta]$

376. (1) $a \sin 45° . \cos 45° . \tan 60°$
$= \tan^2 45° - \cos 60°$

$\Rightarrow a \times \dfrac{1}{\sqrt{2}} \times \dfrac{1}{\sqrt{2}} \times \sqrt{3} = 1 - \dfrac{1}{2}$

$\Rightarrow \dfrac{\sqrt{3}a}{2} = \dfrac{1}{2}$

$\Rightarrow \sqrt{3}a = 1 \Rightarrow a = \dfrac{1}{\sqrt{3}}$

377. (3) $3\sin\theta + 4\cos\theta = 5$

$\Rightarrow \dfrac{3}{5}\sin\theta + \dfrac{4}{5}\cos\theta = 1$

$\because \sin^2\theta + \cos^2\theta = 1$

$\therefore\ \sin\theta = \dfrac{3}{5}, \cos\theta = \dfrac{4}{5}$

378. (2) $\sin x - \cos x = 1$ ..... (i)
$\sin x + \cos x = y$ ..... (ii)
On squaring and adding both equations,
$\sin^2 x + \cos^2 x - 2\sin x.\cos x + \sin^2 x + \cos^2 x + 2\sin x . \cos x$
$= 1 + y^2$
$\Rightarrow 1 + 1 = 1 + y^2$
$\Rightarrow y^2 = 1 \Rightarrow y = 1$

379. (4) $\sin(3x - 20°) = \cos(3y + 20°)$
$\Rightarrow \sin(3x - 20°)$
$= \sin\{90° - (3y + 20°)\}$
$[\because \sin(90° - \theta) = \cos\theta]$
$\Rightarrow 3x - 20° = 90° - 3y - 20°$
$= 70° - 3y$
$\Rightarrow 3x + 3y = 70° + 20° = 90°$
$\Rightarrow 3(x + y) = 90°$

$\Rightarrow x + y = \dfrac{90°}{3} = 30°$

380. (1) $m = \dfrac{\cos\alpha}{\cos\beta}; n = \dfrac{\cos\alpha}{\sin\beta}$

$\therefore\ (m^2 + n^2)\cos^2\beta$

$= \left(\dfrac{\cos^2\alpha}{\cos^2\beta} + \dfrac{\cos^2\alpha}{\sin^2\beta}\right)\cos^2\beta$

$= \cos^2\alpha\left(\dfrac{1}{\cos^2\beta} + \dfrac{1}{\sin^2\beta}\right)\cos^2\beta$

$= \cos^2\alpha . \cos^2\beta\left(\dfrac{\sin^2\beta + \cos^2\beta}{\sin^2\beta.\cos^2\beta}\right)$

$= \dfrac{\cos^2\alpha}{\sin^2\beta} = n^2$

381. (2) $\tan 315° . \cot(-405°)$
$= -\tan 315° . \cot 405°$
$[\cot(-\theta) = -\cot\theta]$
$= -\tan(360° - 45°) . \cot(360° + 45°)$
$= -(-\tan 45°) . \cot 45°$
$= \tan 45° . \cot 45° = 1$

382. (4) $\tan(\alpha - \beta) = 1 = \tan 45°$
$\Rightarrow \alpha - \beta = 45°$ ..... (i)
$\sec(\alpha + \beta) = \dfrac{2}{\sqrt{3}} = \sec 30°$
$\Rightarrow \alpha + \beta = 30°$ ..... (ii)
On adding (i) and (ii),

$2\alpha = 45° + 30° = 75° \Rightarrow \alpha = \dfrac{75}{2}$

$= 37\dfrac{1°}{2}$

383. (4) $\tan\theta + \cot\theta = 2$

$\Rightarrow \tan\theta + \dfrac{1}{\tan\theta} = 2$

$\Rightarrow \dfrac{\tan^2\theta + 1}{\tan\theta} = 2$

$\Rightarrow \tan^2\theta + 1 = 2\tan\theta$
$\Rightarrow \tan^2\theta - 2\tan\theta + 1 = 0$
$\Rightarrow (\tan\theta - 1)^2 = 0$
$\Rightarrow \tan\theta - 1 = 0$
$\Rightarrow \tan\theta = 1$
$\therefore\ \cot\theta = 1$
$\therefore\ \tan^n\theta + \cot^n\theta = 1 + 1 = 2$

384. (3) $\cos x = \sin y$
$\Rightarrow \cos x = \cos(90° - y)$
$\Rightarrow x = 90° - y$
$[\because \cos(90° - \theta = \sin\theta)]$
$\Rightarrow x + y = 90°$ .... (i)
Again,
$\cot(x - 40°) = \tan(50° - y)$
$\Rightarrow (\cot(x - 40°)$
$= \cot\{90° - (50° - y)\}$
$[\because \cot(90° - \theta) = \tan\theta]$
$\Rightarrow x - 40° = 90° - 50° + y$
$\Rightarrow x - 40 = 40 + y$ (i)
$\Rightarrow x - y = 40 + 40 = 80°$ (ii)
On adding equations (i) and (ii),
$x + y + x - y = 90° + 80°$
$\Rightarrow 2x = 170°$

$\Rightarrow x = \dfrac{170°}{2} = 85°$

From equation (i),
$\Rightarrow 85° + y = 90°$
$\Rightarrow y = 90° - 85° = 5°$

385. (3) $\text{cosec}^2 60° + \sec^2 60° - \cot^2 60° + \tan^2 30°$

$= \left(\dfrac{2}{\sqrt{3}}\right)^2 + (2)^2 - \left(\dfrac{1}{\sqrt{3}}\right)^2 + \left(\dfrac{1}{\sqrt{3}}\right)^2$

$= \dfrac{4}{3} + 4 = \dfrac{4 + 12}{3} = \dfrac{16}{3} = 5\dfrac{1}{3}$

386. (3) $\sin\theta + \text{cosec}\theta = 2$

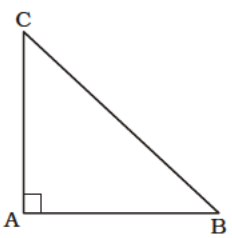
$\Rightarrow \sin\theta + \dfrac{1}{\sin\theta} = 2$

$\Rightarrow \dfrac{\sin^2\theta + 1}{\sin\theta} = 2$

$\Rightarrow \sin^2\theta + 1 = 2\sin\theta$
$\Rightarrow \sin^2\theta - 2\sin\theta + 1 = 0$
$\Rightarrow (\sin\theta - 1)^2 = 0$
$\Rightarrow \sin\theta - 1$
$= 0 \Rightarrow \sin\theta - 1$
$\therefore\ \text{cosec}\theta = 1$
$\therefore\ \sin^n\theta + \text{cosec}^n\theta = 1 + 1 = 2$

387. (2) $\sin A + \sin^2 A = 1$
$\Rightarrow \sin A = 1 - \sin^2 A = \cos^2 A$
$\therefore\ \cos^4 A = \sin^2 A$
$\therefore\ \cos^2 A + \cos^4 A$
$= \cos^2 A + \sin^2 A = 1$

388. (2)



$\angle CAB = 90°$
$\therefore\ \cos A = \cos 90° = 0$

$\cos B = \dfrac{AB}{BC}, \cos C = \dfrac{AC}{BC}$

$\therefore\ \cos^2 A + \cos^2 B + \cos^2 C$

$= 0 + \dfrac{AB^2}{BC^2} + \dfrac{AC^2}{BC^2}$

$= \frac{AB^2 + AC^2}{BC^2} = \frac{BC^2}{BC^2} = 1$

389. (1) $r\sin\theta = \frac{7}{2}$

$r\cos\theta = \frac{7\sqrt{3}}{2}$

$\Rightarrow \frac{r\sin\theta}{r\cos\theta} = \frac{\frac{7}{2}}{\frac{7\sqrt{3}}{2}}$

$\Rightarrow \tan\theta = \frac{7}{2} \times \frac{2}{7\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \tan 30°$

$\Rightarrow \theta = 30°$

290. (3) Expression

$= \frac{8\sin\theta + 5\cos\theta}{\sin^3\theta - 2\cos^3\theta + 7\cos\theta}$

Dividing numerator and denominator by $\cos^3\theta$

$= \frac{\frac{8\sin\theta}{\cos^3\theta} + \frac{5\cos\theta}{\cos^3\theta}}{\frac{\sin^3\theta}{\cos^3\theta} - \frac{2\cos^3\theta}{\cos^3\theta} + \frac{7\cos\theta}{\cos^3\theta}}$

$= \frac{8\tan\theta.\sec^2\theta + 5\sec^2\theta}{\tan^3\theta - 2 + 7\sec^2\theta}$

$= \frac{8\tan\theta(1+\tan^2\theta) + 5(1+\tan^2\theta)}{\tan^3\theta - 2 + 7(1+\tan^2\theta)}$

$= \frac{8(1+1) + 5\times 2}{1-2+7(1+1)} = \frac{16+10}{1-2+14}$

$= \frac{26}{13} = 2$

391. (2) $4\sin^2\theta = 3$

$\Rightarrow \sin^2\theta = \frac{3}{4}$

$\Rightarrow \sin\theta = \frac{\sqrt{3}}{2} = \sin 60°$

$\Rightarrow \theta = 60°$

$\therefore \tan\theta - \cot\frac{\theta}{2}$

$= \tan 60° - \cot 30°$

$= \sqrt{3} - \sqrt{3} = 0$

392. (4) $\frac{\cos^2\theta - 3\cos\theta + 2}{\sin^2\theta} = 1$

$\Rightarrow \cos^2\theta - 3\cos\theta + 2$

$= \sin^2\theta = 1 - \cos^2\theta$

$\Rightarrow 2\cos^2\theta - 3\cos\theta + 1 = 0$

$\Rightarrow 2\cos^2\theta - 2\cos\theta - \cos\theta + 1 = 0$

$\Rightarrow 2\cos\theta(\cos\theta - 1) - 1(\cos\theta - 1) = 0$

$\Rightarrow (2\cos\theta - 1)(\cos\theta - 1) = 0$

$\Rightarrow \cos\theta = \frac{1}{2}$

as $\cos\theta \neq 1$ as $\theta > 0$

$\therefore \cos\theta = \cos 60°$

$\Rightarrow \theta = 60°$

393. (2) $\cot 17°.\cot 73°.\cos^2 22° + \frac{\cot 17°}{\cot 17°.\sec^2 68°}$

$= \cot 17°.\cot(90° - 17°).\cos^2 22° + \cos^2 68°$

$= \cot 17°.\tan 17°.\cos^2 22° + \cos^2(90° - 22°)$

$= \cos^2 22° + \sin^2 22° = 1$

[$\because \cot(90° - \theta) = \tan\theta$; $\cos(90° - \theta) = \sin\theta$]

294. (3) $\sin\theta - \cos\theta = 0$

$\Rightarrow \sin\theta = \cos\theta$

$\Rightarrow \tan\theta = 1 = \tan 45°$

$\Rightarrow \theta = 45°$

$\therefore \sec\theta + \operatorname{cosec}\theta$

$= \sec 45° + \operatorname{cosec} 45°$

$= \sqrt{2} + \sqrt{2} = 2\sqrt{2}$

395. (3) $\frac{2\tan 53°}{\cot 37°} - \frac{\cot 80°}{\tan 10°}$

$= \frac{2\tan(90°-37°)}{\cot 37°} - \frac{\cot(90°-10°)}{\tan 10°}$

$= \frac{2\cot 37°}{\cot 37°} - \frac{\tan 10°}{\tan 10°}$

$= 2 - 1 = 1$

396. (2) The minimum value of $a\tan^2 x + b\cot^2 x = 2\sqrt{ab}$

$\therefore$ The minimum value of $\tan^2 x + \cot^2 x = 2$

397. (1) $\cos 21° = \frac{x}{y}$

$\therefore \cos 69° = \cos(90° - 21°)$

$= \sin 21°$

$= \sqrt{1 - \cos^2 21°} = \sqrt{1 - \frac{x^2}{y^2}}$

$= \frac{\sqrt{y^2 - x^2}}{y}$

$\therefore \operatorname{cosec} 21° = \frac{y}{\sqrt{y^2 - x^2}}$

$\therefore \operatorname{cosec} 21° - \cos 69°$

$= \frac{y}{\sqrt{y^2 - x^2}} - \frac{\sqrt{y^2 - x^2}}{y}$

$= \frac{y^2 - (y^2 - x^2)}{y\sqrt{y^2 - x^2}} = \frac{x^2}{y\sqrt{y^2 - x^2}}$

398. (1) $\alpha : \beta = 2 : 1$

Sum of the terms of ratio

$= 2 + 1 = 3$

$\alpha + \beta = 90°$

$\therefore \alpha = \frac{2}{3} \times 90° = 60°$

$\beta = 30°$

$\therefore \frac{\cos\alpha}{\cos\beta} = \frac{\cos 60°}{\cos 30°} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}}$

$= 1 : \sqrt{3}$

399. (1) $7\cos^2\theta + 3\sin^2\theta = 4$

$\Rightarrow 7(1 - \sin^2\theta) + 3\sin^2\theta = 4$

$\Rightarrow 7 - 7\sin^2\theta + 3\sin^2\theta = 4$

$\Rightarrow 7 - 4\sin^2\theta = 4$

$\Rightarrow 4\sin^2\theta = 7 - 4 = 3$

$\Rightarrow \sin^2\theta = \frac{3}{4}$

$\Rightarrow \sin\theta = \frac{\sqrt{3}}{2}$

$\because 0 < \theta < 90°$

$\Rightarrow \theta = 60°$

400. (3) $\tan\theta = \frac{4}{3}$

Expression $= \frac{3\sin\theta + 2\cos\theta}{3\sin\theta - 2\cos\theta}$

On dividing numerator and denominator by $\cos\theta$,

$= \frac{\frac{3\sin\theta}{\cos\theta} + \frac{2\cos\theta}{\cos\theta}}{\frac{3\sin\theta}{\cos\theta} - \frac{2\cos\theta}{\cos\theta}}$

$= \frac{3\tan\theta + 2}{3\tan\theta - 2}$

$= \frac{3\times\frac{4}{3} + 2}{3\times\frac{4}{3} - 2} = \frac{4+2}{4-2} = \frac{6}{2} = 3$

401. (3) $\sec(4x - 50°) = \sec(50° - x)$

$\Rightarrow \sec(4x - 50°) = \sec(90° - (50° - x)) = \sec(40° + x)$

$\Rightarrow 4x - 50° = 40° + x$

$\Rightarrow 4x - x = 50° + 40°$

$\Rightarrow 3x = 90° \Rightarrow x = \frac{90°}{3} = 30°$

402. (1) $\cos 53° - \sin 37°$

$= \cos(90° - 37°) - \sin 37°$

$= \sin 37° - \sin 37° = 0$

403. (2) $\text{cosec}\theta + \sin\theta = \frac{5}{2}$

$\Rightarrow \frac{1}{\sin\theta} + \sin\theta = \frac{5}{2}$

$\Rightarrow \frac{1+\sin^2\theta}{\sin\theta} = \frac{5}{2}$

$\Rightarrow 2\sin^2\theta + 2 = 5\sin\theta$

$\Rightarrow 2\sin^2\theta - 5\sin\theta + 2 = 0$

$\Rightarrow 2\sin^2\theta - 4\sin\theta - \sin\theta + 2 = 0$

$\Rightarrow 2\sin\theta(\sin\theta - 2) - 1(\sin\theta - 2) = 0$

$\Rightarrow (2\sin\theta - 1)(\sin\theta - 2) = 0$

$\Rightarrow 2\sin\theta - 1 = 0$

$\Rightarrow 2\sin\theta = 1$

$\Rightarrow \sin\theta = \frac{1}{2}$ because $\sin\theta \neq 2$

$\Rightarrow \text{cosec}\theta = 2$

$\therefore \text{cosec}\theta - \sin\theta = 2 - \frac{1}{2} = \frac{3}{2}$

404. (2) $\sin(2a + 45°) = \cos(30° - a)$

$\Rightarrow \sin(2a + 45°)$

$= \sin\{90° - (30° - a)\}$

$\Rightarrow \sin(2a + 45°) = \sin(60° + a)$

$[\because \sin(90° - \theta) = \cos\theta]$

$\Rightarrow 2a + 45° = 60° + a$

$\Rightarrow 2a - a = 60° - 45°$

$\Rightarrow a = 15°$

405. (4) Expression

$= \cot10°.\cot20°.\cot60°.\cot70°.\cot80°$

$= (\cot10°.\cot80°)\ (\cot20°.\cot70°).\cot60°$

$= \{\cot10°.\cot(90° - 10°)\}$

$\{\cot20°.\cot(90° - 20°)\}.\frac{1}{\sqrt{3}}$

$= (\cot10°.\tan10°)$

$(\cot20°.\tan20°).\frac{1}{\sqrt{3}}$

$= 1.1.\frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}}$

$[\because \cot(90° - \theta) = \tan\theta;\ \tan\theta.\cot\theta = 1]$

406. (2)

$7\sin^2\theta + 3\cos^2\theta = 4$

On dividing by $\cos^2\theta$,

$\frac{7\sin^2\theta}{\cos^2\theta} + \frac{3\cos^2\theta}{\cos^2\theta} = \frac{4}{\cos^2\theta}$

$\Rightarrow 7\tan^2\theta + 3 = 4\sec^2\theta = 4(1 + \tan^2\theta)$

$\Rightarrow 7\tan^2\theta + 3 = 4 + 4\tan^2\theta$

$\Rightarrow 7\tan^2\theta - 4\tan^2\theta = 4 - 3$

$\Rightarrow 3\tan^2\theta = 1$

$\Rightarrow \tan^2\theta = \frac{1}{3}$

$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$

407. (2) Expression

$= \frac{(1 + \tan^2 A)\cot A}{\text{cosec}^2 A}$

$= \sec^2 A . \cot A . \sin^2 A$

$(\sin A . \text{cosec} A = 1)$

$= \frac{1}{\cos^2 A} . \frac{\cos A}{\sin A} . \sin^2 A$

$= \frac{\sin A}{\cos A} = \tan A$

408. (4) $\sin(A - B) = \sin A . \cos B - \cos A . \sin B$

$\cos(A - B) = \cos A . \cos B + \sin A . \sin B$

$\therefore \frac{\sin(A - B)}{\cos(A - B)}$

$= \frac{\sin A.\cos B - \cos A.\sin B}{\cos A.\cos B + \sin A.\sin B}$

$\Rightarrow \tan(A - B)$

$= \frac{\frac{\sin A.\cos A}{\cos A.\cos B} - \frac{\cos A.\sin B}{\cos A.\cos B}}{\frac{\cos A.\cos B}{\cos A.\cos B} + \frac{\sin A.\sin B}{\cos A.\cos B}}$

(Dividing numerator and denominator by cosA cosB)

$= \frac{\tan A - \tan B}{1 + \tan A.\tan B}$

409. (4) $\sec 330° = \sec(360° - 30°)$

$= \sec 30° = \frac{2}{\sqrt{3}}$

$[\because \sec(360° - \theta) = \sec\theta]$

410. (1) $\frac{1}{\tan A + \cot A} = x$

$\Rightarrow \frac{1}{\frac{\sin A}{\cos A} + \frac{\cos A}{\sin A}} = x$

$\Rightarrow \frac{1}{\frac{\sin^2 A + \cos^2 A}{\sin A.\cos A}} = x$

$\Rightarrow x = \frac{1}{\frac{1}{\sin A.\cos A}} = \sin A.\cos A$

411. (3) $\sin\frac{11\pi}{6}$

$= \sin\left(2\pi - \frac{\pi}{6}\right)$

$[\because \sin(360° - \theta)$

$= \sin(2\pi - \theta) = -\sin\theta]$

$= -\sin\frac{\pi}{6} = -\frac{1}{2}$

412. (2) $\sec A + \tan A = a$ ..... (i)

$\because \sec^2 A - \tan^2 A = 1$

$\Rightarrow (\sec A + \tan A)(\sec A - \tan A) = 1$

$\Rightarrow \sec A - \tan A = \frac{1}{a}$ ... (ii)

On adding equations (i) and (ii),

$2\sec A = a + \frac{1}{a} = \frac{a^2 + 1}{a}$

$\Rightarrow \sec A = \frac{a^2 + 1}{2a}$

$\Rightarrow \cos A = \frac{2a}{a^2 + 1}$

413. (2) $\sin P + \text{cosec}\ P = 2$

$\Rightarrow \sin P + \frac{1}{\sin P} = 2$

$\Rightarrow \frac{\sin^2 P + 1}{\sin P} = 2$

$\Rightarrow \sin^2 P + 1 = 2\sin P$

$\Rightarrow \sin^2 P - 2\sin P + 1 = 0$

$\Rightarrow (\sin P - 1)^2 = 0$

$\Rightarrow \sin P - 1 = 0 \Rightarrow \sin P = 1$

$\therefore \text{cosec}\ P = 1$

$\therefore \sin^7 P + \text{cosec}^7 P = 1 + 1 = 2$

414. (3) $\cos x . \cos y + \sin x . \sin y = -1$

$\Rightarrow \cos x . \cos y + 1$

$= -\sin x . \sin y$

On squaring both sides,

$(\cos x . \cos y + 1)^2 = \sin^2 x \sin^2 y$

$\Rightarrow \cos^2 x . \cos^2 y + 2\cos x . \cos y + 1 = (1 - \cos^2 x)(1 - \cos^2 y)$

$\Rightarrow \cos^2 x . \cos^2 y + 2\cos x . \cos y + 1 = 1 - \cos^2 x - \cos^2 y + \cos^2 x . \cos^2 y$

$\Rightarrow \cos^2 x + \cos^2 y + 2\cos x . \cos y = 0$

$\Rightarrow (\cos x + \cos y)^2 = 0$

$\Rightarrow \cos x + \cos y = 0$

415. (2) $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1$

$= 2\{(\sin^2\theta + \cos^2\theta)^3 - 3\sin^2\theta\cos^2\theta(\sin^2\theta + \cos^2\theta)\} - 3\{(\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta . \cos^2\theta\} + 1$

$= 2(1 - 3\sin^2\theta . \cos^2\theta) - 3(1 - 2\sin^2\theta . \cos^2\theta) + 1$

$= 2 - 6\sin^2\theta . \cos^2\theta - 3 + 6\sin^2\theta . \cos^2\theta + 1$

$= 3 - 3 = 0$

416. (4) $\cos\theta = \frac{x^2 - y^2}{x^2 + y^2}$

$\therefore \sin\theta = \sqrt{1 - \cos^2\theta}$

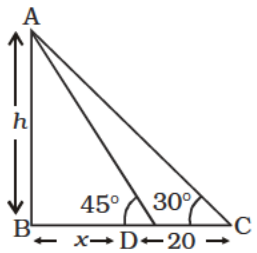
$= \sqrt{1 - \frac{(x^2 - y^2)^2}{(x^2 + y^2)^2}}$

$= \sqrt{\frac{(x^2 + y^2)^2 - (x^2 - y^2)^2}{(x^2 + y^2)^2}}$

$= \sqrt{\frac{4x^2y^2}{(x^2 + y^2)^2}} = \frac{2xy}{x^2 + y^2}$

TYPE-III

1. (4)



Let AB be a pillar of height h meter
If BD = length of shadow = x
and DC = 20 m
then, BC = BD + DC
$\Rightarrow$ BC = $(x + 20)$ metre
From Δ ABD,

$$\tan 45° = \frac{h}{x} \Rightarrow h = x \qquad ...(i)$$

From Δ ABC,

$$\tan 30 = \frac{AB}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+20}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{h+20} \Rightarrow \sqrt{3}h = h + 20$$

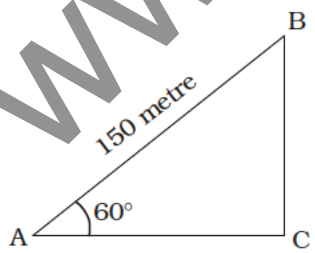
[From (i)]

$$\Rightarrow (\sqrt{3}-1)h = 20 \Rightarrow h = \frac{20}{\sqrt{3}-1}$$

$$= \frac{20}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$$

$$= \frac{20(\sqrt{3}+1)}{2} = 10(\sqrt{3}+1) \text{ metre}$$

2. (2) AB = Length of the thread = 150 metre
$\angle$BAC = 60°

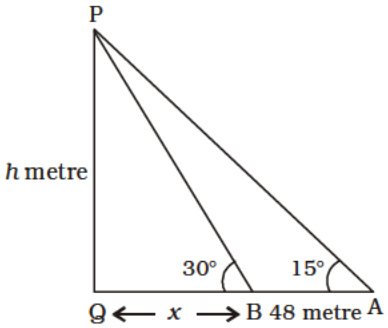


In ΔABC,

$$\sin 60° = \frac{BC}{AB} \Rightarrow \frac{\sqrt{3}}{2} = \frac{BC}{150}$$

$$\Rightarrow BC = 150 \times \frac{\sqrt{3}}{2} = 75\sqrt{3} \text{ metre}$$

3. (2)



Tower = PQ = h metre
QB = x metre
From ΔAPQ,

$$\tan 15° = \frac{h}{x+48}$$

$$2 - \sqrt{3} = \frac{h}{x+48} \qquad ...(i)$$

[$\because$ tan 15° = tan (45° – 30°)

$$= \frac{\tan 45° - \tan 30°}{1 + \tan 45° \tan 30°} = \frac{1 - \frac{1}{\sqrt{3}}}{1 + \frac{1}{\sqrt{3}}}$$

or $\frac{\sqrt{3}-1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1}$

$$= \frac{4 - 2\sqrt{3}}{2} = 2 - \sqrt{3}\Big]$$

From ΔPQB,

$$\tan 30° = \frac{h}{x}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$$

$$\Rightarrow \sqrt{3}h = x \qquad ...(ii)$$

$$\Rightarrow 2 - \sqrt{3} = \frac{h}{\sqrt{3}h + 48}$$

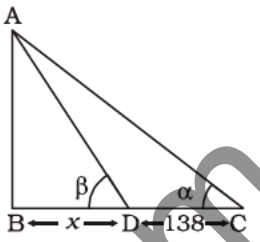
$$\Rightarrow 2\sqrt{3}h - 3h + (2 - \sqrt{3})48 = h$$

$$\Rightarrow h + 3h - 2\sqrt{3}\,h = (2 - \sqrt{3}) \times 48$$

$$\Rightarrow 2h(2 - \sqrt{3}) = 48 \times (2 - \sqrt{3})$$

$$\Rightarrow h = \frac{48}{2} = 24 \text{ metre}$$

4. (3)



AB = monument = h metre
DC = 138 metre
BD = x metre

$$\tan\alpha = \frac{1}{5}$$

$$\sec\beta = \frac{\sqrt{193}}{12}$$

$$\therefore \tan\beta = \sqrt{\sec^2\beta - 1}$$

$$= \sqrt{\frac{193}{144} - 1} = \sqrt{\frac{193-144}{144}}$$

$$= \sqrt{\frac{49}{144}} = \frac{7}{12}$$

$\therefore$ From ΔABC,

$$\tan\alpha = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{5} = \frac{h}{x+138}$$

$$\Rightarrow h = \frac{x+138}{5}$$

$$\Rightarrow 5h = x + 138 \qquad ...(i)$$

From ΔABD,

$$\tan\beta = \frac{h}{x} \Rightarrow \frac{7}{12} = \frac{h}{x}$$

$$\Rightarrow x = \frac{12h}{7} \qquad ...(ii)$$

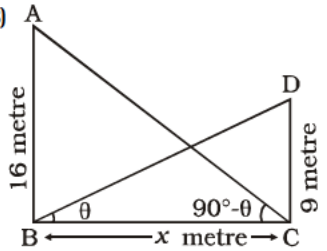
$$\therefore 5h = \frac{12h}{7} + 138 \text{ (By (i) \& (ii))}$$

$$\Rightarrow 35h - 12h = 138 \times 7$$

$$\Rightarrow 23\,h = 138 \times 7$$

$$\Rightarrow h = \frac{138 \times 7}{23} = 42 \text{ metre}$$

5. (3)



From ΔABC,

$$\tan(90^\circ - \theta) = \frac{16}{x}$$

$$\Rightarrow \cot\theta = \frac{16}{x} \quad .....(i)$$

From ΔBCD,

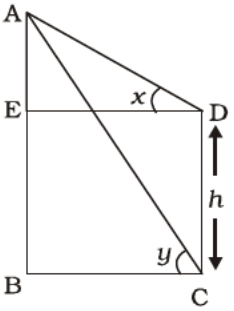
$$\tan\theta = \frac{9}{x} \quad .....(ii)$$

$$\therefore \tan\theta \cdot \cot\theta = \frac{9}{x} \times \frac{16}{x}$$

$$\Rightarrow x^2 = 16 \times 9 \ [\because \tan\theta \cot\theta = 1]$$

$$\Rightarrow x = 4 \times 3 = 12 \text{ metre}$$

6. (3)



CD = tree = h metre

Let AB = building = a metre

& BC = ED = b metre

$\therefore$ From Δ AED,

$$\tan x = \frac{AE}{ED}$$

$$\Rightarrow \tan x = \frac{a-h}{b}$$

$$\Rightarrow b = (a-h)\cot x \quad ...(i)$$

From Δ ABC,

$$\tan y = \frac{AB}{BC}$$

$$\Rightarrow \tan y = \frac{a}{b}$$

$$\Rightarrow b = a \cot y \quad ...(ii)$$

From equations (i) and (ii),

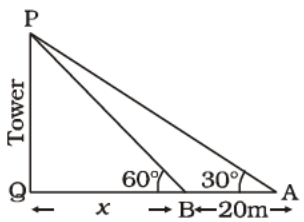
$(a-h)\cot x = a \cot y$

$\Rightarrow a\cot x - h\cot x = a\cot y$

$\Rightarrow h\cot x = a(\cot x - \cot y)$

$$\Rightarrow a = \frac{h\cot x}{\cot x - \cot y}$$

7. (3)



Let PQ = h metre and BQ = x metre.

