CHAPTER

12 Trigonometry

1. A ladder is resting against a wall at height of 10m. If the ladder is inclined with the ground at an angle of 30°, then the distance of the foot of the ladder from the wall is **(SSC Sub. Ins. 2012)**
(a) $10\sqrt{3}$ m (b) $20\sqrt{3}$ m
(c) $\frac{10}{\sqrt{3}}$ m (d) $\frac{20}{\sqrt{3}}$ m

2. tan 7° tan 23° tan 60° tan 67° tan 83° is equal to **(SSC Sub. Ins. 2012)**
(a) $\frac{1}{\sqrt{3}}$ (b) 1 (c) 0 (d) $\sqrt{3}$

3. The value of (sec θ – cos θ) (cosec θ – sin θ) (tan θ + cot θ) is **(SSC Sub. Ins. 2012)**
(a) 2 (b) 0 (c) 1 (d) $\frac{3}{2}$

4. If $\tan(\theta_1+\theta_2)=\sqrt{3}$ and $\sec(\theta_1-\theta_2)=\frac{2}{\sqrt{3}}$, then the value of $\sin 2\theta_1+\tan 3\theta_2$ is equal to
(Assume that $0<\theta_1-\theta_2<\theta_1+\theta_2<90°$) **(SSC Sub. Ins. 2012)**
(a) 1 (b) 2 (c) 0 (d) 3

5. If $\frac{2\sin\theta-\cos\theta}{\cos\theta+\sin\theta}=1$, then value of cotθ is: **(SSC CHSL 2012)**
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) 3 (d) 2

6. If $\tan\left(\frac{\pi}{2}-\frac{\theta}{2}\right)=\sqrt{3}$, value of cos θ is: **(SSC CHSL 2012)**
(a) 0 (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{1}{2}$ (d) 1

7. P and Q are two points observed from the top of a building $10\sqrt{3}$ m high. If the angles of depression of the points are complementary and PQ = 20 m, then the distance of P from the building is **(SSC CGL 1st Sit. 2012)**
(a) 25m (b) 45m
(c) 30m (d) 40m

8. If A and B are complementary angles, then the value of $\sin A\cos B+\cos A\sin B-\tan A\tan B+\sec^2 A-\cot^2 B$ is **(SSC CGL 1st Sit. 2012)**
(a) 2 (b) 0 (c) 1 (d) –1

9. The least value of $2\sin^2\theta+3\cos^2\theta$ is **(SSC CGL 1st Sit. 2012)**
(a) 3 (b) 5 (c) 1 (d) 2

10. If $4x=\sec\theta$ and $\frac{4}{x}=\tan\theta$ then $8\left(x^2-\frac{1}{x^2}\right)$ is **(SSC CGL 1st Sit. 2012)**
(a) $\frac{1}{16}$ (b) $\frac{1}{8}$ (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

11. If $2-\cos^2\theta=3\sin\theta\cos\theta$, $\sin\theta\neq\cos\theta$ then tan θ is **(SSC CGL 1st Sit. 2012)**
(a) $\frac{1}{2}$ (b) 0 (c) $\frac{2}{3}$ (d) $\frac{1}{3}$

12. If $\sin\theta+\cos\theta=\sqrt{2}\cos(90°-\theta)$, then cot θ is **(SSC CGL 1st Sit. 2012)**
(a) $\sqrt{2}+1$ (b) 0 (c) $\sqrt{2}$ (d) $\sqrt{2}-1$

13. If $x\sin^3\theta+y\cos^3\theta=\sin\theta\cos\theta$ and $x\sin\theta=y\cos\theta$, $\sin\theta\neq 0$, $\cos\theta\neq 0$, then x^2+y^2 is **(SSC CGL 1st Sit. 2012)**
(a) $\frac{1}{\sqrt{2}}$ (b) $\frac{1}{2}$ (c) 1 (d) $\sqrt{2}$

14. $\sec^4\theta-\sec^2\theta$ is equal to **(SSC CGL 1st Sit. 2012)**
(a) $\tan^2\theta-\tan^4\theta$ (b) $\tan^2\theta+\tan^4\theta$
(c) $\cos^4\theta-\cos^2\theta$ (d) $\cos^2\theta-\cos^4\theta$

15. A tree is broken by the wind. If the top of the tree struck the ground at an angle of 30° and at a distance of 30 m from the root, then the height of the tree is **(SSC CGL 1st Sit.2012)**
(a) $25\sqrt{3}$ m (b) $30\sqrt{3}$ m
(c) $15\sqrt{3}$ m (d) $20\sqrt{3}$ m

16. If $\cos A+\cos^2 A=1$, then $\sin^2 A+\sin^4 A$ is equal to **(SSC CGL 1st Sit. 2012)**
(a) 1 (b) $\frac{1}{2}$ (c) 0 (d) –1

17. If cot A + cosec A = 3 and A is an acute angle, then the value of cos A is: **(SSC CGL 2nd Sit. 2012)**
(a) $\frac{4}{5}$ (b) 1 (c) $\frac{1}{2}$ (d) $\frac{3}{4}$

18. In a right-angled triangle ABC, ÐB is the right angle and AC = $2\sqrt{5}$ cm. If AB – BC = 2 cm, then the value of ($\cos^2 A - \cos^2 C$) is: **(SSC CGL 2nd Sit. 2012)**

(a) $\frac{2}{5}$ (b) $\frac{3}{5}$ (c) $\frac{6}{5}$ (d) $\frac{3}{10}$

19. A boy standing in the middle of a field, observes a flying bird in the north at an angle of elevation of 30° and after 2 minutes, he observes the same bird in the south at an angle of elevation of 60°. If the bird flies all along in a straight line at a height of $50\sqrt{3}$ m, then its speed in km/h is: **(SSC CGL 2nd Sit. 2012)**

(a) 4.5 (b) 3 (c) 9 (d) 6

20. If tan(x + y) tan (x – y) = 1, then the value of tan x is: **(SSC CGL 2nd Sit. 2012)**

(a) $\sqrt{3}$ (b) 1 (c) 1/2 (d) $\frac{1}{\sqrt{3}}$

21. The least value of $4\,\text{cosec}^2\alpha + 9\sin^2\alpha$ is: **(SSC CGL 2nd Sit. 2012)**

(a) 14 (b) 10 (c) 11 (d) 12

22. The simplified value of

$$1-\frac{\sin^2 A}{1+\cos A}+\frac{1+\cos A}{\sin A}-\frac{\sin A}{1-\cos A}\text{ is:}$$

(SSC CGL 2nd Sit. 2012)

(a) cos A (b) 0 (c) 1 (d) sin A

23. If $a^3 - b^3 = 56$ and $a - b = 2$, then the value of $(a^2 + b^2)$ is: **(SSC CGL 2nd Sit. 2012)**

(a) –10 (b) –12 (c) 20 (d) 18

24. If tan θ – cot θ = a and cos θ – sin θ = b, then the value of $(a^2 + 4)(b^2 - 1)^2$ is: **(SSC CGL 2nd Sit. 2012)**

(a) 4 (b) 1 (c) 2 (d) 3

25. If $(a^2 - b^2)\sin\theta + 2ab\cos\theta = a^2 + b^2$, then the value of tan θ is **(SSC CGL 2nd Sit. 2012)**

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

(c) $\frac{1}{2ab}\left(a^2-b^2\right)$ (d) $\frac{1}{2}\left(a^2+b^2\right)$

26. If α is a positive acute angle and $2\sin\alpha + 15\cos^2\alpha = 7$, then the value of cotα is: **(SSC CGL 2nd Sit. 2012)**

(a) 3/4 (b) 4/3 (c) $\frac{\sqrt{5}}{2}$ (d) $\frac{2}{\sqrt{5}}$

27. If x, y are positive acute angles, x + y < 90° and sin (2x – 20°) = cos (2y + 20°), then the value of sec (x + y) is **(SSC CGL 2nd Sit. 2012)**

(a) $\sqrt{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) 1 (d) 0

28. If 5 tanθ = 4, then the value of $\left(\frac{5\sin\theta-3\cos\theta}{5\sin\theta+3\cos\theta}\right)$ is **(SSC CGL 1st Sit. 2012)**

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{5}{7}$ (d) $\frac{2}{5}$

29. The least value of $(4\sec^2\theta + 9\,\text{cosec}^2\theta)$ is **(SSC CGL 1st Sit. 2012)**

(a) 1 (b) 19 (c) 25 (d) 7

30. If tan (x + y) tan (x – y) = 1, then the value of $\tan\left(\frac{2x}{3}\right)$ is **(SSC CGL 1st Sit. 2012)**

(a) $\frac{1}{\sqrt{3}}$ (b) $\frac{2}{\sqrt{3}}$ (c) $\sqrt{3}$ (d) 1

31. If x = cosecθ – sinθ and y = secθ – cosθ, then the value of $x^2y^2(x^2 + y^2 + 3)$ is **(SSC CGL 1st Sit. 2012)**

(a) 0 (b) 1 (c) 2 (d) 3

32. If $0 \le \theta \le \frac{\pi}{2}$, $2y\cos\theta = x\sin\theta$ and $2x\sec\theta - y\,\text{cosec}\theta = 3$, then the value of $x^2 + 4y^2$ is **(SSC CGL 1st Sit. 2012)**

(a) 1 (b) 2 (c) 3 (d) 4

33. When the angle of elevation of the sum increases from 30° to 60°, the shadow of a post is diminished by 5 metres. then the height of the post is **(SSC CGL 1st Sit. 2012)**

(a) $\frac{5\sqrt{3}}{2}$m (b) $\frac{2\sqrt{3}}{5}$m

(c) $\frac{2}{5\sqrt{3}}$m (d) $\frac{4}{5\sqrt{3}}$m

34. 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 **(SSC CGL 1st Sit. 2012)**

(a) 0 (b) 1 (c) –1 (d) 2

35. If $2y\cos q = x\sin q$ and $2x\sec q - y\,\text{cosec}\,q = 3$, then the relation between x and y is **(SSC CGL 2nd Sit. 2012)**

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

(c) $x^2 + 4y^2 = 1$ (d) $4x^2 + y^2 = 4$

36. If $\sec\theta + \tan\theta = \sqrt{3}$, then the positive value of sin θ is **(SSC CGL 2nd Sit. 2012)**

(a) 0 (b) $\frac{1}{2}$ (c) $\frac{\sqrt{3}}{2}$ (d) 1

37. The radian measure of $63°14'51''$ is **(SSC CGL 2nd Sit. 2012)**

(a) $\left(\frac{2811\pi}{8000}\right)^c$ (b) $\left(\frac{3811\pi}{8000}\right)^c$

(c) $\left(\frac{4811\pi}{8000}\right)^c$ (d) $\left(\frac{5811\pi}{8000}\right)^c$

38. In a triangle ABC, $AB = AC$, BA is produced to D in such a manner that $AC = AD$. The circular measure of ∠BCD is **(SSC CGL 2nd Sit. 2012)**

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) $\frac{2\pi}{3}$ (d) $\frac{\pi}{2}$

39. If $\frac{\cos^4\alpha}{\cos^2\beta}+\frac{\sin^4\alpha}{\sin^2\beta}=1$, then the value of $\frac{\cos^4\beta}{\cos^2\alpha}+\frac{\sin^4\beta}{\sin^2\alpha}$ is **(SSC CGL 2nd Sit. 2012)**

(a) 4 (b) 0 (c) $\frac{1}{8}$ (d) 1

40. $\frac{\sin\theta-\cos\theta+1}{\sin\theta+\cos\theta-1}\left(\text{where } \theta\neq\frac{\pi}{2}\right)$ is equal to **(SSC CGL 2nd Sit. 2012)**

(a) $\frac{1+\sin\theta}{\cos\theta}$ (b) $\frac{1-\sin\theta}{\cos\theta}$

(c) $\frac{1-\cos\theta}{\sin\theta}$ (d) $\frac{1+\cos\theta}{\sin\theta}$

41. The angles of elevation of the top of a tower standing on a horizontal plane from two points on a line passing through the foot of the tower at a distance 9 ft and 16 ft respectively are complementary angles. Then the height of the tower is **(SSC CGL 2nd Sit. 2012)**

(a) 9 ft (b) 12 ft (c) 16 ft (d) 144 ft

42. If $\sin^2\alpha = \cos^3\alpha$, then the value of $(\cot^6\alpha - \cot^2\alpha)$ is **(SSC CGL 2nd Sit. 2012)**

(a) 1 (b) 0 (c) – 1 (d) 2

43. The simplified value of $(1 + \tan\theta + \sec\theta)(1 + \cot\theta - \operatorname{cosec}\theta)$ is **(SSC CGL 2nd Sit. 2012)**

(a) – 2 (b) 2 (c) 1 (d) – 1

44. The value of $\tan 1° \tan 2° \tan 3° \ldots \tan 89°$ is: **(SSC Sub. Ins. 2013)**

(a) 1 (b) 2 (c) undefined (d) 0

45. Minimum value of $4\tan^2\theta + 9\cot^2\theta$ is : **(SSC Sub. Ins. 2013)**

(a) 12 (b) 1 (c) 6 (d) 13

46. If $\sin\theta - \cos\theta = \frac{1}{2}$ the value of $\sin\theta + \cos\theta$ is : **(SSC Sub. Ins. 2013)**

(a) – 2 (b) ±2 (c) $\frac{\sqrt{7}}{2}$ (d) 2

47. If $\operatorname{cosec}\theta - \cot\theta = \frac{7}{2}$, the value of $\operatorname{cosec}\theta$ is : **(SSC Sub. Ins. 2013)**

(a) $\frac{47}{28}$ (b) $\frac{51}{28}$

(c) $\frac{53}{28}$ (d) $\frac{49}{28}$

48. $2\operatorname{cosec}^2 23° \cot^2 67° - \sin^2 23° - \sin^2 67° - \cot^2 67°$ is equal to **(SSC CHSL 2013)**

(a) 0 (b) 1

(c) $\sec^2 23°$ (d) $\tan^2 23°$

49. 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 **(SSC CHSL 2013)**

(a) $10\sqrt{3}$ m (b) $5\sqrt{3}$ m

(c) $10(\sqrt{3}+1)$ m (d) $5(\sqrt{3}+1)$ m

50. If $5\tan\theta = 4$, then $\frac{5\sin\theta-3\cos\theta}{5\sin\theta+2\cos\theta}$ is **(SSC CHSL 2013)**

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

(c) $\frac{1}{4}$ (d) $\frac{1}{6}$

51. If $x\sin\theta + y\cos\theta = \sqrt{x^2+y^2}$ and $\frac{\cos^2\theta}{a^2}+\frac{\sin^2\theta}{b^2}=\frac{1}{x^2+y^2}$, then the correct relation is **(SSC CHSL 2013)**

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

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

52. If $2(\cos^2\theta - \sin^2\theta) = 1$ (θ is a positive acute angle), then $\cot\theta$ is equal to **(SSC CHSL 2013)**

(a) $\sqrt{3}$ (b) $-\sqrt{3}$

(c) $\frac{1}{\sqrt{3}}$ (d) 1

53. The angle of elevation of a tower from a distance 100 m from its foot is 30°. Height of the tower is : **(SSC CGL 1st Sit. 2013)**

(a) $100\sqrt{3}$m (b) $\frac{100}{\sqrt{3}}$m

(c) $50\sqrt{3}$m (d) $\frac{200}{\sqrt{3}}$m

54. The value of $\cos 1° \cos 2° \cos 3° \ldots\ldots\ldots\ldots \cos 177° \cos 178° \cos 179°$ is: **(SSC CGL 1st Sit. 2013)**

(a) $\frac{1}{\sqrt{2}}$ (b) 0 (c) $\frac{1}{2}$ (d) 1

55. The value of $(\sin^2 25° + \sin^2 65°)$ is : **(SSC CGL 1st Sit. 2013)**

(a) $\frac{2}{\sqrt{3}}$ (b) $\frac{\sqrt{3}}{2}$ (c) 1 (d) 0

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

(SSC CGL 1st Sit. 2013)

(a) 57°22' 16° (approx.)
(b) 57° 61' 22" (approx.)
(c) 57° 16' 22" (approx.)
(d) 57° 22' 16" (approx.)