From Δ APQ,

$$\tan 30^\circ = \frac{h}{x+20}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+20}$$

$$\Rightarrow \sqrt{3}h = x + 20 \quad .....(i)$$

From Δ PQB,

$$\tan 60^\circ = \frac{PQ}{BQ} = \frac{h}{x}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x} \Rightarrow h = \sqrt{3}x$$

$$\Rightarrow x = \frac{1}{\sqrt{3}}h \quad .....(ii)$$

$$\therefore \sqrt{3}h = \frac{1}{\sqrt{3}}h + 20$$

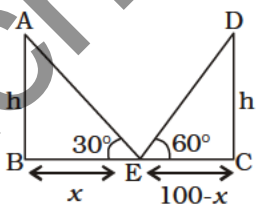
[From equation (i) and (ii)]

$$\Rightarrow 3h - h = 20\sqrt{3}$$

$$\Rightarrow 2h = 20\sqrt{3}$$

$$\therefore h = 10\sqrt{3} \text{ metre}$$

8. (1)



AB = CD = h metre (Height of pole)

From ΔABE,

$$\tan 30^\circ = \frac{h}{x}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x} \Rightarrow \sqrt{3}h = x \quad ...(i)$$

From ΔDEC,

$$\tan 60^\circ = \frac{h}{100-x}$$

$$\Rightarrow \sqrt{3} = \frac{h}{100-x}$$

$$\Rightarrow \sqrt{3}(100-x) = h$$

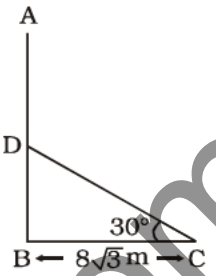
$$\Rightarrow \sqrt{3}(100 - \sqrt{3}h) = h$$

[From equation (i)]

$$\Rightarrow 100\sqrt{3} - 3h = h \Rightarrow 4h = 100\sqrt{3}$$

$$\Rightarrow h = 25\sqrt{3} \text{ metre}$$

9. (3)



AB = Telegraph post = h metre

Telegraph post bends at point D.

DB = x metre

$\therefore$ AD = CD = $(h-x)$ metre

BC = $8\sqrt{3}$ metre

From, Δ DBC,

$$\sin 30^\circ = \frac{DB}{DC}$$

$$\Rightarrow \frac{1}{2} = \frac{x}{h-x} \Rightarrow 2x = h - x$$

$$\Rightarrow 3x = h \quad ..... (i)$$

Again,

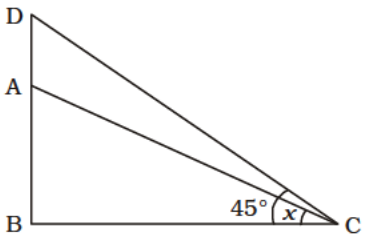
$$\tan 30^\circ = \frac{DB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{8\sqrt{3}}$$

$\Rightarrow x = 8$ metre

$\therefore h = 3 \times 8 = 24$ metre

10. (2)



AB = Buidling

= h metre

AD = Chimney = y metre

From ΔBCD,

$$\tan 45^\circ = \frac{BD}{BC} \Rightarrow 1 = \frac{h+y}{BC}$$

$$\Rightarrow BC = h + y \quad ... (i)$$

From ΔABC,

$$\tan x = \frac{AB}{BC} \Rightarrow \tan x = \frac{h}{BC}$$

$$\Rightarrow BC = h\cot x \quad ...(ii)$$

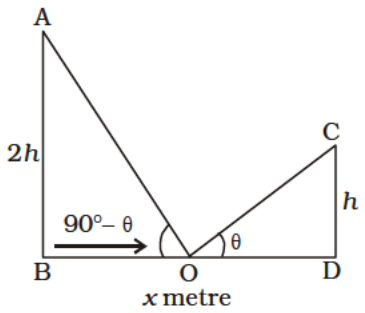
From equations (i) and (ii),

$h + y = h \cot x$

$\Rightarrow y = (h\cot x - h)$ metre

TRIGONOMETRY

11. (1) CD = h metre, AB = 2h metre



$OB = OD = \frac{x}{2}$ metre

From ΔOCD,

$$\tan\theta = \frac{h}{\frac{x}{2}} = \frac{2h}{x} \quad \ldots(i)$$

From ΔOAB,

$$\tan(90° - \theta) = \frac{AB}{BO}$$

$$\Rightarrow \cot\theta = \frac{2h}{\frac{x}{2}} = \frac{4h}{x} \quad \ldots(ii)$$

Multiplying both equations,

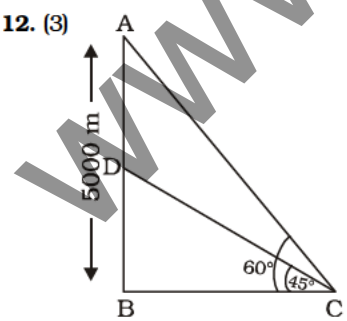
$$\tan\theta.\cot\theta = \frac{2h}{x} \times \frac{4h}{x}$$

$\Rightarrow x^2 = 8h^2$ $[\because \tan\theta\cot\theta = 1]$

$$\Rightarrow h^2 = \frac{x^2}{8}$$

$$\Rightarrow h = \frac{x}{2\sqrt{2}} \text{ metre}$$

12. (3)



$\angle ACB = 60°$
$\angle DCB = 45°$
AB = 5000 metre
AD = x metre
$\therefore$ From ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{5000}{BC}$$

$$\Rightarrow BC = \frac{5000}{\sqrt{3}} \text{ metre}$$

From ΔDBC,

$$\tan 45° = \frac{DB}{BC}$$

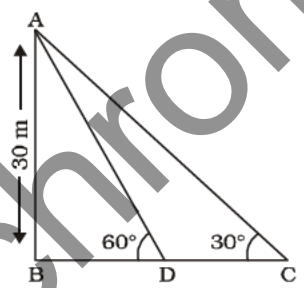
$$\Rightarrow DB = BC = \frac{5000}{\sqrt{3}}$$

$\therefore$ AD = AB – BD

$$= 5000 - \frac{5000}{\sqrt{3}}$$

$$= 5000\left(1 - \frac{1}{\sqrt{3}}\right) \text{m}$$

13. (4)



AB = Tower = 30 metre
CD = x metre
$\angle ACB = 30°$
$\angle ADB = 60°$
From Δ ABD,

$$\tan 60° = \frac{AB}{BD}$$

$$\Rightarrow \sqrt{3} = \frac{30}{BD}$$

$$\Rightarrow BD = \frac{30}{\sqrt{3}} = 10\sqrt{3} \text{ metre}$$

From Δ ABC,

$$\tan 30° = \frac{AB}{BC}$$

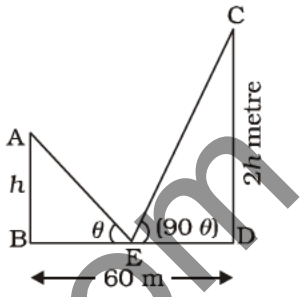
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{30}{10\sqrt{3} + x}$$

$$\Rightarrow 10\sqrt{3} + x = 30\sqrt{3}$$

$$\Rightarrow x = 30\sqrt{3} - 10\sqrt{3}$$

$$= 20\sqrt{3} \text{ metre}$$

14. (4)



BE = DE = 30 metre
$\angle AEB = \theta \therefore \angle CED = 90° - \theta$
From Δ ABE,

$$\tan\theta = \frac{AB}{BE}$$

$$\Rightarrow \tan\theta = \frac{h}{30}$$

$\Rightarrow h = 30\tan\theta$ ...(i)
From Δ CDE,

$$\tan(90° - \theta) = \frac{2h}{30}$$

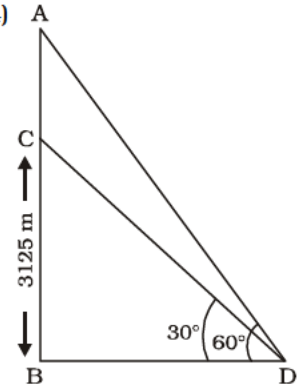
$$\Rightarrow \cot\theta = \frac{h}{15} \Rightarrow h = 15\cot\theta \quad \ldots(ii)$$

By multiplying both equations,
$h^2 = 30 \times 15 \times \tan\theta.\cot\theta$
$\Rightarrow h^2 = 30 \times 15$
$[\because \tan\theta . \cot\theta = 1]$

$\Rightarrow h = 15\sqrt{2}$ metre = AB

$\Rightarrow 2h = 30\sqrt{2}$ metre = CD

15. (4)



A and C $\Rightarrow$ position of planes
BC = 3125m
Let AC = x metre
In ΔABD,

$$\tan 60° = \frac{AB}{BD}$$

$$\Rightarrow \sqrt{3} = \frac{3125 + x}{BD}$$

$\Rightarrow BD = \dfrac{3125 + x}{\sqrt{3}}$

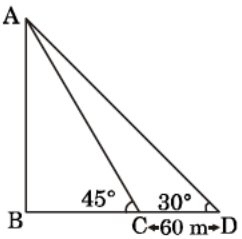
In ΔBCD,

$\tan 30° = \dfrac{BC}{BD}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{3125}{\dfrac{3125 + x}{\sqrt{3}}}$

$\Rightarrow 3\,(3125) = 3125 + x$
$\Rightarrow 9375 = 3125 + x$
$\Rightarrow x = 9375 - 3125$
$x = 6250$ metre

16. (3)



AB = Tower = h metre
$\angle ADB = 30°$
$\angle ACB = 45°$
CD = 60 metre
BC = x metre
From ΔABC,

$\tan 45° = \dfrac{AB}{BC}$

$\Rightarrow 1 = \dfrac{h}{x} \Rightarrow h = x$

From ΔABD,

$\tan 30° = \dfrac{AB}{BD}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{h}{x + 60}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{h}{h + 60}$

$\Rightarrow \sqrt{3}\,h = h + 60$

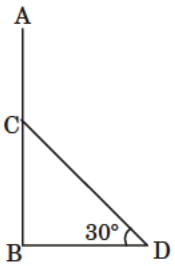
$\Rightarrow \sqrt{3}\,h - h = 60$

$\Rightarrow h\left(\sqrt{3} - 1\right) = 60$

$\Rightarrow h = \dfrac{60}{\sqrt{3} - 1} = \dfrac{60\left(\sqrt{3} + 1\right)}{\left(\sqrt{3} - 1\right)\left(\sqrt{3} + 1\right)}$

$= 30\left(\sqrt{3} + 1\right)$ metre

17. (2)



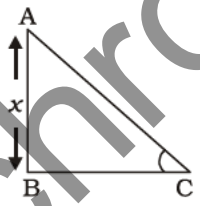
AB = Post = 15 feet
The post breaks at point C.
BC = x feet
$\Rightarrow$ AC = CD = $(15 - x)$ feet
$\angle CDB = 30°$
From ΔBCD,

$\sin 30° = \dfrac{BC}{CD}$

$\Rightarrow \dfrac{1}{2} = \dfrac{x}{15 - x}$

$\Rightarrow 2x = 15 - x$
$\Rightarrow 3x = 15 \Rightarrow x = 5$ feet

18. (2)



AB = Tower = x units
BC = Shadow = $\sqrt{3}\,x$ units

$\tan (ACB) = \dfrac{AB}{BC}$

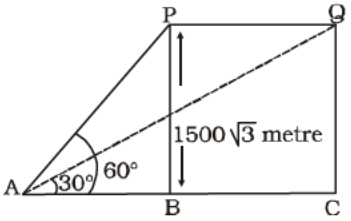
$= \dfrac{x}{\sqrt{3}x} = \dfrac{1}{\sqrt{3}} = \tan 30°$

$\therefore \angle ACB = 30°$

19. (2) $\dfrac{6}{4} = \dfrac{h}{50}$ (Assuming 'h' be the height of flag pole)

$\Rightarrow h = \dfrac{50 \times 6}{4} = 75$ feet

20. (2)



P & Q are the positions of the plane.
$\angle PAB = 60°$; $\angle QAB = 30°$
PB = $1500\sqrt{3}$ metre
In ΔABP,

$\tan 60° = \dfrac{BP}{AB}$

$\Rightarrow \sqrt{3} = \dfrac{1500\sqrt{3}}{AB}$

$\Rightarrow$ AB = 1500 metre
In ΔACQ,

$\tan 30° = \dfrac{CQ}{AC}$

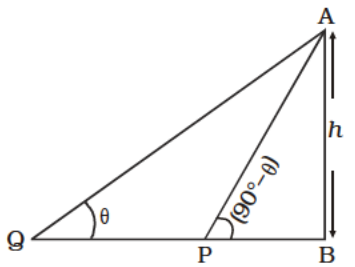
$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{1500\sqrt{3}}{AC}$

$=$ AC = $1500 \times 3 = 4500$ metre
PQ = BC = AC – AB
$= 4500 - 1500 = 3000$ metre
$\Rightarrow$ 3000 m travelled in 15 sec.

$\therefore$ Speed of plane $= \dfrac{3000}{15}$

$= 200$ metre/second

21. (1)



AB = Tower = h units
Let, $\angle AQB = \theta \therefore \angle APB = 90° - \theta$
PB = a; BQ = b
From ΔAQB,

$\tan\theta = \dfrac{AB}{BQ}$

$\Rightarrow \tan\theta = \dfrac{h}{b}$ ...(i)

From ΔAPB

$\tan(90° - \theta) = \dfrac{h}{PB}$

$\Rightarrow \cot\theta = \dfrac{h}{a}$ ...(ii)

By multiplying (i) & (ii)

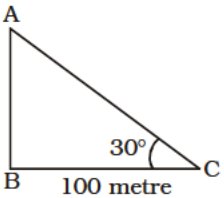
$\tan\theta.\cot\theta = \dfrac{h}{b} \times \dfrac{h}{a}$

$\Rightarrow h^2 = ab$

$\Rightarrow h = \sqrt{ab}$

TRIGONOMETRY

22. (1)



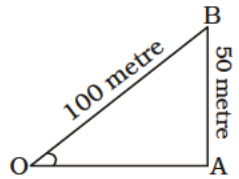
AB = Tower = h metre
$\angle ACB = 30°$;
BC = 100 metre

$\therefore \tan 30° = \frac{AB}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{100}$

$\Rightarrow h = \frac{100}{\sqrt{3}}$ metre

23. (4)

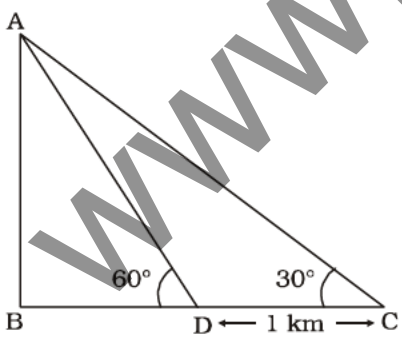


AB = Height of kite
= 50 metre
OB = length of thread
= 100 metre

$\therefore \sin BOA = \frac{AB}{OB} = \frac{50}{100} = \frac{1}{2}$

$= \sin 30°$
$\therefore \angle BOA = 30°$

24. (1)



AB = Height of balloon = h km
BD = x km, CD = 1 km
From Δ ABD,

$\tan 60° = \frac{AB}{BD}$

$\Rightarrow \sqrt{3} = \frac{h}{x}$

$\Rightarrow x = \frac{h}{\sqrt{3}}$ km .....(i)

From Δ ABC,

$\tan 30° = \frac{AB}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{\frac{h}{\sqrt{3}} + 1}$ [By (i)]

$\Rightarrow \sqrt{3}\,h = \frac{h}{\sqrt{3}} + 1$

$\Rightarrow \sqrt{3}\,h - \frac{h}{\sqrt{3}} = 1$

$\Rightarrow \frac{3h - h}{\sqrt{3}} = 1$

$\Rightarrow 2h = \sqrt{3}$

$\Rightarrow h = \frac{\sqrt{3}}{2}$ km

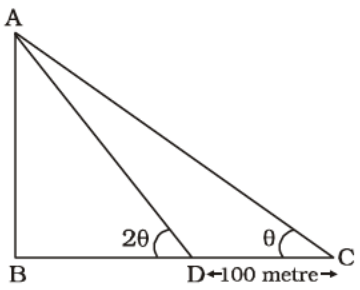
25. (2) $\frac{\text{Height of tower}}{\text{Length of stick}}$

$= \frac{\text{Length of shadow of tower}}{\text{Length of shadow of stick}}$

$\Rightarrow \frac{h}{12} = \frac{40}{8}$

$\Rightarrow h = \frac{40 \times 12}{8} = 60$ metre

26. (1)



AB = Tower = h metre
CD = 100 metre; BC = 160 metre
$\angle ACB =$ $\therefore \angle ADB = 2\theta$
In Δ ABC,

$\tan\theta = \frac{AB}{BC} \Rightarrow \tan\theta = \frac{h}{160}$ ....(i)

In Δ ABD,

$\tan 2\theta = \frac{AB}{BD} = \frac{h}{60}$

$\Rightarrow \frac{2\tan\theta}{1 - \tan^2\theta} = \frac{h}{60}$

$\Rightarrow \frac{2 \times \frac{h}{160}}{1 - \frac{h^2}{160 \times 160}} = \frac{h}{60}$

$\Rightarrow \frac{1}{80\left(1 - \frac{h^2}{160 \times 160}\right)} = \frac{1}{60}$

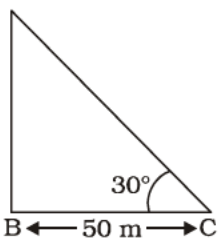
$\Rightarrow 4\left(1 - \frac{h^2}{160 \times 160}\right) = 3$

$\Rightarrow \frac{h^2}{160 \times 160} = 1 - \frac{3}{4} = \frac{1}{4}$

$\Rightarrow h^2 = 6400$

$\Rightarrow h = \sqrt{6400} = 80$ metre

27. (2)



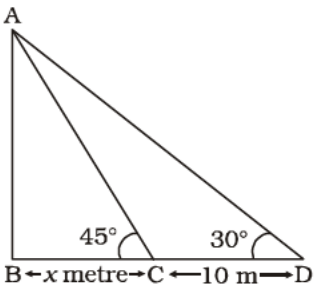
AB = Tower = h metre
BC = 50 metre
$\angle ACB = 30°$

$\therefore \tan 30° = \frac{AB}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{50}$

$\Rightarrow AB = \frac{50}{\sqrt{3}}$ metre

28. (3)



AB = Tower = h metre
$\angle BDA = 30°$
$\angle ACB = 45°$

CD = 10 metre

From ΔABC,

$\tan 45° = \frac{AB}{BC} \Rightarrow 1 = \frac{h}{x} \Rightarrow h = x$

From ΔABD,

$\tan 30° = \frac{AB}{BD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+10}$

$\Rightarrow \sqrt{3}h = h + 10 \quad [\because h = x]$

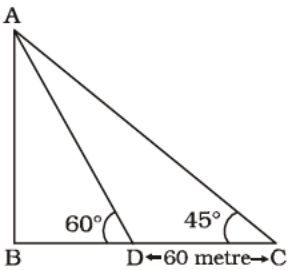
$\Rightarrow \sqrt{3}h - h = 10$

$\Rightarrow h(\sqrt{3} - 1) = 10$

$\Rightarrow h = \frac{10}{\sqrt{3}-1} = \frac{10}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

$= \frac{10(\sqrt{3}+1)}{2} = 5(\sqrt{3}+1)$ metre

29. (3)



AB = tower = h metre

∠ACB = 45°, ∠ADB = 60°

CD = 60 metre, BD = x metre

From ΔABC,

$\tan 45° = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{h}{x+60}$

$\Rightarrow h = x + 60$ .....(i)

From ΔABD,

$\tan 60° = \frac{AB}{BD}$

$\Rightarrow \sqrt{3} = \frac{h}{x} \Rightarrow h = \sqrt{3}x$

$\Rightarrow h = \sqrt{3}.(h - 60)$

$\Rightarrow \sqrt{3}h - h = 60\sqrt{3}$

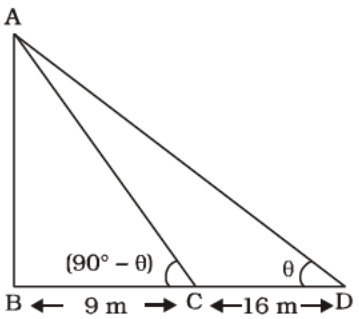
$\Rightarrow h(\sqrt{3} - 1) = 60\sqrt{3}$

$\Rightarrow h = \frac{60\sqrt{3}}{\sqrt{3}-1} = \frac{60\sqrt{3}(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$

$= 30\sqrt{3}(\sqrt{3}+1)$

$= 30(3 + \sqrt{3})$ metre

30. (4)



AB = Pole = h metre

BC = 9 metre BD = 16 metre

∠ADB = θ;

∴ ∠ACB = 90° – θ

From ΔABC,

$\tan(90° - \theta) = \frac{AB}{BC}$

$\Rightarrow \cot\theta = \frac{h}{9}$ ...(i)

ΔABD from,

$\Rightarrow \tan\theta = \frac{h}{16}$ ...(ii)

By multiplying (i) & (ii)

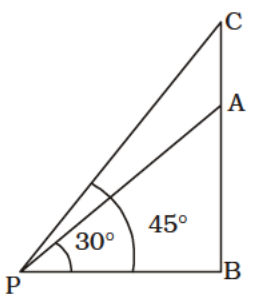
$\tan\theta \cdot \cot\theta = \frac{h}{9} \times \frac{h}{16}$

$\Rightarrow \frac{h^2}{144} = 1$

$\Rightarrow h^2 = 144$

$\Rightarrow h = \sqrt{144} = 12$ metre

31. (4)



AC = Flag

AB = building = 10 metre

∠ APB = 30°; ∠ CPB = 45°

In Δ APB,

$\tan 30° = \frac{AB}{PB}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{10}{PB}$

$\Rightarrow$ PB = 10 $\sqrt{3}$ metre

In Δ PBC,

$\tan 45° = \frac{BC}{PB}$

$\Rightarrow 1 = \frac{AB + AC}{PB}$

$\Rightarrow$ PB = AB + AC

$\Rightarrow 10\sqrt{3} = 10 + AC$

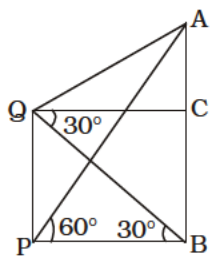
$\Rightarrow AC = 10\sqrt{3} - 10$

$= 10(\sqrt{3} - 1)$ metre

$= 10(1.732 - 1)$ metre

$= 10 \times 0.732 = 7.32$ metre

32. (2)



AB = Tower = h metre

PQ = 10 metre

∠ APB = 60°,

∠ CQB = ∠ QBP = 30°

In Δ PBQ,

$\tan 30° = \frac{PQ}{PB} \Rightarrow \frac{1}{\sqrt{3}} = \frac{10}{PB}$

$\Rightarrow$ PB = 10 $\sqrt{3}$ metre

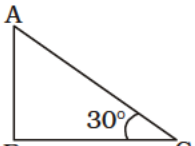
In Δ APB,

$\tan 60° = \frac{AB}{PB}$

$\Rightarrow \sqrt{3} = \frac{h}{10\sqrt{3}}$

$\Rightarrow h = \sqrt{3} \times 10\sqrt{3} = 30$ metre

33. (4)



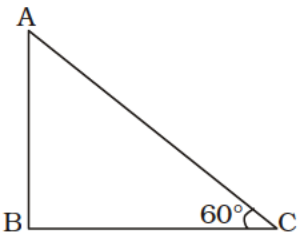
AB = Tower, BC = 20 metre
In Δ ABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{20}$$

$$\Rightarrow AB = \frac{20}{\sqrt{3}} \text{ metre}$$

34. (2)

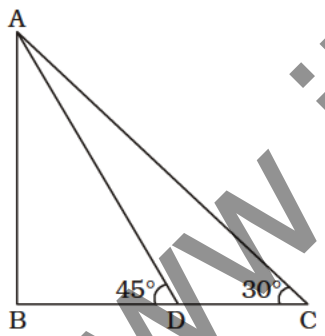


AB = house, AC = ladder
In ΔABC,

$$\cos 60° = \frac{BC}{AC} \Rightarrow \frac{1}{2} = \frac{6.5}{AC}$$

$$\Rightarrow AC = 2 \times 6.5$$
$$= 13 \text{ metre}$$

35. (4)