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

(SSC CGL 1st Sit. 2013)

(a) 1 (b) 3 (c) 2 (d) 4

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

(SSC CGL 1st Sit. 2013)

(a) $\frac{1}{\sqrt{5}}$ (b) $\frac{3}{\sqrt{5}}$ (c) $\sqrt{5}$ (d) $\frac{7}{\sqrt{5}}$

59. Evaluate : tan 1° tan 2° tan 3° .... tan 89°.

(SSC CGL 1st Sit. 2013)

(a) 0 (b) 1 (c) –1 (d) 2

60. 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

(SSC CGL 2nd Sit. 2013)

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{12}$ (c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

61. Maximum value of (2 sin θ + 3 cos θ) is

(SSC CGL 2nd Sit. 2013)

(a) 2 (b) $\sqrt{13}$ (c) $\sqrt{15}$ (d) 1

62. The value of
152 (sin 30° + 2 cos² 45° + 3 sin 30° + 4 cos² 45° + ... + 17 sin 30° + 18 cos² 45°) is **(SSC CGL 2nd Sit. 2013)**

(a) an integer but not a perfect square
(b) a rational number but not an integer
(c) a perfect square of an integer
(d) irrational

63. If (1 + sinα) (1 + sinβ) (1 + sinγ) = (1 – sinα) (1 – sinβ) (1 – sinγ), then each side is equal to

(SSC CGL 2nd Sit. 2013)

(a) $\pm\cos\alpha\cos\beta\cos\gamma$ (b) $\pm\sin\alpha\sin\beta\sin\gamma$
(c) $\pm\sin\alpha\cos\beta\cos\gamma$ (d) $\pm\sin\alpha\sin\beta\cos\gamma$

64. One of the four angles of a rhombus is 60°. If the length of each side of the rhombus is, 8 cm, then the length of the longer diagonal is **(SSC CGL 2nd Sit. 2013)**

(a) $8\sqrt{3}$ cm (b) 8 cm (c) $4\sqrt{3}$ cm (d) $\frac{8}{\sqrt{3}}$ cm

65. If tanθ = $\frac{3}{4}$ and θ is acute, then cosec θ

(SSC CGL 1st Sit. 2013)

(a) $\frac{5}{4}$ (b) $\frac{4}{3}$ (c) $\frac{4}{5}$ (d) $\frac{5}{3}$

66. The value of $\frac{1}{(1+\tan^2\theta)} + \frac{1}{(1+\cot^2\theta)}$ is

(SSC CGL 1st Sit. 2013)

(a) 2 (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) 1

67. The tops 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 **(SSC CGL 1st Sit. 2013)**

(a) 8m (b) $6\sqrt{3}$m (c) 6m (d) $8\sqrt{3}$m

68. If tan α = n tan β, and sin α = m sin β, then $\cos^2\alpha$ is

(SSC CGL 1st Sit. 2013)

(a) $\frac{m^2-1}{n^2-1}$ (b) $\frac{m^2+1}{n^2+1}$ (c) $\frac{m^2}{n^2+1}$ (d) $\frac{m^2}{n^2}$

69. The value of $\frac{1}{\text{cosec}\,\theta - \cot\theta} - \frac{1}{\sin\theta}$ is **(SSC CGL 1st Sit. 2013)**

(a) cosec θ (b) tan θ (c) 1 (d) cot θ

70. If cosθ + sinθ = $\sqrt{2}\cos\theta$, then cosθ – sinθ is

(SSC CGL 1st Sit. 2013)

(a) $-\sqrt{2}\sin\theta$ (b) $\sqrt{2}\sin\theta$
(c) $\sqrt{2}\tan\theta$ (d) $-\sqrt{2}\cos\theta$

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

(SSC CGL 1st Sit. 2013)

(a) $\frac{2}{3}$ (b) $\frac{1}{3}$ (c) $\frac{4}{3}$ (d) 0

72. The value of $\frac{\sin 53°}{\cos 37°} \div \frac{\cot 65°}{\tan 25°}$ is

(SSC CGL 1st Sit. 2013)

(a) 2 (b) 1 (c) 3 (d) 0

73. The value of $\frac{\cos 60° + \sin 60°}{\cos 60° - \sin 60°}$ is

(SSC CGL 1st Sit. 2013)

(a) – 1 (b) $\sqrt{3}+2$ (c) $-(2+\sqrt{3})$ (d) $\sqrt{3}-2$

74. The value of

$$\frac{\cot 5°.\cot 10°.\cot 15°.\cot 60°.\cot 75°.\cot 80°.\cot 85°}{(\cos^2 20° + \cos^2 70°) + 2}$$ is

(SSC CGL 1st Sit. 2013)

(a) $\frac{9}{\sqrt{3}}$ (b) $\frac{1}{9}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{\sqrt{3}}{9}$

75. In a triangle, the angles are in the ratio 2 : 5 : 3. What is the value of the least angle in the radian ?

(SSC CGL 1st Sit. 2013)

(a) $\frac{\pi}{20}$ (b) $\frac{\pi}{10}$ (c) $\frac{2\pi}{5}$ (d) $\frac{\pi}{5}$

76. If $x = a\cos\theta - b\sin\theta$, $y = b\cos\theta + a\sin\theta$, then find the value of $x^2 + y^2$. **(SSC CGL 1st Sit. 2013)**

(a) a^2 (b) b^2 (c) $\frac{a^2}{b^2}$ (d) $a^2 + b^2$

77. If $\tan\alpha + \cot\alpha = 2$, then the value of $\tan^7\alpha + \cot^7\alpha$ is **(SSC CGL 1st Sit. 2013)**

(a) 2 (b) 16 (c) 64 (d) 128

78. From 125 metre high towers, the angle of depression of a car is 45°. Then how far the car is from the tower ? **(SSC CGL 1st Sit. 2013)**

(a) 125 metre (b) 60 metre
(c) 75 metre (d) 95 metre

79. If the angles 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 **(SSC CGL 1st Sit. 2013)**

(a) $\frac{\sqrt{3}}{2}$ km (b) $\frac{1}{2}$ km (c) $\frac{2}{\sqrt{3}}$ km (d) $3\sqrt{3}$ km

80. Evaluate : $3\cos 80° \operatorname{cosec} 10° + 2\cos 59° \operatorname{cosec} 31°$ **(SSC CGL 1st Sit. 2013)**

(a) 1 (b) 3 (c) 2 (d) 5

81. $\left(\frac{3\pi}{5}\right)$ radians is equal to **(SSC CGL 1st Sit. 2013)**

(a) 100° (b) 120° (c) 108° (d) 180°

82. If $\tan\theta + \cot\theta = 2$, then the value of $\tan^2\theta + \cot^2\theta$ is **(SSC CGL 1st Sit. 2013)**

(a) 2 (b) 1 (c) $\sqrt{2}$ (d) 0

83. The eliminant of q from xcos q – y sinq = 2 and x sin q + y cos q = 4 will give **(SSC CGL 1st Sit. 2013)**

(a) $x^2+y^2=20$ (b) $3x^2+y^2=20$
(c) $x^2-y^2=20$ (d) $3x^2-y^2=10$

84. $\sin^2\theta - 3\sin\theta + 2 = 0$ will be true if **(SSC CGL 1st Sit. 2013)**

(a) $0 \le \theta < 90$ (b) $0 < \theta < 90$
(c) $\theta = 0°$ (d) $\theta = 90°$

85. The value of

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

$(\sec^2 A - \operatorname{cosec}^2 A)$ **(SSC CGL 1st Sit. 2013)**

(a) 1 (b) 3
(c) 2 (d) 4

86. If $0 \le \theta \le \frac{\pi}{2}$ and $\sec^2\theta + \tan^2\theta = 7$, then θ is **(SSC Sub. Ins. 2014)**

(a) $\frac{5\pi}{12}$ radian (b) $\frac{\pi}{3}$ radian

(c) $\frac{\pi}{5}$ radian (d) $\frac{\pi}{6}$ radian

87. The simplest value of **(SSC Sub. Ins. 2014)**
$\sin^2 x + 2\tan^2 x - 2\sec^2 x + \cos^2 x$ is

(a) 1 (b) 0 (c) –1 (d) 2

88. 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 **(SSC Sub. Ins. 2014)**

(a) 90° (b) 60° (c) 45° (d) 30°

89. 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 **(SSC Sub. Ins. 2014)**

(a) 20 m (b) $20\sqrt{3}$ m
(c) 30m (d) $30\sqrt{3}$ m

90. If $x = a\sin\theta$ and $y = b\tan\theta$ then prove that $\frac{a^2}{x^2} - \frac{b^2}{y^2}$ is **(SSC Sub. Ins. 2014)**

(a) 1 (b) 2 (c) 3 (d) 4

91. The value of

$$\frac{\sin 25°\cos 65° + \cos 25°\sin 65°}{\tan^2 70° - \operatorname{cosec}^2 20°}$$ is **(SSC CHSL 2014)**

(a) –1 (b) 0 (c) 1 (d) 2

92. 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 **(SSC CHSL 2014)**

(a) 0 (b) 1 (c) $\sqrt{3}$ (d) $\frac{1}{\sqrt{3}}$

93. 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 **(SSC CHSL 2014)**

(a) $\frac{4}{5}$ (b) $\frac{5}{4}$ (c) $\sqrt{\frac{3}{4}}$ (d) $\sqrt{\frac{5}{4}}$

94. A vertical pole and a vertical tower are standing on the same level ground. Height of the pole is 10 metres. Form the top of the pole is 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 **(SSC CHSL 2014)**

(a) 20m (b) 30m (c) 40m (d) 50m

95. The value of $\sin^2 1° + \sin^2 2° + \sin^2 3° + ... + \sin^2 89°$ is **(SSC CGL 2014)**

(a) 22 (b) 44 (c) $22\frac{1}{2}$ (d) $44\frac{1}{2}$

96. 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 **(SSC CGL 2014)**

(a) –1 (b) 1 (c) 2 (d) 0

97. The shadow of a tower standing on a level plane is found to be 30 m longer when the Sun's altitude changes from 60° to 45°. The height of the tower is **(SSC CGL 2014)**

(a) $15(3+\sqrt{3})$m (b) $15(\sqrt{3}+1)$m

(c) $15(\sqrt{3}-1)$m (d) $15(3-\sqrt{3})$m

98. If $\sin 17° = \frac{x}{y}$ then $\sec 17° - \sin 73°$ is equal to **(SSC CGL 2014)**

(a) $\frac{y}{\sqrt{y^2-x^2}}$ (b) $\frac{y^2}{\left(x\sqrt{y^2-x^2}\right)}$

(c) $\frac{x}{\left(y\sqrt{y^2-x^2}\right)}$ (d) $\frac{x^2}{\left(y\sqrt{y^2-x^2}\right)}$

99. If θ is a positive acute angle and $\text{cosec}\,\theta + \cot\theta = \sqrt{3}$, then the value of cosec θ is **(SSC CGL 2014)**

(a) $\frac{1}{\sqrt{3}}$ (b) $\sqrt{3}$ (c) $\frac{2}{\sqrt{3}}$ (d) 1

100. If $\cos\alpha + \sec\alpha = \sqrt{3}$, then the value of $\cos^3\alpha + \sec^3\alpha$ is **(SSC CGL 2014)**

(a) 2 (b) 1 (c) 0 (d) 4

101. If $\sin\theta + \cos\theta = \sqrt{2}\cos\theta$, then the value of cot θ is **(SSC CGL 2014)**

(a) $\sqrt{2}+1$ (b) $\sqrt{2}-1$ (c) $\sqrt{3}-1$ (d) $\sqrt{3}+1$

102. 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 **(SSC CHSL 2014)**

(a) $5(\sqrt{3}+1)$ metres (b) $5(\sqrt{3}-1)$ metres

(c) $5\sqrt{3}$ metres (d) $\frac{5}{\sqrt{3}}$ metres

103. 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: **(SSC Sub. Ins. 2015)**

(a) $30(3+\sqrt{3})$m (b) $40(3+\sqrt{3})$m

(c) $10(3+\sqrt{3})$m (d) $20(3+\sqrt{3})$m

104. If α is an acute angle and $2\sin\alpha + 15\cos^2\alpha = 7$, then the value of cot α is: **(SSC Sub. Ins. 2015)**

(a) $\frac{4}{5}$ (b) $\frac{5}{4}$

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

105. If $\sin\theta + \sin^2\theta = 1$, then the value of $\cos^2\theta + \cos^4\theta$ is: **(SSC Sub. Ins. 2015)**

(a) 2 (b) 0
(c) 1 (d) –1

106. 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: **(SSC Sub. Ins. 2015)**

(a) 16 (b) 12 (c) 15 (d) 18

107. The value of x in the equation

$$\tan^2\frac{\pi}{4} - \cos^2\frac{\pi}{3} - x\sin\frac{\pi}{4}\cos\frac{\pi}{4}\tan\frac{\pi}{3} \text{ is :}$$

(SSC CHSL 2015)

(a) $\frac{\sqrt{3}}{2}$ (b) $\frac{3\sqrt{3}}{4}$ (c) $\frac{2}{\sqrt{3}}$ (d) $\frac{1}{\sqrt{3}}$

108. Value of the expression :

$$\frac{1+2\sin 60°\cos 60°}{\sin 60° + \cos 60°} + \frac{1-2\sin 60°\cos 60°}{\sin 60° - \cos 60°}$$

(SSC CHSL 2015)

(a) 0 (b) 2 (c) $\sqrt{3}$ (d) $2\sqrt{3}$

109. If $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$ then the value of $\sin^2\theta$ is : **(SSC CHSL 2015)**

(a) $\frac{4}{5}$ (b) $\frac{2}{5}$ (c) $\frac{1}{5}$ (d) $\frac{3}{5}$

110. If $\sin 2\theta = \frac{\sqrt{3}}{2}$ then the value of sin 3θ is equal to : (take $(0° \le \theta \le 90°)$) **(SSC CHSL 2015)**

(a) 0 (b) $\frac{\sqrt{3}}{2}$ (c) 1 (d) $\frac{1}{2}$

111. If $\alpha + \beta = 90°$ then the expression $\frac{\tan\alpha}{\tan\beta} + \sin^2\alpha + \sin^2\beta$ is equal to : **(SSC CHSL 2015)**

(a) $\sec^2\beta$ (b) $\tan^2\beta$
(c) $\sec^2\alpha$ (d) $\tan^2\alpha$

112. The maximum value of $\sin^4\theta + \cos^4\theta$ is **(SSC CGL 1st Sit. 2015)**

(a) 1 (b) 2 (c) 3 (d) $\frac{1}{3}$

113. Find the value of tan 4° tan 43° tan 47° tan 86° **(SSC CGL 1st Sit. 2015)**

(a) 1 (b) $\frac{1}{2}$ (c) 2 (d) $\frac{2}{3}$

114. 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 **(SSC CGL 1st Sit. 2015)**

(a) $\frac{3}{4}$ (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $1\frac{1}{4}$

115. If x cos θ – sin θ = 1, then $x^2 - (1 + x^2) \sin \theta$ equals **(SSC CGL 1st Sit. 2015)**

(a) 1 (b) –1 (c) 0 (d) 2

116. A 10 m 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 $\sqrt{3} = 1.732$)

(SSC CGL 1st Sit. 2015)

(a) 7.32 (b) 8.26 (c) 8.66 (d) 8.16

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

(SSC CGL 1st Sit. 2015)

(a) 1 (b) 3 (c) 2 (d) 4

118. 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 p as $\frac{22}{7}$ is: **(SSC CGL 1st Sit. 2015)**

(a) 60° (b) 48° (c) 52° (d) 56°

119. The value of $\sin^2 22° + \sin^2 68° + \cot^2 30°$ is

(SSC CGL 1st Sit. 2015)

(a) $\frac{3}{4}$ (b) 4 (c) $\frac{5}{4}$ (d) 3

120. If q be acute angle and tan (4q – 50°) = cot (50° – q), then the value of q in degrees is : **(SSC CGL 1st Sit. 2015)**

(a) 30 (b) 40 (c) 20 (d) 50

121. If 5sin θ = 3, the numerical value of $\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta}$

(SSC CGL 1st Sit. 2015)

(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$ (d) $\frac{1}{5}$

122. A kite is flying at the height of 75 m from the ground. The string makes an angle q (where cot q = $\frac{8}{15}$) with the level ground. Assuming that there is no slack in the string, the length of the string is equal to :**(SSC CGL 1st Sit. 2015)**

(a) 75 m (b) 85 m (c) 40 m (d) 65 m

123. If sec θ + tan θ = p, (p ≠ 0) then secθ is equal to

(SSC CGL 1st Sit. 2015)

(a) $\left(p + \frac{1}{p}\right), p \neq 0$ (b) $\frac{1}{2}\left(p + \frac{1}{p}\right), p \neq 0$

(c) $2\left(p - \frac{1}{p}\right), p \neq 0$ (d) $\left(p - \frac{1}{p}\right), p \neq 0$

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

(SSC CGL 1st Sit. 2016)

(a) π/4 (b) π/3

(c) 5π/12 (d) π/2

125. If $\sin 31° = \frac{x}{y}$. The value of sec 31° – sin 59° is

(SSC CGL 1st Sit. 2016)

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

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

126. A tower is 50 meters high.Its shadow is x metres shorter when the sun's altitude is 45° than when it is 30°. The value of x in metres is **(SSC CGL 1st Sit. 2016)**

(a) $50\sqrt{3}$ (b) $50(\sqrt{3} - 1)$

(c) $50(\sqrt{3} + 1)$ (d) 50

127. If θ > 0, be an acute angle, then the value of θ in degrees satisfying $\frac{\cos^2 \theta - 3 \cos \theta + 2}{\sin^2 \theta} = 1$ is

(SSC CGL 1st Sit. 2016)

(a) 90° (b) 30°

(c) 45° (d) 60°

128. The upper part of a tree broke at a certain height makes an angle of 60° with the ground at a distance of 10 m. from its feet. The original height of the tree was

(SSC CGL 1st Sit. 2016)

(a) $20\sqrt{3}$ m. (b) $10\sqrt{3}$ m.

(c) $10(2+\sqrt{3})$ m. (d) $10(2-\sqrt{3})$m.