∠ACB = 30°
∠ADB = 45°
CD = 4 metre
AB = pole = h metre
BD = x metre
From ΔABD,

$$\tan 45° = \frac{AB}{BD}$$

$$\Rightarrow 1 = \frac{h}{x} \Rightarrow h = x \quad \text{...(i)}$$

From ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+4}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{h+4} \Rightarrow h + 4$$

$$= \sqrt{3}h$$

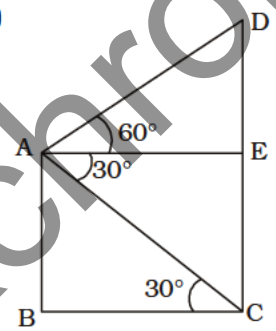
$$\Rightarrow \sqrt{3}h - h = 4$$

$$\Rightarrow h(\sqrt{3} - 1) = 4$$

$$\Rightarrow h = \frac{4}{\sqrt{3}-1} = \frac{4(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$$

$$= \frac{4(\sqrt{3}+1)}{3-1} = 2(\sqrt{3}+1)$$
$$= 2\ (1.732 + 1)$$
$$= 2 \times 2.732$$
$$= 5.464 \text{ metre}$$

36. (3)



AB = Pole = 10 metre
CD = Tower = h metre (let)
∠DAE = 60°
∠EAC = ∠ACB = 30°
From Δ ABC,

$$\tan 30° = \frac{AB}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{10}{BC}$$

$$\Rightarrow BC = 10\sqrt{3} \text{ metre}$$

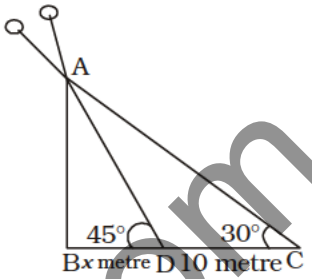
$$\therefore AE = 10\sqrt{3} \text{ metre}$$

From Δ ADE,

$$\tan 60° = \frac{DE}{AE} \Rightarrow \sqrt{3} = \frac{DE}{10\sqrt{3}}$$

$$\Rightarrow DE = 10\sqrt{3} \times \sqrt{3}$$
$$= 30 \text{ metre}$$
$$\therefore CD = \text{Heigth of tower}$$
$$= CE + ED = 10 + 30$$
$$= 40 \text{ metre}$$

37. (1)



AB = Tower = h metre
BD = Shadow = x metre
∠ ADB = 45°
∠ ACB = 30°
In Δ ABD,

$$\tan 45° = \frac{AB}{BD} \Rightarrow 1 = \frac{AB}{BD} = \frac{h}{x}$$

$$\Rightarrow h = x \quad \text{..... (i)}$$

In Δ ABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+10}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{h+10}$$

$$\Rightarrow \sqrt{3}h = h + 10$$

$$\Rightarrow \sqrt{3}h - h = 10$$

$$\Rightarrow h(\sqrt{3} - 1) = 10$$

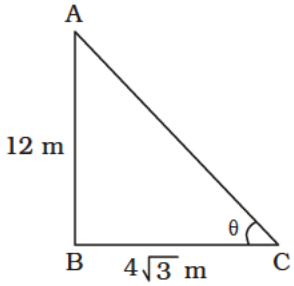
$$\Rightarrow h = \frac{10}{\sqrt{3}-1}$$

$$= \frac{10}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$$

$$= \frac{10(\sqrt{3}+1)}{3-1}$$

$$= 5\ (\sqrt{3}+1) \text{ metre}$$

38. (2)



AB = pole = 12 metre
Shadow = BC = $4\sqrt{3}$ metre

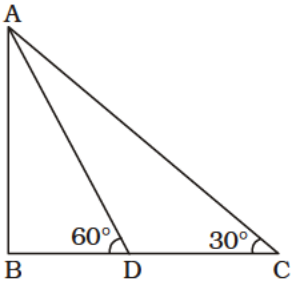
From ΔABC,

$$\tan\theta = \frac{AB}{BC} = \frac{12}{4\sqrt{3}} = \sqrt{3}$$

$\Rightarrow \tan\theta = \tan 60°$

$\Rightarrow \theta = 60°$

39. (4)



AB = Height of tower
= h metre (let)
CD = 70 metre
BD = x metre (let)
In ΔABC,

$$\tan 30° = \frac{AB}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+70}$$

$\Rightarrow \sqrt{3}h = x + 70$

$\Rightarrow x = \sqrt{3}h - 70$ ...(i)

In ΔABD,

$$\tan 60° = \frac{h}{x}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow x = \frac{h}{\sqrt{3}} \quad \text{...(ii)}$$

From equations (i) and (ii),

$$\sqrt{3}h - 70 = \frac{h}{\sqrt{3}}$$

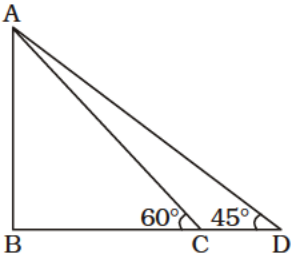
$$\Rightarrow \sqrt{3}h - \frac{h}{\sqrt{3}} = 70$$

$$\Rightarrow \frac{3h-h}{\sqrt{3}} = 70$$

$\Rightarrow 2h = 70\sqrt{3}$

$$\Rightarrow h = \frac{70\sqrt{3}}{2} = 35\sqrt{3} \text{ metre}$$

40. (1)



AB = Tower = h metre (let)
CD = 30 metre
BC = x metre (let)
From ΔABC,

$$\tan 60° = \frac{AB}{BC} \Rightarrow \sqrt{3} = \frac{h}{x}$$

$\Rightarrow h = \sqrt{3}x$ metre ...(i)

From ΔABD,

$$\tan 45° = \frac{AB}{BD} \Rightarrow 1 = \frac{h}{x+30}$$

$\Rightarrow h = x + 30$

$$\Rightarrow h = \frac{h}{\sqrt{3}} + 30$$

$\Rightarrow \sqrt{3}h = h + 30\sqrt{3}$

$\Rightarrow \sqrt{3}h - h = 30\sqrt{3}$

$\Rightarrow h\left(\sqrt{3}-1\right) = 30\sqrt{3}$

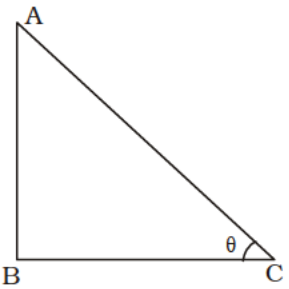
$$\Rightarrow h = \frac{30\sqrt{3}}{\sqrt{3}-1} = \frac{30\sqrt{3}\left(\sqrt{3}+1\right)}{\left(\sqrt{3}-1\right)\left(\sqrt{3}+1\right)}$$

$$= \frac{30\sqrt{3}\left(\sqrt{3}+1\right)}{3-1}$$

$= 15\sqrt{3}\ (\sqrt{3}+1)$

$= 15(3+\sqrt{3})$ metre

41. (2)



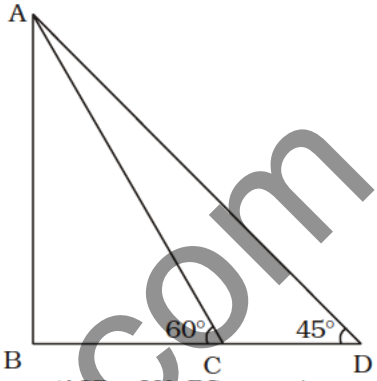
AB = Tower = $100\sqrt{3}$ metre
BC = 100 metre
From Δ ABC,

$$\tan\theta = \frac{AB}{BC}$$

$$\Rightarrow \tan\theta = \frac{100\sqrt{3}}{100} = \sqrt{3}$$

$\Rightarrow \tan\theta = \tan 60° \Rightarrow \theta = 60°$

42. (3)



$\angle ACB = 60°$; BC = x metre
CD = 40 metre, AB = Tower = h metre
From ΔABC,

$$\tan 60° = \frac{AB}{BC} \Rightarrow \sqrt{3} = \frac{h}{x}$$

$\Rightarrow h = \sqrt{3}x$ ...(i)

From ΔABD,

$$\tan 45° = \frac{AB}{BD}$$

$$\Rightarrow 1 = \frac{h}{x+40}$$

$$\Rightarrow h = x + 40 = \frac{h}{\sqrt{3}} + 40$$

$$\Rightarrow h - \frac{h}{\sqrt{3}} = 40$$

$$\Rightarrow \frac{\sqrt{3}h - h}{\sqrt{3}} = 40$$

$\Rightarrow (\sqrt{3}-1)h = 40\sqrt{3}$

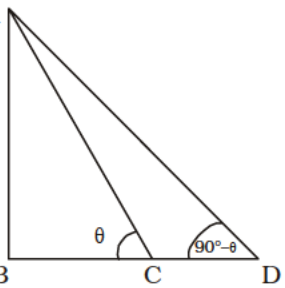
$$\Rightarrow h = \frac{40\sqrt{3}}{\sqrt{3}-1}$$

$$= \frac{40\sqrt{3}(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$$

$$= \frac{40\sqrt{3}(\sqrt{3}+1)}{3-1}$$

$= 20\ (3 + \sqrt{3})$ metre

43. (2)



Let, $\angle ACB = \theta$
$\therefore \angle ADB = 90° - \theta$
BC = 12 metre,
BD = 27 metre
AB = Pillar = h metre
From ΔABC,

$$\tan\theta = \frac{AB}{BC} = \frac{h}{12} \quad \text{....(i)}$$

From ΔABD

$$\tan(90° - \theta) = \frac{AB}{BD}$$

$$\Rightarrow \cot\theta = \frac{h}{27} \quad \text{....(ii)}$$

$$\therefore \tan\theta . \cot\theta = \frac{h}{12} \times \frac{h}{27}$$

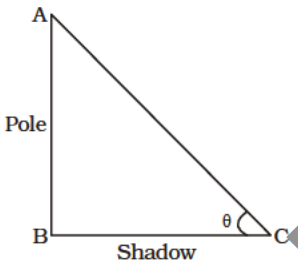
$$\Rightarrow h^2 = 12 \times 27$$

$$\Rightarrow h = \sqrt{12 \times 27}$$

$$= \sqrt{2 \times 2 \times 3 \times 3 \times 3 \times 3}$$

$= 2 \times 3 \times 3 = 18$ metre

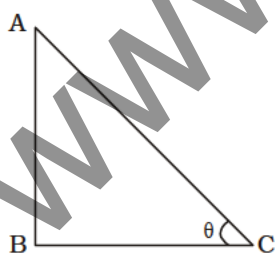
44. (4)



$$\tan\theta = \frac{AB}{BC} = \frac{2\sqrt{3}}{2} = \sqrt{3}$$

$\Rightarrow \tan\theta = \tan 60° \Rightarrow \theta = 60°$

45. (4)



AC = ladder = 10 metre
BC = ?
$\angle ABC = \theta = 30°$
From ΔABC,

$$\cos\theta = \frac{BC}{AC}$$

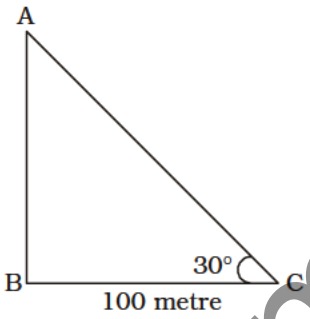
$$\Rightarrow \cos 30° = \frac{BC}{10}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{BC}{10}$$

$$\Rightarrow BC = \frac{10\sqrt{3}}{2} = 5\sqrt{3}$$

$= 5 \times 1.732$
$= 8.660$ metre

46. (4)



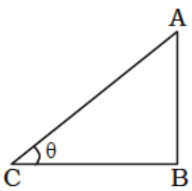
AB = Tower = h metre
From ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{100}$$

$$\Rightarrow h = \frac{100}{\sqrt{3}} \text{ metre}$$

47. (1)



A = Position of kite
AC = length of string
AB = 75 metre

$$\cot\theta = \frac{8}{15}$$

$$\therefore \operatorname{cosec}\theta = \sqrt{1 + \cot^2\theta}$$

$$= \sqrt{1 + \left(\frac{8}{15}\right)^2} = \sqrt{1 + \frac{64}{225}}$$

$$= \sqrt{\frac{225 + 64}{225}} = \sqrt{\frac{289}{225}} = \frac{17}{15}$$

$$\therefore \sin\theta = \frac{15}{17}$$

From ΔABC

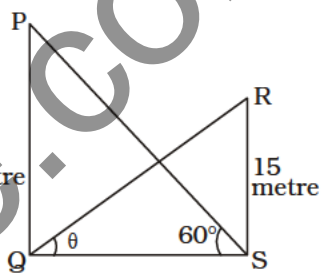
$$\sin\theta = \frac{AB}{AC}$$

$$\Rightarrow \frac{15}{17} = \frac{75}{AC}$$

$\Rightarrow AC \times 15 = 17 \times 15$

$$\Rightarrow AC = \frac{17 \times 75}{15} = 85 \text{ metre}$$

48. (2)



PQ = Tower A = 45 metre
RS = Tower B = 15 metre,
QS = x metre (let)
$\angle PSQ = 60°$; $\angle RQS = \theta$
From ΔPQS,

$$\tan\theta\ 60° = \frac{PQ}{QS}$$

$$\Rightarrow \sqrt{3} = \frac{45}{x} \Rightarrow \sqrt{3}\,x = 45$$

$$\Rightarrow x = \frac{45}{\sqrt{3}} = 15\sqrt{3} \text{ metre}$$

From ΔRSQ,

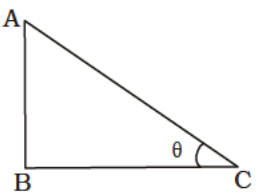
$$\tan\theta = \frac{RS}{QS} = \frac{15}{15\sqrt{3}}$$

$$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$$

$\Rightarrow \tan\theta = \tan 30°$
$\Rightarrow \theta = 30°$

$$\therefore \sin\theta = \sin 30° = \frac{1}{2}$$

49. (4)



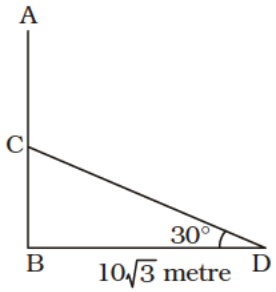
AB = Building = 48 metre
BC = Shadow = $48\sqrt{3}$ metre
$\angle ACB = \theta = ?$

$\therefore \tan\theta = \frac{AB}{BC} = \frac{48}{48\sqrt{3}}$

$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}} = \tan 30°$

$\Rightarrow \theta = 30°$

50. (1)



AB = Telegraph post
AC = CD = bent part
BD = $10\sqrt{3}$ metre
In Δ BCD,

$\tan 30° = \frac{BC}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{BC}{10\sqrt{3}}$

$\Rightarrow BC = \frac{1}{\sqrt{3}} \times 10\sqrt{3}$

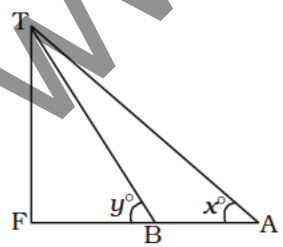
= 10 metre
Again,

$\sin 30° = \frac{BC}{CD}$

$\Rightarrow \frac{1}{2} = \frac{10}{CD}$

$\Rightarrow$ CD = 20 metre
$\therefore$ AB = BC + CD
= (10 + 20) metre
= 30 metre

51. (4)



TF = Tower = h metre
$\angle TAF = x°$; $\angle TBF = y°$,
BF = 80 metre
In ΔAFT,

$\tan x° = \frac{TF}{AF}$

$\Rightarrow \frac{2}{5} = \frac{h}{200}$

$\Rightarrow h = \frac{2}{5} \times 200$

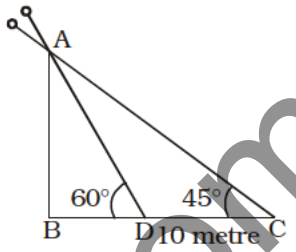
= 80 metre
In ΔBFT,

$\tan y° = \frac{TF}{FB}$

$\Rightarrow \tan y° = \frac{80}{80} = 1$

$\Rightarrow \tan y° = \tan 45°$
$\Rightarrow y = 45°$

52. (4)



AB = Height of pillar
= h metre (let)
CD = 10 metre
$\angle ACB = 45°$
$\angle ADB = 60°$
BD = x metre (let)
From ΔABC,

$\tan 45° = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{h}{x+10}$

$\Rightarrow h = (x + 10)$ metre (i)
From ΔABD,

$\tan 60° = \frac{AB}{BD}$

$\Rightarrow \sqrt{3} = \frac{h}{x}$

$\Rightarrow x = \frac{h}{\sqrt{3}}$ metre (ii)

From equation (i),

$h = \frac{h}{\sqrt{3}} + 10$

$\Rightarrow h - \frac{h}{\sqrt{3}} = 10$

$\Rightarrow \frac{\sqrt{3}h - h}{\sqrt{3}} = 10$

$\Rightarrow h(\sqrt{3} - 1) = 10\sqrt{3}$

$\Rightarrow h = \frac{10\sqrt{3}}{\sqrt{3} - 1}$

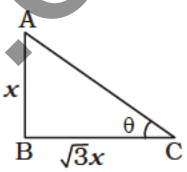
$= \frac{10\sqrt{3}(\sqrt{3} + 1)}{(\sqrt{3} - 1)(\sqrt{3} + 1)}$

$= \frac{10\sqrt{3}(\sqrt{3} + 1)}{3 - 1}$

$= 5\sqrt{3}(\sqrt{3} + 1)$

$= 5(3 + \sqrt{3})$ metre

53. (2)

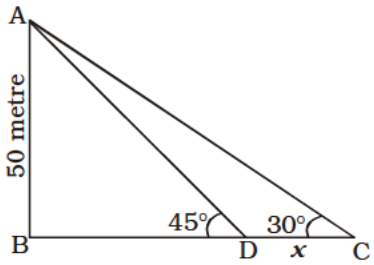


$\frac{AB}{BC} = \frac{1}{\sqrt{3}}$

$\tan\theta = \frac{AB}{BC} = \frac{1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \tan 30°$
$\Rightarrow \theta = 30°$

54. (2)



AB = Height of tower
= 50 metre
$\angle ACB = 30°$; $\angle ADB = 45°$
CD = x metre (let)
In Δ ABD,

$\tan 45° = \frac{50}{BD}$

$\Rightarrow 1 = \frac{50}{BD} \Rightarrow BD = 50$ metre

In Δ ABC,

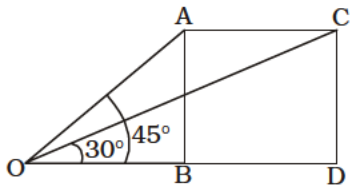
$\tan 30° = \frac{AB}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{50}{50 + x}$

$\Rightarrow 50 + x = 50\sqrt{3}$

$\Rightarrow x = 50\sqrt{3} - 50$

$= 50(\sqrt{3} - 1)$ metre

55. (4)



Let A and C be the positions of plane.
AB = CD = 2500 metre
BD = AC = x metre (let)
$\angle AOB = 60°$; $\angle COD = 30°$
In ΔOAB,

$$\tan 45° = \frac{AB}{OB} \Rightarrow 1 = \frac{2500}{OB}$$

$\Rightarrow$ OB = 2500 metre
In ΔOCD,

$$\tan 30° = \frac{CD}{OD}$$

$$\Rightarrow \frac{1}{\sqrt{3}}$$

$$= \frac{2500}{2500 + x}$$

$$\Rightarrow 2500 + x = 2500\sqrt{3}$$

$$\Rightarrow x$$

$$= 2500\sqrt{3} - 2500$$

$$= 2500\ (\sqrt{3} - 1) \text{ metre}$$

Time = 15 seconds

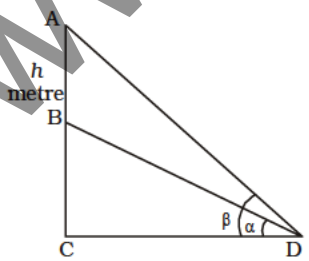
$$= \frac{15}{60 \times 60} \text{ hour} = \frac{1}{240} \text{ hour}$$

$\therefore$ Speed of plane

$$= \frac{2500(\sqrt{3} - 1)}{1000} \times 240 \text{ kmph}$$

$$= 600\ (\sqrt{3} - 1) \text{ kmph.}$$

56. (2)



Let height of tower = BC
= y metre
AB = height of flag-staff
= h metre
$\angle BDC = \alpha$; $\angle ADC = \beta$
Let, CD = x metre
In ΔBCD,

$$\tan\alpha = \frac{BC}{CD}$$

$$\Rightarrow \tan\alpha = \frac{y}{x}$$

$$\Rightarrow x = \frac{y}{\tan\alpha} \quad \text{..... (I)}$$

In ΔACD,

$$\tan\beta = \frac{AC}{CD}$$

$$\Rightarrow \tan\beta = \frac{h + y}{x}$$

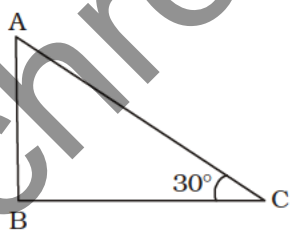
$$\Rightarrow x = \frac{h + y}{\tan\beta} \quad \text{..... (II)}$$

$$\therefore \frac{y}{\tan\alpha} = \frac{h + y}{\tan\beta}$$

$\Rightarrow y \tan\beta = h \tan\alpha + y \tan\alpha$
$\Rightarrow y \tan\beta - y \tan\alpha = h \tan\alpha$
$\Rightarrow y(\tan\beta - \tan\alpha) = h \tan\alpha$

$$\Rightarrow y = \frac{h \tan\alpha}{\tan\beta - \tan\alpha}$$

57. (1)

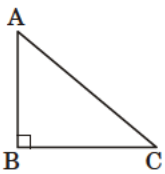


AB = pole = 5 metre
$\angle ACB = 30°$, BC = ?
In ΔABC,

$$\tan 30° = \frac{AB}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{5}{BC}$$

$\Rightarrow$ BC = $5\sqrt{3}$ metre

58. (3)



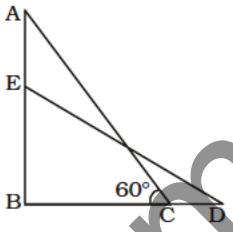
AB = Height of the wall
AC = Length of ladder
= h metre
BC = b = 4.6 metre
$\angle ACB = 60°$

$$\therefore \cos 60° = \frac{BC}{AC}$$

$$\Rightarrow \frac{1}{2} = \frac{4.6}{h}$$

$\Rightarrow h = (2 \times 4.6)$ metre
= 9.2 metre

59. (3)



In ΔABC,
AB = Wall
BC = 10 feet
$\angle ACB = 60°$

$$\therefore \tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{AB}{10}$$

$$\Rightarrow AB = 10\sqrt{3} \text{ feet}$$

$$\therefore AC = \sqrt{AB^2 + BC^2}$$

$$= \sqrt{(10\sqrt{3})^2 + 10^2}$$

$$= \sqrt{300 + 100}$$

$$= \sqrt{400} = 20 \text{ feet}$$

Case II,
$\angle BDE = 30°$

$$\therefore \sin 30° = \frac{BE}{DE}$$

$$\Rightarrow \frac{1}{2} = \frac{BE}{20}$$

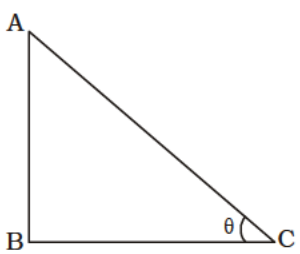
$\Rightarrow$ BE = 10 feet

$$\therefore AE = 10\sqrt{3} - 10$$

$$= 10\left(\sqrt{3} - 1\right) \text{feet}$$

$= 10\ (1.732 - 1)$
$= 10 \times 0.732 = 7.32$ feet

60. (2)

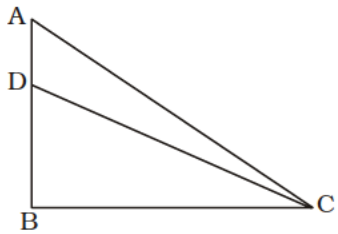


AB = BC

$$\tan\theta = \frac{AB}{BC}$$

$\Rightarrow \tan\theta = 1 = \tan 45°$
$\Rightarrow \theta = 45°$

61. (4)



AD = flag = x metre
AB = flagpost = h metre
BC = 30 metre
$\angle ACB = 45°$; $\angle DCB = 30°$
From Δ ABC,

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow 1 = \frac{h}{30} \Rightarrow h = 30 \text{ metre}$$

From Δ BCD,

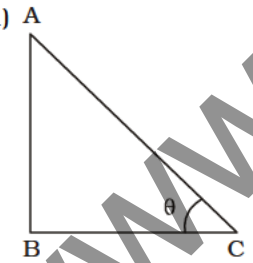
$$\tan 30° = \frac{BD}{BC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h-x}{30}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{30-x}{30}$$

$$\Rightarrow 30 - x = \frac{30}{\sqrt{3}} = 10\sqrt{3}$$

$$\Rightarrow x = 30 - 10\sqrt{3}$$
$$= 30 - 10 \times 1.732$$
$$= 30 - 17.32$$
$$= 12.68 \text{ metre}$$

62. (1)



AB = Tower = h metre
BC = 40 metre

$$\therefore \tan\theta = \frac{AB}{BC}$$

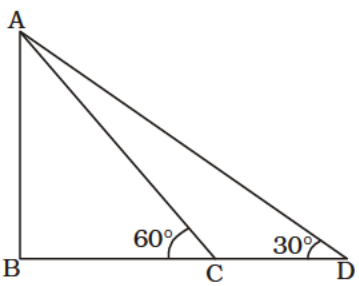
$$\Rightarrow \tan 60° = \frac{h}{40}$$

$$\Rightarrow \sqrt{3} = \frac{h}{40}$$

$$\Rightarrow h = 40\sqrt{3} = \frac{40\sqrt{3} \times \sqrt{3}}{\sqrt{3}}$$

$$= \frac{120}{\sqrt{3}} \text{ metre}$$

63. (2)



AB = tree = h metre
BC = width of river = x metre
CD = 36 metre
From Δ ABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow h = \sqrt{3}\,x \text{ metre} \quad \ldots. (1)$$

From Δ ABD,

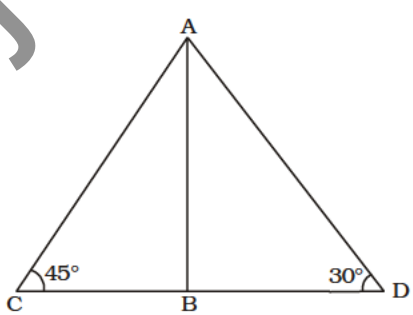
$$\tan 30° = \frac{AB}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+36}$$

$$\Rightarrow \sqrt{3}\,h = x + 36$$

$$\Rightarrow \sqrt{3} \times \sqrt{3}\,x = x + 36$$
$$\Rightarrow 3x - x = 36$$
$$\Rightarrow 2x = 36 \Rightarrow x = 18 \text{ metre}$$

64. (3)



AB = Light house = 100 metre
C and D are positions of ships.
Let,
BC = x metre and BD = y metre
$\angle ACB = 45°$ and $\angle ADB = 30°$
From Δ ABC,

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow 1 = \frac{100}{x} \Rightarrow x = 100 \text{ metre}$$

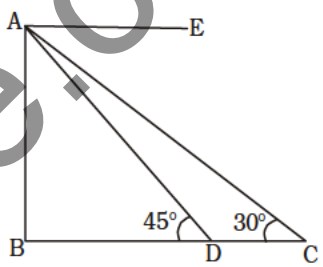
From Δ ABD,

$$\tan 30° = \frac{AB}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{100}{y}$$

$$\Rightarrow y = 100\sqrt{3} \text{ metre}$$
$$= (100 \times 1.73) \text{ metre}$$
$$= 173 \text{ metre}$$
$$\therefore \text{ Required distance} = x + y$$
$$= 100 + 173 = 273 \text{ metre}$$

65. (3)



AB = Height of mountain
= 500 metre
$\angle ACB = 30°$; $\angle ADB = 45°$
C and D $\Rightarrow$ Positions of boats
Let CD = x metre
From Δ ABD,

$$\tan 45° = \frac{AB}{BD}$$

$$\Rightarrow AB = BD$$
$$= 500 \text{ metre}$$

From ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

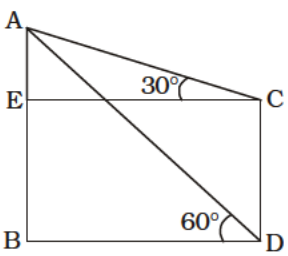
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{500}{500+x}$$

$$\Rightarrow 500 + x = 500\sqrt{3}$$

$$\Rightarrow x = 500\sqrt{3} - 500$$

$$= 500\ (\sqrt{3} - 1) \text{ metre}$$
$$= 500\ (1.732 - 1) \text{ metre}$$
$$= (500 \times 0.732) \text{ metre}$$
$$= 366 \text{ metre}$$

66. (4)



Let, AB = height of pole
= h metre
CD = height of building
= 20 metre = BE
$\angle ADB = 60°$; $\angle ACE = 30°$
Let, AE = x metre ; BD = EC
= y metre
In Δ ABD,

$$\tan 60° = \frac{AB}{BD} \Rightarrow \sqrt{3} = \frac{x+20}{y}$$

$$\Rightarrow x + 20 = \sqrt{3}\ y \ldots. (1)$$

In Δ AEC,

$$\tan 30° = \frac{AE}{EC}$$

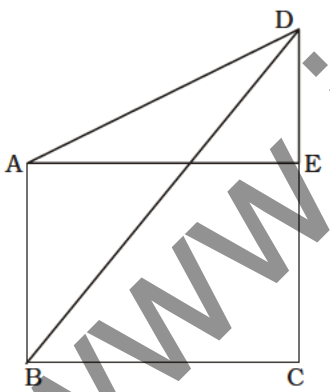
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{x}{y} \Rightarrow y = \sqrt{3}\ x \ldots. (11)$$

From equation (1),

$$x + 20 = \sqrt{3} \times \sqrt{3}x$$
$$\Rightarrow 3x - x = 20$$
$$\Rightarrow 2x = 20$$
$$\Rightarrow x = \frac{20}{2} = 10 \text{ metre}$$

$\therefore$ Height of pole
= (20 + 10) metre
= 30 metre

67. (4)



AB = Height of building
= 30 metre
CD = Height of temple
= h metre
AB = CE = 30 metre
$\therefore$ DE = (h – 30) metre;
BC = AE = x metre
$\angle DAE = 30°$; $\angle DBC = 60°$
In ΔBCD,

$$\tan 60° = \frac{CD}{BC} \Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow h = \sqrt{3}x \text{ metre} \quad \ldots.. (1)$$

In ΔADE,

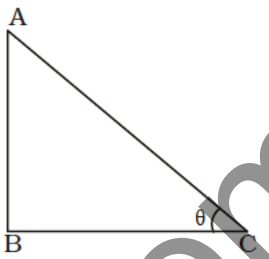
$$\tan 30° = \frac{DE}{AE}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h-30}{x}$$

$$\Rightarrow x = \sqrt{3}h - 30\sqrt{3} \quad \ldots.. (11)$$

$$\therefore h = \sqrt{3}x$$
$$= 3h - 30 \times 3$$
$$\Rightarrow 3h - h = 90 \Rightarrow 2h = 90$$
$$\Rightarrow h = \frac{90}{2} = 45 \text{ metre}$$

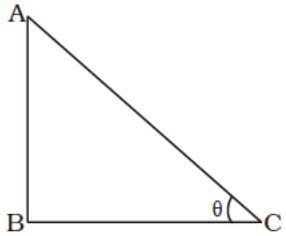
68. (3)



AB = Height of tower
= $50\sqrt{3}$ metre
BC = 50 metre

$$\therefore \tan\theta = \frac{AB}{BC} = \frac{50\sqrt{3}}{50}$$
$$\Rightarrow \tan\theta = \sqrt{3} = \tan 60°$$
$$\Rightarrow \theta = 60°$$

69. (2)

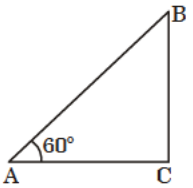


AB = Tower
BC = distance of point C

$$\tan\theta = \frac{AB}{BC} = \frac{5\sqrt{3}}{5} = \sqrt{3}$$

$\therefore \tan\theta = \tan 60° \Rightarrow \theta = 60°$

70. (4)



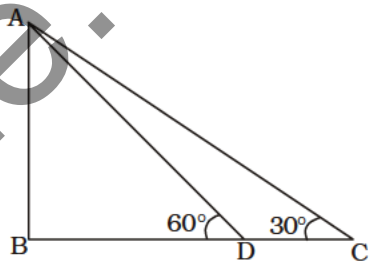
AB = Length of thread
= h metre
= 80 metre
$\angle BAC = 60°$
BC = Vertical height of kite
In ΔABC,

$$\sin 60° = \frac{BC}{AB}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{h}{80}$$

$$\Rightarrow h = 80 \times \frac{\sqrt{3}}{2} = 40\sqrt{3} \text{ metre}$$

71. (3)



Let, AB = height of tower
= h metre
$\angle ACB = 30°$,
$\angle ADB = 60°$
CD = 20 metre ; BC = x metre
In Δ ABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$$

$$\Rightarrow x = \sqrt{3}\ h \ldots. (1)$$

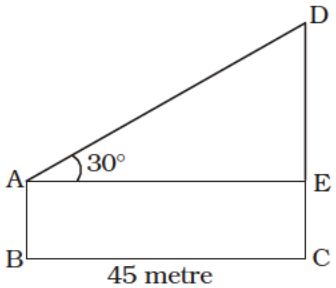
In Δ ABD,

$$\tan 60° = \frac{AB}{BD}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x-20}$$

$$\Rightarrow h = \sqrt{3}\ x - 20\sqrt{3}$$
$$= \sqrt{3} \times \sqrt{3}\ h - 20\sqrt{3}$$
$$\Rightarrow h = 3h - 20\sqrt{3}$$
$$\Rightarrow 3h - h = 20\sqrt{3}$$
$$\Rightarrow 2h = 20\sqrt{3}$$
$$\Rightarrow h = \frac{20\sqrt{3}}{2} = 10\sqrt{3} \text{ metre}$$

72. (3)



AB = Height of observer = 1.6 metre
CD = Height of tower
= h metre
$\therefore$ DE = $(h - 1.6)$ metre ; BC = AE = 45 metre
$\angle$ DAE = 30°

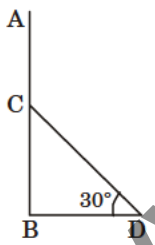
$$\therefore \tan 30° = \frac{DE}{AE}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h-1.6}{45}$$

$$\Rightarrow h - 1.6 = \frac{45}{\sqrt{3}} = 15\sqrt{3}$$

$\Rightarrow h - 1.6 = 15 \times 1.732 = 25.98$
$\Rightarrow h = (25.98 + 1.6)$ metre
= 27.58 metre

73. (1)



AB = Height of tree
BD = 10 metre
AC = CD = broken part of tree
$\angle$CDB = 30°
In ΔBCD,

$$\tan 30° = \frac{BC}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{BC}{10}$$

$$\Rightarrow BC = \frac{10}{\sqrt{3}} \text{ metre}$$

$$\text{Again, } \sin 30° = \frac{BC}{CD}$$

$$\Rightarrow \frac{1}{2} = \frac{10}{\sqrt{3} \times CD}$$

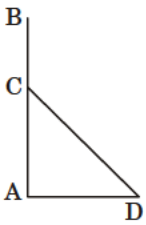
$$\Rightarrow CD = \frac{10 \times 2}{\sqrt{3}} = \frac{20}{\sqrt{3}} \text{ metre}$$

$\therefore$ AB = BC + CD

$$= \frac{10}{\sqrt{3}} + \frac{20}{\sqrt{3}} = \frac{30}{\sqrt{3}}$$

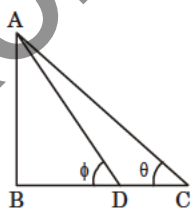
$= 10\sqrt{3}$ metre

74. (3)



Let AB = height of tree
= h metre
AC = 8 metre,
BC = CD = Broken part of tree
AD = 15 metre
In ΔACD,
$CD^2 = AC^2 + AD^2 = 8^2 + 15^2$
$= 64 + 225 = 289$
$\therefore$ CD = $\sqrt{289}$ = 17 metre
$\therefore$ Original height of tree
= 17 + 8 = 25 metre

75. (3)



Let AB = height of pole
= h metre
$\angle$ACB = θ, $\angle$ADB = ϕ
In ΔABD,

$$\tan\phi = \frac{AB}{BD}$$

$$\Rightarrow BD = \frac{h}{\tan\phi} = h\cot\phi$$

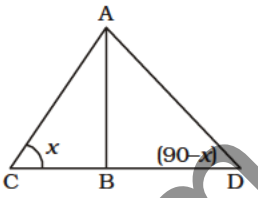
In ΔABC,

$$\tan\theta = \frac{AB}{BC}$$

$$\Rightarrow BC = \frac{h}{\tan\theta} = h\cot\theta$$

$\therefore$ Required distance
= CD = $h\cot\theta - h\cot\phi$
= $h(\cot\theta - \cot\phi)$ metre

76. (4)



Let AB = Height of tower
= h metre
BC = 25 metre
BD = 64 metre
$\angle$ACB = $x°$ and $\angle$ADB
= $(90 - x)$
In ΔABC,

$$\tan x = \frac{AB}{BC}$$

$$\Rightarrow \tan x = \frac{h}{25}$$

In ΔABD,

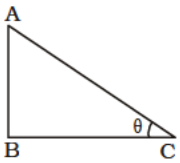
$$\tan(90° - x) = \frac{AB}{BD}$$

$$\Rightarrow \cot x = \frac{h}{64}$$

$$\therefore \tan x \cdot \cot x = \frac{h}{25} \times \frac{h}{64}$$

$\Rightarrow h^2 = 25 \times 64$
$\therefore h = \sqrt{25 \times 64} = 5 \times 8$
= 40 metre

77. (3)



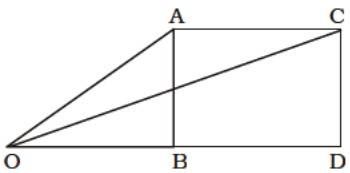
AB = Height of pole = x units
BC = Length of shadow
= $\sqrt{3}x$ units
$\angle$ACB = θ

$$\therefore \tan\theta = \frac{AB}{BC}$$

$$\Rightarrow \tan\theta = \frac{x}{\sqrt{3}x} = \frac{1}{\sqrt{3}} = \tan 30°$$

$\Rightarrow \theta = 30°$

78. (2)



AB = CD = 3000 metre
A and C = Positions of aeroplane

$\angle AOB = 60°$; $\angle COD = 30°$
In ΔOAB,

$$\tan 60° = \frac{AB}{OB}$$

$$\Rightarrow \sqrt{3} = \frac{3000}{OB}$$

$$\Rightarrow OB = \frac{3000}{\sqrt{3}}$$

$= 1000\sqrt{3}$ metre
In ΔOCD,

$$\tan 30° = \frac{CD}{OD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{3000}{OD}$$

$\Rightarrow OD = 3000\sqrt{3}$ metre

$\therefore$ BD = $(3000\sqrt{3} - 1000\sqrt{3})$ metre

$= 2000\sqrt{3}$ metre

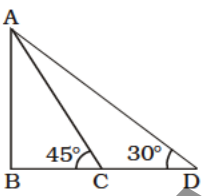
$\therefore$ Speed of aeroplane

$$= \frac{2000\sqrt{3}}{15} \text{ m./sec.}$$

$$= \left(\frac{2000 \times 1.732}{15}\right) \text{ m./sec.}$$

$= 230.93$ m./sec.

79. (3)



AB = Height of pole = h metre
CD = 60 metre
In ΔABC,

$$\tan 45° = \frac{AB}{BC} \Rightarrow 1 = \frac{h}{BC}$$

$\Rightarrow$ BC = h metre
In ΔABD,

$$\tan 30° = \frac{AB}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{h+60}$$

$\Rightarrow \sqrt{3}h = h + 60$

$\Rightarrow \sqrt{3}h - h = 60$

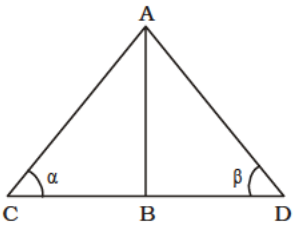
$\Rightarrow h\left(\sqrt{3}-1\right) = 60$

$$\Rightarrow h = \frac{60}{\sqrt{3}-1}$$

$$= \frac{60\left(\sqrt{3}+1\right)}{\left(\sqrt{3}-1\right)\left(\sqrt{3}+1\right)} = \frac{60\left(\sqrt{3}+1\right)}{2}$$

$= 30\left(\sqrt{3}+1\right)$ metre

80. (4)



Let AB = height of tower
= h metre
$\angle ACB = \alpha$; $\angle ADB = \beta$
In ΔABC,

$$\tan\alpha = \frac{AB}{BC}$$

$$\Rightarrow \tan\alpha = \frac{h}{BC} \Rightarrow BC = \frac{h}{\tan\alpha}$$

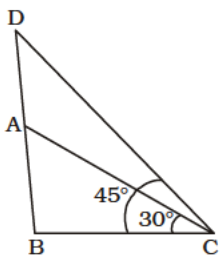
$= h\cot\alpha$
In ΔABD,

$$\tan\beta = \frac{AB}{BD} \Rightarrow \tan\beta = \frac{h}{BD}$$

$$\Rightarrow BD = \frac{h}{\tan\beta} = h\cot\beta$$

$\therefore$ BC = BC + BD
$= h\cot\alpha + h\cot\beta$
$= h(\cot\alpha + \cot\beta)$

81. (1)



AB = incomplete pole
BC = 150 metre
$\angle ACB = 30°$
In ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{150}$$

$$\Rightarrow AB = \frac{150}{\sqrt{3}} = 50\sqrt{3} \text{ metre}$$

In ΔBCD,

$$\tan 45° = \frac{BD}{BC}$$

$$\Rightarrow 1 = \frac{BD}{150}$$

$\Rightarrow$ BD = 150 metre

$\therefore$ AD = BD – AB

$= (150 - 50\sqrt{3})$ metre

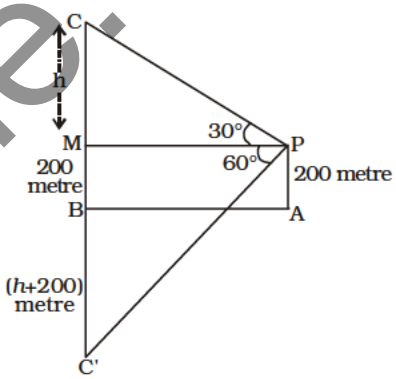
$= 50\left(3 - \sqrt{3}\right)$ metre

$= 50\ (3 - 1.732)$ metre

$= (50 \times 1.268)$ metre

$= 63.4$ metre

82. (4)



AB is the surface of lake. C' is the reflection of cloud 'C'.
$\angle CPM = 30°$ and $\angle C'PM = 60°$
Let, CM = h metre
CB = $(h + 200)$ metre
C'B = $(h + 200)$ metre
In ΔCMP,

$$\tan 30° = \frac{CM}{PM}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{PM}$$

$$\Rightarrow PM = \sqrt{3}h \quad \text{....(i)}$$

In $\Delta PMC'$,

$$\tan 60° = \frac{C'M}{PM}$$

$$\Rightarrow \tan 60° = \frac{C'B + BM}{PM}$$

$$\Rightarrow \sqrt{3} = \frac{h + 200 + 200}{PM}$$

$$\Rightarrow PM = \frac{h + 400}{\sqrt{3}} \quad \text{.... (ii)}$$

From equations (i) and (ii),

$\sqrt{3}\,h = \dfrac{h+400}{\sqrt{3}}$

$\Rightarrow 3h = h + 400$

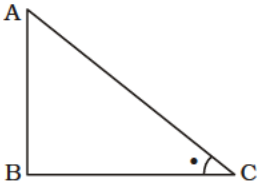
$\Rightarrow 2h = 400 \Rightarrow h = 200$

$\therefore$ CB = h + 200 = 400 metre

Note : If the angle of elevation of a cloud from a point h metre above a lake is α and the angle of depression of its reflection in the lake is β, then the height of the cloud

$= \dfrac{h(\tan\beta + \tan\alpha)}{(\tan\beta - \tan\alpha)}$

83. (3)



AB = Height of cliff = h metre

BC = 129 metre

In ΔABC,

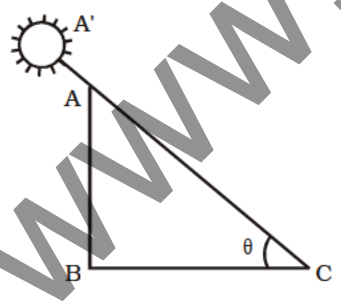
$\tan\theta = \dfrac{AB}{BC}$

$\Rightarrow \tan 30° = \dfrac{h}{129}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{h}{129}$

$\Rightarrow h = \dfrac{129}{\sqrt{3}} = 43\sqrt{3}$ metre

84. (2)



A' $\Rightarrow$ Position of sun

AB = Height of pole = 15 metre

BC = Length of shadow

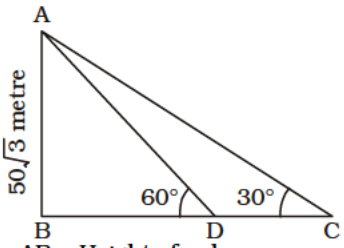
$= \dfrac{15}{\sqrt{3}}$ metre

$\therefore \tan\theta = \dfrac{AB}{BC} = \dfrac{15}{\frac{15}{\sqrt{3}}} = \sqrt{3}$

$\Rightarrow \tan\theta = \tan 60°$

$\Rightarrow \theta = 60°$

85. (3)



AB = Height of pole

$= 50\sqrt{3}$ metre

BC = Length of shadow

= x metre

When,

$\angle ACB = 30°$

BD = Length of shadow

= y metre

when,

$\angle ADB = 60°$

In ΔABC,

$\tan 30° = \dfrac{AB}{BC}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{50\sqrt{3}}{x}$

$\Rightarrow x = 50\sqrt{3} \times \sqrt{3} = 150$ metre

In ΔABD,

$\tan 60° = \dfrac{AB}{BD}$

$\Rightarrow \sqrt{3} = \dfrac{50\sqrt{3}}{y}$

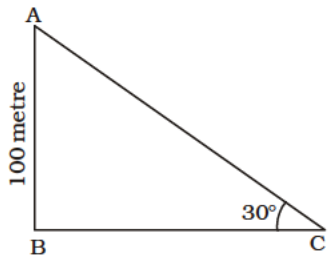
$\Rightarrow \sqrt{3}y = 50\sqrt{3}$

$\Rightarrow y = \dfrac{50\sqrt{3}}{\sqrt{3}} = 50$ metre

$\therefore$ CD = $x - y$ = 150 – 50

= 100 metre

86. (3)



Let, AB = Height of tower

= 100 metre

$\angle ACB = 30°$

In ΔABC,

$\tan 30° = \dfrac{AB}{BC}$

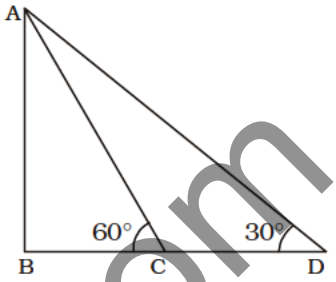
$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{100}{BC}$

$\Rightarrow$ BC = $100\sqrt{3}$ metre

= (100 × 1.73) metre

= 173 metre

87. (3)



AB = Height of pole

= 75 metre

C and D $\Rightarrow$ positions of persons

Let, BC = x metre,

BD = y metre

$\angle ACB = 60°$; $\angle ADB = 30°$

In ΔABC,

$\tan 60° = \dfrac{AB}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{75}{x}$

$\Rightarrow x = \dfrac{75}{\sqrt{3}} = 25\sqrt{3}$ metre

In ΔABD,

$\tan 30° = \dfrac{AB}{BD}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{75}{y}$

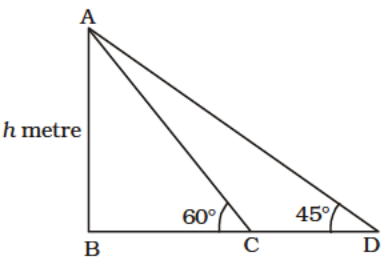
$\Rightarrow y = 75\sqrt{3}$ metre

$\therefore$ CD = $y - x$

$= \left(75\sqrt{3} - 25\sqrt{3}\right)$ metre

$= 50\sqrt{3}$ metre

88. (4)



Two consecutive kilometre stones $\Rightarrow$ C and D

$\angle ADB = 45°$; $\angle ACB = 60°$

CD = 1 km.

AB = height of plane = h metre

BC = x metre (let)

In ΔABC,

$\tan 60° = \dfrac{AB}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{h}{x}$

$\Rightarrow h = \sqrt{3}x$ metre ..... (i)

In ΔABD,

$\tan 45° = \frac{AB}{BD}$

$\Rightarrow 1 = \frac{h}{x+1}$

$\Rightarrow h = x + 1$

$\Rightarrow h = \frac{h}{\sqrt{3}} + 1$

[From equation (i)]

$\Rightarrow h - \frac{h}{\sqrt{3}} = 1$

$\Rightarrow \frac{\sqrt{3}h - h}{\sqrt{3}} = 1$

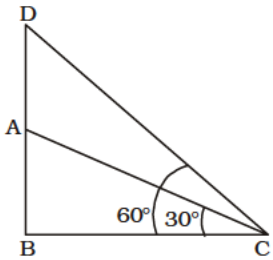
$\Rightarrow \left(\sqrt{3}-1\right) h = \sqrt{3}$

$\Rightarrow h = \frac{\sqrt{3}}{\sqrt{3}-1}$

$= \frac{\sqrt{3}\left(\sqrt{3}+1\right)}{\left(\sqrt{3}-1\right)\left(\sqrt{3}+1\right)} = \frac{\sqrt{3}}{2}\left(\sqrt{3}+1\right)$

$= \frac{1}{2}\left(3+\sqrt{3}\right)$ metre

89. (2)



AB = Height of tower
= h metre
AD = Height of flagstaff
= x metre
$\angle BCD = 60°$; $\angle BCA = 30°$
BC = 9 metre
In ΔABC,

$\tan 30° = \frac{AB}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{9}$

$\Rightarrow h = \frac{9}{\sqrt{3}} = 3\sqrt{3}$ metre

In ΔBCD,

$\tan 60° = \frac{BD}{BC}$

$\Rightarrow \sqrt{3} = \frac{h+x}{9}$

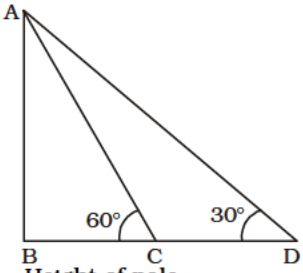
$\Rightarrow h + x = 9\sqrt{3}$

$\Rightarrow 3\sqrt{3} + x = 9\sqrt{3}$

$\Rightarrow x = 9\sqrt{3} - 3\sqrt{3}$

$= 6\sqrt{3}$ metre

90. (3)



AB = Height of pole
= 15 metre
$\angle ACB = 60°$; $\angle ADB = 30°$
In ΔABC,

$\tan 60° = \frac{AB}{BC} \Rightarrow \sqrt{3} = \frac{15}{BC}$

$\Rightarrow BC = \frac{15}{\sqrt{3}} = 5\sqrt{3}$ metre

In ΔABD,

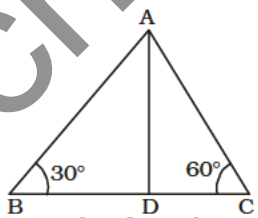
$\tan 30° = \frac{AB}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{15}{BD}$

$\Rightarrow BD = 15\sqrt{3}$ metre

$\therefore$ Required difference
= BD – BC
$= \left(15\sqrt{3} - 5\sqrt{3}\right)$ metre
$= 10\sqrt{3}$ metre

91. (1)



AD = Height of temple
= 75 metre
B and C $\Rightarrow$ Positions of men
$\angle ABD = 30°$; $\angle ACD = 60°$
In ΔABD,

$\tan 30° = \frac{AD}{BD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{75}{BD}$

$\Rightarrow BD = 75\sqrt{3}$ metre

In ΔACD,

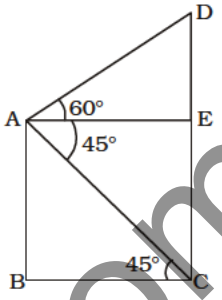
$\tan 60° = \frac{AD}{DC}$

$\Rightarrow \sqrt{3} = \frac{75}{DC}$

$\Rightarrow DC = \frac{75}{\sqrt{3}} = 25\sqrt{3}$ metre

$\therefore$ BC = BD + DC
$= 75\sqrt{3} + 25\sqrt{3}$
$= 100\sqrt{3}$ metre
= (100 × 1.732) metre
= 173.2 metre

92. (3)



AB = Height of building
= 20 metre
CD = Height of tower
= h metre (let)
$\angle ACB = \angle EAC = 45°$
$\angle DAE = 60°$
BC = AE = x metre
In ΔABC,

$\tan 45° = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{20}{x}$

$\Rightarrow x = 20$ metre

In ΔADE,

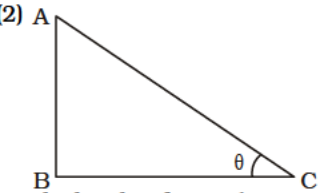
$\tan 60° = \frac{DE}{AE} \Rightarrow \sqrt{3} = \frac{h-20}{20}$

$\Rightarrow h - 20 = 20\sqrt{3}$

$\Rightarrow h = 20\sqrt{3} + 20$

$= 20\left(\sqrt{3}+1\right)$ metre
= 20 (1.732 + 1) metre
= (20 × 2.732) metre
= 54.64 metre

93. (2)



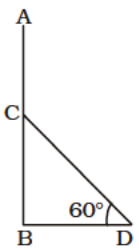
Let the height of tower be x units.
$\therefore$ Length of shadow = $\sqrt{3}x$ units
In ΔABC,

$\therefore \tan\theta = \frac{AB}{BC} = \frac{x}{\sqrt{3}x} = \frac{1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \tan 30°$

$\Rightarrow \theta = 30°$

94. (3)



AB = Height of tree
Let the tree break at point C.