129. The value of

$$\cot 17° \left(\cot 73° \cos^2 22° + \frac{1}{\cot 17° \sec^2 68°}\right) \text{ is}$$

(SSC CGL 1st Sit. 2016)

(a) 0 (b) 1 (c) 2 (d) √3

130. If tan (5x - 10°) = cot (5y + 20°), then the value of x + y is

(SSC CGL 1st Sit. 2016)

(a) 15° (b) 16° (c) $22\frac{1}{2}°$ (d) 24°

131. A pilot in an aeroplane at an altitude of 200 m 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 **(SSC CGL 1st Sit. 2016)**

(a) $\left(200 + \frac{200}{\sqrt{3}}\right)$m (b) $\left(200 - \frac{200}{\sqrt{3}}\right)$m

(c) $400\sqrt{3}$ m (d) $\left(\frac{400}{\sqrt{3}}\right)$m

132. 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 m, the distance between the two men is (Take $\sqrt{3} = 1.7$)

(SSC CGL 1st Sit. 2016)

(a) 136.5 m (b) $50\sqrt{3}$ m (c) $100\sqrt{3}$ m (d) 135.5 m

133. Value of (cos 53° – sin 37°) is

(SSC CGL 1st Sit. 2016)

(a) 0 (b) 1
(c) 2 sin 37° (d) 2 cos 53°

134. If cosec θ + sin θ = 5/2 then the value of cosec θ – sin θ is

(SSC CGL 1st Sit. 2016)

(a) –3/2 (b) 3/2 (c) $-\sqrt{3}/2$ (d) $\sqrt{3}/2$

135. If $0 < \theta < 90^0$, $\tan\theta + \sin\theta = m$ and $\tan\theta - \sin\theta = n$, where $m \neq n$, then value of $m^2 - n^2$ is

(SSC Sub. Ins. 2016)

(a) $2(m^2+n^2)$ (b) $4\sqrt{mn}$
(c) 4mn (d) $2(\tan^2\theta + \sin^2\theta)$

136. If 0 < A < 90°, then the value of

$\frac{1}{2}\cot A\left[\frac{1+(\sec A-\tan A)^2}{\text{cosec}A(\sec A-\tan A)}\right]$ is **(SSC Sub. Ins. 2016)**

(a) 2 (b) 0 (c) 1 (d) $\frac{1}{2}$

137. The value of $\sin^2 2° + \sin^2 4° + \sin^2 6° + ...+ \sin^2 90°$ is

(SSC Sub. Ins. 2016)

(a) 0 (b) 22
(c) 23 (d) 44

138. From the top and bottom of a straight hill, the angle of depression and elevation of the top of a pillar of 10 m. height are observed to be 60° and 30° respectively. The height (metres) of the hill is **(SSC Sub. Ins. 2016)**

(a) 40 (b) 30 (c) 80 (d) 60

139. If $\tan\theta + \sec\theta = 2$, then the value of $\tan\theta$ is

(SSC Sub. Ins. 2016)

(a) $\frac{2}{3}$ (b) $\frac{3}{5}$ (c) $\frac{4}{5}$ (d) $\frac{3}{4}$

140. What is the simplified value of $\frac{\cot A + \tan B}{\cot B + \tan A}$?

(SSC CGL 2017)

(a) tan B cot A (b) tan A cot B
(c) tan A tan B (d) cot A cot B

141. What is the simplified value of $\left(\frac{1}{\text{cosec } A + \cot A}\right)^2$?

(SSC CGL 2017)

(a) sec A + tan A
(b) (1 – cos A) / (1 + cos A)
(c) (1 – cos A) / (1 + cosec A)
(d) sin A

142. If $\cos^2\theta - \sin\theta = 1/4$, then what is the value of sin θ?

(SSC CGL 2017)

(a) –1 (b) 1/2
(c) 1 (d) 3/2

143. What is the simplified value of $\frac{\sin 2A}{1+\cos 2A}$?

(SSC CGL 2017)

(a) tan A (b) cot A
(c) sin A (d) cos A

144. What is the simplified value of $\left(\frac{\sec A}{\cot A + \tan A}\right)^2$?

(SSC CGL 2017)

(a) $1 - \cos^2 A$ (b) $2\sin^2 A$
(c) $\sec^2 A$ (d) $\text{cosec}^2 A$

145. What is the simplified value of 1 + tan A tan (A/2)?

(SSC CGL 2017)

(a) sin A/2 (b) cos A
(c) sec A (d) sin A

146. What is the simplified value of cosec 2A + cot 2A?

(SSC CGL 2017)

(a) sec A (b) sec (A/2)
(c) cot A (d) $\cot^2 A$

147. If A = 30°, B = 60° and C = 135°, then what is the value of $\sin^3 A + \cos^3 B + \tan^3 C - 3\sin A\cos B\tan C$?

(SSC CGL 2017)

(a) 0 (b) 1
(c) 8 (d) 9

148. What is the least value of $\tan^2\theta + \cot^2\theta + \sin^2\theta + \cos^2\theta + \sec^2\theta + \text{cosec}^2\theta$?

(SSC CGL 2017)

(a) 1 (b) 3 (c) 5 (d) 7

149. What is the simplified value of $\text{cosec}^6 A - \cot^6 A - 3\,\text{cosec}^2 A \cot^2 A$? **(SSC CGL 2017)**

(a) – 2 (b) – 1
(c) 0 (d) 1

150. What is the simplified value of $\sqrt{\frac{\sec A - 1}{\sec A + 1}}$?

(SSC CGL 2017)

(a) cosec A – cot A (b) sec A – tan A
(c) $\sec^2 A$ (d) sec A cosec A

151. If tan A = 1/2 and tan B = 1/3, then what is the value of tan (2A + B)? **(SSC CGL 2017)**

(a) 1 (b) 3
(c) 5 (d) 9

152. If tan (A/2) = x, then the value of x is

(SSC CHSL 2017)

(a) sin A/(1 – cosA) (b) sin A/(1 + cosA)
(c) cos A/(1+sin A) (d) cos A/(1 – sin A)

153. If 2sec A – (1 + sinA)/cos A = x, then the value of x is

(SSC CGL 2017)

(a) cosec A/(1 + sin A) (b) cos A/(1 + sin A)
(c) cos A(1 – sin A) (d) cosec A(1 – sin A)

154. If $\sec\left(-\frac{5\pi}{4}\right) = x$, then value of x is **(SSC CGL 2017)**

(a) $-11\sqrt{3}$ (b) $-\sqrt{2}$

(c) -1 (d) $\sqrt{3}$

155. What is the simplified value of $\left(\frac{1}{\operatorname{cosec}\theta + \cot\theta}\right)^2$?

(SSC Sub. Ins. 2017)

(a) $\operatorname{cosec}\theta + \tan\theta$

(b) $\sin\theta + \cos\theta$

(c) $(1-\cos\theta)/(1+\cos\theta)$

(d) $(1-\sin\theta)/(1+\sin\theta)$

156. If $\sec\theta + \operatorname{cosec}\theta = \sqrt{2}\sec(90-\theta)$ then what is the value of $\cot\theta$? **(SSC Sub. Ins. 2017)**

(a) $\sqrt{2}$ (b) 2

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

157. If $\sin(\theta + 23°) = \cos 58°$, then what is the value of $\cos 5\theta$?

(SSC Sub. Ins. 2017)

(a) 1/2 (b) $1/\sqrt{2}$

(c) $\sqrt{3}/2$ (d) 0

158. If $x\sin\theta = \frac{5\sqrt{3}}{2}$ and $x\cos\theta = \frac{5}{2}$ then what is the value of x?

(SSC Sub. Ins. 2017)

(a) $\sqrt{3}$ (b) 1/2 (c) $\sqrt{3}/2$ (d) 5

159. If $\theta + \varphi = \frac{2}{3}\pi$ and $\cos\theta = \frac{\sqrt{3}}{2}$, then what is the value of $\sin\varphi$? **(SSC Sub. Ins. 2017)**

(a) 0 (b) 1/2 (c) $1/\sqrt{2}$ (d) 1

160. A ladder leaning against a wall makes an angle θ with the horizontal ground such that $\sin\theta = \frac{12}{13}$. If the foot of the ladder is 7.5 m from the wall, then what is the height of the point where the top of the ladder touches the wait?

(SSC Sub. Ins. 2018)

(a) 15m (b) 8m (c) 18m (d) 12m

161. The value of $\frac{\sin 30° - \cos 60° + \cot^2 45°}{\cos 30° - \tan 45° + \sin 90°}$ is equal to

(SSC Sub. Ins. 2018)

(a) $\frac{3}{2}$ (b) $\frac{\sqrt{3}}{4}$ (c) $\frac{2\sqrt{3}}{3}$ (d) $\frac{\sqrt{3}}{2}$

162. If $\tan 3x = \cot(30° + 2x)$, then what is the value of x?

(SSC Sub. Ins. 2018)

(a) 12° (b) 18° (c) 10° (d) 15°

163. From the top of a 12 m high building, the angle of elevation of the top of a tower is 60° and the angle of depression of the foot of the tower is q, such that $\tan q = \frac{3}{4}$. What is the height of the tower $(\sqrt{3} = 1.73)$?

(SSC Sub. Ins. 2018)

(a) 36.22 m (b) 41.41 m (c) 37.95 m (d) 39.68 m

164. If $\theta = 9°$, then what is the value of $\cot\theta \cot 2\theta \cot 3\theta \cot 4\theta \cot 5\theta \cot 6\theta \cot 7\theta \cot 8\theta \cot 9\theta$? **(SSC CHSL-2018)**

(a) $\sqrt{3}-1$ (b) 1 (c) $\sqrt{3}$ (d) $\frac{1}{\sqrt{3}}$

165. For α and β both being acute angles, it is given that $\sin(\alpha+\beta) = 1$, $\cos(\alpha-\beta) = \frac{1}{2}$. The values of α and β are :

(SSC CHSL-2018)

(a) 75°, 15° (b) 45°, 15°

(c) 75°, 45° (d) 60°, 30°

166. It is given that, $\sqrt{\frac{1-\sin x}{1+\sin x}} = a - \tan x$ then a is equal to :

(SSC CGL-2018)

(a) $\cos x$ (b) $\sin x$

(c) $\operatorname{cosec} x$ (d) $\sec x$

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

(SSC CGL-2018)

(a) $-\frac{1}{3}$ (b) $\frac{2}{3}$ (c) $-\frac{2}{3}$ (d) $\frac{1}{3}$

168. If $\sec 4\theta = \operatorname{cosec}(\theta + 20°)$, then θ is equal to:

(SSC CGL-2018)

(a) 22° (b) 18° (c) 14° (d) 20°

169. The value of $\sin^2 38° + \sin^2 52° + \sin^2 30° - \tan^2 45°$ is equal to: **(SSC CGL-2018)**

(a) $\frac{1}{3}$ (b) $\frac{1}{4}$ (c) $\frac{3}{4}$ (d) $\frac{1}{2}$

170. If $2\sin\theta = 5\cos\theta$, then $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta}$ is equal to:

(SSC CGL-2018)

(a) $\frac{5}{3}$ (b) $\frac{9}{5}$ (c) $\frac{2}{3}$ (d) $\frac{7}{3}$

171· The value of $\sin^2 32° + \sin^2 58° - \sin 30° + \sec^2 60°$ is equal to: **(SSC CGL-2018)**

(a) 5.5 (b) 3.5

(c) 4.5 (d) 4

172· If $\operatorname{cosec} 2\theta = \sec(3\theta - 15°)$, then θ is equal to:

(SSC CGL-2018)

(a) 22° (b) 20° (c) 25° (d) 21°

173. If A lies in the first quadrant and 6 tanA = 5, then the value of $\frac{8\sin A - 4\cos A}{\cos A + 2\sin A}$ is : **(SSC CGL 2019-20)**

(a) 1 (b) 4 (c) –2 (d) 16

174. If A + B = 45°, then the value of 2(1 + tan A)(1 + tan B) is : **(SSC CGL 2019-20)**

(a) 4 (b) 1 (c) 0 (d) 2

175. If $x = 4\cos A + 5\sin A$ and $y = 4\sin A - 5\cos A$, then the value of $x^2 + y^2$ is : **(SSC CGL 2019-20)**

(a) 25 (b) 16 (c) 0 (d) 41

176. Find the value of $\frac{\tan 60° - \tan 15°}{1 + \tan 60° \tan 15°}$ **(SSC CHSL 2019-20)**

(a) $\frac{\sqrt{3}}{2}$ (b) 1 (c) $\frac{1}{2}$ (d) $\frac{1}{\sqrt{2}}$

177. If $3\sec^2 x - 4 = 0$, then the value of x $(0 < x < 90°)$ **(SSC CHSL 2019-20)**

(a) 15° (b) 45° (c) 30° (d) 60°

178. If $4\cos^2\theta - 3\sin^2\theta + 2 = 0$, then the value of tanθ is (where $0 \le \theta < 90°$) **(SSC CHSL 2019-20)**

(a) 1 (b) $\sqrt{6}$ (c) $\sqrt{2}$ (d) $\frac{1}{\sqrt{3}}$

179. If $3\tan\theta = 2\sqrt{3}\sin\theta, 0° < \theta < 90°$, then find the value of $2\sin^2 2\theta - 3\cos^2 3\theta$. **(SSC CGL-2020-21)**

(a) $-\frac{3}{2}$ (b) $\frac{1}{2}$ (c) $\frac{3}{2}$ (d) 1

180. If $3\sec\theta + 4\cos\theta - 4\sqrt{3} = 0$ where θ is an acute angle then the value of θ is: **(SSC CGL-2020-21)**

(a) 45° (b) 60° (c) 20° (d) 30°

181. The value of $\frac{\tan(45° - \alpha)}{\cot(45° + \alpha)} - \frac{(\cos 19° + \sin 71°)(\sec 19° + \text{cosec} 71°)}{\tan 12° \tan 24° \tan 66° \tan 78°}$ is: **(SSC CGL-2020-21)**

(a) – 3 (b) 2 (c) – 2 (d) 0

182. If $\tan A + \sec A = \frac{3}{2}$ and A is an acute angle, then the value of $\frac{10\cot A + 13\cos A}{12\tan A + 5\text{cosec} A}$ is: **(SSC CHSL-2020-21)**

(a) 4 (b) 2 (c) 1 (d) 5

183. If $\sec\theta - \text{cosec}\theta = 0$ is an acute angle, then what is the value of $\sec^2\theta + \text{cosec}^2\theta$? **(SSC CHSL-2020-21)**

(a) 1 (b) 2 (c) 0 (d) 4

184. If a triangle ABC is right-angled at A, then what is the value of $\sin\frac{B+C}{2}\cos\frac{B+C}{2}$? **(SSC CHSL-2020-21)**

(a) $\sqrt{2}$ (b) $\frac{\sqrt{3}}{4}$ (c) $\frac{1}{4}$ (d) $\frac{1}{2}$

185. The sum of all the three sides of an equilateral triangle is $15\sqrt{3}$ cm. The height of the triangle is : **(SSC CHSL-2020-21)**

(a) 9 cm (b) 7.5 cm (c) 8 cm (d) 7 cm

186. In ΔABC, $AC = BC$ and the length of the base AB is 10 cm. If $CG = 8$ cm, where G is the centroid, then what is the length of AC? **(SSC CHSL-2020-21)**

(a) 13 cm (b) 12 cm (c) $\sqrt{91}$ cm (d) 15 cm

187. If $4(\text{cosec}^2 57° - \tan^2 33°) - \cos 90° - y\tan^2 66° \tan^2 24° = \frac{y}{2}$, the value of y is : **(SSC Sub-Inspector 2020-21)**

(a) $\frac{8}{3}$ (b) $\frac{3}{8}$ (c) 8 (d) $\frac{1}{3}$

188. If $4 - 2\sin^2\theta - 5\cos\theta = 0$, $0° < \theta < 90°$, then the value of $\cos\theta + \tan\theta$ is: **(SSC Sub-Inspector 2020-21)**

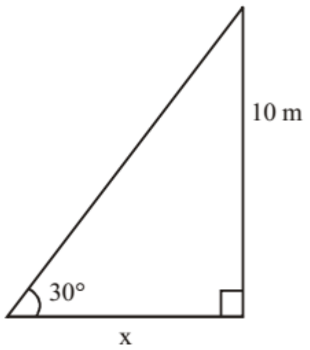
(a) $\frac{2-\sqrt{3}}{2}$ (c) $\frac{1+2\sqrt{3}}{2}$

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

189. A ladder leaning against a wall makes an angle θ with the horizontal ground such that $\cos\theta = \frac{5}{13}$. If the height of the top of the ladder from the wall is 18 m, then what is the distance (in m) of the foot of the ladder from the wall? **(SSC Sub-Inspector 2020-21)**

(a) 18 (b) 7.5 (c) 13 (d) 19.5

1. (a)



Let 'x' be the distance of foot of ladder

$\tan 30° = \frac{P}{B} = \frac{10}{x}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{10}{x} \Rightarrow x = 10\sqrt{3}$ m

2. (d) $\tan 7° \tan 23° \tan 60° \tan 67° \tan 83°$

$\Rightarrow \tan(90° - 83°) \tan(90° - 67°) \tan 60° \tan 67° \tan 83°$

$\Rightarrow \cot 83° \cot 67° \tan 60° \tan 67° \tan 83°$

$[\because \tan(90° - \theta) = \cot\theta]$

$\Rightarrow \frac{1}{\tan 83°} \times \frac{1}{\tan 67°} \times \tan 60° \times \tan 67° \times \tan 83°$

$\Rightarrow \tan 60° = \sqrt{3}$

3. (c) $(\sec\theta - \cos\theta)(\operatorname{cosec}\theta - \sin\theta)(\tan\theta + \cot\theta)$

$\Rightarrow \left(\frac{1}{\cos\theta} - \cos\theta\right)\left(\frac{1}{\sin\theta} - \sin\theta\right)\left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)$

$\Rightarrow \frac{1-\cos^2\theta}{\cos\theta} \times \frac{1-\sin^2\theta}{\sin\theta} \times \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$

$\Rightarrow \frac{\sin^2\theta}{\cos\theta} \times \frac{\cos^2\theta}{\sin\theta} \times \frac{1}{\sin\theta\cos\theta} [\because \sin^2\theta + \cos^2\theta = 1]$

$\Rightarrow 1$

4. (b) $\tan(\theta_1 + \theta_2) = \sqrt{3}$

or $\tan(\theta_1 + \theta_2) = \tan 60°$

$\theta_1 + \theta_2 = 60°$ ...(1)

$\sec(\theta_1 - \theta_2) = \frac{2}{\sqrt{3}}$

or $\sec(\theta_1 - \theta_2) = \sec 30°$

$\theta_1 - \theta_2 = 30°$ ...(2)

Adding equation (1) & (2)

$\theta_1 + \theta_2 + \theta_1 - \theta_2 = 90°$

$\theta_1 = 45°$ & $\theta_2 = 15°$

Now, $\sin 2 \times 45° + \tan 3 \times 15°$

$= \sin 90° + \tan 45° = 1 + 1 = 2$

5. (a) $\frac{2\sin\theta - \cos\theta}{\cos\theta + \sin\theta} = 1$

Dividing numerator and denominator by $\cos\theta$.