BC = x metre
$\therefore$ AC = CD
$\angle CDB = 60°$; BD = 10 metre
In ΔBCD,

$$\tan 60° = \frac{BC}{BD} \Rightarrow \sqrt{3} = \frac{x}{10}$$

$$\Rightarrow x = 10\sqrt{3} \text{ metre}$$

Again, $\sin 60° = \frac{BC}{CD}$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{10\sqrt{3}}{CD}$$

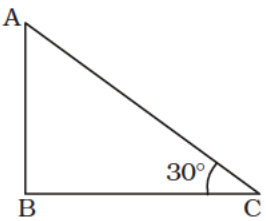
$$\Rightarrow CD = \frac{2 \times 10\sqrt{3}}{\sqrt{3}} = 20 \text{ metre}$$

$\therefore$ Height of tree = AB

$$= \left(20 + 10\sqrt{3}\right) \text{ metre}$$

$$= 10\left(2 + \sqrt{3}\right) \text{ metre}$$

95. (4)



Let telegraph pole bend at point A.
BC = $8\sqrt{3}$ metre
In ΔABC,

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{8\sqrt{3}}$$

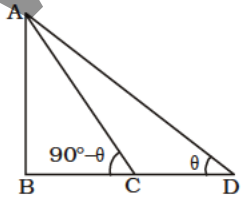
$$\Rightarrow AB = \frac{8\sqrt{3}}{\sqrt{3}} = 8 \text{ metre}$$

Again, $\sin 30° = \frac{AB}{AC}$

$$\Rightarrow \frac{1}{2} = \frac{8}{AC}$$

$\Rightarrow$ AC = 2 × 8 = 16 metre
$\therefore$ Height of telegraph–pole
= AB + AC
= 8 + 16 = 24 metre

96. (4)



Let, AB = Height of tower = h metre
BC = 4 metre, BD = 9 metre
$\angle ACB = 90° - \theta$; $\angle ADB = \theta$
In ΔABC,

$$\tan(90° - \theta) = \frac{AB}{BC}$$

$$\Rightarrow \cot\theta = \frac{h}{4} \quad \text{..... (I)}$$

In ΔABD,

$$\tan\theta = \frac{h}{9} \quad \text{..... (II)}$$

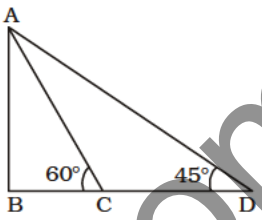
On multiplying both equations,

$$\tan\theta \cdot \cot\theta = \frac{h}{4} \times \frac{h}{9}$$

$$\Rightarrow \frac{h^2}{36} = 1 \Rightarrow h^2 = 36$$

$$\Rightarrow h = \sqrt{36} = 6 \text{ metre}$$

97. (2)



AB = Height of tower
= h metre
BC = Length of shadow when $\angle BCA = 60° = x$ metre
BD = Length of shadow when $\angle ADB = 45° = (x + 10)$ metre
In ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow h = \sqrt{3}x \text{ metre} \quad \text{..... (I)}$$

In ΔABD,

$$\tan 45° = \frac{AB}{BD} \Rightarrow 1 = \frac{h}{x + 10}$$

$$\Rightarrow h = x + 10 \Rightarrow h = \frac{h}{\sqrt{3}} + 10$$

$$\Rightarrow h - \frac{h}{\sqrt{3}} = 10$$

$$\Rightarrow \frac{\sqrt{3}h - h}{\sqrt{3}} = 10$$

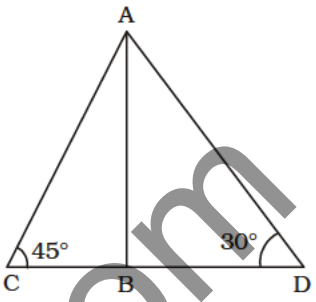
$$\Rightarrow h\left(\sqrt{3} - 1\right) = 10\sqrt{3}$$

$$\Rightarrow h = \frac{10\sqrt{3}}{\sqrt{3} - 1} = \frac{10\sqrt{3}\left(\sqrt{3} + 1\right)}{\left(\sqrt{3} - 1\right)\left(\sqrt{3} + 1\right)}$$

$$= \frac{10\sqrt{3}\left(\sqrt{3} + 1\right)}{2}$$

$$= 5\left(3 + \sqrt{3}\right) \text{ metre}$$

98. (1)



AB = Height of tower
C and D $\Rightarrow$ Positions of men
BC = x metre (let)
BD = y metre
$\angle ACB = 45°$; $\angle ADB = 30°$
In ΔABC,

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow 1 = \frac{50}{x}$$

$\Rightarrow x = 50$ metre
In ΔABD,

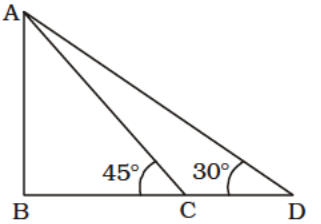
$$\tan 30° = \frac{AB}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{50}{y}$$

$$\Rightarrow y = 50\sqrt{3}$$

= (50 × 1.73) metre
= 86.5 metre
$\therefore$ CD = (50 + 86.5) metre
= 136.5 metre

99. (1)



Suppose, AB = Height of tower = h metre
When $\angle ACB = 45°$, length of shadow = BC = x metre
When $\angle ADB = 30°$, length of shadow = BD = $(x + 10)$ metre
In ΔABC,

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow 1 = \frac{h}{x}$$

$\Rightarrow h = x$ metre ...(I)
In ΔABD,

$$\tan 30° = \frac{AB}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x + 10}$$

$\Rightarrow \sqrt{3}h = x + 10$

$\Rightarrow \sqrt{3}h = h + 10$

$\Rightarrow \sqrt{3}h - h = 10$

$\Rightarrow h(\sqrt{3}-1) = 10$

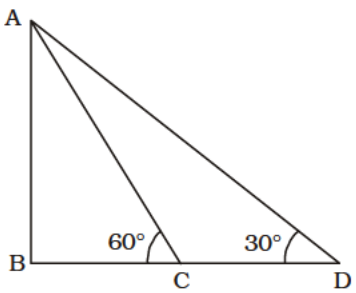
$\Rightarrow h = \dfrac{10}{\sqrt{3}-1}$

$= \dfrac{10(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}-1)}$

$= \dfrac{10(\sqrt{3}+1)}{2}$

$= 5\ (\sqrt{3}+1)$ metre

100. (3)



Suppose, height of tree
= AB = h foot
BC = width of river = x foot
CD = $20\sqrt{3}$ foot
$\angle ACB = 60°$ and $\angle ADB = 30°$
In ΔABC,

$\tan 60° = \dfrac{AB}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{h}{x}$

$\Rightarrow h = \sqrt{3}x$ foot ...(i)

In ΔABD,

$\tan 30° = \dfrac{AB}{BD}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{h}{x + 20\sqrt{3}}$

$\Rightarrow \sqrt{3}h = x + 20\sqrt{3}$

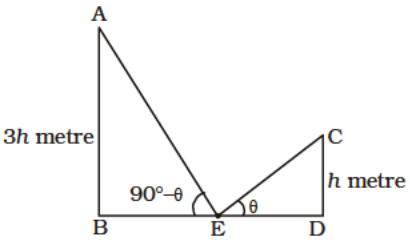
$\Rightarrow \sqrt{3}h = \dfrac{h}{\sqrt{3}} + 20\sqrt{3}$

$\Rightarrow 3h = h + 20\sqrt{3} \times \sqrt{3}$

$\Rightarrow 2h = 60$

$\Rightarrow h = \dfrac{60}{2} = 30$ feet

101. (4)



Let, AB = $3h$ metre
CD = h metre
BE = ED = 60° metre
$\angle AEB = 90° - \theta$; $\angle CED = \theta$
In ΔABE,

$\tan(90° - \theta) = \dfrac{AB}{BE}$

$\Rightarrow \cot\theta = \dfrac{3h}{60}$ ..... (i)

In ΔCED,

$\tan\theta = \dfrac{h}{60}$ ..... (ii)

$\therefore \tan\theta \cdot \cot\theta = \dfrac{3h}{60} \times \dfrac{h}{60}$

$\Rightarrow 3h^2 = 60 \times 60$

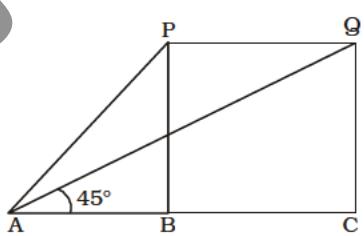
$\Rightarrow h^2 = \dfrac{60 \times 60}{3} = 1200$

$\Rightarrow h = \sqrt{1200}$

$= 20\sqrt{3}$ metre

$\therefore$ Height of larger pole
$= 3 \times 20\sqrt{3} = 60\sqrt{3}$ metre
$= (60 \times 1.732)$ metre
= 103.92 metre

102. (4)



If height of balloown = $3800\sqrt{3}$ m, then,

$\tan 60° = \dfrac{BP}{AB}$

$\Rightarrow \sqrt{3} = \dfrac{3800\sqrt{3}}{AB}$

$\Rightarrow AB = 3800$ m

$\tan 45° = \dfrac{CQ}{AC}$

$\Rightarrow 1 = \dfrac{3800\sqrt{3}}{AC}$

$\Rightarrow AC = 3800\sqrt{3}$ m

$\therefore PQ = AC - AB$

$= (3800\sqrt{3} - 3800)$

$= 3800 \times 0.732 = 3800\ (\sqrt{3}-1)$

= 2782 m

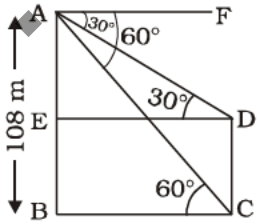
$\therefore$ Required speed

$= \left(\dfrac{2782}{\frac{5}{60} \times 1000}\right)$ km/hr.

= 33.3 km/hr. (Approximately)

TYPE-IV

1. (2)



[Note : Interior alternate angles are equal]
AB = 108 m
CD = x metre
From Δ ABC,

$\tan 60° = \dfrac{AB}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{108}{BC}$

$\Rightarrow BC = \dfrac{108}{\sqrt{3}} = 36\sqrt{3}\,m$

From Δ AED,

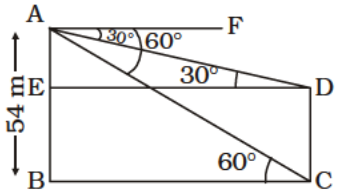
$\tan 30° = \dfrac{AE}{ED}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{108 - x}{36\sqrt{3}}$

$\Rightarrow 108 - x = 36$

$\Rightarrow x = 108 - 36 = 72$ m

2. (2)



AB = temple = 54 metre
CD = temple = h metre
BC = width of river
= x metre

From ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{54}{x} \Rightarrow x = \frac{54}{\sqrt{3}}$$

$= 18\sqrt{3}$ metre

From ΔADE,

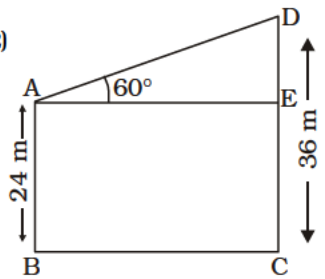
$$\tan 30° = \frac{AE}{DE}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{54 - h}{18\sqrt{3}}$$

$\Rightarrow 54 - h = 18$

$\Rightarrow h = 54 - 18 = 36$ metre

3. (2)



$DE = 36 - 24 = 12$ metre

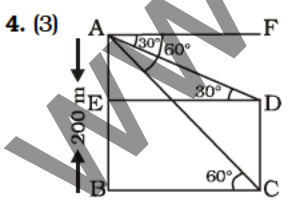
From ΔADE,

$$\sin 60° = \frac{DE}{AD}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{12}{AD}.$$

$$\Rightarrow AD = \frac{12 \times 2}{\sqrt{3}} = 8\sqrt{3} \text{ metre}$$

4. (3)



AB = Hill = 200 metre

$\angle ADE = 30°$

$\angle ACB = 60°$

$DE = BC = x$ metre

From ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{200}{x}$$

$$\Rightarrow x = \frac{200}{\sqrt{3}} \text{ metre}$$

From ΔAED,

$$\tan 30° = \frac{AE}{DE}$$

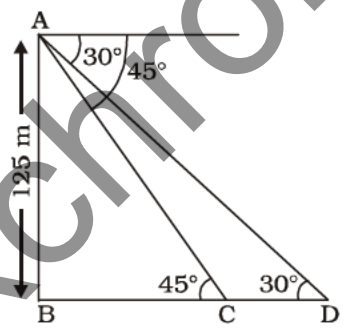
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AE}{\frac{200}{\sqrt{3}}}$$

$$\Rightarrow AE = \frac{200}{3} \text{ metre}$$

$$\therefore CD = 200 - \frac{200}{3} = \frac{400}{3}$$

$= 133\frac{1}{3}$ metre

5. (2)



AB = Tower = 125 metre

$BC = x$ metre, $BD = y$ metre

From ΔABC,

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow 1 = \frac{125}{x} \Rightarrow x = 125 \text{ metre}$$

From ΔABD,

$$\tan 30° = \frac{AB}{BD}$$

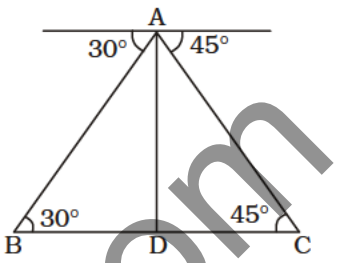
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{125}{y}$$

$$\Rightarrow y = 125\sqrt{3} \text{ metre}$$

$$\therefore CD = y - x = 125\sqrt{3} - 125$$

$= 125(\sqrt{3} - 1)$ metre

6. (4)



AD is tower and B and C are two objects,

$\angle ABD = 30°$ and $\angle ACD = 45°$

$AD = 180$ metre

From ΔABD,

$$\tan 30° = \frac{AD}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{180}{BD}$$

$\Rightarrow BD = 180\sqrt{3}$ metre

From ΔADC,

$$\tan 45° = \frac{AD}{DC}$$

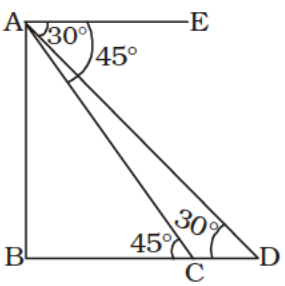
$$\Rightarrow 1 = \frac{180}{DC} \Rightarrow DC = 180 \text{ metre}$$

$\therefore BC = BD + DC$

$= 180\sqrt{3} + 180$

$= 180(\sqrt{3} + 1)$ metre

7. (1)



AB = hill = 300 metre

CD = bridge = x metre

In ΔABC,

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow 1 = \frac{300}{BC}$$

$\Rightarrow$ BC = 300 metre

In ΔABD,

$$\tan 30° = \frac{AB}{BD}$$

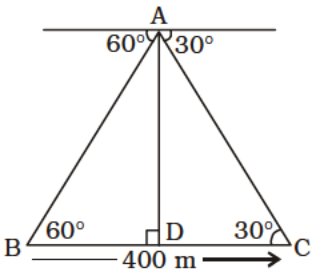
$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{300}{300 + x}$$

$$\Rightarrow 300 + x = 300\sqrt{3}$$

$$\Rightarrow x = 300\sqrt{3} - 300$$

$$= 300 (\sqrt{3} - 1) \text{ metre}$$

8. (1)



BC = River = 400 metre

AD = Height of plane = h metre

BD = x metre (let)

$\therefore$ CD = (400 – x) metre

From ΔABD,

$$\tan 60° = \frac{AD}{BD}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow h = \sqrt{3}\, x \text{ metre}$$

$$\Rightarrow x = \frac{h}{\sqrt{3}} \text{ metre} \quad ...(i)$$

From ΔACD,

$$\tan 30° = \frac{AD}{CD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{400 - x}$$

$$\Rightarrow \sqrt{3}h = 400 - x$$

$$\Rightarrow \sqrt{3}h = 400 - \frac{h}{\sqrt{3}}$$

[From equation (i)]

$$\Rightarrow \sqrt{3}h + \frac{h}{\sqrt{3}} = 400$$

$$\Rightarrow \frac{3h + h}{\sqrt{3}} = 400$$

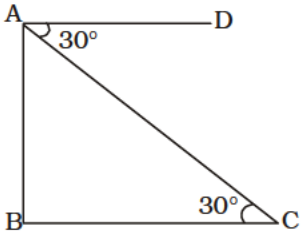
$$\Rightarrow 4h = 400\sqrt{3}$$

$$\Rightarrow h = \frac{400\sqrt{3}}{4}$$

$$= 100\sqrt{3} \text{ metre}$$

$$= 100 \times 1.732 = 173.2 \text{ metre}$$

9. (2)



AB = Height of light house

= 20 metre

= 20 metre

$\angle DAC = \angle ACB = 30°$

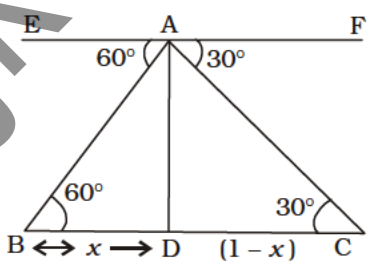
In ΔABC

$$\tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{20}{BC}$$

$$\Rightarrow BC = 20\sqrt{3} \text{ metre}$$

10. (3)



A = Position of aeroplane

B and C are km stones,

$\angle ABD = 60°$, $\angle ACD = 30°$

BD = x km.

$\therefore$ CD = (1 – x) km.

In ΔABD,

$$\tan 60° = \frac{AD}{BD}$$

$$\Rightarrow \sqrt{3} = \frac{AD}{x}$$

$$\Rightarrow AD = \sqrt{3}\, x \text{ km.} \quad ...(i)$$

In ΔACD,

$$\tan 30° = \frac{AD}{CD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AD}{1 - x}$$

$$\Rightarrow AD = \frac{1 - x}{\sqrt{3}} \text{ km.} \quad ...(ii)$$

$\therefore$ From equations (i) and (ii),

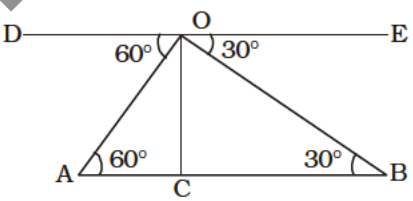
$$\sqrt{3}\, x = \frac{1 - x}{\sqrt{3}}$$

$$\Rightarrow 3x = 1 - x$$

$$\Rightarrow 4x = 1 \Rightarrow x = \frac{1}{4} \text{ km.}$$

$$\therefore AD = \sqrt{3}\, x = \frac{\sqrt{3}}{4} \text{ km.}$$

11. (4)



OC = Height of plane = h km (let)

$\angle DOA = \angle OAC = 60°$;

$\angle BOE = \angle OBC = 30°$

AB = 2 km.

AC = x km (let)

$\therefore$ BC = (2 – x) km.

From, ΔOAC

$$\tan 60° = \frac{OC}{AC}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow x = \frac{h}{\sqrt{3}} \text{ km.} \quad ....(i)$$

From ΔOBC,

$$\tan 30° = \frac{OC}{CB}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{2 - x}$$

$$\Rightarrow \sqrt{3}\, h = 2 - \frac{h}{\sqrt{3}}$$

[From equation(i)]

$$\Rightarrow \sqrt{3}\, h + \frac{h}{\sqrt{3}} = 2$$

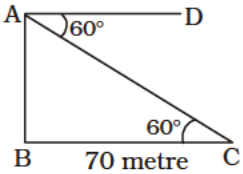
$$\Rightarrow \frac{3h + h}{\sqrt{3}} = 2$$

$\Rightarrow 4h = 2\sqrt{3}$

$\Rightarrow h = \frac{2\sqrt{3}}{4} = \frac{\sqrt{3}}{2}$ km.

$= \frac{1.732}{2} = 0.866$ km.

12. (2)



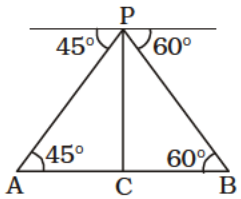
AB = Tower = h metre (let)
$\angle DAC = \angle ACB = 60°$
BC = 70 metre
In ΔABC,

$\tan 60° = \frac{AB}{BC}$

$\Rightarrow \sqrt{3} = \frac{h}{70}$

$\Rightarrow h = 70\sqrt{3}$ metre

13. (1)



P = Position of pilot ;
PC = 200 metre
AB = width of river
AC = x metre (let)
CB = y metre (let)
$\angle PAC = 45°$; $\angle PBC = 60°$
In Δ APC,

$\tan 45° = \frac{PC}{AC}$

$\Rightarrow 1 = \frac{200}{x}$

$\Rightarrow x = 200$ metre
In Δ PCB,

$\tan 60° = \frac{PC}{CB}$

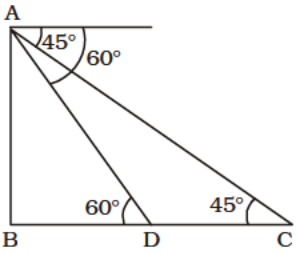
$\Rightarrow \sqrt{3} = \frac{200}{y}$

$\Rightarrow y = \frac{200}{\sqrt{3}}$ metre

$\therefore$ Width of river = $x + y$

$= \left(200 + \frac{200}{\sqrt{3}}\right)$ metre

14. (3)



AB = height of hill = h metre
Let speed of vehicle be v metre/minute.
Time taken to reach B from D = t minutes
CD = $10v$ metre
BD = vt metre
In ΔABC,

$\tan 45° = \frac{AB}{BC}$

$\Rightarrow 1 = \frac{h}{BC}$

$\Rightarrow BC = h$
$= (10v + vt)$ metre ....(i)
In ΔABD,

$\tan 60° = \frac{AB}{BD}$

$\Rightarrow \sqrt{3} = \frac{h}{vt}$

$\Rightarrow h = \sqrt{3}\,vt$

$\Rightarrow 10v + vt = \sqrt{3}\,vt$

$\Rightarrow 10 = \sqrt{3}\,t - t$

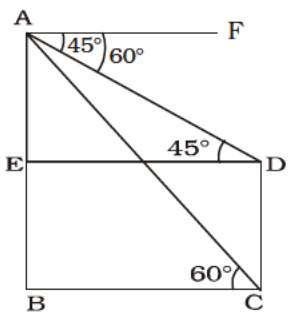
$\Rightarrow 10 = t\left(\sqrt{3} - 1\right)$

$\Rightarrow t = \frac{10}{\sqrt{3} - 1}$

$= \frac{10\left(\sqrt{3} + 1\right)}{\left(\sqrt{3} - 1\right)\left(\sqrt{3} + 1\right)} = \frac{10\left(\sqrt{3} + 1\right)}{2}$

$= 5\,(1.732 + 1) = 5 \times 2.732$
$= 13.66$ minutes
$= 13$ minutes 40 seconds

15. (1)



AB = Height of cliff = 100 metre.
CD = Height of tower = h metre.
$\angle ADE = 45°$, $\angle ACB = 60°$
In ΔABC,

$\tan 60° = \frac{AB}{BC}$

$\Rightarrow \sqrt{3} = \frac{100}{BC}$

$\Rightarrow BC = \frac{100}{\sqrt{3}}$ metre .... (i)

In ΔADE,

$\tan 45° = \frac{AE}{DE}$

$\Rightarrow 1 = \frac{AE}{BC} = \frac{100 - h}{BC}$

$\Rightarrow BC = 100 - h$

$\therefore \frac{100}{\sqrt{3}} = 100 - h$

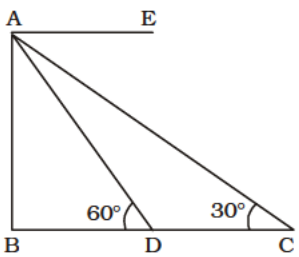
$\Rightarrow h = 100 - \frac{100}{\sqrt{3}}$

$= \frac{100\sqrt{3} - 100}{\sqrt{3}}$

$= \frac{100\left(\sqrt{3} - 1\right)}{\sqrt{3}} = \frac{100\sqrt{3}\left(\sqrt{3} - 1\right)}{3}$

$= \frac{100\left(3 - \sqrt{3}\right)}{3}$ metre

16. (1)



Let speed of boat
= v metre/minute
Time taken to reach B from D = t minutes
$\angle ACB = 30°$; $\angle ADB = 60°$
AB = Tower
In ΔABC,

$\tan 30° = \frac{AB}{BC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{vt + 10v}$

$\Rightarrow AB = \dfrac{vt + 10v}{\sqrt{3}}$

In ΔABD,

$\tan 60° = \dfrac{AB}{BD}$

$\Rightarrow \sqrt{3} = \dfrac{AB}{vt}$

$\Rightarrow \sqrt{3}\, vt = AB$

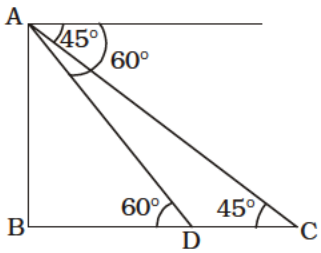
$\Rightarrow \sqrt{3}\, vt = \dfrac{10v + vt}{\sqrt{3}}$

$\Rightarrow 3t = 10 + t$

$\Rightarrow 2t = 10$

$\Rightarrow t = 5$ minutes

17. (2)



CD = 2 metre

BD = x metre

AB = Tree = h metre

From Δ ABC,

$\tan 45° = \dfrac{AB}{BC}$

$\Rightarrow 1 = \dfrac{h}{x+2}$

$\Rightarrow h = (x + 2)$ metre .....(i)

From Δ ABD,

$\tan 60° = \dfrac{AB}{BD}$

$\Rightarrow \sqrt{3} = \dfrac{h}{x}$

$\Rightarrow x = \dfrac{h}{\sqrt{3}}$ .... (ii)

From equations (i) and (ii),

$h = \dfrac{h}{\sqrt{3}} + 2$

$\Rightarrow h - \dfrac{h}{\sqrt{3}} = 2$

$\Rightarrow \dfrac{\sqrt{3}h - h}{\sqrt{3}} = 2$

$\Rightarrow h\left(\sqrt{3} - 1\right) = 2\sqrt{3}$

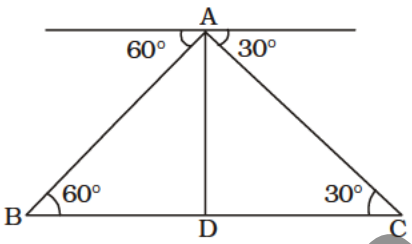
$\Rightarrow h = \dfrac{2\sqrt{3}}{\sqrt{3} - 1}$

$= \dfrac{2\sqrt{3}\left(\sqrt{3} + 1\right)}{\left(\sqrt{3} - 1\right)\left(\sqrt{3} + 1\right)}$

$= \dfrac{2\sqrt{3}\left(\sqrt{3} + 1\right)}{3 - 1} = \sqrt{3}\left(\sqrt{3} + 1\right)$

$= \left(3 + \sqrt{3}\right)$ metre

18. (3)



AD = Cliff = 180 metre

$\angle ABD = 60°$, $\angle ACD = 30°$

From ΔABD,

$\tan 60° = \dfrac{AD}{BD}$

$\Rightarrow \sqrt{3} = \dfrac{180}{BD}$

$\Rightarrow BD = \dfrac{180}{\sqrt{3}} = 60\sqrt{3}$ metre

From ΔACD,

$\tan 30° = \dfrac{AD}{CD}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{180}{CD}$

$\Rightarrow CD = 100\sqrt{3}$ metre

$\therefore$ BC = BD + DC

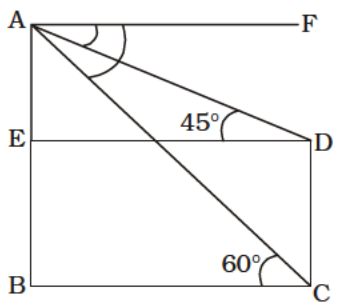
$= 60\sqrt{3} + 180\sqrt{3}$

$= 240\sqrt{3}$ metre

$= (240 \times 1.732)$ metre

$= 415.68$ metre

19. (3)



AB = height of tower

= 60 metre

BE = CD = height of pole

= h metre

BC = ED = x metre

In Δ AED,

$\tan 45° = \dfrac{AE}{ED}$

$\Rightarrow 1 = \dfrac{60 - h}{x}$

$\Rightarrow x$

$= 60 - h$ ... (i)

In Δ ABC,

$\tan 60° = \dfrac{AB}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{60}{x}$

$\Rightarrow \sqrt{3}\, x = 60$

$\Rightarrow x = \dfrac{60}{\sqrt{3}} = 20\sqrt{3}$ metre

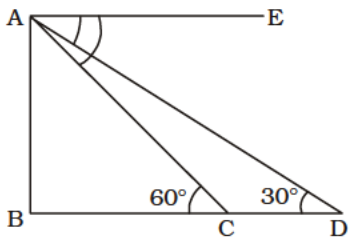
From equation (i),

$20\sqrt{3} = 60 - h$

$\Rightarrow h = 60 - 20\sqrt{3}$

$= 20\left(3 - \sqrt{3}\right)$ metre

20. (1)



AD = Height of helicopter

= 1500 metre

C and D $\Rightarrow$ positions of ships

$\angle ADB = 30°$; $\angle ACB = 60°$

Let, BC = x metre and BD = y metre

In ΔABD,

$\tan 30° = \dfrac{AB}{BD}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{1500}{y}$

$\Rightarrow y = 1500\sqrt{3}$ metre ...(i)

In ΔABC,

$\tan 60° = \dfrac{AB}{BC}$

$\Rightarrow \sqrt{3} = \dfrac{1500}{x}$

$\Rightarrow x = \dfrac{1500}{\sqrt{3}}$

$= 500\sqrt{3}$ metre ...(ii)

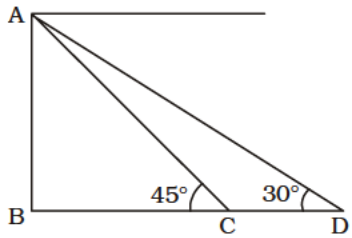
$\therefore$ Distance between ships

$= (y - x)$ metre

$= \left(1500\sqrt{3} - 500\sqrt{3}\right)$ metre

$= 1000\sqrt{3}$ metre

21. (1)



AB = Height of light-post = h metre

CD = 200 metre;

C and D ⇒ positions of ships

$\angle ACB = 45°$; $\angle ADB = 30°$

In ΔABC,

$$\tan 45° = \frac{AB}{BC}$$

$$\Rightarrow 1 = \frac{AB}{BC} \Rightarrow AB = BC = h \text{ metre}$$

In ΔABD,

$$\tan 30° = \frac{AB}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{h + 200}$$

$$\Rightarrow \sqrt{3}h = h + 200$$

$$\Rightarrow \sqrt{3}h - h = 200$$

$$\Rightarrow h(\sqrt{3} - 1) = 200$$

$$\Rightarrow h = \frac{200}{\sqrt{3} - 1}$$

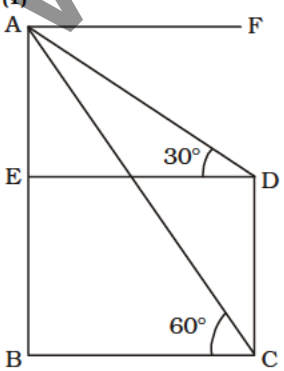
$$= \frac{200\left(\sqrt{3} + 1\right)}{\left(\sqrt{3} - 1\right)\left(\sqrt{3} + 1\right)}$$

$$= \frac{200\left(\sqrt{3} + 1\right)}{2}$$

= 100 (1.73 + 1) metre

= 273 metre

22. (1)



AB = Height of building = 60 metre

CD = Height of tower = h metre

$\angle FAD = \angle ADE = 30°$

$\angle FAC = \angle ACB = 60°$

From ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{60}{BC}$$

$$\Rightarrow BC = \frac{60}{\sqrt{3}} = 20\sqrt{3} \text{ metre} = DE$$

From ΔADE,

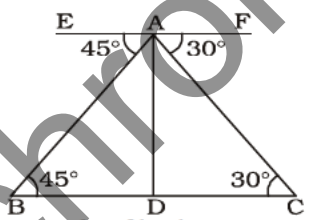
$$\tan 30° = \frac{AE}{ED}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{60 - h}{20\sqrt{3}}$$

$$\Rightarrow 60 - h = \frac{20\sqrt{3}}{\sqrt{3}} = 20$$

$$\Rightarrow h = 60 - 20 = 40 \text{ metre}$$

23. (2)



AD = Height of bridge = 2.5 metre

$\angle EAB = \angle ABD = 45°$; $\angle FAC = \angle ACD = 30°$

In ΔABD,

$$\tan 45° = \frac{AD}{BD} \Rightarrow 1 = \frac{2.5}{BD}$$

$\Rightarrow$ BD = 2.5 metre

In ΔACD,

$$\tan 30° = \frac{AD}{CD} \Rightarrow \frac{1}{\sqrt{3}} = \frac{2.5}{CD}$$

$$\Rightarrow CD = 2.5\sqrt{3} \text{ metre}$$

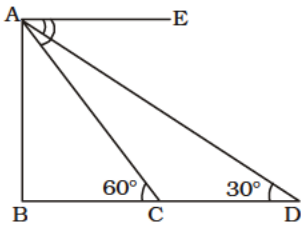
CD = (2.5 × 1.732) metre

= 4.33 metre

$\therefore$ BC = (2.5 + 4.33) metre

= 6.83 metre

24. (3)



AB = Height of observation tower = h metre

C and D = Positions of boat

BC = 50 metre

Let, CD = x metre

$\angle ACB = 60° = \angle EAC$

$\angle ADB = 30° = \angle EAD$

In ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{h}{50}$$

$$\Rightarrow h = 50\sqrt{3} \text{ metre}$$

In ΔABD,

$$\tan 30° = \frac{AB}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{50\sqrt{3}}{50 + x}$$

$$\Rightarrow 50 + x = 50\sqrt{3} \times \sqrt{3} = 150$$

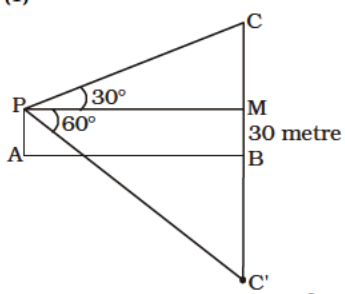
$$\Rightarrow x = 150 - 50 = 100 \text{ metre}$$

$$\therefore \text{ Speed of boat} = \frac{\text{Distance}}{\text{Time}}$$

$$= \left(\frac{100}{8}\right) \text{ m/sec.}$$

$$= \left(\frac{100}{8} \times \frac{18}{5}\right) \text{ kmph}$$

25. (1)



AB = transparent water-surface

$\angle CPM = 30°$; $\angle C'PM = 60°$

CM = h

CB = h + 30

$\therefore$ C'B = h + 30

In ΔCMP,

$$\tan 30° = \frac{CM}{PM}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{PM}$$

$$\Rightarrow PM = \sqrt{3}\,h \qquad \text{..... (i)}$$

In $\Delta PMC'$

$$\tan 60° = \frac{C'M}{PM}$$

$$\Rightarrow \sqrt{3} = \frac{h + 30 + 30}{PM}$$

$$\Rightarrow PM = \frac{h + 60}{\sqrt{3}} \qquad \text{..... (ii)}$$

$$\therefore \sqrt{3}\,h = \frac{h + 60}{\sqrt{3}}$$

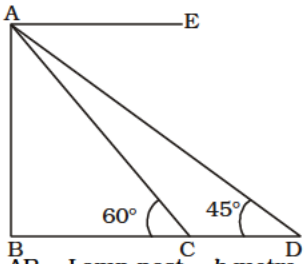
$$\Rightarrow 3h = h + 60$$

$$\Rightarrow 2h = 60 \Rightarrow h = 30$$

$\therefore$ CB = BM + CM = 30 + 30

= 60 metre

26. (3)



AB = Lamp post = h metre
C and D = Positions of ships
CD = 300 metre; BC = x metre
$\angle ACB = 60$ metre; $\angle ADB = 45°$
In ΔABC,

$$\tan 60° = \frac{AB}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{h}{x}$$

$$\Rightarrow h = \sqrt{3}x \quad \text{..... (i)}$$

In ΔABD,

$$\tan 45° = \frac{AB}{BD}$$

$$\Rightarrow 1 = \frac{h}{x+300}$$

$$\Rightarrow h = x + 300$$

$$\Rightarrow h = \frac{h}{\sqrt{3}} + 300$$

$$\Rightarrow h - \frac{h}{\sqrt{3}} = 300$$

$$\Rightarrow \frac{\sqrt{3}h - h}{\sqrt{3}} = 300$$

$$\Rightarrow h\left(\sqrt{3}-1\right) = 300\sqrt{3}$$

$$\Rightarrow h = \frac{300\left(\sqrt{3}\right)}{\sqrt{3}-1}$$

$$= \frac{300\sqrt{3}\left(\sqrt{3}+1\right)}{\left(\sqrt{3}-1\right)\left(\sqrt{3}+1\right)}$$

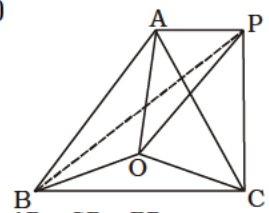
$$= \frac{300\left(3+\sqrt{3}\right)}{2}$$

$$= 150\left(3+\sqrt{3}\right) \text{ metre}$$

= 45 kmph.

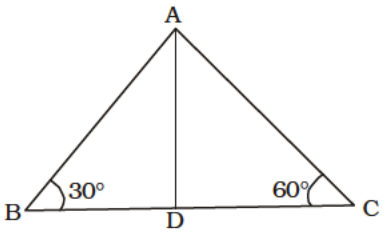
TYPE-V

1. (2)



AP = CP = BP
It is possible only when
OA = OB = OC i.e. radii of circum circle. or, (circumcentre)

2. (4)



$12\sqrt{3}$ cm.
BD = x cm. (let)

$$\therefore \text{CD} = \left(12\sqrt{3} - x\right) \text{ cm.}$$

$\angle ADB = \angle ADC = 90°$
From ΔABD,

$$\tan 30° = \frac{AD}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AD}{x}$$

$$\Rightarrow AD = \frac{x}{\sqrt{3}} \quad \text{.... (i)}$$

From ΔACD,

$$\tan 60° = \frac{AD}{CD}$$

$$\Rightarrow \sqrt{3} = \frac{AD}{12\sqrt{3} - x}$$

$$\Rightarrow AD = \sqrt{3}\left(12\sqrt{3} - x\right)$$

$$= 36 - \sqrt{3}x \quad \text{.... (ii)}$$

$$\therefore \frac{x}{\sqrt{3}} = 36 - \sqrt{3}x$$

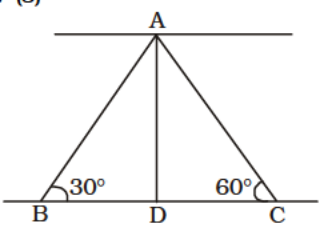
$$\Rightarrow x = 36\sqrt{3} - 3x$$

$$\Rightarrow 4x = 36\sqrt{3}$$

$$\Rightarrow x = \frac{36\sqrt{3}}{4} = 9\sqrt{3}$$

$$\therefore AD = \frac{x}{\sqrt{3}} = \frac{9\sqrt{3}}{\sqrt{3}} = 9 \text{ cm.}$$

3. (3)



100 metre
BD = x metre (let)
$\therefore$ CD = (100 – x) metre
AD $\perp$ BC; AD = y metre
From ΔABD,

$$\tan 30° = \frac{AD}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{y}{x}$$

$$\Rightarrow x = \sqrt{3}\,y \quad \text{....(i)}$$

From ΔACD

$$\tan 60° = \frac{y}{100-x}$$

$$\Rightarrow \sqrt{3} = \frac{y}{100-x}$$

$$\Rightarrow y = 100\sqrt{3} - \sqrt{3}x$$

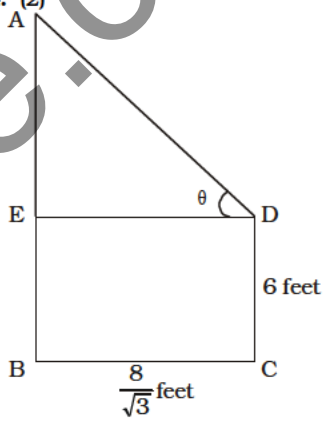
$$\Rightarrow y = 100\sqrt{3} - \sqrt{3} \times \sqrt{3}\,y$$

$$\Rightarrow y = 100\sqrt{3} - 3y$$

$$\Rightarrow 4y = 100\sqrt{3}$$

$$\Rightarrow y = 25\sqrt{3} \text{ metre}$$

4. (2)



$$\text{AB} = \text{Tree} = \frac{26}{3} \text{ feet}$$

BE = CD = 6 feet

$$\text{AE} = \text{AB} - \text{BE} = \frac{26}{3} - 6$$

$$= \frac{26-18}{3} = \frac{8}{3} \text{ feet}$$

$$\text{DE} = \text{BC} = \frac{8}{\sqrt{3}} \text{ feet}$$

From ΔAED,

$$\tan\theta = \frac{AE}{ED} = \frac{\frac{8}{3}}{\frac{8}{\sqrt{3}}}$$

$$= \frac{8}{3} \times \frac{\sqrt{3}}{8} = \frac{1}{\sqrt{3}}$$

$\therefore \tan\theta = \tan 30° \Rightarrow \theta = 30°$

5. (2) $x = a\cos\theta + b\sin\theta$ .... (i)
$y = b\cos\theta - a\sin\theta$ ... (ii)
On squaring both equations and adding.
$x^2 + y^2 = a^2\cos^2\theta + b^2\sin^2\theta + 2ab\sin\theta.\cos\theta + b^2\cos^2\theta + a^2\sin^2\theta - 2ab\sin\theta.\cos\theta$
$= a^2\cos^2\theta + a^2\sin^2\theta + b^2\sin^2\theta + b^2\cos^2\theta$
$= a^2(\cos^2\theta + \sin^2\theta) + b^2(\sin^2\theta + \cos^2\theta)$
$= a^2 + b^2$ [$\because \cos^2\theta + \sin^2\theta = 1$]

TEST YOURSELF

1. If $\sec\theta + \tan\theta = \sqrt{2}$, find the value of $\sin\theta$.

(1) $\frac{1}{2}$ (2) $\frac{1}{4}$

(3) $\frac{1}{\sqrt{2}}$ (4) $\frac{1}{3}$

2. If $\sin A = \frac{3}{5}$ and $\cos B = \frac{12}{13}$, what is the value of $\frac{\tan A - \tan B}{1 + \tan A \tan B}$; it being given that A and B are acute angles?

(1) $\frac{15}{63}$ (2) $\frac{19}{63}$

(3) $\frac{17}{65}$ (4) $\frac{16}{63}$

3. Find the value of $\sin^2 1° + \sin^2 3° + \sin^2 5° + \ldots\ldots \sin^2 87° + \sin^2 89°$.

(1) $23\frac{1}{2}$ (2) $22\frac{1}{2}$

(3) $11\frac{1}{2}$ (4) $12\frac{1}{2}$

4. To a man standing at the mid point of the line joining the feet of two vertical poles of same height. the angle of elevation of the tip of each pole is 30°. When the man advances a distance of 40 metres towards one pole, the angle of elevation of the tip of this pole is 60°. What is the distance between the two poles ?

(1) 120 metre (2) 110 metre

(3) 130 metre (4) 115 metre

5. If α be an acute angle and $a \sin\alpha - b\cos\alpha = 0$, what will be the values of $\sin\alpha$ and $\cos\alpha$ in terms of a and b ?

(1) $\frac{b}{\sqrt{a^2+b^2}}, \frac{a}{\sqrt{a^2+b^2}}$

(2) $\frac{-b}{\sqrt{a^2+b^2}}, \frac{a}{\sqrt{a^2+b^2}}$

(3) $\frac{b}{\sqrt{a^2+b^2}}, \frac{-a}{\sqrt{a^2+b^2}}$

(4) $\frac{b^2}{\sqrt{a^2+b^2}}, \frac{a^2}{\sqrt{a^2+b^2}}$

6. Find the simplest numerical value of $3(\sin x - \cos x)^4 + 4(\sin^6 x + \cos^6 x) + 6(\sin x + \cos x)^2$

(1) 12 (2) 10

(3) 21 (4) 13

7. If $3\cos\theta + 4\sin\theta = 5$, then $\tan\theta$ = ?

(1) $\frac{4}{3}$ (2) $\frac{3}{4}$

(3) $\frac{3}{5}$ (4) $\frac{5}{3}$

8. The angular elevation of the top of a tower from a distant point on the horizontal ground is observed to be 30° and proceeding 30 metres from the point towards the foot of the tower it is observed to be 45°. Find the height of the tower.

(1) 15 metre

(2) $15\sqrt{3}$ metre

(3) $15(\sqrt{3}+1)$ metre

(4) None of these

9. If $\tan\theta = \frac{a}{b}$, find the value of $\frac{a\sin^3\theta - b\cos^3\theta}{a\sin^3\theta + b\cos^3\theta}$.

(1) $\frac{a^4-b^4}{a^4+b^4}$ (2) $\frac{a^4+b^4}{a^4-b^4}$

(3) $\frac{a^3-b^3}{a^3+b^3}$ (4) $\frac{a^3+b^3}{a^3-b^3}$

10. If $0° < \theta < 90°$, and $\tan^2\theta - (\sqrt{3}+1)\tan\theta + \sqrt{3} = 0$, then θ = ?

(1) 30° (2) 45°

(3) 60° (4) 45° or 60°

11. If $4x^2 - 4x\sec\theta + 1 = 0$, then $\sec\theta + \tan\theta$ = ?

(1) $2x$ (2) $\frac{1}{2x}$

(3) $3x$ (4) $2x$ or $\frac{1}{2x}$

12. If $\cos\theta + \sec\theta = 2$, then $\cos^5\theta + \sec^5\theta$ = ?

(1) 1 (2) 2

(3) –1 (4) –2

13. If $\cos\theta - \sin\theta = \sqrt{2}\sin\theta$, then $\cos\theta + \sin\theta$ = ?

(1) $2\cos\theta$ (2) $2\sin\theta$

(3) $\sqrt{2}\cos\theta$ (4) None of these

14. The shadow of a vertical tower becomes 30 metres longer when the altitude of the sun changes from 60° to 45°. Find the height of the tower.

(1) $15\sqrt{3}$ metres

(2) $15(3+\sqrt{3})$ metres

(3) $15(3-\sqrt{3})$ metres

(4) $12(3+\sqrt{3})$ metres

15. Evaluate :

$\frac{\sec 39°}{\text{cosec } 51°} + \frac{2}{\sqrt{3}}(\tan 17° \cdot \tan 38° \cdot \tan 60° \cdot \tan 52° \cdot \tan 73° - 3(\sin^2 31° + \sin^2 59°)$

(1) 2 (2) 3

(3) 0 (4) –2

16. If $\frac{\cos\alpha}{\cos\beta} = m$ and $\frac{\cos\alpha}{\sin\beta} = n$, then $(m^2 + n^2)\cos^2\beta$ = ?

(1) 1 (2) $2n^2$

(3) $n^2 + 3$ (4) n^2

17. If α, β and γ each is positive acute angle, and $\sin(\alpha + \beta - \gamma) = \frac{1}{2}$, $\cos(\beta + \gamma - \alpha) = \frac{1}{2}$ and $\tan(\gamma + \alpha - \beta) = 1$ then $2\alpha + \beta$ = ?

(1) 105° (2) 115°

(3) 110° (4) 120°

18. Evaluate :

$\frac{\tan^2 60 + 4\cos^2 45 + 3\sec^2 30 + 5\cos^2 90}{\text{cosec } 30 + \sec 60 - \cot^2 30}$

(1) 4 (2) 9

(3) 7 (4) 1

19. If A + B = 90°, then

$\sqrt{\frac{\tan A \cdot \tan B + \tan A \cdot \cot B}{\sin A \cdot \sec B} - \frac{\sin^2 B}{\cos^2 A}}$ = ?

(1) 2 tan A (2) tan A

(3) $\tan^2 A$ (4) $2\cot^2 B$

20. $\frac{\sin A - \sin B}{\cos A + \cos B} + \frac{\cos A - \cos B}{\sin A + \sin B}$ = ?

(1) 1 (2) cos A

(3) sin A (4) 0

21. $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1$ = ?

(1) 1 (2) 0

(3) –1 (4) 2

TRIGONOMETRY

22. If $\sin\theta + \sin^2\theta + \sin^3\theta = 1$, then, $\cos^6\theta - 4\cos^4\theta + 8\cos^2\theta = ?$
(1) 2 (2) 3
(3) 4 (4) 0

23. The shadow of a vertical tower increases 10 metre, when the altitude of the sun changes from 45° to 30°. What is the height of tower ? ($\pi = 1.73$)
(1) 12.65 metre (2) 13.65 metre
(3) 14.65 metre (4) 16.65 metre

24. The angle of elevation of an aeroplane from a point A on the ground is 60°. After a straight flight of the plane for 30 seconds, the angle of elevation becomes 30°. If the palne flies at a constant height of $3600\sqrt{3}$ metre, what is the speed of plane ?
(1) 864 kmph (2) 846 kmph
(3) 684 kmph (4) None of these

25. $\sin 75° + \sin 15°$ can be expressed as
(1) $\frac{\sqrt{3}}{2}$ (2) $\frac{2}{\sqrt{3}}$
(3) $\sqrt{\frac{2}{3}}$ (4) $\sqrt{\frac{3}{2}}$

26. What will be the value of $2\cos 45° \cdot \sin 15°$
(1) $\frac{\sqrt{3}+1}{2}$ (2) $\frac{\sqrt{3}-2}{2}$
(3) $\frac{\sqrt{3}-1}{2}$ (4) $\frac{2}{\sqrt{3}+1}$

27. The value of $\sin 22\frac{1}{2}$ will be
(1) $\sqrt{2}-1$ (2) $\frac{\sqrt{2}+1}{2\sqrt{2}}$
(3) $\frac{\sqrt{2}-1}{\sqrt{2}}$ (4) $\sqrt{\frac{\sqrt{2}-1}{2\sqrt{2}}}$

28. The value of $\frac{\cos\alpha + \cos\beta}{\sin\alpha + \sin\beta}$ will be
(1) $\tan\left(\frac{\alpha+\beta}{2}\right)$
(2) $\cot\left(\frac{\alpha+\beta}{2}\right)$
(3) $\tan\left(\frac{\alpha-\beta}{2}\right)$
(4) $\cot\left(\frac{\alpha-\beta}{2}\right)$

29. Which of the folliwing is correct ?
(1) $\sin 1° > \sin 1$
(2) $\sin 1° < \sin 1$
(3) $\sin 1° = \sin 1$
(4) $\sin 1° = \frac{\pi}{18°}\sin 1$

30. If $\tan\alpha = \frac{m}{m+1}$, $\tan\beta = \frac{1}{2m+1}$, then $\alpha + \beta$ equal to
(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{6}$
(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{4}$

31. If $\alpha + \beta = \frac{\pi}{4}$, then the value of $(1 + \tan\alpha)(1 + \tan\beta)$ is
(1) 1 (2) 2
(3) –2 (4) 5

32. If $\tan A = \frac{1-\cos B}{\sin B}$, then $\tan 2A$ is equal to
(1) cot B (2) tan B
(3) cos B (4) cosec B

33. The value of $\sin(45° + \theta) - \cos(45° - \theta)$ is
(1) $2\cos\theta$ (2) $2\sin\theta$
(3) 1 (4) 0

34. The value of $2\cos\frac{\pi}{13}\cos\frac{9\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$ is
(1) $\frac{1}{2}$ (2) 0
(3) $-\frac{1}{2}$ (4) $\frac{1}{8}$

35. If $\sin\theta + \cos\theta = 1$, then the value of $\sin 2\theta$ is equal to
(1) 1 (2) $\frac{1}{2}$
(3) 0 (4) – 1

36. If $\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$, then the value of $\frac{\tan x}{\tan y}$ is equal to
(1) $\frac{2a}{b}$ (2) $\frac{a}{b}$
(3) $\frac{a}{2b}$ (4) $\frac{2a}{3b}$

37. The value of $\frac{3\cos\theta + \cos 3\theta}{3\sin\theta - \sin 3\theta}$ is equal to
(1) $\tan^3\theta$ (2) $\cot^3\theta$
(3) $\sin^3\theta$ (4) $\cos^3\theta$

38. The value of $\sin\frac{5\pi}{12}\sin\frac{\pi}{12}$ is
(1) $\frac{1}{4}$ (2) $\frac{1}{8}$
(3) $\frac{1}{5}$ (4) $\frac{1}{6}$

39. The value of $\frac{\cos(\pi + x)\cos(-x)}{\sin(\pi - x)\cos\left(\frac{\pi}{2} + x\right)}$ is
(1) $\tan^2 x$ (2) $\cos^2 x$
(3) $\cot^2 x$ (4) $\sec^2 x$

40. The value of $\frac{\sin 50°}{\sin 130°} + \frac{\cos 70°}{\cos 110°} - 2\tan^2 225°$ is equal to
(1) 1 (2) –2
(3) 2 (4) 0

41. What is the value of $\sin 240°$?
(1) $\frac{\sqrt{3}}{2}$ (2) $-\frac{\sqrt{3}}{2}$
(3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

42. If $\cot(A + B) = x$, then value of x is
(1) $\frac{\cot A \cot B - 1}{\cot A + \cot B}$
(2) $\frac{\cot A \cot B + 1}{\cot A - \cot B}$
(3) $\frac{\cot A \cot B - 1}{\cot B - \cot A}$
(4) $\frac{\cot A \cdot \cot B - 1}{\cot A - \cot B}$

TRIGONOMETRY

43. What is the value of $\cos\left(\frac{7\pi}{4}\right)$?

(1) 0 (2) 1

(3) 2 (4) $\frac{1}{\sqrt{2}}$

44. What is the value of $\tan\left(\frac{5\pi}{6}\right)$ $\sin\left(\frac{7\pi}{6}\right)$?

(1) $\frac{1}{\sqrt{3}}$ (2) $\frac{2}{\sqrt{3}}$

(3) $\frac{1}{2\sqrt{3}}$ (4) $\frac{1}{2}$

45. What is the value of $\tan 56°$?

(1) $\frac{\cos 11° - \sin 11°}{\cos 11° + \sin 11°}$

(2) $\frac{\cos 11° + \sin 11°}{\cos 11° - \sin 11°}$

(3) $\frac{\cos 11° + \sin 11°}{\sin 11° - \cos 11°}$

(4) $\frac{\sin 11° - \cos 11°}{\cos 11° + \sin 11°}$

46. What is the value of A ?

$A = \left(\frac{\cos\theta}{\sin(90+\theta)} + \frac{\sin(-\theta)}{\sin(180+\theta)} - \frac{\tan(90+\theta)}{\cot+\theta}\right)$?