$\frac{\frac{2\sin\theta}{\cos\theta} - \frac{\cos\theta}{\cos\theta}}{\frac{\cos\theta}{\cos\theta} + \frac{\sin\theta}{\cos\theta}} = 1 \Rightarrow \frac{2\tan\theta - 1}{1 + \tan\theta} = 1$

$\Rightarrow 2\tan\theta - 1 = 1 + \tan\theta \Rightarrow \tan\theta = 2$

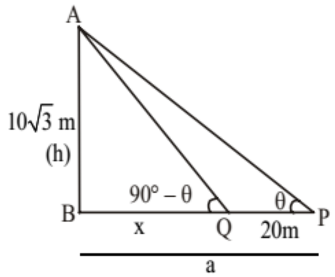
Hence, $\cot\theta = \frac{1}{\tan\theta} = \frac{1}{2}$

6. (c) $\tan\left(\frac{\pi}{2} - \frac{\theta}{2}\right) = \sqrt{3}$, $\tan\left(\frac{\pi}{2} - \frac{\theta}{2}\right) = \tan\frac{\pi}{3}$

$\frac{\pi}{2} - \frac{\theta}{2} = \frac{\pi}{3} \Rightarrow \frac{\theta}{2} = \frac{\pi}{2} - \frac{\pi}{3} \Rightarrow \theta = \frac{\pi}{3}$

$\therefore \cos\theta = \cos\frac{\pi}{3} = \frac{1}{2}$

7. (c)



In this type of question, just put

$h^2 = x(x + 20)$

$\Rightarrow (10\sqrt{3})^2 = x(x + 20)$

$300 = x(x + 20)$

$10(30) = x(x + 20)$

$x + 20 = 30$

8. (c) $A + B = 90° \Rightarrow A = 90° - B$

$\Rightarrow \sin A = \sin(90° - B) = \cos B$

Similarly,

$\Rightarrow \cos A = \sin B$ and $\tan A = \cot B$

$\therefore \sin A . \cos B + \cos A. \sin B - \tan A. \tan B + \sec^2 A - \cot^2 B = \cos^2 B + \sin^2 B - \cot B. \tan B + \sec^2 A - \tan^2 A$

$= 1 - 1 + 1 = 1$

$[\because \tan B.\cot B = 1, \sec^2 A - \tan^2 A = 1]$

9. (d) $2\sin^2\theta + 3\cos^2\theta = 2\sin^2\theta + 2\cos^2\theta + \cos^2\theta$

$= 2(\sin^2\theta + \cos^2\theta) + \cos^2\theta = 2 + \cos^2\theta$

$\therefore$ Least value $= 2 + 0 = 2$ $[\because \cos^2\theta \geq 0]$

10. (c) $4x = \sec\theta$

$\Rightarrow x = \frac{\sec\theta}{4}$

Again, $\frac{4}{x} = \tan\theta \Rightarrow \frac{1}{x} = \frac{\tan\theta}{4}$

$\therefore 8\left(x^2 - \frac{1}{x^2}\right)$

$= 8\left(\frac{\sec^2\theta}{16} - \frac{\tan^2\theta}{16}\right) = \frac{8}{16}\left(\sec^2\theta - \tan^2\theta\right) = \frac{1}{2}$

11. (a) $2 - \cos^2\theta = 3\sin\theta.\cos\theta$

Dividing by $\cos^2\theta$

$\frac{2}{\cos^2\theta} - 1 = \frac{3\sin\theta.\cos\theta}{\cos^2\theta}$

$\Rightarrow 2\sec^2\theta - 1 = 3\tan\theta$

$\Rightarrow 2(1 + \tan^2\theta) - 1 = 3\tan\theta$

$\Rightarrow 2\tan^2\theta + 2 - 1 = 3\tan\theta$

$\Rightarrow 2\tan^2\theta - 3\tan\theta + 1 = 0$

$\Rightarrow 2\tan^2\theta - 2\tan\theta - \tan\theta + 1 = 0$

$\Rightarrow 2\tan\theta(\tan\theta - 1) - 1(\tan\theta - 1) = 0$

$\Rightarrow (2\tan\theta - 1)(\tan\theta - 1) = 0$

$\Rightarrow \tan\theta = \frac{1}{2}$ or 1

12. (d) $\sin\theta + \cos\theta = \sqrt{2}\cos(90° - \theta)$

$\sin\theta + \cos\theta = \sqrt{2}\sin\theta$

Divide eq. by $\sin\theta$

$1 + \cot\theta = \sqrt{2}$

$\cot\theta = \sqrt{2} - 1$

13. (c) $x\sin^3\theta + y\cos^3\theta = \sin\theta.\cos\theta$

$\Rightarrow (x\sin\theta).\sin^2\theta + (y\cos\theta)\cos^2\theta = \sin\theta.\cos\theta$

$\Rightarrow x\sin\theta.\sin^2\theta + x\sin\theta.\cos^2\theta = \sin\theta.\cos\theta$

$\Rightarrow x\sin\theta(\sin^2\theta + \cos^2\theta) = \sin\theta.\cos\theta$

$\Rightarrow x = \cos\theta$

now, $x\sin\theta = y\cos\theta$

$\Rightarrow \cos\theta.\sin\theta = y\cos\theta$

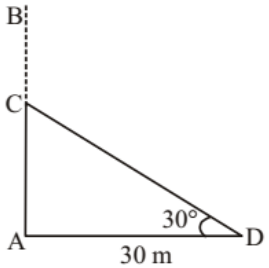
$\Rightarrow y = \sin\theta$

$\therefore x^2 + y^2 = \cos^2\theta + \sin^2\theta = 1$

14. (b) $\sec^4\theta - \sec^2\theta = \sec^2\theta(\sec^2\theta - 1)$

$= (1 + \tan^2\theta)(1 + \tan^2\theta - 1) = \tan^2\theta + \tan^4\theta$

15. (b)



AB = tree

BC = broken part

$\therefore$ BC = CD

AD = 30 metre

From ΔACD, $\tan 30° = \frac{AC}{AD}$

$\Rightarrow AC = AD \times \frac{1}{\sqrt{3}} = \frac{30}{\sqrt{3}} = 10\sqrt{3}$ metre

$AC = CD \times \sin 30° \Rightarrow CD = \frac{AC}{\sin 30°} = \frac{10\sqrt{3}}{\frac{1}{2}} = 20\sqrt{3}$ m

$\therefore AB = AC + BC$

$= 10\sqrt{3} + 20\sqrt{3} = 30\sqrt{3}$ metre

16. (a) $\cos A = 1 - \cos^2 A = \sin^2 A$

$\therefore \sin^2 A + \sin^4 A = \sin^2 A + \cos^2 A = 1$

17. (a) $\cot A + \operatorname{cosec} A = 3$

$\operatorname{cosec}^2 A - \cot^2 A = 1$

$(\operatorname{cosec} A - \cot A)(\operatorname{cosec} A + \cot A) = 1$

$\operatorname{cosec} A - \cot A = \frac{1}{3}$ ... (i)

$\operatorname{cosec} A + \cot A = 3$ ... (ii)

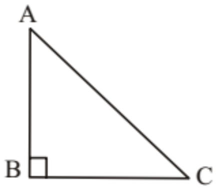
By Adding (i) and (ii),

$2\operatorname{cosec} A = 3 + \frac{1}{3} = \frac{10}{3}$

$\operatorname{cosec} A = \frac{\cancel{10}^{5}}{\cancel{6}_{3}} = \frac{5}{3} = \frac{H}{P}$

$B = \sqrt{5^2 - 3^2} = 4$; $\cos A = \frac{4}{5}$

18. (b)



Let BC = x

$\therefore AB = x + 2$

$\therefore AB^2 + BC^2 = AC^2$

$\Rightarrow (x + 2)^2 + x^2 = (2\sqrt{5})^2 \Rightarrow x^2 + 4x + 4 + x^2 = 20$

$\Rightarrow 2x^2 + 4x - 16 = 0 \Rightarrow x^2 + 2x - 8 = 0$

$\Rightarrow x^2 + 4x - 2x - 8 = 0 \Rightarrow x(x + 4) - 2(x + 4) = 0$

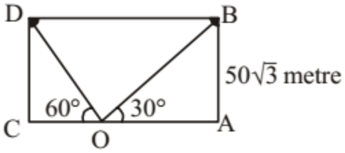
$\Rightarrow (x - 2)(x + 4) = 0 \Rightarrow x = 2 = BC$

$\therefore AB = 2 + 2 = 4$ cm

$\therefore \cos^2 A - \cos^2 C = \frac{AB^2}{AC^2} - \frac{BC^2}{AC^2}$

$= \frac{16}{20} - \frac{4}{20} = \frac{12}{20} = \frac{3}{5}$

19. (d)



$AB = CD = 50\sqrt{3}$ metre

From Δ OAB,

$\tan 30° = \frac{AB}{OA} \Rightarrow \frac{1}{\sqrt{3}} = \frac{50\sqrt{3}}{OA}$

$\Rightarrow OA = 50\sqrt{3} \times \sqrt{3} = 150$ metre

From ΔOCD, $\tan 60° = \frac{CD}{OC}$

$\sqrt{3} = \frac{50\sqrt{3}}{OC} \Rightarrow OC = 50$ metre

$\therefore BD = AC = 150 + 50 = 200$ metre

$\therefore$ Speed of bird

$= \frac{200}{2} = 100$ m/minute $= \frac{100}{1000} \times 60$ kmph $= 6$ kmph

20. (b) $\tan(x+y)\tan(x-y) = 1$

$\Rightarrow \tan(x+y) = \cot(x-y)$

$= \tan(90° - (x-y))$

$\Rightarrow x + y = 90° - (x-y)$

$\Rightarrow 2x = 90° \Rightarrow x = 45°$

$\therefore \tan x = \tan 45° = 1$

21. (d) $4\operatorname{cosec}^2\alpha + 9\sin^2\alpha$

$= 4\operatorname{cosec}^2\alpha + 4\sin^2\alpha + 5\sin^2\alpha$

$= 4[(\operatorname{cosec}\alpha - \sin\alpha)^2 + 2] + 5\sin^2\alpha$

$= 12$ $\quad [\because \operatorname{cosec}\alpha - \sin\alpha \geq 1]$

22. (a) $1 - \frac{\sin^2 A}{1+\cos A} + \frac{1+\cos A}{\sin A} - \frac{\sin A}{1-\cos A}$

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

$= 1 - 1 + \cos A + \frac{\sin^2 A - \sin^2 A}{\sin A(1-\cos A)} = \cos \mathbf{A}$

23. (c) $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$

$\Rightarrow 8 = 56 - 3ab(2)$

$\Rightarrow 6ab = 56 - 8 = 48$

$\Rightarrow 2ab = 16$ $\quad$ ...(i)

$\therefore a^2 + b^2 = (a-b)^2 + 2ab$

$= 4 + 16 = 20$

24. (a) Put $\theta = 45°$

$a = \tan 45° - \cot 45°$, $b = \sin 45° - \cos 45°$

$a = 1 - 1 = 0$

$b = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}} = 0$

Put in equation

$(a^2+4)(b^2-1)^2 = (0+4)(0-1)^2 = 4$

25. (c) $(a^2 - b^2)\sin\theta + 2ab\cos\theta = a^2 + b^2$

$\frac{a^2-b^2}{a^2+b^2}\sin\theta + \frac{2ab}{a^2+b^2}\cos\theta = 1$

$\sin\theta = \frac{a^2-b^2}{a^2+b^2}$, $\cos\theta = \frac{2ab}{a^2+b^2}$

$\{\because \sin^2\theta + \cos^2\theta = 1\}$

$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{a^2-b^2}{2ab}$

26. (a) $2\sin\alpha + 15\cos^2\alpha = 7$

$\Rightarrow 2\sin\alpha + 15(1 - \sin^2\alpha) = 7$

$\Rightarrow 2\sin\alpha + 15 - 15\sin^2\alpha = 7$

$\Rightarrow 15\sin^2\alpha - 2\sin\alpha - 8 = 0$

$\Rightarrow 15\sin^2\alpha - 12\sin\alpha + 10\sin\alpha - 8 = 0$

$\Rightarrow 3\sin\alpha(5\sin\alpha - 4) + 2(5\sin\alpha - 4) = 0$

$\Rightarrow (3\sin\alpha + 2)(5\sin\alpha - 4) = 0$

$\Rightarrow 5\sin\alpha - 4 = 0$

$\Rightarrow \sin\alpha = \frac{4}{5}$

$\therefore \operatorname{cosec}\alpha = \frac{5}{4}$

$\cot\alpha = \sqrt{\operatorname{cosec}^2\alpha - 1} = \sqrt{\frac{25}{16} - 1} = \sqrt{\frac{9}{16}} = \frac{3}{4}$

27. (a) $\sin(2x - 20°) = \cos(2y + 20°)$

$\Rightarrow \sin(2x - 20°) = \sin(90° - 2y - 20°) = \sin(70° - 2y)$

$\Rightarrow 2x - 20° = 70° - 2y \Rightarrow 2(x+y) = 90° \Rightarrow x + y = 45°$

$\therefore \sec(x+y) = \sec 45° = \sqrt{2}$

28. (a) $5\tan\theta = 4 \Rightarrow \tan\theta = \frac{4}{5}$

$\therefore \frac{5\sin\theta - 3\cos\theta}{5\sin\theta + 3\cos\theta}$

$= \frac{\frac{5\sin\theta - 3\cos\theta}{\cos\theta}}{\frac{5\sin\theta + 3\cos\theta}{\cos\theta}} = \frac{5\tan\theta - 3}{5\tan + 3} = \frac{5 \times \frac{4}{5} - 3}{5 \times \frac{4}{5} + 3}$

$= \frac{4-3}{4+3} = \frac{1}{7}$

29. (c) $4\sec^2\theta + 9\operatorname{cosec}^2\theta$

$= 4(1 + \tan^2\theta) + 9(1 + \cot^2\theta)$

$= 4 + 4\tan^2\theta + 9 + 9\cot^2\theta$

$= 4\tan^2\theta + 9\cot^2\theta + 12 - 12 + 13$

$= (2\tan^2\theta - 3\text{Cot}^2\theta)^2 + 25$

$\{\because$ least value of $2\tan^2\theta - 3\cot^2\theta = 0\}$

$\therefore$ the minimum value is 25.

30. (a) $\tan(x+y).\tan(x-y) = 1$

$\Rightarrow \tan(x+y) = \cot(x-y) = \tan(90° - x + y)$

$\Rightarrow x + y = 90° - x + y \Rightarrow 2x = 90°$

$\therefore \tan\frac{2x}{3} = \tan 30° = \frac{1}{\sqrt{3}}$

31. (b) $x^2y^2(x^2 + y^2 + 3)$

$= (\operatorname{cosec}\theta - \sin\theta)^2(\sec\theta - \cos\theta)^2$

$\{(\operatorname{cosec}\theta - \sin\theta)^2 + (\sec\theta - \cos\theta)^2 + 3\}$

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

$\left\{\left(\frac{1}{\sin\theta} - \sin\theta\right)^2 + \left(\frac{1}{\cos\theta} - \cos\theta\right)^2 + 3\right\}$

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

$\left\{\left(\frac{1 - \sin^2\theta}{\sin\theta}\right)^2 + \left(\frac{1 - \cos^2\theta}{\cos\theta}\right)^2 + 3\right\}$

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

$$\left\{\left(\frac{\cos^2\theta}{\sin\theta}\right)^2 + \left(\frac{\sin^2\theta}{\cos\theta}\right)^2 + 3\right\}$$

$$= \left(\frac{\cos^6\theta + \sin^6\theta + 3\cos^2\theta.\sin^2\theta}{\cos^2\theta.\sin^2\theta}\right) \times \cos^2\theta \times \sin^2\theta$$

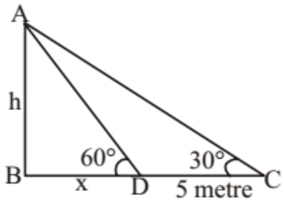
$= \cos^6\theta + \sin^6\theta + 3\cos^2\theta \sin^2\theta$

$$= \left\{(\cos^2\theta)^3 + (\sin^2\theta)^3 + 3\cos^2\theta\sin^2\theta\right\}$$
$$-3\cos^2\theta.\sin^2\theta$$

$= (\cos^2\theta + \sin^2\theta)^3 - 3\cos^2\theta.\sin^2\theta$
$(\cos^2\theta + \sin^2\theta) + 3\cos^2\theta.\sin^2\theta$
$= 1 - 3\cos^2\theta.\sin^2\theta + 3\cos^2\theta.\sin^2\theta = 1$

32. (d) $2y \cos\theta = x\sin\theta$
$\Rightarrow x \sec\theta = 2y \operatorname{cosec}\theta$
Also, $2x \sec\theta - y \operatorname{cosec}\theta = 3$
$\Rightarrow 4y \operatorname{cosec}\theta - y \operatorname{cosec}\theta = 3$
$\Rightarrow 3y \operatorname{cosec}\theta = 3$
$\Rightarrow y \operatorname{cosec}\theta = 1$
$\Rightarrow y = \sin\theta$
$\therefore x \sec\theta = 2y \operatorname{cosec}\theta$
$= 2\sin\theta.\operatorname{cosec}\theta = 2$
$\Rightarrow x = 2\cos\theta$
$\therefore x^2 + 4y^2 = 4\cos^2\theta + 4\sin^2\theta = 4$

33. (a)



AB = Pole = h metre
BD = x metre
From ΔABC,

$$\tan 30° = \frac{h}{x+5} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x+5}$$

$\Rightarrow x + 5 = \sqrt{3}h$ ...(i)
From ΔABD,

$$\tan 60° = \frac{h}{x} \Rightarrow \sqrt{3} = \frac{h}{x} \Rightarrow x = \frac{h}{\sqrt{3}}$$

$\therefore x + 5 = \sqrt{3}h$

$$\Rightarrow \frac{h}{\sqrt{3}} + 5 = \sqrt{3}h \Rightarrow h + 5\sqrt{3} = 3h \Rightarrow 2h = 5\sqrt{3}$$

$$\Rightarrow h = \frac{5\sqrt{3}}{2} \text{metre}$$

34. (a) $\sin\theta + \sin^2\theta = 1$
$\Rightarrow \sin\theta = 1 - \sin^2\theta$
$\Rightarrow \sin\theta = \cos^2\theta$
$\therefore \cos^{12}\theta + 3\cos^{10}\theta + 3\cos^8\theta + \cos^6\theta - 1$
$= (\cos^4\theta + \cos^2\theta)^3 - 1$
$= (\sin^2\theta + \cos^2\theta)^3 - 1 = 1 - 1 = 0$

35. (b) $2y \cos\theta = x \sin\theta$

$$\Rightarrow \sin\theta = \frac{2y}{x}\cos\theta$$

And $2x \sec\theta - y \operatorname{cosec}\theta = 3$

$$\Rightarrow 2x \sec\theta - \frac{y}{\sin\theta} = 3$$

$$\Rightarrow \frac{2x}{\cos\theta} - \frac{yx}{2y\cos\theta} = 3$$

$$\Rightarrow 3\cos\theta = \frac{3}{2}x \Rightarrow \cos\theta = \frac{x}{2}$$

Now $\sin^2\theta + \cos^2\theta = 1$

$$\Rightarrow y^2 + \frac{x^2}{4} = 1$$

$$\Rightarrow 4y^2 + x^2 = 4$$

36. (b) $\sec^2\theta - \tan^2\theta = 1$
$(\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

$$\sqrt{3}(\sec\theta - \tan\theta) = 1 \Rightarrow \sec\theta - \tan\theta = \frac{1}{\sqrt{3}} \quad ...(1)$$

$\sec\theta + \tan\theta = \sqrt{3}$ (Given) ...(2)
Adding eqn. (1) and (2)

$$2\sec\theta = \sqrt{3} + \frac{1}{\sqrt{3}} \Rightarrow 2\sec\theta = \frac{4}{\sqrt{3}} \Rightarrow \sec\theta = \frac{2}{\sqrt{3}}$$

$$\therefore \cos\theta = \frac{\sqrt{3}}{2} \qquad \left[\because \sec\theta = \frac{1}{\cos\theta}\right]$$

$$\text{Therefore, } \sin\theta = \sqrt{1-\cos^2\theta} \Rightarrow \sqrt{1-\frac{3}{4}} = \frac{1}{2}$$

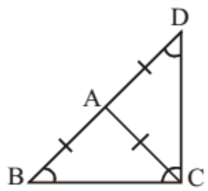
37. (a) $63° \; 14'\left(\frac{51}{60}\right)'$ [1 minute = 60 seconds]

$$\Rightarrow 63°\left[14 + \frac{17}{20}\right]' \Rightarrow 63°\left[\frac{297}{20}\right]' \Rightarrow 63° + \frac{297}{20 \times 60}$$

[1 degree = 60 minutes]

$$\Rightarrow \left(\frac{75897}{1200}\right)^\circ \Rightarrow \frac{75897}{1200} \times \frac{\pi}{180} \text{radian} \Rightarrow \left(\frac{2811}{8000}\pi\right)^c$$

38. (d) AB = AC
$\therefore \angle ABC = \angle ACB$ ...(1)



[opposite angles of equal sides are equal]
AC = AD and BA = AC
$\therefore \angle ACD = \angle ADC$ and $\angle ABC = \angle ACB$ ...(2)

In a triangle,
$\angle ABC + \angle ADC + \angle DCB = 180°$ (Angle sum property)
$\angle ABC + \angle ADC + \angle ACB + \angle ACD = 180°$
$2\angle ACB + 2\angle ACD = 180°$
[From eqn. (1) & (2)]
$\therefore \angle BCD = 90°$ or $\pi/2$

39. (d) $\frac{\cos^4\alpha}{\cos^2\beta} + \frac{\sin^4\alpha}{\sin^2\beta} = 1$
$\Rightarrow \cos^4\alpha\sin^2\beta + \sin^4\alpha\cos^2\beta = \cos^2\beta\sin^2\beta$
$\Rightarrow \cos^4\alpha(1-\cos^2\beta) + \cos^2\beta(1-\cos^2\alpha)^2$
$= \cos^2\beta(1-\cos^2\beta)$
$\Rightarrow \cos^4\alpha - \cos^4\alpha\cos^2\beta + \cos^2\beta - 2\cos^2\alpha\cos^2\beta$
$+ \cos^4\alpha\cos^2\beta = \cos^2\beta - \cos^4\beta$
$\Rightarrow \cos^4\alpha - 2\cos^2\alpha\cos^2\beta + \cos^4\beta = 0$
$\Rightarrow (\cos^2\alpha - \cos^2\beta)^2 = 0$
$\Rightarrow \cos^2\alpha = \cos^2\beta$
$\Rightarrow \sin^2\alpha = \sin^2\beta$

Then, $\frac{\cos^4\beta}{\cos^2\alpha} + \frac{\sin^4\beta}{\sin^2\alpha}$

$\Rightarrow \frac{\cos^2\beta\cos^2\alpha}{\cos^2\alpha} + \frac{\sin^2\beta\sin^2\alpha}{\sin^2\alpha}$

$\Rightarrow \cos^2\beta + \sin^2\beta = 1$

40. (a) $\frac{\sin\theta - \cos\theta + 1}{\sin\theta + \cos\theta - 1}$
Dividing Numerator and Denominator by $\cos\theta$

$$= \frac{\frac{\sin\theta}{\cos\theta} - \frac{\cos\theta}{\cos\theta} + \frac{1}{\cos\theta}}{\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\cos\theta} - \frac{1}{\cos\theta}} = \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$$

$$= \frac{(\tan\theta + \sec\theta) - (\sec^2\theta - \tan^2\theta)}{\tan\theta - \sec\theta + 1}$$

$$= \frac{(\tan\theta + \sec\theta)[1 - \sec\theta + \tan\theta]}{\tan\theta - \sec\theta + 1}$$

$= \tan\theta + \sec\theta$

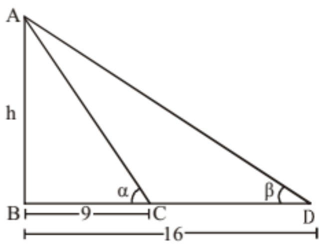
$$= \frac{\sin\theta}{\cos\theta} + \frac{1}{\cos\theta} = \frac{1+\sin\theta}{\cos\theta}$$

41. (b) In ΔABC

$\tan\alpha = \frac{h}{9}$ ...(1)

In ΔABD

$\tan\beta = \frac{h}{16}$



$\alpha + \beta = 90°$ (given)
$\beta = 90 - \alpha$

Since, $\tan\beta = \frac{h}{16}$

$\tan(90-\alpha) = \frac{h}{16} \Rightarrow \cot\alpha = \frac{h}{16}$ or $\tan\alpha = \frac{16}{h}$ ...(2)

From eqn. (1) and (2)

$\frac{h}{9} = \frac{16}{h} \Rightarrow h^2 = 16\times 9 \Rightarrow h = 12$ feet.

42. (a) If $\sin^2\alpha = \cos^3\alpha$

$\tan^2\alpha = \cos\alpha$ ...(1)

Now consider, $\cot^6\alpha - \cot^2\alpha$

$= \frac{1}{\tan^6\alpha} - \frac{1}{\tan^2\alpha}$ $\left(\text{Since } \cot\alpha = \frac{1}{\tan\alpha}\right)$

Substituting for $\tan^2\alpha$ with $\cos\alpha$ from (1) above equation will be

$$= \frac{1}{\cos^3\alpha} - \frac{1}{\cos\alpha} = \frac{1-\cos^2\alpha}{\cos^3\alpha} = \frac{\sin^2\alpha}{\cos^3\alpha} = \frac{\tan^2\alpha}{\cos\alpha} = 1$$

43. (b) $(1 + \tan\theta + \sec\theta)(1 + \cot\theta - \operatorname{cosec}\theta)$

$$\Rightarrow \left(1 + \frac{\sin\theta}{\cos\theta} + \frac{1}{\cos\theta}\right)\left(1 + \frac{\cos\theta}{\sin\theta} - \frac{1}{\sin\theta}\right)$$

$$\Rightarrow \left(\frac{\sin\theta + \cos\theta + 1}{\cos\theta}\right)\left(\frac{\sin\theta + \cos\theta - 1}{\sin\theta}\right)$$

$$= \frac{(\sin\theta + \cos\theta)^2 - 1}{\sin\theta\cos\theta}$$

$$= \frac{\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta - 1}{\sin\theta\cos\theta} = \frac{2\sin\theta\cos\theta}{\sin\theta\cos\theta} = 2$$

44. (a) $\tan 1° \tan 2° \tan 3° \ldots \tan 89°$
$= \tan 1° \tan 2° \ldots \tan 45° \ldots \tan(90° - 2)\tan(90° - 1)$
$= \tan 1° \tan 2° \ldots 1 \ldots \cot 2° \cot 1°$
$= (\tan 1° \cot 1°)(\tan 2° \cot 2°) \ldots 1 = 1$

45. (a) $4\tan^2\theta + 9\cot^2\theta$
$\Rightarrow (2\tan\theta)^2 + (3\cot\theta)^2$
$(2\tan\theta)^2 + (3\cot\theta)^2 - 12 + 12 = (2\tan\theta - 3\cot\theta)^2 + 12$
$\therefore$ Minimum value = 12 because $(2\tan\theta - 3\cot\theta)^2 \geq 0$

46. (c) $\sin\theta - \cos\theta = \frac{1}{2}$
$\sin\theta + \cos\theta = x$.
On squaring and adding.

$2(\sin^2\theta + \cos^2\theta) = \frac{1}{4} + x^2$

$\Rightarrow x^2 = 2 - \frac{1}{4} = \frac{7}{4} \Rightarrow x = \frac{\sqrt{7}}{2}$

47. (c) $\operatorname{cosec}\theta - \cot\theta = \frac{7}{2}$ ...(i)
$\operatorname{cosec}^2\theta - \cot^2\theta = 1$
$\Rightarrow (\operatorname{cosec}\theta + \cot\theta)(\operatorname{cosec}\theta - \cot\theta) = 1$

$\Rightarrow \operatorname{cosec}\theta + \cot\theta = \frac{1}{\operatorname{cosec} - \cot\theta} = \frac{2}{7}$ ...(ii)

On adding both equations.

$$2\operatorname{cosec}\theta = \frac{7}{2}+\frac{2}{7}=\frac{49+4}{14}=\frac{53}{14}$$

$$\Rightarrow \operatorname{cosec}\theta = \frac{53}{28}$$

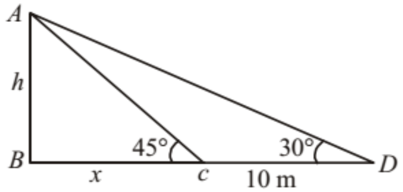
48. **(c)** $\frac{2}{\sin^2 23°}.\frac{\sin^2 23°}{\cos^2 23°}-(\sin^2 23+\cos^2 23°)-\tan^2 23°$

$= 2\sec^2 23° - 1 - \tan^2 23°$

$= (\sec^2 23° - 1) + (\sec^2 23° - \tan^2 23°)$

$= \tan^2 23° + 1 = \sec^2 23°$

49. **(d)**



From $\Delta ABC, \tan 45° = \frac{h}{x} \Rightarrow h = x$

In $\Delta ABD, \tan 30° = \frac{h}{x+10} = \frac{h}{h+10}$

$$\frac{1}{\sqrt{3}} = \frac{h}{h+10}$$

$$h = 5(\sqrt{3}+1)m$$

50. **(d)** $\dfrac{\frac{5\sin\theta-3\cos\theta}{\cos\theta}}{\frac{5\sin\theta+2\cos\theta}{\cos\theta}} = \frac{5\tan\theta-3}{5\tan\theta+2} = \dfrac{5\times\frac{4}{5}-3}{5\times\frac{4}{5}+2} = \frac{1}{6}$

51. **(d)** $x\sin\theta + y\cos\theta = \sqrt{x^2+y^2}$

Put $x = \sin\theta$

$y = \cos\theta$ in the above equation, we have

$\sin^2\theta + \cos^2\theta = \sqrt{\sin^2\theta+\cos^2\theta}$

$\Rightarrow 1 = 1$

$\Rightarrow x = \sin\theta$ & $y = \cos\theta$ is the solution of above equation. Now, on using $x = \sin\theta$ & $y = \cos\theta$ in

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

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

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

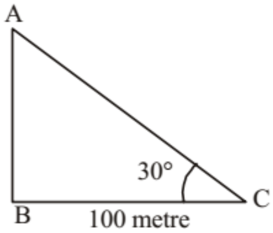
52. **(a)** $2\cos 2\theta = 1$

$\cos 2\theta = \frac{1}{2}$

$\theta = 30°$

$\cot 30° = \sqrt{3}$

53. **(b)**



AB = h metre

$\angle ACB = 30°$;

BC = 100 metre

$$\therefore \tan 30° = \frac{AB}{BC}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{100} \Rightarrow h = \frac{100}{\sqrt{3}} \text{ metre}$$

54. **(b)** $\cos 90° = 0$

$\therefore \cos 1°, \cos 2° .... \cos 179° = 0$

55. **(c)** $\sin^2 25° + \sin^2 65°$

$= \sin^2 25° + \sin^2(90° - 25°)$

$= \sin^2 25° + \cos^2 25° = 1$

56. **(c)** π radian = 180°

$$\therefore 1 \text{ radian} = \frac{180°}{\pi}$$

$$= \frac{180\times 7°}{22} = \frac{630}{11} = 57\frac{3}{11}° = 57°\frac{3}{11}\times 60' = 57°\frac{180'}{11}$$

$$= 57°16'\frac{4}{11}\times 60' = 57°16'22''$$

57. **(c)** $\sin\theta + \operatorname{cosec}\theta = 2$

if $x + \frac{1}{x} = 2$ then $x^n + \frac{1}{x^n} = 2$

$$\therefore \sin\theta + \frac{1}{\sin\theta} = 2$$

$$\therefore \sin^9\theta + \frac{1}{\sin^9\theta} = 2$$

58 **(b)** $\sec\theta + \tan\theta = 2 + \sqrt{5}$ ...(i)

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

$$\sec\theta - \tan\theta = \frac{1}{2+\sqrt{5}} = \frac{1}{2+\sqrt{5}}\times\frac{2-\sqrt{5}}{2-\sqrt{5}}$$

$= \frac{2-\sqrt{5}}{-1} = (-2+\sqrt{5})$ ...(ii)

Adding eq. (i) and (ii),

$2\sec\theta = 2\sqrt{5}$

$$\Rightarrow \sec\theta = \sqrt{5} \text{ or } \cos\theta = \frac{1}{\sqrt{5}}$$

$$\sin\theta = \sqrt{1-\cos^2\theta} = \sqrt{1-\frac{1}{5}} = \frac{2}{\sqrt{5}}$$

$$\therefore \sin\theta + \cos\theta = \frac{1}{\sqrt{5}} + \frac{2}{\sqrt{5}} = \frac{3}{\sqrt{5}}$$

59. **(b)** $\tan 89° = \tan(90° - 1°) = \cot 1°$
$\tan 88° = \tan(90° - 2°) = \cot 2°$
$\therefore$ Expression $= \tan 1°, \cot 1°, \tan 2°, \cot 2° \ldots \tan 45° = 1$
$[\because \tan\theta.\cot\theta = 1]$

60. **(b)** $\sin(A - B) = \frac{1}{2} = \sin 30° \Rightarrow A - B = 30°$

$\cos(A + B) = \frac{1}{2} = \cos 60° \Rightarrow A + B = 60°$
$\therefore A + B + A - B = 30° + 60° = 90°$
$\Rightarrow 2A = 90° \Rightarrow A = 45°$
$\therefore A - B = 30°$

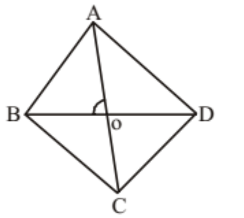
$\Rightarrow B = A - 30° = 45° - 30° = 15° = \frac{15 \times \pi}{180} = \frac{\pi}{12}$ radian

61. **(b)** Maximum value of $a \sin\theta + b\cos\theta = \sqrt{a^2 + b^2}$
$\therefore$ Maximum value of $2\sin\theta + 3\cos\theta$
$= \sqrt{2^2 + 3^2} = \sqrt{13}$

62. **(c)**

63. **(a)** $(1 + \sin\alpha)(1 + \sin\beta)(1 + \sin\gamma) = (1 - \sin\alpha)(1 - \sin\beta)(1 - \sin\gamma) = x$
$\therefore x.x = (1 + \sin\alpha)(1 - \sin\alpha)(1 + \sin\beta)(1 - \sin\beta)(1 + \sin\gamma)(1 - \sin\gamma)$
$x^2 = (1 - \sin^2\alpha)(1 - \sin^2\beta)(1 - \sin^2\gamma)$
$x^2 = \cos^2\alpha.\cos^2\beta.\cos^2\gamma$
$\Rightarrow x = \pm\cos\alpha.\cos\beta.\cos\gamma$

64. **(a)**



$\angle BAD = 60°$
$\therefore \angle BAO = 30°$
$\angle ABO = 60°$

$\therefore \sin 60° = \frac{OA}{AB} \Rightarrow \frac{\sqrt{3}}{2} \times 8 = OA$
$\therefore OA = 4\sqrt{3}$
$\therefore AC = 8\sqrt{3}$ metre

65. **(d)** $\tan\theta = \frac{3}{4}$

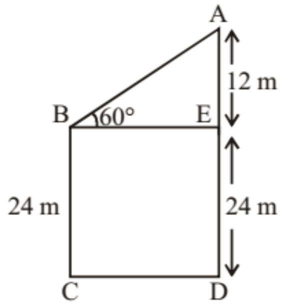
$\therefore \cot\theta = \frac{4}{3}$; $\because \text{cosec}^2\theta - \cot^2\theta = 1$

$\Rightarrow \text{cosec}\theta = \sqrt{1 + \cot^2\theta}$

$= \sqrt{1 + \left(\frac{4}{3}\right)^2} = \sqrt{1 + \frac{16}{9}} = \sqrt{\frac{25}{9}} = \frac{5}{3}$