(1) 1 (2) 2

(3) 3 (4) 4

47. What is the value of $\tan\left(\frac{\pi}{4} + x\right)$?

(1) $\frac{1-\tan x}{1+\tan x}$ (2) $\frac{1+\tan x}{1-\tan x}$

(3) $\frac{1+\cot x}{1-\cot x}$ (4) $\frac{1-\cot x}{1+\cot x}$

48. If cosC – cosD = y, then the value of y is

(1) $2\sin\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{C-D}{2}\right)$

(2) $2\cos\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$

(3) $-2\sin\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{C-D}{2}\right)$

(4) $-2\cos\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$

49. If $\sin x = \frac{1}{3}$, then the value of $\sin 3x$ will be

(1) $\frac{13}{27}$ (2) $\frac{27}{23}$

(3) $\frac{27}{13}$ (4) $\frac{23}{27}$

50. If $\sin x \cdot \cos y + \cos x \cdot \sin y = 1$, then the value of $x + y$ will be

(1) $\frac{\pi}{2}$ (2) $-\frac{\pi}{2}$

(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{4}$

51. If $\cos x = -\frac{3}{5}$ and $\pi < x < \frac{3\pi}{2}$, then the value of $\sin 2x$ will be

(1) $\frac{12}{25}$ (2) $\frac{1}{15}$

(3) $\frac{24}{25}$ (4) $\frac{5}{26}$

52. What is the value of $\tan 330°$?

(1) $\frac{1}{\sqrt{3}}$ (2) 0

(3) 1 (4) $-\frac{1}{\sqrt{3}}$

53. The degree measure of $\left(\frac{5\pi}{12}\right)$ will be

(1) 105° (2) 75°

(3) 85° (4) 110°

54. The radian measure of 120° will be

(1) $\frac{\pi}{3}$ (2) $\frac{3\pi}{2}$

(3) $\frac{\pi}{2}$ (4) $\frac{2\pi}{3}$

55. If $\tan\theta = \frac{x-y}{x+y}$, the value of $\sin\theta$ is equal to

[If $0° \le \theta \le 90°$]

(1) $\frac{x-y}{\sqrt{2(x^2+y^2)}}$

(2) $\frac{x+y}{\sqrt{2(x^2+y^2)}}$

(3) $\frac{x+y}{\sqrt{2(x^2-y^2)}}$

(4) $\frac{x-y}{\sqrt{2(x^2-y^2)}}$

56. If sinC + sinD = x, then the value of x is

(1) $2\sin\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$

(2) $2\sin\left(\frac{C-D}{2}\right)\cos\left(\frac{C+D}{2}\right)$

(3) $2\cos\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$

(4) $2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$

57. What is the angle in radian through which a pendulum swings and its length is 75 cm and the tip describes an arc of length 21 cm.

(1) $\left(\frac{3}{25}\right)^R$ (2) $\left(\frac{7}{25}\right)^R$

(3) $\left(\frac{4}{21}\right)^R$ (4) $\left(\frac{2}{15}\right)^R$

58. What will be the radius of circle in which a central angle of 60° intercepts an arc of length 37.4 cm.

(1) 35 cm (2) 34.7 cm

(3) 35.7 cm (4) 40 cm

59. What is the value of cosec (–1410°) ?

(1) $\frac{1}{\sqrt{3}}$ (2) 2

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{2}{\sqrt{3}}$

60. The value of cos $\left(\frac{\pi}{4} + x\right) + \cos\left(\frac{\pi}{4} - x\right)$ will be

(1) $\sqrt{2}\sin x$ (2) $\sqrt{2}\cos x$

(3) $\sqrt{2}\,\text{cosec}\,x$

(4) $\sqrt{2}\tan x$

61. The value of $\tan\frac{13\pi}{12}$ will be

(1) $\frac{\sqrt{3}+1}{\sqrt{3}-1}$ (2) $\frac{\sqrt{3}-1}{\sqrt{3}+1}$

(3) $\frac{\sqrt{3}}{\sqrt{3}+1}$ (4) $\frac{1}{\sqrt{3}-1}$

62. If $\cos\theta = -\frac{1}{2}$ and θ lies in third quadrant, then what will be the value of $\sin\theta + \tan\theta$

(1) $\frac{1}{2}$ (2) $\frac{2}{\sqrt{3}}$

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{1}{\sqrt{3}}$

63. What is the value of cos 105°?

(1) $\frac{1-\sqrt{3}}{2\sqrt{2}}$ (2) $\frac{1+\sqrt{3}}{2\sqrt{2}}$

(3) $\frac{\sqrt{3}-1}{2\sqrt{2}}$ (4) $\frac{\sqrt{3}}{2\sqrt{2}}$

64. The value of $\cos\left(\frac{\pi}{4}-\theta\right)$

$\cos\left(\frac{\pi}{4}-\phi\right) - \sin\left(\frac{\pi}{4}-\theta\right)$

$\sin\left(\frac{\pi}{4}-\phi\right)$ will be

(1) $\sin(\theta-\phi)$ (2) $\sin(\theta+\phi)$

(3) $\cos(\theta-\phi)$ (4) $\cos(\theta+\phi)$

SHORT ANSWERS

1. (4)	**2.** (4)	**3.** (2)	**4.** (1)
5. (1)	**6.** (4)	**7.** (1)	**8.** (3)
9. (1)	**10.** (4)	**11.** (4)	**12.** (2)
13. (3)	**14.** (2)	**15.** (3)	**16.** (4)
17. (4)	**18.** (2)	**19.** (2)	**20.** (4)
21. (2)	**22.** (3)	**23.** (2)	**24.** (1)
25. (4)	**26.** (3)	**27.** (4)	**28.** (2)
29. (2)	**30.** (4)	**31.** (2)	**32.** (2)
33. (4)	**34.** (2)	**35.** (3)	**36.** (2)
37. (2)	**38.** (1)	**39.** (3)	**40.** (2)
41. (2)	**42.** (1)	**43.** (4)	**44.** (3)
45. (2)	**46.** (3)	**47.** (2)	**48.** (3)
49. (4)	**50.** (1)	**51.** (3)	**52.** (4)
53. (2)	**54.** (4)	**55.** (1)	**56.** (4)
57. (2)	**58.** (3)	**59.** (2)	**60.** (2)
61. (2)	**62.** (3)	**63.** (1)	**64.** (2)

EXPLANATIONS

1. (4) $\sec\theta + \tan\theta = \sqrt{2}$ ....(i)

$\because \sec^2\theta - \tan^2\theta = 1$

$\Rightarrow (\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$\Rightarrow \sec\theta - \tan\theta = \frac{1}{\sqrt{2}}$ ....(ii)

On adding (i) and (ii),

$2\sec\theta = \sqrt{2} + \frac{1}{\sqrt{2}}$

$\Rightarrow \sec\theta = \frac{3}{2\sqrt{2}}$

On subtracting equation (ii) from (i),

$2\tan\theta = \sqrt{2} - \frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}}$

$\Rightarrow \tan\theta = \frac{1}{2\sqrt{2}}$

$\therefore \sin\theta = \frac{\tan\theta}{\sec\theta} = \frac{\frac{1}{2\sqrt{2}}}{\frac{3}{2\sqrt{2}}} = \frac{1}{3}$

2. (4) $\sin A = \frac{3}{5}$

$\therefore \cos A = \sqrt{1-\sin^2 A}$

$= \sqrt{1-\frac{9}{25}}$

$= \sqrt{\frac{25-9}{25}} = \sqrt{\frac{16}{25}} = \frac{4}{5}$

$\cos B = \frac{12}{13}$

$\sin B = \sqrt{1-\cos^2 B} = \sqrt{1-\left(\frac{12}{13}\right)^2}$

$= \sqrt{1-\frac{144}{169}} = \sqrt{\frac{169-144}{169}} = \sqrt{\frac{25}{169}} = \frac{5}{13}$

$\therefore \tan A = \frac{\sin A}{\cos A} = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4}$

$\tan B = \frac{\sin B}{\cos B} = \frac{\frac{5}{13}}{\frac{12}{13}} = \frac{5}{12}$

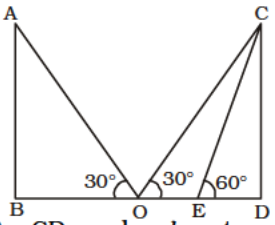
$\therefore \frac{\tan A - \tan B}{1+\tan A.\tan B} = \frac{\frac{3}{4}-\frac{5}{12}}{1+\frac{3}{4}.\frac{5}{12}}$

$= \frac{\frac{9-5}{12}}{1+\frac{5}{16}}$

$= \frac{\frac{1}{3}}{\frac{21}{16}} = \frac{1}{3}\times\frac{16}{21} = \frac{16}{63}$

3. (2) $\sin 89° = \sin(90° - 1°)$
$= \cos 1°$
$\sin 87° = \sin(90° - 3°)$
$= \cos 3°$
$\therefore \sin^2 1° + \sin^2 3° + ... + \sin^2 45° + ... + \sin^2 87° + \sin^2 89°$
$= (\sin^2 1° + \sin^2 89°) + (\sin^2 3° + \sin^2 87°) + ... \text{ to 22 terms} + \sin^2 45°$
$= (\sin^2 1° + \cos^2 1°) + (\sin^2 3° + \cos^2 3°) + ... \text{ to 22 terms} + \frac{1}{2}$
$= 22 + \frac{1}{2} = 22\frac{1}{2}$

4. (1)



AB = CD = pole = h metre
BO = OD = x metre
OE = 40 metre
ED = $(x - 40)$ metre
In Δ OCD,

$\tan 30° = \frac{CD}{OD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$

$\Rightarrow \sqrt{3}h = x$ ....(i)

In Δ CDE,

$\tan 60° = \frac{CD}{DE}$

$\Rightarrow \sqrt{3} = \frac{h}{x-40}$

$\Rightarrow \sqrt{3}(x-40) = h$

$\Rightarrow \sqrt{3}(x-40) = \frac{x}{\sqrt{3}}$

$\Rightarrow 3(x-40) = x$
$\Rightarrow 3x - 120 = x$
$\Rightarrow 2x = 120 \Rightarrow x = 60$
$\therefore$ BD = 2 × 60 = 120 metre

5. (1) $a\sin\alpha = b\cos\alpha$
$\Rightarrow a^2\sin^2\alpha = b^2\cos^2\alpha$
$\Rightarrow a^2\sin^2\alpha = b^2(1-\sin^2\alpha)$
$\Rightarrow a^2\sin^2\alpha + b^2\sin^2\alpha = b^2$
$\Rightarrow \sin^2\alpha(a^2 + b^2) = b^2$

$\Rightarrow \sin^2\alpha = \frac{b^2}{a^2+b^2}$

$\Rightarrow \sin\alpha = \dfrac{b}{\sqrt{a^2+b^2}}$

Again,
$a^2 \sin^2\alpha = b^2 \cos^2\alpha$
$\Rightarrow a^2 (1 - \cos^2\alpha) = b^2 \cos^2\alpha$
$\Rightarrow a^2 = (a^2 + b^2) \cos^2 \alpha$

$\Rightarrow \cos^2 \alpha = \dfrac{a^2}{a^2+b^2}$

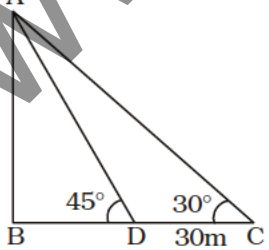
$\Rightarrow \cos \alpha = \dfrac{a}{\sqrt{a^2+b^2}}$

6. (4) $3 (\sin x - \cos x)^4$
$= 3 (\sin^2 x + \cos^2 x - 2 \sin x . \cos x)^2$
$= 3 (1 - 2\sin x. \cos x)^2$
$= 3 (1 + 4 \sin^2 x . \cos^2 x - 4 \sin x . \cos x)$
$4 (\sin^6 x + \cos^6 x)$
$= 4 [(\sin^2 x + \cos^2 x)^3 - 3 \sin^2 x.\cos^2 x (\sin^2 x + \cos^2 x)$
$[a^3 + b^3 = (a+b)^3 - 3ab (a+b)]$
$= 4 (1 - 3 \sin^2 x . \cos^2 x)$
$= 6 (\sin x + \cos x)^2$
$= 6 (\sin^2 x + \cos^2 x + 2 \sin x. \cos x)$
$= 6 (1 + 2 \sin x . \cos x)$
$\therefore$ Expression
$= 3 (1 + 4 \sin^2 x . \cos^2 x - 4 \sin x . \cos x)$
$+ 4 (1 - 3 \sin^2 x . \cos^2 x) + 6 (1 + 2 \sin x . \cos x)$
$= 3 + 4 + 6 = 13$

7. (1) $3 \cos\theta + 4 \sin\theta = 5$
Dividing by $\cos\theta$,
$3 + 4 \tan\theta = 5 \sec\theta$
On squaring,
$9 + 16 \tan^2\theta + 24 \tan\theta = 25 (1 + \tan^2\theta)$
$\Rightarrow 9 \tan^2\theta - 24 \tan\theta + 16 = 0$
$\Rightarrow (3 \tan\theta - 4)^2 = 0$
$\Rightarrow 3 \tan\theta = 4$

$\Rightarrow \tan\theta = \dfrac{4}{3}$

8. (3) A



AB = tower = h metre
BD = x metre
From Δ ABC,

$\tan 30° = \dfrac{AB}{BC}$

$\Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{h}{x+30}$

$\Rightarrow \sqrt{3}h = x + 30$ ....(i)
From Δ ABD,

$\tan 45° = \dfrac{AB}{BD}$

$\Rightarrow h = x$ .....(ii)
From equation (i)
$\Rightarrow \sqrt{3}h = h + 30$
$\Rightarrow (\sqrt{3} - 1)h = 30$

$\Rightarrow h = \dfrac{30}{\sqrt{3}-1} = \dfrac{30}{\sqrt{3}-1} \times \dfrac{\sqrt{3}+1}{\sqrt{3}+1}$

$= \dfrac{30(\sqrt{3}+1)}{2} = 15(\sqrt{3}+1)$ metre

9. (1) $\tan\theta = \dfrac{a}{b}$.
Expression

$= \dfrac{a\sin^3\theta - b\cos^3\theta}{a\sin^3\theta + b\cos^3\theta}$

Dividing numerator and denominator by $\cos^3\theta$,

$= \dfrac{a\tan^3\theta - b}{a\tan^3\theta + b} = \dfrac{a \times \dfrac{a^3}{b^3} - b}{a \times \dfrac{a^3}{b^3} + b}$

$= \dfrac{a^4 - b^4}{a^4 + b^4}$

10. (4)

$\tan^2\theta - \sqrt{3}\tan\theta - \tan\theta + \sqrt{3} = 0$

$= \tan\theta (\tan\theta - \sqrt{3}) - 1 (\tan\theta - \sqrt{3}) = 0$

$= (\tan\theta - 1)(\tan\theta - \sqrt{3}) = 0$
$= \tan\theta = 1 = \tan 45°$
$= \theta = 45°$
Again,
$\tan\theta - \sqrt{3} = 0$
$\Rightarrow \tan\theta = \sqrt{3} = \tan 60°$
$\Rightarrow \theta = 60°$.

11. (4) $4x^2 - 4x \sec\theta + 1 = 0$
$= 4x \sec\theta = 4x^2 + 1$

$= \sec\theta = \dfrac{4x^2+1}{4x}$

$\therefore \tan\theta = \sqrt{\sec^2\theta - 1}$

$= \sqrt{\left(\dfrac{(4x^2+1)}{4x}\right)^2 - 1}$

$= \sqrt{\dfrac{16x^4 + 8x^2 + 1 - 16x^2}{16x^2}}$

$= \pm \dfrac{4x^2 - 1}{4x}$

$\therefore \sec\theta + \tan\theta$

$= \dfrac{4x^2+1}{4x} + \dfrac{4x^2-1}{4x}$

$= \dfrac{4x^2 + 1 + 4x^2 - 1}{4x} = \dfrac{8x^2}{4x}$
$= 2x$
or, $\sec\theta + \tan\theta$

$= \dfrac{4x^2+1}{4x} - \dfrac{4x^2-1}{4x}$

$= \dfrac{4x^2 + 1 - 4x^2 + 1}{4x}$

$= \dfrac{2}{4x} = \dfrac{1}{2x}$

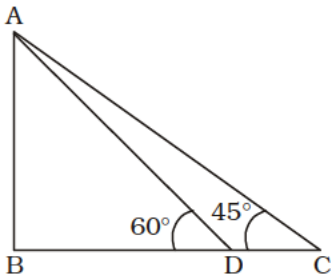
12. (2) $\cos\theta + \sec\theta = 2$

$\Rightarrow \cos\theta + \dfrac{1}{\cos\theta} = 2$

$\Rightarrow \cos^2\theta - 2\cos\theta + 1 = 0$
$\Rightarrow (\cos\theta - 1)^2 = 0$
$\Rightarrow \cos\theta = 1$
$\therefore \cos^5\theta + \sec^5\theta = 1 + 1 = 2$

13. (3) $\cos\theta - \sin\theta = \sqrt{2} \sin\theta$ ..(i)
$\cos\theta + \sin\theta = x$ ....(ii)
On squaring both the equations and adding.
$2 (\cos^2\theta + \sin^2\theta) = 2\sin^2\theta + x^2$
$\Rightarrow x^2 = 2 - 2\sin^2\theta = 2 (1 - \sin^2\theta)$
$= 2\cos^2\theta$
$\Rightarrow x = \sqrt{2} \cos\theta$

14. (2)



AB = Tower = h metre
DC = 30 metre
BD = x metre

From Δ ABC,

$\tan 45° = \frac{AB}{BC} \Rightarrow 1 = \frac{h}{x+30}$

$\Rightarrow h = x + 30$ .....(i)

From Δ ABD,

$\tan 60° = \frac{AB}{BD} \Rightarrow \sqrt{3} = \frac{h}{x}$

$h = \sqrt{3}x$

$\Rightarrow x = \frac{h}{\sqrt{3}}$ ...(ii)

$\therefore h = x + 30$

$\Rightarrow h = \frac{h}{\sqrt{3}} + 30$

$\Rightarrow \left(\sqrt{3}-1\right)h = 30\sqrt{3}$

$\Rightarrow h = \frac{30\sqrt{3}}{\sqrt{3}-1}$

$= \frac{30\sqrt{3}\left(\sqrt{3}+1\right)}{\left(\sqrt{3}-1\right)\left(\sqrt{3}+1\right)}$

$= 15\left(3+\sqrt{3}\right)$ metre

15. (3) $\frac{\sec 39}{\sec(90-51)} + \frac{2}{\sqrt{3}} \tan 17° \cdot \tan 38° \cdot \tan 60° \cdot \cot(90° - 52°) \cdot \cot(90° - 73°) - 3(\sin^2 31° + \cos^2(90° - 59°)$

$= \frac{\sec 39°}{\sec 39°} + \frac{2}{\sqrt{3}} \cdot \tan 17° \cdot \tan 38° \times \sqrt{3} \cdot \cot 38° \cdot \cot 17° - 3(\sin^2 31° + \cos^2 31°)$

$= 1 + \frac{2}{\sqrt{3}} \times \sqrt{3}\,(\tan 17° \cdot \cot 17°) \cdot (\tan 38° \cdot \cot 38°) - 3 \times 1$

$= 1 + 2 - 3 = 0$

$\tan\theta \cdot \cot\theta = 1$

$\left[\begin{array}{l}\tan(90°-\theta) = \cot\theta; \\ \cot(90°-\theta) = \tan\theta; \\ \sec(90°-\theta) = \operatorname{cosec}\theta\end{array}\right]$

16. (4) $(m^2 + n^2)\cos^2\beta$

$= \left(\frac{\cos^2\alpha}{\cos^2\beta} + \frac{\cos^2\alpha}{\sin^2\beta}\right)\cos^2\beta$

$= \left(\frac{\cos^2\alpha.\sin^2\beta + \cos^2\alpha.\cos^2\beta}{\cos^2\beta.\sin^2\beta}\right)\cos^2\beta$

$= \cos^2\alpha \cdot \cos^2\beta \left(\frac{\sin^2\beta + \cos^2\beta}{\cos^2\beta.\sin^2\beta}\right)$

$= \frac{\cos^2\alpha}{\sin^2\beta} = \left(\frac{\cos\alpha}{\sin\beta}\right)^2 = n^2$

17. (4) $\sin(\alpha + \beta - \gamma) = \frac{1}{2}$,

$\cos(\beta + \gamma - \alpha) = \frac{1}{2}$

and $\tan(\gamma + \alpha - \beta) = 1$

$\Rightarrow \sin(\alpha + \beta - \gamma) = \sin 30°$,

$\cos(\beta + \gamma - \alpha) = \cos 60°$ and $\tan(\gamma + \alpha - \beta) = \tan 45°$

$\Rightarrow \alpha + \beta - \gamma = 30°$ .....(i)

$\beta + \gamma - \alpha = 60°$ .....(ii)

$\gamma + \alpha - \beta = 45°$ .....(iii)

By equations (i) + (ii) and equations (i) + (iii).

$2\beta = 90°$ and $2\alpha = 75°$

$\Rightarrow \beta = 45°$ and $2\alpha = 75°$

$\Rightarrow 2\alpha + \beta = 75° + 45° = 120°$

18. (2)

$\frac{\tan^2 60 + 4\cos^2 45 + 3\sec^2 30 + 5\cos^2 90}{\operatorname{cosec} 30 + \sec 60 - \cot^2 30}$

$= \frac{\left(\sqrt{3}\right)^2 + 4 \times \left(\frac{1}{\sqrt{2}}\right)^2 + 3\left(\frac{2}{\sqrt{3}}\right)^2 + 5 \times 0}{2 + 2 - \left(\sqrt{3}\right)^2}$

$= \frac{3 + 4 \times \frac{1}{2} + \frac{3 \times 4}{3} + 0}{4 - 3}$

$= 3 + 2 + 4 = 9$

19. (2) $A + B = 90° \Rightarrow B = 90° - A$

$\therefore \sqrt{\frac{\tan A \cdot \tan B + \tan A \cdot \cot B}{\sin A \cdot \sec B} - \frac{\sin^2 A}{\cos^2 A}}$

$= \sqrt{\frac{\tan A \tan(90 - A) + \tan A \cdot}{\frac{\cot(90 - A)}{\sin A \sec(90 - A))}} - \frac{\sin^2(90 - A)}{\cos^2 A}}$

$= \sqrt{\frac{\tan A.\cot A + \tan A.\tan A}{\sin A \cdot \operatorname{cosec} A} - \frac{\cos^2 A}{\cos^2 A}}$

$= \sqrt{1 + \tan^2 A - 1} = \sqrt{\tan^2 A} = \tan A$

20. (4) $\frac{\sin A - \sin B}{\cos A + \cos B} + \frac{\cos A - \cos B}{\sin A + \sin B}$

$= \frac{(\sin A - \sin B)(\sin A + \sin B) + (\cos A + \cos B)(\cos A - \cos B)}{(\cos A + \cos B)(\sin A + \sin B)}$

$= \frac{\sin^2 A - \sin^2 B + \cos^2 A - \cos^2 B}{(\cos A + \cos B)(\sin A + \sin B)}$

$= \frac{\left(\sin^2 A + \cos^2 A\right) - \left(\sin^2 B + \cos^2 B\right)}{(\cos A + \cos B)(\sin A + \sin B)}$

$= \frac{1 - 1}{(\cos A + \cos B)(\sin A + \sin B)}$

$= 0$

21. (2) $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1$

$= 2[(\sin^2\theta)^3 + (\cos^2\theta)^3] - 3[(\sin^2\theta)^2 + (\cos^2\theta)^2] + 1$

$= 2(\sin^2\theta + \cos^2\theta)(\sin^4\theta + \cos^4\theta - \sin^2\theta \cdot \cos^2\theta) - 3[(\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta \cdot \cos^2\theta] + 1$

$[\because a^3 + b^3 = (a + b)(a^2 - ab + b^2)$; $a^2 + b^2 = (a + b)^2 - 2ab]$

$= 2\sin^4\theta + 2\cos^4\theta - 2\sin^2\theta \cdot \cos^2\theta - 3 + 6\sin^2\theta \cdot \cos^2\theta + 1$

$= 2[(\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta \cdot \cos^2\theta] - 3 + 4\sin^2\theta \cdot \cos^2\theta + 1$

$= 2 - 4\sin^2\theta \cdot \cos^2\theta - 3 + 4\sin^2\theta \cos^2\theta + 1$

$= 2 - 3 + 1 = 0$

22. (3) $\sin\theta + \sin^2\theta + \sin^3\theta = 1$

$\Rightarrow \sin\theta + \sin^3\theta = 1 - \sin^2\theta$

$\Rightarrow \sin\theta(1 + \sin^2\theta) = \cos^2\theta$

$\Rightarrow \sin^2\theta(1 + \sin^2\theta)^2 = \cos^4\theta$

$\Rightarrow (1 - \cos^2\theta)\{1 + (1 - \cos^2\theta)\}^2 = \cos^4\theta$

$\Rightarrow (1 - \cos^2\theta)(2 - \cos^2\theta)^2 = \cos^4\theta$

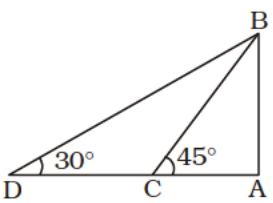
$\Rightarrow (1 - \cos^2\theta)(4 - 4\cos^2\theta + \cos^4\theta) = \cos^4\theta$

$\Rightarrow 4 - 4\cos^2\theta + \cos^4\theta - 4\cos^2\theta + 4\cos^4\theta - \cos^6\theta = \cos^4\theta$

$\Rightarrow -\cos^6\theta + 4\cos^4\theta - 8\cos^2\theta + 4 = 0$

$\Rightarrow \cos^6\theta - 4\cos^4\theta + 8\cos^2\theta = 4$

23. (2)



AB = Tower = h Metre

CD = 10 metre, AC = x metre (let)

$\angle BCA = 45°$, $\angle BDA = 30°$

In ΔACB,

$\tan 45° = \frac{AB}{AC}$

$\Rightarrow 1 = \frac{h}{x}$

$\Rightarrow h = x$ --- (i)

In ΔDAB,

$\tan 30° = \frac{AB}{AD}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+10}$

$\Rightarrow x + 10 = \sqrt{3}\,h$

$\Rightarrow h + 10 = \sqrt{3}\,h$

$\Rightarrow h\left(\sqrt{3}-1\right) = 10$

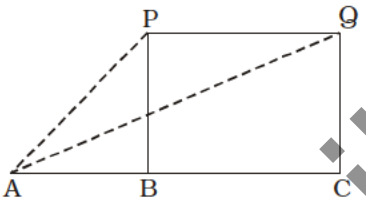
$\Rightarrow h = \frac{10}{\sqrt{3}-1}$

$= \frac{10}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1}$

$= \frac{10\left(\sqrt{3}+1\right)}{2} = 5\,(1.73 + 1)$

= 13.65 metre

24. (1)



P and Q = Positions of plane

$\angle PAB = 60°$, $\angle QAB = 30°$, PB = $3600\sqrt{3}$ metre

In Δ ABP,

$\tan 60° = \frac{BP}{AB}$

$\Rightarrow \sqrt{3} = \frac{3600\sqrt{3}}{AB}$

$\Rightarrow$ AB = 3600 metre

In ΔACQ,

$\tan 30° = \frac{CQ}{AC}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{3600\sqrt{3}}{AC}$

$\Rightarrow$ AC = 3600 × 3

= 10800 metre

$\therefore$ PQ = BC = AC – AB

= 10800 – 3600

= 7200 metre

This distance is covered in 30 seconds.

$\therefore$ Speed of plane = $\frac{7200}{30}$

= 240 m/sec.