66. **(d)** Expression
$= \frac{1}{1 + \tan^2\theta} + \frac{1}{1 + \cot^2\theta} = \frac{1}{\sec^2\theta} + \frac{1}{\text{cosec}^2\theta}$
$= \cos^2\theta + \sin^2\theta = 1$

67. **(d)**



$BC = ED = 24$ m
$\therefore AE = AD - ED = 36$ m $- 24$ m $= 12$ m
In ΔABE,

$\text{Sin } 60° = \frac{AE}{AB} = \frac{12}{AB}$

$\Rightarrow \frac{\sqrt{3}}{2} = \frac{12}{AB} \Rightarrow AB = \frac{24}{\sqrt{3}} = 8\sqrt{3}$ m

68. **(a)** $\tan\alpha = n\tan\beta$

$\Rightarrow \tan\beta = \frac{1}{n}\tan\alpha$

$\Rightarrow \cot\beta = \frac{n}{\tan\alpha}$ and

$\sin\alpha = m\sin\beta \Rightarrow \sin\beta = \frac{1}{m}\sin\alpha$

$\Rightarrow \text{coses } \beta = \frac{m}{\sin\alpha}$
$\therefore \text{cosec}^2\beta - \cot^2\beta = 1$

$\Rightarrow \frac{m^2}{\sin^2\alpha} - \frac{n^2}{\tan^2\alpha} = 1$

$\Rightarrow \frac{m^2}{\sin^2\alpha} - \frac{n^2\cos^2\alpha}{\sin^2\alpha} = 1$

$\Rightarrow \frac{m^2 - n^2\cos^2\alpha}{\sin^2\alpha} = 1$
$\Rightarrow m^2 - n^2\cos^2\alpha = \sin^2\alpha$
$= 1 - \cos^2\alpha$
$\Rightarrow m^2 - 1 = n^2\cos^2\alpha - \cos^2\alpha$
$= (n^2 - 1)\cos^2\alpha$

$\Rightarrow \cos^2\alpha = \frac{m^2 - 1}{n^2 - 1}$

69. **(d)** Expression

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

$= \frac{\text{cosec}^2\theta - \cot^2\theta}{\text{cosec}\theta - \cot\theta} - \text{cosec}\theta$
$= \text{cosec }\theta + \cot\theta - \text{cosec }\theta = \cot\theta$

$\left[\text{cosec}^2\theta - \cot^2\theta = 1; \frac{1}{\sin\theta} = \text{cosec}\theta\right]$

70. (b) $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$

On squaring both sides,

$\cos^2\theta + \sin^2\theta + 2\cos\theta.\sin\theta = 2\cos^2\theta$

$\Rightarrow \cos^2\theta - \sin^2\theta = 2\cos\theta.\cos\theta$

$\Rightarrow (\cos\theta + \sin\theta)(\cos\theta - \sin\theta) = 2\sin\theta.\cos\theta$

$\Rightarrow \sqrt{2}\cos\theta(\cos\theta - \sin\theta) = 2\sin\theta.\cos\theta$

$\Rightarrow \cos\theta - \sin\theta = \dfrac{2\sin\theta.\cos\theta}{\sqrt{2}\cos\theta} = \sqrt{2}\sin\theta$

71. (a) $\cos^4\theta - \sin^4\theta = \dfrac{2}{3}$

$\Rightarrow (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta) = \dfrac{2}{3}$

$\Rightarrow \cos^2\theta - \sin^2\theta = \dfrac{2}{3} \Rightarrow 1 - \sin^2\theta - \sin^2\theta = \dfrac{2}{3}$

$\Rightarrow 1 - 2\sin^2\theta = \dfrac{2}{3}$

72. (b) $\dfrac{\sin 53^\circ}{\cos 37^\circ} \div \dfrac{\cot 65^\circ}{\tan 25^\circ}$; $\dfrac{\sin 53^\circ}{\cos 37^\circ} \times \dfrac{\tan 25^\circ}{\cot 65^\circ}$

$\Rightarrow \dfrac{\sin 53^\circ}{\cos(90^\circ - 53^\circ)} \times \dfrac{\tan 25^\circ}{\cot(90^\circ - 25^\circ)}$

$\Rightarrow \dfrac{\sin 53^\circ}{\sin 53^\circ} \times \dfrac{\tan 25^\circ}{\tan 25^\circ} = 1$

[$\because \cos(90^\circ - \theta) = \sin\theta$ and $\cot(90^\circ - \theta) = \tan\theta$]

73. (c) $\dfrac{\cos 60^\circ + \sin 60^\circ}{\cos 60^\circ - \sin 60^\circ} = \dfrac{\frac{1}{2} + \frac{\sqrt{3}}{2}}{\frac{1}{2} - \frac{\sqrt{3}}{2}} = \dfrac{1+\sqrt{3}}{1-\sqrt{3}} \times \dfrac{1+\sqrt{3}}{1+\sqrt{3}}$

$\Rightarrow \dfrac{(1+\sqrt{3})^2}{1^2 - (\sqrt{3})^2} = \dfrac{1+3+2\sqrt{3}}{1-3} = \dfrac{4+2\sqrt{3}}{-2}$

$\Rightarrow \dfrac{-2(2+\sqrt{3})}{2} = -(2+\sqrt{3})$

74 (d) $\dfrac{\cot + 5^\circ.\cot 10^\circ.\cot 15^\circ.\cot 60^\circ.\cot 75^\circ.\cot 80^\circ.\cot 85^\circ}{(\cos^2 20 + \cos^2 70^\circ) + 2}$

$\Rightarrow \dfrac{\cot(90^\circ - 85^\circ).\cot(90^\circ - 80^\circ).\cot(90^\circ - 75^\circ).\cot 60^\circ.\cot 75^\circ.\cot 80^\circ \cot 85^\circ}{(\cos^2(90^\circ - 70^\circ) + \cos^2 70^\circ) + 2}$

$\Rightarrow \dfrac{\cot 60^\circ}{(1+2)} = \dfrac{\frac{1}{\sqrt{3}}}{3} = \dfrac{1}{3\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{\sqrt{3}}{9}$

75. (d) Let angles are $2x$, $5x$ and $3x$.

$2x + 5x + 3x = 180^\circ$

(sum of interior angle of triangles is 180º)

$10x = 18^\circ$

$x = 18^\circ$

$\therefore$ Least angle in degree $= 2x = 2 \times 18 = 36^\circ$

In radian $= \dfrac{\pi}{180^\circ} \times 36^\circ = \dfrac{\pi}{5}$

76. (d) $x = a\cos\theta - b\sin\theta$

$y = b\cos\theta + \sin\theta$

$x^2 + y^2 = (a\cos\theta - b\sin\theta)^2 + (b\cos\theta + a\sin\theta)^2$

$= a^2\cos^2\theta + b^2\sin^2\theta + a^2\sin^2\theta + b^2\cos^2\theta$

$= a^2 + b^2$

77. (a) $\tan\alpha + \cot\alpha = 2$

$\tan\alpha + \dfrac{1}{\tan\alpha} = 2 \Rightarrow \tan^2\alpha + 1 = 2\tan\alpha$

$\Rightarrow \tan^2\alpha - 2\tan\alpha + 1 = 0$

$\Rightarrow \tan^2\alpha - \tan\alpha - \tan\alpha + 1 = 0$

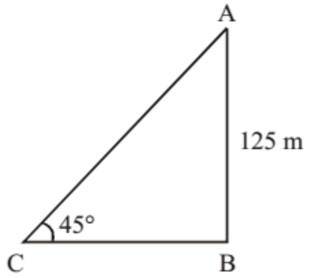
$\Rightarrow \tan\alpha(\tan\alpha - 1) - 1(\tan\alpha - 1) = 0$

$(\tan\alpha - 1)(\tan\alpha - 1) = 0$

$\therefore \tan\alpha = 1$

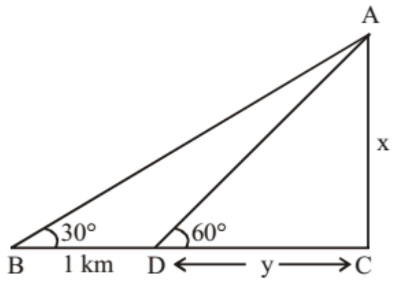
Now, $\tan^7\alpha + \cot^7\alpha \Rightarrow (\tan\alpha)^7 + \dfrac{1}{(\tan\alpha)^7} = 1 + 1 = 2$

78. (a)



$\tan 45^\circ = \dfrac{AB}{BC} \Rightarrow 1 = \dfrac{AB}{BC} \Rightarrow AB = BC = 125$ m

79. (a)



In ΔADC,

$\text{Tan } 60^\circ = \dfrac{x}{y} \Rightarrow \sqrt{3} = \dfrac{x}{y}$

$\Rightarrow y = \dfrac{x}{\sqrt{3}}$ ... (i)

In ΔABC,

$\tan 30^\circ = \dfrac{x}{y+1} \Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{x}{y+1}$

$\Rightarrow \sqrt{3}x = y + 1 \Rightarrow \sqrt{3}x = \dfrac{x}{\sqrt{3}} + 1$

$\Rightarrow \sqrt{3}x - \dfrac{x}{\sqrt{3}} = 1 \Rightarrow x\left(\sqrt{3} - \dfrac{1}{\sqrt{3}}\right) = 1$

$\Rightarrow x \times \dfrac{2}{\sqrt{3}} = 1 \Rightarrow x = \dfrac{\sqrt{3}}{2}$ m

80. **(d)** $3\cos 80°.\ \text{cosec } 10° + 2\cos 59°.\ \text{cosec } 31°$

$= 3\cos(90° - 10°).\ \text{cosec } 10° + 2\cos(90° - 31°).\ \text{cosec } 31°$

$= 3\sin 10°.\ \text{cosec } 10° + 2\sin 31°.\ \text{cosec } 31°$

$= 3 + 2 = 5$

$[\because \cos(90° - \theta) = \sin\theta;\ \sin\theta.\text{cosec}\theta = 1]$

81. **(c)** $\because \pi$ radian $= 180°$

$\therefore\ \dfrac{3\pi}{5}$ radians $= \dfrac{180}{\pi} \times \dfrac{3\pi}{5} = 108°$

82. **(a)** $\tan\theta + \cot\theta = 2$

On squaring both sides,

$(\tan\theta + \cot\theta)^2 = 4$

$\Rightarrow \tan^2\theta + \cot^2\theta + 2\tan\theta\cot\theta = 4$

$\Rightarrow \tan^2\theta + \cot^2\theta = 4 - 2 = 2 \qquad [\tan\theta.\ \cot\theta = 1]$

83. **(a)** $x\cos\theta - y\sin\theta = 2$

$x\sin\theta + y\cos\theta = 4$

On squaring both the equations and adding

$x^2\cos^2\theta + y^2\sin^2\theta - 2xy\sin\theta.\cos\theta + x^2\sin^2\theta + y^2\cos^2\theta + 2xy\sin\theta.\cos\theta = 4 + 16$

$\Rightarrow x^2(\cos^2\theta + \sin^2\theta) + y^2(\sin^2\theta + \cos^2\theta) = 20$

$\Rightarrow x^2 + y^2 = 20$

84. **(d)** $\sin^2\theta - 3\sin\theta + 2 = 0$

$\Rightarrow \sin^2\theta - 2\sin\theta - \sin\theta + 2 = 0$

$\Rightarrow \sin\theta(\sin\theta - 2) - 1(\sin\theta - 2) = 0$

$\Rightarrow (\sin\theta - 1)(\sin\theta - 2) = 0$

$\Rightarrow \sin\theta = 1 = \sin 90°$

$\Rightarrow \theta = 90°$ and $\sin\theta \neq 2$

85. **(c)**

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

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

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

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

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

$= 2 \times 1 = 2$

86. **(b)** $\sec^2\theta + \tan^2\theta = 7$

$1 + \tan^2\theta + \tan^2\theta = 7$

$\tan^2\theta = \dfrac{6}{2} = 3$

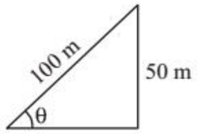
for $0 \le \theta \le \dfrac{\pi}{2}\quad \tan\theta = \sqrt{3}$

$\theta = 60° = \dfrac{\pi}{3}$

87. **(c)** $\sin^2 x + \cos^2 x - 2(\sec^2 x - \tan^2 x)$

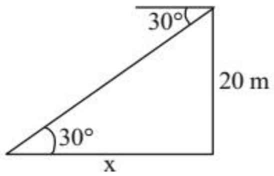
$1 - 2(1) = -1$

88. **(d)**



$\sin\theta = \dfrac{50\text{m}}{100\text{ m}} = \dfrac{1}{2}$; $\theta = 30°$

89. **(b)**



$\tan 30° = \dfrac{20}{x} \Rightarrow \dfrac{1}{\sqrt{3}} = \dfrac{20}{x}$

$x = 20\sqrt{3}$

90. **(a)** $\dfrac{a^2}{a^2\sin^2\theta} - \dfrac{b^2}{b^2\tan^2\theta}$

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

91. **(a)** $\dfrac{\sin 25°\cos 65° + \cos 25°\sin 65°}{\tan^2 70° - \sec^2 70°}$

$= \dfrac{\sin(25° + 65°)}{-1} = \dfrac{\sin 90°}{(-1)} = -1$

92. **(b)** $4\cos^2\theta - 4\cos\theta + 1 = 0$

$(2\cos\theta - 1)^2 = 0$

or, $2\cos\theta = 1$

$\Rightarrow \cos\theta = \dfrac{1}{2}$; $\theta = 60°$

Hence, the value of $\tan(\theta - 15°) = \tan(60° - 15°) = \tan 45° = 1$

93. **(a)** $(r\cos\theta - \sqrt{3})^2 (r\sin\theta - 1)^2 = 0$

On comparing, we get

$(r\cos\theta - \sqrt{3})^2 = 0 \Rightarrow r\cos\theta = \sqrt{3}$ ...(i)

and $(r\sin\theta - 1)^2 = 1 \Rightarrow r\sin\theta = 1$ ...(ii)

On dividing (ii) from (i), we get

$\dfrac{r\sin\theta}{r\cos\theta} = \dfrac{1}{\sqrt{3}} \Rightarrow \tan\theta = \dfrac{1}{\sqrt{3}} \Rightarrow \theta = 30°$

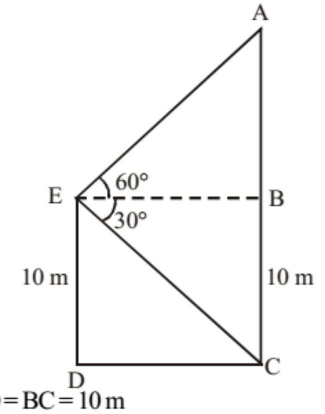
from eq (i), $r\cos\theta = \sqrt{3} \Rightarrow r\cos 30° = \sqrt{3}$

$\Rightarrow r = \dfrac{\sqrt{3}}{\cos 30°} = \dfrac{\sqrt{3}}{\frac{\sqrt{3}}{2}} = 2$

$\therefore\ \dfrac{r\tan\theta + \sec\theta}{r\sec\theta + \tan\theta} = \dfrac{r\tan 30° + \sec 30°}{r\sec 30° + \tan 30°}$

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

94. (c)



ED = BC = 10 m

In ΔABE, $\tan 60° = \frac{AB}{EB}$

$\sqrt{3} = \frac{AB}{EB} \Rightarrow AB = \sqrt{3}EB$ ...(1)

In ΔEBC, $\tan 30° = \frac{BC}{EB}$

$\frac{1}{\sqrt{3}} = \frac{10}{EB} \Rightarrow EB = 10\sqrt{3}m$

Putting value of EB in (1)

$AB = \sqrt{3}\left(10\sqrt{3}\right) = 30m$

$AC = AB + BC = 40\,m$

95. (d) $(\sin^2 1° + \sin^2 89°) + (\sin^2 2° + \sin^2 88°) + ... + (\sin^2 44° + \sin^2 48°) + \sin^2 45°$

$= (\sin^2 1° + \cos^2 1°) + (\sin^2 2° + \cos^2 2°) + ... + (\sin^2 44° + \cos^2 44°) + \sin^2 45°$

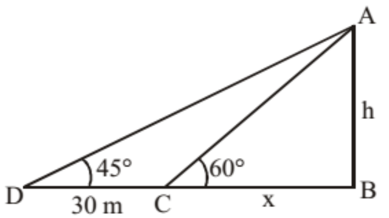
$= 1 + 1 + ... + 1$ (44 times) $+ \frac{1}{2} = 44\frac{1}{2}$

96. (c) $\frac{(\cos\theta + \sin\theta)(\cos^2\theta + \sin^2\theta - \sin\theta\cos\theta)}{(\cos\theta + \sin\theta)}$

$+ \frac{(\cos\theta - \sin\theta)(\cos^2\theta + \sin^2\theta + \sin\theta\cos\theta)}{(\cos\theta - \sin\theta)}$

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

97. (a)



In ΔABC, $\tan 60° = \frac{h}{x}$

$x = \frac{h}{\sqrt{3}}$ ...(1)

In ΔABD, $\tan 45° = \frac{h}{30 + x}$

$1 = \frac{h}{30 + x}$ or $h = 30 + x$

Putting value of x from (1)

$h = 30 + \frac{h}{\sqrt{3}}$

or $h\frac{(\sqrt{3} - 1)}{\sqrt{3}} = 30 \Rightarrow h = 15\ (3 + \sqrt{3})$ m

98. (d) $\sin 17° = \frac{x}{y}$

$\cos 17° = \sqrt{1 - \frac{x^2}{y^2}} = \frac{\sqrt{y^2 - x^2}}{y}$

$\sec 17° - \sin 73° = \sec 17° - \cos 17°$

$= \frac{y}{\sqrt{y^2 - x^2}} - \frac{\sqrt{y^2 - x^2}}{y} = \frac{y^2 - y^2 + x^2}{y\sqrt{y^2 - x^2}} = \frac{x^2}{y\sqrt{y^2 - x^2}}$

99. (c) $\operatorname{cosec}\theta + \cot\theta = \sqrt{3}$

$\frac{1}{\sin\theta} + \frac{\cos\theta}{\sin\theta} = \sqrt{3}$

$\frac{1 + \cos\theta}{\sin\theta} = \sqrt{3}$

$\frac{2\cos^2\frac{\theta}{2}}{2\sin\frac{\theta}{2}\cos\frac{\theta}{2}} = \sqrt{3}$

$\cot\frac{\theta}{2} = \sqrt{3}$

$\tan\frac{\theta}{2} = \frac{1}{\sqrt{3}}$; $\frac{\theta}{2} = 30°$; $\theta = 60°$

$\operatorname{cosec}\theta = \operatorname{cosec} 60° = \frac{2}{\sqrt{3}}$

100. (c) $\cos\alpha + \sec\alpha = \sqrt{3}$

taking cube both sides

$\cos^3\alpha + \sec^3\alpha + 3\cos\alpha\sec\alpha(\cos\alpha + \sec\alpha) = 3\sqrt{3}$

$\cos^3\alpha + \sec^3\alpha + 3\sqrt{3} = 3\sqrt{3}$

$\cos^3\alpha + \sec^3\alpha = 0$

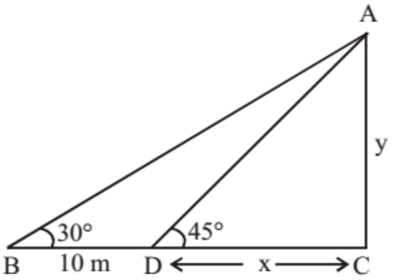
101. (a) $\sin\theta + \cos\theta = \sqrt{2}\cos\theta$

$\sin\theta = (\sqrt{2} - 1)\cos\theta$

$\cot\theta = \frac{1}{\sqrt{2} - 1}$

$\cot\theta = \frac{1}{\sqrt{2} - 1} \times \frac{\sqrt{2} + 1}{\sqrt{2} + 1} = \sqrt{2} + 1$

102. (a)



In ΔADC, $\tan 45° = \frac{y}{x} \Rightarrow 1 = \frac{y}{x} \Rightarrow x = y$ ... (i)

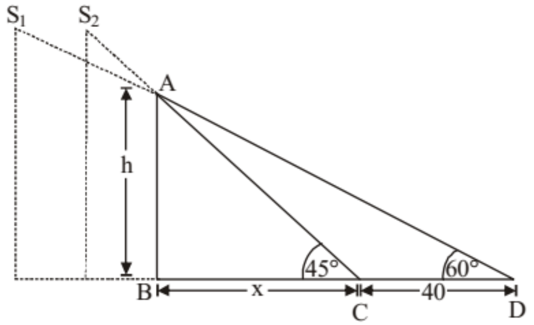
In ΔABC, $\tan 30° = \frac{y}{x+10}$

$\Rightarrow \frac{1}{\sqrt{3}} = \frac{y}{x+10} \Rightarrow \sqrt{3}y = x + 10$

$\Rightarrow \sqrt{3}x = x + 10 \Rightarrow x(\sqrt{3}-1) = 10$

$\Rightarrow x = \frac{10}{\sqrt{3}-1} \Rightarrow y = \frac{10}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = 5(\sqrt{3}+1)$ m

103. (d)



Let S_1 and S_2 be the two different positions of sun and AB is the tower

In ΔABC

$$\tan 45° = \frac{h}{x} \quad (\because \tan 45° = 1)$$

$$h = x$$

In ΔABD $\tan 60° = \frac{h}{x+40}$

$$\sqrt{3} = \frac{h}{x+40} = \frac{x}{x+40}$$

$$\left(\sqrt{3}-1\right)x = 40\sqrt{3}$$

$$x = \frac{40\sqrt{3}}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}+1} = \frac{40\sqrt{3}\left(\sqrt{3}+1\right)}{3-1}$$

$$= 20\sqrt{3}\left(\sqrt{3}+1\right) = 20\left(3+\sqrt{3}\right)\text{m}$$

104. (d) $2\sin\alpha + 15\cos^2\alpha = 7$ where α is acute angle

$\Rightarrow 2\sin\alpha + 15(1 - \sin^2\alpha) = 7$

$\Rightarrow 2\sin\alpha + 15 - 15\sin^2\alpha - 7 = 0$

$\Rightarrow -15\sin^2\alpha + 2\sin\alpha + 8 = 0$

$\Rightarrow 15\sin^2\alpha - 2\sin\alpha - 8 = 0$

Let $\sin\alpha = t$

So $15t^2 - 2t - 8 = 0$

$15t^2 - 12t + 10t - 8 = 0$

$3t(5t-4) + 2(5t-4) = 0$

$\Rightarrow 5t - 4 = 0;\ 3t + 2 = 0$

$t = 4/5$ or $t = -\frac{2}{3}$ (–ve value not possible)

$\therefore \sin\alpha = \frac{4}{5}$

$\cos\alpha = \frac{\sqrt{5^2 - 4^2}}{5} = \frac{3}{5}$

$\therefore \cot\alpha = \frac{\cos\alpha}{\sin\alpha} = \frac{3}{5} \times \frac{5}{4} = \frac{3}{4}$

105. (c) $\sin\theta + \sin^2\theta = 1$

$\Rightarrow \sin\theta = 1 - \sin^2\theta$

$\Rightarrow \sin\theta = \cos^2\theta$

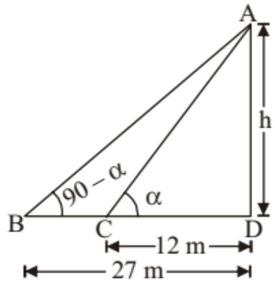
Squaring both sides

$\Rightarrow \sin^2\theta = \cos^4\theta$

$\Rightarrow 1 - \cos^2\theta = \cos^4\theta$

$\Rightarrow \cos^2\theta + \cos^4\theta = 1$

106. (d) Let height of the pillar is h m



In ΔACD

$\tan\alpha = \frac{h}{12}$

In ΔABD

$\tan(90 - \alpha) = \frac{h}{27}$

$\cot\alpha = \frac{h}{27}$

$\frac{1}{\tan\alpha} = \frac{h}{27}$

$\frac{12}{h} = \frac{h}{27}$

$h = \sqrt{27 \times 12} = 18$ cm

107. (a) $\tan^2\frac{\pi}{4} - \cos^2\frac{\pi}{3} = x\sin\frac{\pi}{4}\cos\frac{\pi}{4}\tan\frac{\pi}{3}$

$\tan\frac{\pi}{4} = 1;\ \cos\frac{\pi}{3} = \frac{1}{2};\ \cos\frac{\pi}{4} = \frac{1}{\sqrt{2}};\ \sin\frac{\pi}{4} = \frac{1}{\sqrt{2}};$

$\tan\frac{\pi}{3} = \sqrt{3}$

So, $(1)^2 - \left(\frac{1}{2}\right)^2 - x\left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{\sqrt{2}}\right)\left(\sqrt{3}\right)$

$\Rightarrow \frac{3}{4} = \frac{\sqrt{3}x}{2}$

$x = \frac{3 \times 2}{\sqrt{3} \times 4} = \frac{\sqrt{3}}{2}$

108. (b) $= \dfrac{1+2\left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{2}\right)}{\frac{\sqrt{3}}{2}+\frac{1}{2}} + \dfrac{1-2\left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{2}\right)}{\frac{\sqrt{3}}{2}-\frac{1}{2}}$

$= \dfrac{\frac{2+\sqrt{3}}{2}}{\frac{\sqrt{3}+1}{2}} + \dfrac{\frac{2-\sqrt{3}}{2}}{\frac{\sqrt{3}-1}{2}} = \dfrac{2+\sqrt{3}}{\sqrt{3}+1} + \dfrac{2-\sqrt{3}}{\sqrt{3}-1}$

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

$= \dfrac{2\sqrt{3}}{2} = 2$

109. (a) $\dfrac{\sin\theta+\cos\theta}{\sin\theta-\cos\theta} = 3$

By componendo and dividendo

$\dfrac{2\sin\theta}{2\cos\theta} = \dfrac{4}{2} = 2$

So, $\tan\theta = 2$

$\sin^2\theta = (1-\cos^2\theta) = \left(1-\dfrac{1}{\sec^2\theta}\right)$

$= \dfrac{\sec^2\theta-1}{\sec^2\theta} = \dfrac{\tan^2\theta}{1+\tan^2\theta} = \dfrac{(2)^2}{1+(2)^2} = \dfrac{4}{5}$

110. (c) $\sin 2\theta = \dfrac{\sqrt{3}}{2} = \sin 60°$

$\Rightarrow 2\theta = 60°$,

$\theta = 30°$

$\sin 3\theta = \sin 3(30°) = 90° = \sin 90° = 1$

111. (c) $\alpha + \beta = 90° \Rightarrow \beta = 90° - \alpha$

$\dfrac{\tan\alpha}{\tan\beta} + \sin^2\alpha + \sin^2\beta$

$= \dfrac{\tan\alpha}{\tan(90°-\alpha)} + \sin^2(90-\beta) + \sin^2\beta$

$= \dfrac{\tan\alpha}{\cot\alpha} + \cos^2\beta + \sin^2\beta = \tan^2\alpha + 1 = \sec^2\alpha$

112. (a) The maximum value of $\sin^4\theta + \cos^4\theta$ is 1.

113. (a) Tan 4° tan 43° tan47° tan 86°

Tan (90° – 86°) × tan (90° – 47°) × tan 47° × tan 86°

= cot 86° × cot 47° × tan 47° × tan 86°

= 1

114. (a) $\dfrac{\cos^2 45°}{\sin^2 60°} + \dfrac{\cos^2 60°}{\sin^2 45°} - \dfrac{\tan^2 30°}{\cot^2 45°} - \dfrac{\sin^2 30°}{\cot^2 30°}$

$\Rightarrow \dfrac{\left(\frac{1}{\sqrt{2}}\right)^2}{\left(\frac{\sqrt{3}}{2}\right)^2} + \dfrac{\left(\frac{1}{2}\right)^2}{\left(\frac{1}{\sqrt{2}}\right)^2} - \dfrac{\left(\frac{1}{\sqrt{3}}\right)^2}{(1)^2} - \dfrac{\left(\frac{1}{2}\right)^2}{(\sqrt{3})^2}$

$= \dfrac{1}{2}\times\dfrac{4}{3} + \dfrac{1}{4}\times\dfrac{2}{1} - \dfrac{1}{3} - \dfrac{1}{4}\times\dfrac{1}{3}$

$\Rightarrow \dfrac{2}{3} + \dfrac{1}{2} - \dfrac{1}{3} - \dfrac{1}{12} \Rightarrow \dfrac{8+6-4-1}{12} = \dfrac{9}{12} = \dfrac{3}{4}$

115. (a) $x\cos\theta - \sin\theta = 1$

$x\cos\theta = 1 + \sin\theta$

$x = \dfrac{1+\sin\theta}{\cos\theta} \Rightarrow x^2 = \dfrac{(1+\sin\theta)^2}{\cos^2\theta}$

$x^2 = \dfrac{(1+\sin\theta)^2}{1-\sin^2\theta} \Rightarrow x^2 = \dfrac{1+\sin\theta}{1-\sin\theta}$

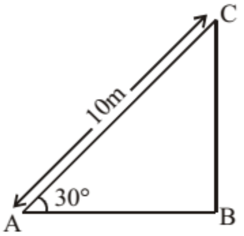
$\Rightarrow x^2(1-\sin\theta) = (1+\sin\theta)$

$x^2 - x^2\sin\theta = 1 + \sin\theta$

$x^2 - x^2\sin\theta - 1 - \sin\theta = 0$

$x^2 - (x^2+1)\sin\theta = 1$

116. (c)



$\cos 30° = \dfrac{AB}{AC}$

$AB = AC \times \cos 30°$

$= 10\times\dfrac{\sqrt{3}}{2} = 8.66$ m

117. (c) Given that

$2\sin^2\theta + 3\cos^2\theta$

$= 2(1-\cos^2\theta) + 3\cos^2\theta = 2 - 2\cos^2\theta + 3\cos^2\theta$

$= 2 + \cos^2\theta$

For minimum value $\cos\theta = 0$

Minimum value of $2\sin^2\theta + 3\cos^2\theta = 2$

118. (c) Let angles are x and y rad.

$x - y = 36°$ ... (i)

$x + y = \dfrac{22}{9}$

$x + y = \dfrac{22}{9}\times\dfrac{180}{\pi} = \dfrac{440°}{\pi} = 140°$ ...(ii)

Now, on solving each (i) and (ii), we get

$x = 88°$, and $y = 52°$

So, smaller angle = 52°

119. (b) $\sin^2 22° + \sin^2 68° + \cot^2 30°$

$= \sin^2(90°-68)° + \sin^2 68° + \cot^2 30°$

$= \cos^2 68° + \sin^2 68° + \cot^2 30°$

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

120. (a) $\tan(4\theta - 50°) = \cot(50° - \theta)$

$\Rightarrow \tan(4\theta - 50°) = \tan(90 - (50° - \theta))$

$\Rightarrow 4\theta - 50° = 90 - 50° + \theta$

$\Rightarrow 3\theta = 90°;\ \theta = 30°.$

121. (c) $5 \sin \theta = 3$

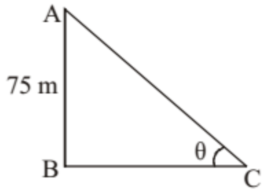
$\sin \theta = \frac{3}{5} = \frac{p}{H}$

$B = \sqrt{(5)^2 - (3)^2} = \sqrt{16} = 4$

$\tan \theta = \frac{3}{4}, \qquad \cos \theta = \frac{4}{5} \qquad \Rightarrow \sec \theta = \frac{5}{4}$

Now, $\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta} = \frac{\frac{5}{4} - \frac{3}{4}}{\frac{5}{4} + \frac{3}{4}} = \frac{2}{8} = \frac{1}{4}$

122. (b)



$\cot \theta = \frac{BC}{AB}$

$\Rightarrow \quad \frac{8}{15} = \frac{BC}{75}$

$\Rightarrow \quad BC = 40$

$AC = \sqrt{(BC)^2 + AB^2}$

$AC = \sqrt{(75)^2 + (40)^2} = \sqrt{5625 + 1600}$

$= \sqrt{7225} = 85$ cm.

123. (b) $\text{Sec}\, \theta + \tan \theta = p$ ...(i)

We know that $\sec^2 \theta - \tan^2 \theta = 1$

$\Rightarrow \quad (\sec \theta - \tan \theta)(\sec \theta + \tan \theta) = 1$

Now, Put the value of $\sec \theta + \tan \theta = p$

$\sec \theta - \tan \theta = \frac{1}{p}$ ...(ii)

Now, solving eqn. (i) and (ii)

$\sec \theta = \frac{1}{2}\left(P + \frac{1}{p}\right)$

124. (d) Hour hand covered in 12 hr = 360°

$3 \text{ hr} = \frac{360}{12} \times 3 = 90° \text{ or } \frac{\pi}{2}$

125. (a) $\sin 31° = \frac{x}{y} \qquad \cos° 31 = \frac{\sqrt{y^2 - x^2}}{y}$

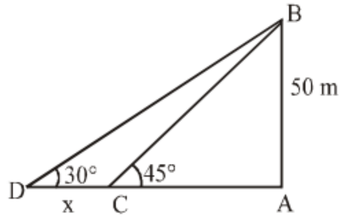
sec 31° – sin 59

sec 31° – cos 31°

$= \frac{y}{\sqrt{y^2 - x^2}} - \frac{\sqrt{y^2 - x^2}}{y} = \frac{y^2 - y^2 + x^2}{y\sqrt{y^2 - x^2}} = \frac{x^2}{y\sqrt{y^2 - x^2}}$

126. (b) In Δ ABC $\frac{AB}{AC} = \tan 45°$

$\frac{AB}{50} = 1$, AC = 50m



In Δ ABD $\frac{50}{50 + x} = \tan 30°$

$50\sqrt{3} = 50 + x$

$50\sqrt{3} - 50 = x$

$x = 50(\sqrt{3} - 1)$

127. (d) $\frac{\cos^2 \theta - 3\cos \theta + 2}{\sin^2 \theta} = 1$

$\frac{\cos^2 \theta - \cos \theta - 2\cos \theta + 2}{1 - \cos^2 \theta} = 1$

$\frac{\cos \theta[\cos \theta - 1] - 2[\cos \theta - 1]}{(1 - \cos \theta)(1 + \cos \theta)} = 1$

$-\left[\frac{(\cos \theta - 2)(1 - \cos \theta)}{(1 - \cos \theta)(1 + \cos \theta)}\right] = 1$

$(2 - \cos \theta) = (1 + \cos \theta)$

$2 \cos \theta = 1$

$\cos \theta = \frac{1}{2}$

$\theta = 60°$

128. (c)

129. (b) $\cot 17°\left(\cot 73° \cos^2 22° + \frac{1}{\cot 17° \sec^2 68°}\right)$