$= \left(240 \times \frac{18}{5}\right)$ kmph

= 864 kmph

25. (4)

$\sin 75° + \sin 15° = 2 \sin\left(\frac{75°+15°}{2}\right)\cdot\cos\left(\frac{75°-15°}{2}\right)$

$\because \sin C + \sin D$

$= 2\sin\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$

$= 2 \sin 45° \cdot \cos 30°$

$= 2 \cdot \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{3}}{2}$

$= \sqrt{\frac{3}{2}}$

26. (3) We know that,

$2 \cos A \sin B = \sin(A + B) - \sin(A - B)$

$\Rightarrow 2 \cos 45° \sin 15°$

$= \sin (45° + 15°) - \sin (45° - 15°)$

$= \sin 60° - \sin 30°$

$= \frac{\sqrt{3}}{2} - \frac{1}{2}$

$= \frac{\sqrt{3}-1}{2}$

27. (4) We know that,

$\cos 2A = 1 - 2 \sin^2 A$

$\Rightarrow \cos A = 1 - 2 \sin^2 \frac{A}{2}$

Let A = 45°

$\Rightarrow \cos 45° = 1 - 2 \sin^2 \frac{45°}{2}$

$\Rightarrow 2 \sin^2 22\frac{1}{2} = 1 - \cos 45°$

$2 \sin^2 22\frac{1}{2} = 1 - \frac{1}{\sqrt{2}}$

$2 \sin^2 22\frac{1}{2} = \frac{\sqrt{2}-1}{\sqrt{2}}$

$= \sin^2 22\frac{1}{2} = \frac{\sqrt{2}-1}{2\sqrt{2}}$

$= \sin 22\frac{1}{2}° = \sqrt{\frac{\sqrt{2}-1}{2\sqrt{2}}}$

28. (2) $\frac{\cos\alpha + \cos\beta}{\sin\alpha + \sin\beta}$

$= \frac{2\cdot\cos\left(\frac{\alpha+\beta}{2}\right)\cdot\cos\left(\frac{\alpha-\beta}{2}\right)}{2\sin\left(\frac{\alpha+\beta}{2}\right)\cdot\cos\left(\frac{\alpha-\beta}{2}\right)}$

$= \frac{\cos\left(\frac{\alpha+\beta}{2}\right)}{\sin\left(\frac{\alpha+\beta}{2}\right)}$

$= \cot\left(\frac{\alpha+\beta}{2}\right)$

29. (2) We know that,

$1^R = \left(\frac{180°}{\pi}\right)$

$1^R = 57.29°$

As we know that the value of sinθ increases as θ increases.

$\Rightarrow \sin 1° < \sin 57.29°$

$\sin 1° < \sin \left(\frac{180}{\pi}\right)^\circ$

$\Rightarrow \sin 1° < \sin 1$

30. (4) We know that,

$\tan(\alpha + \beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha \cdot \tan\beta}$

$\Rightarrow \tan(\alpha + \beta)$

$= \frac{\frac{m}{m+1} + \frac{1}{2m+1}}{1 - \frac{m}{(m+1)}\cdot\frac{1}{(2m+1)}}$

$\because \tan\alpha = \frac{m}{m+1}$

$\tan\beta = \frac{1}{2m+1}$

$$= \frac{2m^2 + m + m + 1}{(m+1)(2m+1)} \Big/ \frac{2m^2 + 3m + 1 - m}{(m+1)(2m+1)}$$

$$= \frac{2m^2 + 2m + 1}{2m^2 + 2m + 1}$$

$= 1$

$\Rightarrow \tan(\alpha + \beta) = 1$

$\tan(\alpha + \beta) = \tan\frac{\pi}{4}$

$\therefore \alpha + \beta = \frac{\pi}{4}$.

31. (2) Here, $\alpha + \beta = \frac{\pi}{4}$

$(1 + \tan\alpha)(1 + \tan\beta)$

$= 1 + \tan\beta + \tan\alpha + \tan\alpha\tan\beta$

$= 1 + \tan\alpha + \tan\beta + \tan\alpha\tan\beta$

Also, we know that,

$$\tan(\alpha + \beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$$

$$\tan\frac{\pi}{4} = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$$

$\Rightarrow \boxed{1 - \tan\alpha\tan\beta = \tan\alpha + \tan\beta}$

$\Rightarrow (1 + \tan\alpha)(1 + \tan\beta)$

$= 1 + 1 - \tan\alpha\tan\beta + \tan\alpha\tan\beta$

$= 2$

32. (2) Here, $\tan A = \frac{1 - \cos B}{\sin B}$

We know that,

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

$$\tan 2A = \frac{2\cdot\left(\frac{1-\cos B}{\sin B}\right)}{1 - \left(\frac{1-\cos B}{\sin B}\right)^2}$$

$$= \frac{\frac{2(1-\cos B)}{\sin B}}{\frac{\sin^2 B - (1-\cos B)^2}{\sin^2 B}}$$

$$= \frac{2(1-\cos B)\sin B}{1 - \cos^2 B - (1-\cos B)^2}$$

$[\because \sin^2\theta = 1 - \cos^2\theta]$

$$= \frac{2(1-\cos B)\sin B}{(1-\cos B)[1 + \cos B - 1 + \cos B]}$$

$$= \frac{2\sin B}{2\cos B}$$

$= \tan B.$

33. (4) $\sin(45° + \theta) - \cos(45° - \theta)$

$= \sin 45°\cos\theta + \cos 45°\sin\theta$

$- (\cos 45°\cos\theta + \sin 45°\sin\theta)$

$\because \sin(A + B) = \sin A\cos B + \cos A\sin B$

$\cos(A - B) = \cos A\cos B + \sin A\sin B$

$$= \frac{\cos\theta}{\sqrt{2}} + \frac{\sin\theta}{\sqrt{2}} - \frac{\cos\theta}{\sqrt{2}} - \frac{\sin\theta}{\sqrt{2}}$$

$= 0$

34. (2) $2\cos\frac{\pi}{13}\cos\frac{9\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$

$$= \cos\left(\frac{\pi}{13} + \frac{9\pi}{13}\right) + \cos\left(\frac{\pi}{13} - \frac{9\pi}{13}\right) + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$$

$\because 2\cos A\cos B = \cos(A + B) + \cos(A - B)$

$$= \cos\frac{10\pi}{13} + \cos\left(-\frac{8\pi}{13}\right) + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$$

$$= \cos\frac{10\pi}{13} + \cos\frac{8\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$$

$\because \cos(-\theta) = \cos\theta$

$$= \cos\left(\pi - \frac{3\pi}{13}\right) + \cos\left(\pi - \frac{5\pi}{13}\right) + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$$

$$= -\cos\frac{3\pi}{13} - \cos\frac{5\pi}{13} + \cos\frac{3\pi}{13} + \cos\frac{5\pi}{13}$$

$= 0$

35. (3) Here,

$\sin\theta + \cos\theta = 1$

Squaring on both sides, we get

$(\sin\theta + \cos\theta)^2 = 1$

$\sin^2\theta + \cos^2\theta + 2\sin\theta\cdot\cos\theta = 1$

$1 + 2\sin\theta\cos\theta = 1$

$2\sin\theta\cdot\cos\theta = 0$

And we know that,

$\sin 2\theta = 2\sin\theta\cos\theta$

$\Rightarrow \sin 2\theta = 0$

36. (2) Here,

$$\frac{\sin(x+y)}{\sin(x-y)} = \frac{a+b}{a-b}$$

Using componendo and dividendo both sides we get,

$$\frac{\sin(x+y) + \sin(x-y)}{\sin(x+y) - \sin(x-y)}$$

$$= \frac{a + b + a - b}{a + b - (a - b)}$$

$$\frac{2\sin\left(\frac{x+y+x-y}{2}\right)\cdot\cos\left(\frac{x+y-x+y}{2}\right)}{2\sin\left(\frac{x+y-x+y}{2}\right)\cdot\cos\left(\frac{x+y+x-y}{2}\right)}$$

$$= \frac{2a}{2b}$$

$\because \sin C + \sin D$

$$= 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$$

$\sin C - \sin D$

$$= 2\cos\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$$

$$\Rightarrow \frac{\sin x\cdot\cos y}{\sin y\cdot\cos x} = \frac{a}{b}$$

$$\Rightarrow \tan x\cdot\cot y = \frac{a}{b}$$

$$\frac{\tan x}{\tan y} = \frac{a}{b}$$

37. (2) $\frac{3\cos\theta + \cos 3\theta}{3\sin\theta - \sin 3\theta}$

$$= \frac{3\cos\theta + 4\cos^3\theta - 3\cos\theta}{3\sin\theta - (3\sin\theta - 4\sin^3\theta)}$$

$\because \cos 3\theta = 4\cos^3\theta - 3\cos\theta$

$\sin 3\theta = 3\sin\theta - 4\sin^3\theta$

$= \frac{4\cos^3\theta}{4\sin^3\theta}$

$= \cot^3\theta$

38. (1)

$\sin\frac{5\pi}{12}\cdot\sin\frac{\pi}{12}$

$= \frac{1}{2}\times\left(2\sin\frac{5\pi}{12}\sin\frac{\pi}{12}\right)$

$= \frac{1}{2}\left[\cos\left(\frac{5\pi}{12}-\frac{\pi}{12}\right)-\cos\left(\frac{5\pi}{12}+\frac{\pi}{12}\right)\right]$

$\because$ $2\sin A \sin B$
$= \cos(A-B)-\cos(A+B)$

$= \frac{1}{2}\left[\cos\left(\frac{4\pi}{12}\right)-\cos\left(\frac{6\pi}{12}\right)\right]$

$= \frac{1}{2}\left[\cos\left(\frac{\pi}{3}\right)-\cos\left(\frac{\pi}{2}\right)\right]$

$= \frac{1}{2}\cdot\frac{1}{2}$

$= \frac{1}{4}$

39. (3)

$\frac{\cos(\pi+x)\cos(-x)}{\sin(\pi-x)\cos\left(\frac{\pi}{2}+x\right)}$

$= \frac{-\cos x\cdot\cos x}{\sin x(-\sin x)}$

$\because$ $\cos(\pi+\theta) = -\cos\theta$
$\cos(-\theta) = \cos\theta$
$\sin(\pi-\theta) = -\sin\theta$
$\cos\left(\frac{\pi}{2}+\theta\right) = -\sin\theta$

$= \left(\frac{\cos x}{\sin x}\right)\cdot\left(\frac{\cos x}{\sin x}\right)$

$= \cot x\cdot\cot x$

$= \cot^2 x.$

40. (2)

$\frac{\sin 50^\circ}{\sin 130^\circ}+\frac{\cos 70^\circ}{\cos 110^\circ}$

$-2\tan^2 225^\circ$

$= \frac{\sin 50^\circ}{\sin(180^\circ-50^\circ)}$

$+\frac{\cos 70^\circ}{\cos(180^\circ-70^\circ)}$

$-2[\tan(180^\circ+45^\circ)]^2$

$= \frac{\sin 50^\circ}{\sin 50^\circ}+\frac{\cos 70^\circ}{-\cos 70^\circ}$

$-2\tan^2 45^\circ$

$\because$ $\sin(180^\circ-\theta) = \sin\theta$
$\cos(180^\circ-\theta) = -\cos\theta$
$\tan(180^\circ+\theta) = \tan\theta$

$= 1-1-2$

$= -2$

41. (2) $\sin 240^\circ = \sin(180^\circ+60^\circ)$

$= -\sin 60^\circ$

$[\because \sin(180^\circ+\theta) = -\sin\theta]$

$= -\frac{\sqrt{3}}{2}$

42. (1) We know that,

$\cot(A+B) = \frac{\cot A\cdot\cot B-1}{\cot A+\cot B}$

$\Rightarrow x = \frac{\cot A\cdot\cot B-1}{\cot A+\cot B}$

43. (4) $\cos\frac{7\pi}{4} = \cos\left(2\pi-\frac{\pi}{4}\right)$

$= \cos\frac{\pi}{4}$

$\because$ $\cos(2\pi-\theta) = \cos\theta$

$= \frac{1}{\sqrt{2}}$

44. (3) $\tan\left(\frac{5\pi}{6}\right)\cdot\sin\left(\frac{7\pi}{6}\right)$

$= \tan\left(\pi-\frac{\pi}{6}\right)\cdot\sin\left(\pi+\frac{\pi}{6}\right)$

$[\because \tan(180^\circ-\theta) = -\tan\theta$
$\sin(180^\circ+\theta) = -\sin\theta]$

$= -\tan\frac{\pi}{6}\cdot\left(-\sin\frac{\pi}{6}\right)$

$= \tan\frac{\pi}{6}\cdot\sin\frac{\pi}{6}$

$= \frac{1}{\sqrt{3}}\cdot\frac{1}{2}$

$= \frac{1}{2\sqrt{3}}$

45. (2) $\tan 56^\circ = \tan(45^\circ+11^\circ)$

$= \frac{\tan 45^\circ+\tan 11^\circ}{1-\tan 45^\circ\cdot\tan 11^\circ}$

$\because$ $\tan(A+B) = \frac{\tan A+\tan B}{1-\tan A\tan B}$

$\because$ $\tan 45^\circ = 1$

$= \frac{1+\tan 11^\circ}{1-\tan 11^\circ}$

$= \frac{1+\frac{\sin 11^\circ}{\cos 11^\circ}}{1-\frac{\sin 11^\circ}{\cos 11^\circ}}$

$= \frac{\cos 11^\circ+\sin 11^\circ}{\cos 11^\circ-\sin 11^\circ}$

46. (3)

$\frac{\cos\theta}{\sin(90^\circ+\theta)}+\frac{\sin(-\theta)}{\sin(180^\circ+\theta)}$

$-\frac{\tan(90^\circ+\theta)}{\cot\theta}$

$= \frac{\cos\theta}{\cos\theta}+\left(\frac{-\sin\theta}{-\sin\theta}\right)+\frac{\cot\theta}{\cot\theta}$

$= 1+1+1$

$= 3$

47. (2)

$\tan\left(\frac{\pi}{4}+x\right) = \frac{\tan\frac{\pi}{4}+\tan x}{1-\tan\frac{\pi}{4}\cdot\tan x}$

$\left[\because \tan(A+B) = \frac{\tan A+\tan B}{1-\tan A\tan B}\right]$

$= \frac{1+\tan x}{1-\tan x}$

48. (3) Here,

$\cos C-\cos D = y$

$\Rightarrow y = \cos C-\cos D$

$\Rightarrow y = -2\sin$

$\left(\frac{C+D}{2}\right)\cdot\sin\left(\frac{C-D}{2}\right)$

$[\because$ It is the basic formula of $\cos C-\cos D]$

49. (4) Here,

$\sin x = \frac{1}{3}$

We know that,

$\sin 3x = 3\sin x - 4\sin^3 x$

On putting the value of $\sin x$, we get

$\sin 3x = 3\cdot\left(\frac{1}{3}\right) - 4\cdot\left(\frac{1}{3}\right)^3$

$= 1 - \frac{4}{27}$

$= \frac{27-4}{27}$

$\sin 3x = \frac{23}{27}$

50. (1) Here,

$\sin x \cdot \cos y + \cos x \cdot \sin y = 1$

$\Rightarrow \sin(x+y) = 1$

[$\because$ sin (A + B) = sinA cosB + cosA sinB]

$\Rightarrow \sin(x+y) = \sin\frac{\pi}{2}$

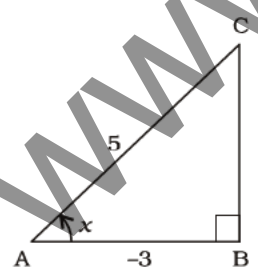
$\Rightarrow x + y = \frac{\pi}{2}$

51. (3) Here,

$\cos x = -\frac{3}{5}$ and $\pi < x < \frac{3\pi}{2}$

$\Rightarrow x$ lies in third quadrant, and we know that in third quadrant only tan and cot are positive.

Consider right angled ΔABC,



Using pythagoras theorem,

$AC^2 = AB^2 + BC^2$

$\Rightarrow 5^2 = (-3)^2 + BC^2$

$16 = BC^2$

$\Rightarrow BC = 4$

We know that,

$\sin 2A = 2\sin A \cdot \cos A$

$\Rightarrow \sin 2x = 2 \cdot \sin x \cdot \cos x$

$= 2 \times \left(\frac{-4}{5}\right) \times \frac{-3}{5}$

$= \frac{24}{25}$

$\because$ Here, $\sin\theta$ is –ve

52. (4) $\tan 330° = \tan(360° - 30°)$

$= -\tan 30°$

$\because \tan(360° - \theta) = -\tan\theta$

$= \frac{-1}{\sqrt{3}}$

53. (2) We know that,

$1^R = \left(\frac{180}{\pi}\right)$

$\frac{5\pi}{12}^R = \left(\frac{180}{\pi} \times \frac{5\pi}{12}\right) = 75°$

54. (4) We know that,

$1° = \left(\frac{\pi}{180}\right)^R$

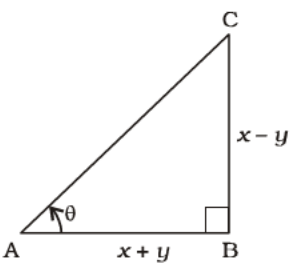
$\Rightarrow 120° = \left(\frac{\pi}{180} \times 120\right)^R$

$= \left(\frac{2\pi}{3}\right)^R$

55. (1) Here,

$\tan\theta = \frac{x-y}{x+y}$

Consider ΔABC,



Using pythagoras theorem, we get

$AC^2 = AB^2 + BC^2$

$\Rightarrow AC^2 = (x+y)^2 + (x-y)^2$

$= x^2 + y^2 + 2xy + x^2 + y^2 - 2xy$

$AC^2 = 2(x^2 + y^2)$

$AC = \sqrt{2(x^2+y^2)}$

As θ lies in first quadrant,

$\because \sin\theta$ will be +ve

$\sin\theta = \frac{BC}{AC}$

$\sin\theta = \frac{x-y}{\sqrt{2(x^2+y^2)}}$

56. (4) Here, $\sin C + \sin D = x$

$\Rightarrow x = \sin C + \sin D$

$\Rightarrow x = 2\cdot\sin\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$

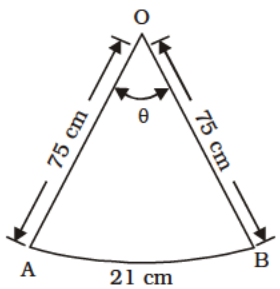
[$\because$ it is the basic formula of sinC + sinD]

57. (2) We know that,

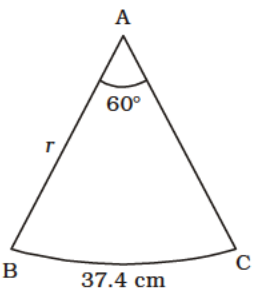
$\text{Angle} = \frac{\text{arc}}{\text{radius}}$

$\Rightarrow \theta = \frac{21}{75}$

$\theta = \left(\frac{7}{25}\right)^R$



58. (3) Here,



$\theta = 60°$

$l = 37.4$ cm

$r = ?$

We know that,

$1° = \left(\frac{\pi}{180°}\right)^R$

$\Rightarrow 60^\circ\left(\frac{\pi}{180^\circ}\times 60\right)^R$

$\Rightarrow 60^\circ\left(\frac{\pi}{3}\right)^R$

We know that,

$\theta = \frac{l}{r}$

$\Rightarrow \frac{\pi}{3} = \frac{37.4}{r}$

$\Rightarrow r = \frac{37.4\times 3}{\pi}$

$r = \frac{37.4\times 3\times 7}{22}$

$= 1.7 \times 21$

$= 35.7$ cm

59. (2)

$\text{cosec}\,(-1410^\circ) = -\,\text{cosec}\,(1410^\circ)$

$\because$ $\text{cosec}\,(-\theta) = -\,\text{cosec}\theta$

$= -\text{cosec}\,(360^\circ \times 3 + 330^\circ)$

$= -\text{cosec}\,(330^\circ)$

$= -\text{cosec}\,(360^\circ - 30^\circ)$

$= \text{cosec}\,30^\circ$

$= 2$

60. (2) $\cos\left(\frac{\pi}{4}+x\right)+\cos\left(\frac{\pi}{4}-x\right)$

$= 2\cos\left(\frac{\frac{\pi}{4}+x+\frac{\pi}{4}-x}{2}\right)\cdot\cos\left(\frac{\frac{\pi}{4}+x-\frac{\pi}{4}+x}{2}\right)$

$\because$ $\cos C + \cos D$

$= 2\cos\left(\frac{C+D}{2}\right)\cdot\cos\left(\frac{C-D}{2}\right)$

$= 2\cos\left(\frac{\pi}{4}\right)\cdot\cos x$

$= \frac{2}{\sqrt{2}}\cdot\cos x$

$= \sqrt{2}\cos x$

61. (2) $\tan\frac{13\pi}{12}$

$= \tan\left(\pi+\frac{\pi}{12}\right)$

$= \tan\frac{\pi}{12}$

$[\because \tan(\pi+\theta) = \tan\theta]$

$= \tan\left(\frac{\pi}{3}-\frac{\pi}{4}\right)$

$\because \frac{1}{12} = \frac{1}{3}-\frac{1}{4}$

$= \frac{\tan\frac{\pi}{3}-\tan\frac{\pi}{4}}{1+\tan\frac{\pi}{3}\tan\frac{\pi}{4}}$

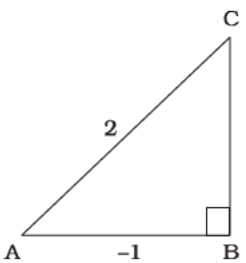
$\because$ $\tan(A-B)$

$= \frac{\tan A - \tan B}{1+\tan A\tan B}$

$= \frac{\sqrt{3}-1}{1+\sqrt{3}}$

$= \frac{\sqrt{3}-1}{\sqrt{3}+1}$

62. (3) Here, $\cos\theta = -\frac{1}{2}$ and θ, lies in third quadrant



Consider ΔABC, Using Pythagoras theorem,

$AC^2 = AB^2 + BC^2$

$2^2 = (-1)^2 + BC^2$

$\Rightarrow BC^2 = 4 - 1$

$BC^2 = 3$

$BC = \sqrt{3}$

$\tan\theta + \sin\theta = -\left(\frac{\sqrt{3}}{-1}\right) + -\left(\frac{\sqrt{3}}{2}\right)$

$\because$ In third quadrant $\sin\theta$ is negative and $\tan\theta$ is positive.

$= \frac{\sqrt{3}}{2}$

63. (1) $\cos 105^\circ = \cos(60^\circ + 45^\circ)$

$= \cos 60^\circ \cdot \cos 45^\circ - \sin 60^\circ \cdot \sin 45^\circ$

$[\because \cos(A+B) = \cos A \cos B - \sin A \sin B]$

$= \frac{1}{2}\cdot\frac{1}{\sqrt{2}} - \frac{\sqrt{3}}{2}\cdot\frac{1}{\sqrt{2}}$

$= \frac{1-\sqrt{3}}{2\sqrt{2}}$

64. (2) Here,

$\cos\left(\frac{\pi}{4}-\theta\right)\cos\left(\frac{\pi}{4}-\phi\right)$

$-\sin\left(\frac{\pi}{4}-\theta\right)\sin\left(\frac{\pi}{4}-\phi\right) = ?$

Let

$\frac{\pi}{4}-\theta = A$

$\frac{\pi}{4}-\phi = B$

$\Rightarrow \cos\left(\frac{\pi}{4}-\theta\right)\cos\left(\frac{\pi}{4}-\phi\right)$

$-\sin\left(\frac{\pi}{4}-\theta\right)\sin\left(\frac{\pi}{4}-\phi\right)$

$= \cos A\cos B - \sin A\sin B$

$= \cos(A+B)$

$= \cos\left[\frac{\pi}{4}-\theta+\frac{\pi}{4}-\phi\right]$

$= \cos\left[\frac{\pi}{2}-\theta-\phi\right]$

$= \cos\left[\frac{\pi}{2}-(\theta+\phi)\right]$

$= \sin(\theta+\phi)$

$\because \cos\left(\frac{\pi}{2}-\theta\right) = \sin\theta$

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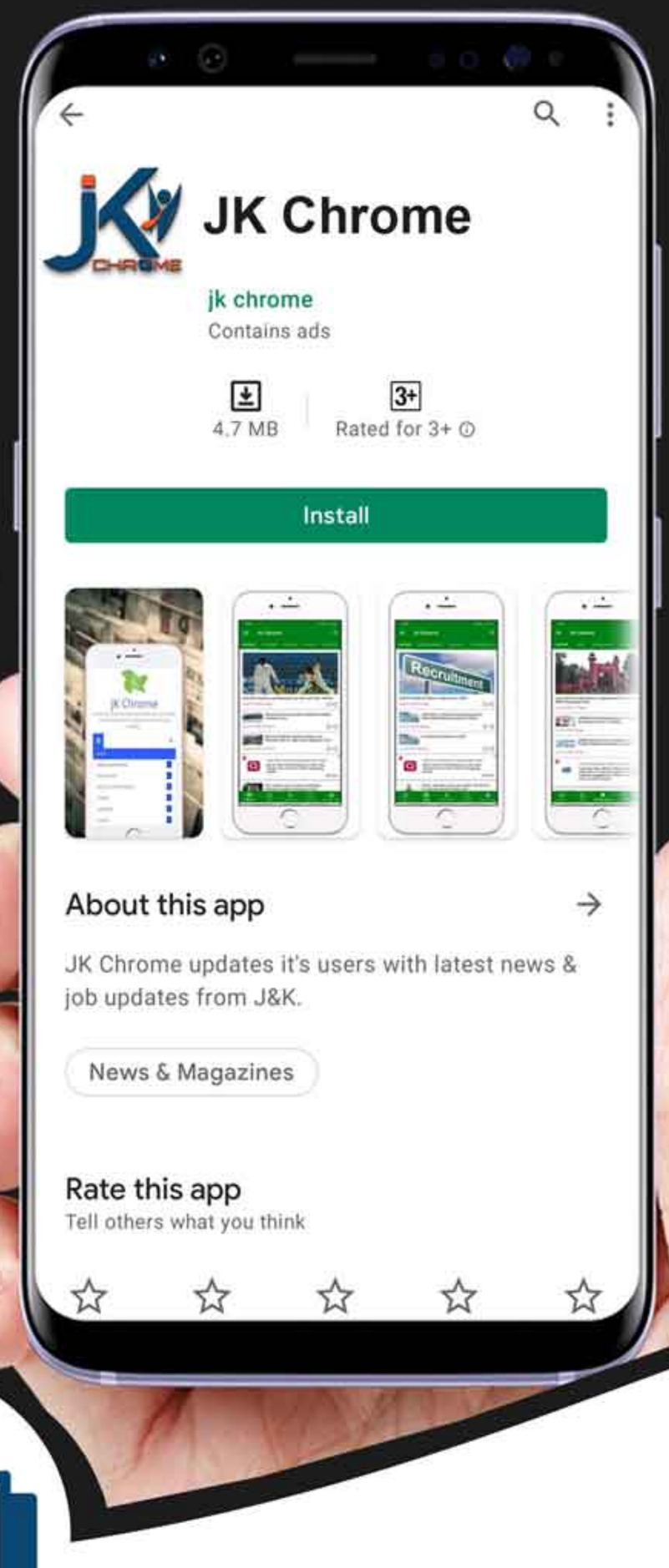

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