$\cot 17° (\tan 17° \sin^2 68° + \tan 17° \cos^2 68°)$

$\cot 17° \tan 17° (\sin^2 68° + \cos^2 68°)$

$(1)(1) = 1$

130. (b) $\tan(5x - 10°) = \cot(5y + 20°)$

$\tan(5x - 10°) = \tan(90° - 5y - 20°)$

$5x - 10° = -5y + 70°$

$5x + 5y = 80°$

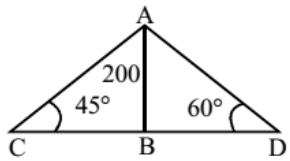
$x + y = 16°$

131. (a) Let BC be the width of river in Δ ABC

$\frac{AB}{BC} = \tan 45°$

$\frac{200}{BC} = 1$

BC = 200



In Δ ABD

$\frac{AB}{BD} = \tan 60°$

$BD = \frac{200}{\sqrt{3}}$

$DC = 200 + \frac{200}{\sqrt{3}}$

132. (a) In ΔADC

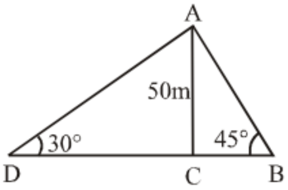
$AC = 50\,m$

$\frac{AC}{DC} = \tan 30°$

$\frac{50}{DC} = \frac{1}{\sqrt{3}}$

$DC = 50\sqrt{3}$

in ΔABC



$\frac{AC}{BC} = \tan 45°$

$BC = 50$

$BD = 50 + 50\sqrt{3} = 50(1+\sqrt{3}) = 50(2.73) = 136.5\,m$

133. (a) $\cos 53° - \sin 37° \Rightarrow \cos 53° - \sin(90° - 53°)$

$\Rightarrow \cos 53° - \cos 53° = 0$

134. (b) $\text{cosec}\theta + \frac{1}{\text{cosec}\,\theta} = \frac{5}{2}$

Squaring on both sides

$\text{cosec}^2\theta + \frac{1}{\text{cosec}^2\theta} + 2 = \frac{25}{4}$

$\text{cosec}^2\theta + \frac{1}{\text{cosec}^2\theta} + 2 - 4 = \frac{25}{4} - 4$

$\text{cosec}^2\theta + \frac{1}{\text{cosec}^2\theta} - 2 = \frac{9}{4}$

$(\text{cosec}\,\theta - \sin\theta)^2 = \frac{9}{4}$

$(\text{cosec}\,\theta - \sin\theta) = \sqrt{\frac{9}{4}}$

$\text{cosec}\,\theta - \sin\theta = \frac{3}{2}$

135. (b) $\tan\theta - \sin\theta = n$

$\tan\theta + \sin\theta = m$

$m^2 - n^2 = (\tan\theta + \sin\theta)^2 - (\tan\theta - \sin\theta)^2$

$= 2\tan\theta\sin\theta + 2\tan\theta\sin\theta$

$= 4\frac{\sin^2\theta}{\cos\theta} = 4\sqrt{\frac{\sin^2\theta}{\cos^2\theta}} = 4\sqrt{\frac{\sin^2\theta(1-\cos^2\theta)}{\cos^2\theta}}$

$= 4\sqrt{\tan^2\theta(1-\cos^2\theta)} = 4\sqrt{\tan^2\theta - \tan^2\theta\cos^2\theta}$

$= 4\sqrt{\tan^2\theta - \sin^2\theta} = 4\sqrt{mn}$

136. (c) $\frac{1}{2}\cot A\left[\frac{1+(\sec A - \tan A)^2}{\text{cosec}\,A(\sec A - \tan A)}\right]$

$= \frac{1}{2}\cot A\left[\frac{(\sec^2 A - \tan^2 A) + (\sec A - \tan A)^2}{\text{cosec}\,A(\sec A - \tan A)}\right]$

$= \frac{1}{2} \times \frac{\cot A}{\text{cosec}\,A} \times [(\sec A + \tan A) + (\sec A - \tan A)]$

$= \frac{1}{2} \times \cos A \times (2\sec A) = 1$

137. (c) $\sin^2 2° + \sin^2 4° + \sin^2 6° + ... + \sin^2 86° + \sin^2 88° + \sin^2 90°$

$\Rightarrow \sin^2 2° + \sin^2 4° + \sin^2 6° ... \sin^2(90° - 4°) + \sin^2(90° - 2°) + \sin^2 90°$

$\Rightarrow \sin^2 2° + \sin^2 4° + \sin^2 6° + ... + \cos^2 4° + \cos^2 2° + \sin^2 90°$

$\Rightarrow (\sin^2 2° + \cos^2 2°) + (\sin^2 4° + \cos^2 4°) + (\sin^2 6° + \cos^2 6°) + \sin^2 90°$

$\Rightarrow (1 + 1 + ... 22 \text{ terms}) + \sin^2 90°$

$\Rightarrow 22 + 1 = 23$

138. (a) Let $ED = x$ cm

In ΔABC

$AB = BC \cot 30°$

$AB = 10\sqrt{3}$

and

$AB = DC = 10\sqrt{3}$

and

In ΔDEC

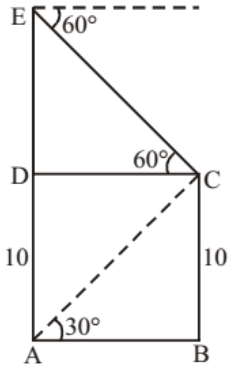
$DE = DC \tan 60°$

$DE = 10\sqrt{3} \times \sqrt{3}$

$= 30$ cm

and $AE = AD + DE$

$\Rightarrow AE = 30 + 10 = 40$ cm



139. (d) $\tan\theta + \sec\theta = 2$ (Given) ...(i)

$\tan^2\theta - \sec^2\theta = -1$ (Identity)

$(\tan\theta - \sec\theta)(\tan\theta + \sec\theta) = -1$

$\Rightarrow \tan\theta - \sec\theta = -\frac{1}{2}$ ... (ii)

Adding eqn. (i) and (ii)

$2\tan\theta = \frac{3}{2}$

$\tan\theta = \frac{3}{4}$

140. (a) $\frac{\cot A + \tan B}{\cot B + \tan A} \Rightarrow \frac{\cot A + \frac{1}{\cot B}}{\cot B + \frac{1}{\cot A}}$

$\Rightarrow \frac{\frac{\cot A.\cot B + 1}{\cot B}}{\frac{\cot A.\cot B + 1}{\cot A}} \Rightarrow \frac{\cot A}{\cot B} = \cot A.\tan B$

141. (b) $\left(\frac{1}{\text{cosec}\,A + \cot A}\right)^2$

$\Rightarrow \left[\frac{1}{\left(\frac{1}{\sin A} + \frac{\cos A}{\sin A}\right)}\right]^2 = \frac{\sin^2 A}{(1+\cos A)^2}$

$\Rightarrow \frac{1-\cos^2 A}{(1+\cos A)^2} = \frac{(1-\cos A)(1+\cos A)}{(1+\cos A)^2}$

$= \frac{1-\cos A}{1+\cos A}$

142. (b) $\cos^2\theta - \sin\theta = \frac{1}{4}$

$\Rightarrow 1-\sin^2\theta - \sin\theta = \frac{1}{4} \Rightarrow \sin^2\theta - \sin\theta - \frac{3}{4} = 0$

$\Rightarrow 4\sin^2\theta + 4\sin\theta - 3 = 0 \Rightarrow (2\sin\theta - 1)(2\sin\theta + 3)$

$\sin\theta = \frac{1}{2}$ or $\sin\theta = -\frac{3}{2}$, which is not possible

$\therefore \sin^2\theta = \frac{1}{2}$

143. (a) $\frac{\sin 2A}{1+\cos 2A} = ?$

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

144. (a) $\left(\frac{\sec A}{\cot A + \tan A}\right)^2$

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

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

145. (c) $1 + \tan A.\tan\left(\frac{A}{2}\right) = ?$

$\Rightarrow 1 + \frac{\sin A}{\cos A} \times \frac{\sin(A/2)}{\cos(A/2)}$

$\Rightarrow 1 + \frac{\sin A}{\cos A} \times \frac{2\sin(A/2).\sin(A/2)}{2\sin(A/2).\cos(A/2)}$

$\Rightarrow 1 + \frac{\sin A}{\cos A} \times \frac{2\sin^2(A/2)}{\sin A}$

$\Rightarrow 1 + \frac{1-\cos A}{\cos A} = 1 + \frac{1}{\cos A} - \frac{\cos A}{\cos A} = \sec A$

146. (c) cosec 2A + cot 2A

$\Rightarrow \frac{1}{\sin 2A} + \frac{\cos 2A}{\sin 2A} \Rightarrow \frac{1+\cos 2A}{\sin 2A}$

$\Rightarrow \frac{(1+2\cos^2 A - 1)}{2\sin A.\cos A} \Rightarrow \frac{\cos A}{\sin A} = \cot A$

147. (a) Here,
$A = 30°, B = 60°$ and $C = 135°$
then,
$\sin^3 A + \cos^3 B + \tan^3 C - 3\sin A\cos B\tan C$
$\sin^3 30° + \cos^3 60° + \tan^3 135° - 3\sin 30°\cos 60°\tan 135°$

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

$\Rightarrow \frac{1}{8} + \frac{1}{8} - 1 + \frac{3}{4} \Rightarrow \frac{1+1-8+6}{8} = 0$

148. (d) $\tan^2\theta + \cot^2\theta + \sin^2\theta + \cos^2\theta + \sec^2\theta + \text{cosec}^2\theta$
$\Rightarrow \sin^2\theta + \cos^2\theta + \tan^2\theta + 1 + \tan^2\theta + \cot^2\theta + 1 + \cot^2\theta$
$\Rightarrow 1 + 1 + 1 + 2\tan^2\theta + 2\cot^2\theta$
$\Rightarrow 3 + 2(\tan^2\theta + \cot^2\theta)$
$\Rightarrow 3 + 2\times 2 \Rightarrow 3 + 4 = 7$

149. (d) $\text{cosec}^6 A - \cot^6 A - 3\,\text{cosec}^2 A\cot^2 A$
$\Rightarrow (\text{cosec}^2 A)^3 - (\cot^2 A)^3 - 3\cot^2 A.\,\text{cosec}^2 A$
$\Rightarrow [(\text{cosec}^2 A - \cot^2 A)((\text{cosec}^2 A)^2 + (\cot^2 A)^2$
$+ \text{cosec}^2 A\cot^2 A)] - 3\cot^2 A.\,\text{cosec}^2 A$
$\Rightarrow 1[(\text{cosec}^2 A)^2 + (\cot^2 A)^2 - 2\,\text{cosec}^2 A\cot^2 A$
$+ 2\,\text{cosec}^2 A\cot^2 A + \text{cosec}^2 A\cot^2 A)]$
$- 3\cot^2 A\,\text{cosec}^2 A$
$\Rightarrow [(\text{cosec}^2 A - \cot^2 A)^2 + 3\,\text{cosec}^2 A\cot^2 A]$
$- 3\,\text{cosec}^2 A\cot^2 A$
$\Rightarrow (\text{cosec}^2 A - \cot^2 A)^2$
$= (1)^2 = 1.$

150. (a) $\sqrt{\frac{\sec A - 1}{\sec A + 1} \times \frac{\sec A - 1}{\sec A - 1}} = \frac{\sec A - 1}{\sqrt{\sec^2 A - 1}}$

$= \frac{\sec A - 1}{\sqrt{\tan^2 A}} = \frac{\sec A - 1}{\tan A} = \frac{\sec A}{\tan A} - \frac{1}{\tan A}$
$=$ cosec A – cot A.

151. (b) $\tan A = \frac{1}{2}$

$\tan 2A = \frac{2\tan A}{1-\tan^2 A} = \frac{2\times\frac{1}{2}}{1-\frac{1}{4}} = \frac{1\times 4}{3} = \frac{4}{3}$

$\tan B = \frac{1}{3}$

$\therefore \tan(2A+B) = \frac{\tan 2A + \tan B}{1 - \tan 2A\tan B}$

$= \frac{\frac{3}{4}+\frac{1}{3}}{1-\left(\frac{4}{3}\right)\left(\frac{1}{3}\right)} = \frac{5}{3\times\left(1-\frac{4}{9}\right)} = \frac{\cancel{5}\times\cancel{9}^3}{\cancel{3}\times\cancel{5}} = 3$

152. (b) $\because \tan\left(\frac{A}{2}\right) = \frac{\sin A}{(1+\cos A)}$

$\therefore x = \frac{\sin A}{(1+\cos A)}$

153. (b) $2\sec A - \frac{(1+\sin A)}{\cos A} = x$
then,
$\frac{2}{\cos A} - \frac{(1+\sin A)}{\cos A} = \frac{2-1-\sin A}{\cos A}$

$= \frac{1-\sin A}{\cos A} \times \frac{(1+\sin A)}{(1+\sin A)} = \frac{1-\sin^2 A}{\cos A(1+\sin A)}$

$= \frac{\cos^2 A}{\cos A(1+\sin A)} = \frac{\cos A}{1+\sin A}$

154. (b) $\sec\left(-\frac{5\pi}{4}\right) = x$

$\therefore \quad \sec\left(\frac{-5\times 180°}{4}\right) = \sec(-225°)$

$= -\sec(180° + 45°) = -\sec 45° = -\sqrt{2}$

$\therefore \quad x = -\sqrt{2}$

155. (d) $\dfrac{1}{\frac{1}{\sin\theta}+\frac{\cos\theta}{\sin\theta}} \Rightarrow \dfrac{1}{\frac{1+\cos\theta}{\sin\theta}}$

$\Rightarrow \dfrac{\sin\theta}{1+\cos\theta}$, Now $\left(\dfrac{1}{\text{cosec}\,\theta+\cot\theta}\right)^2$

$= \left(\dfrac{\sin\theta}{1+\cos\theta}\right)^2 = \dfrac{1-\cos^2\theta}{(1+\cos\theta)^2} = \dfrac{(1-\cos\theta)}{(1+\cos\theta)}$

$\Rightarrow \dfrac{1-\cos\theta}{1+\cos\theta}$

156. (d) $\sec\theta + \text{cosec}\,\theta = \sqrt{2}\sec(90° - \theta)$

$\Rightarrow \sec\theta + \text{cosec}\,\theta = \sqrt{2}\,\text{cosec}\,\theta$

$\Rightarrow \sec\theta = (\sqrt{2}-1)\text{cosec}\,\theta$

$\Rightarrow \dfrac{\sin\theta}{\cos\theta} = (\sqrt{2}-1)$

$\Rightarrow \cot\theta = \dfrac{1}{\sqrt{2}-1}\times\dfrac{\sqrt{2}+1}{\sqrt{2}+1} = (\sqrt{2}+1)$

157. (b) $\sin(\theta + 23°) = \cos 58°$
$\sin(\theta + 23°) = \sin(90° - 58°)$
$\sin(\theta + 23°) = \sin 32°$
$\theta + 23° = 32°$
$\theta = 32° - 23° = 9°$

$\cos 58 = \cos(5 \times 9°) = \cos 45° = \frac{1}{2}$

158. (d) $x\sin\theta = 5\sqrt{3}$ ...(1)

and $x\cos 5\sqrt{3} = \frac{5}{2}$ ...(2)

Squaring both equations

$x^2\sin^2\theta = \dfrac{25\times 3}{4}$ ...(3)

and $x^2\cos^2\theta = \dfrac{25}{4}$ ....(4)

Adding both (3) & (4) equation, we get

$x^2(\sin 2\theta + \cos^2\theta) = \dfrac{25\times 3}{4} + \dfrac{25}{4}$

$\Rightarrow x^2(1) = \dfrac{75}{4} + \dfrac{25}{4} \Rightarrow x^2 = \dfrac{100}{4}$

$\Rightarrow x = \dfrac{10}{2} = 5$

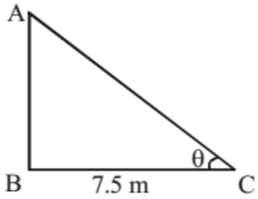
159. (d) $\because \quad \cos\theta = \frac{\sqrt{3}}{2}, \quad \because \quad \cos 30° = \frac{\sqrt{3}}{2}$

$\therefore \cos\theta = \cos 30°$
$\therefore \theta = 30°$

Now, $30° + \varphi = \frac{2}{3}\times 180°$; $\varphi = 120° - 30° = 90°$

$\therefore \sin\varphi = \sin 90° = 1.$

160. (c)



Let AC is a ladder and AB is the height of the wall.

Now, in ΔABC, $\sin(\theta) = \frac{12}{13}$

$\cos\theta = \sqrt{1-\sin^2\theta}$

$= \sqrt{1-\left(\frac{12}{13}\right)^2} = \sqrt{\frac{169-144}{169}} = \sqrt{\frac{25}{169}} = \frac{5}{13}$

$\therefore \tan\theta = \dfrac{\sin\theta}{\cos\theta} = \dfrac{\frac{12}{13}}{\frac{5}{13}} = \dfrac{12}{5}$

From ΔABC, $\tan\theta = \dfrac{AB}{BC} \Rightarrow \dfrac{12}{5} = \dfrac{AB}{7.5}$

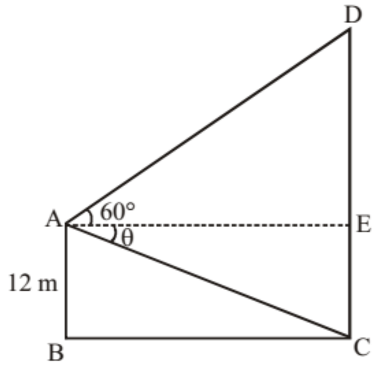
$AB = \frac{12}{5}\times 7.5 = 18\text{m}$

161. (c) $\dfrac{\sin 30° - \cos 60° + \cot^2 45°}{\cos 30° - \tan 45° + \sin 90°} = \dfrac{\frac{1}{2}-\frac{1}{2}+(1)^2}{\frac{\sqrt{3}}{2}-1+1} = \dfrac{1}{\frac{\sqrt{3}}{2}}$

$= \dfrac{2}{\sqrt{3}} = \dfrac{2\sqrt{3}}{3}$

162. (a) $\tan 3x = \cot(30° + 2x)$
$\cot(90° - 3x) = \cot(30° + 2x)$
$90° - 3x = 30° + 2x$
$60° = 2x + 3x \Rightarrow 5x = 60°$
$x = 12°$

163. (d)



Let AB is the height of the building and CD is the height of the tower.

Angle of elevation $\angle DAE = 60°$
and angle of depression $\angle CAE = \theta$

From ΔAEC, $\tan\theta = \frac{CE}{AE} \Rightarrow \frac{3}{4} = \frac{12}{AE}$ $[\because CE = AB = 12]$

$\therefore \quad AE = 16\,m$

Now, in ΔAED, $\tan 60° = \frac{DE}{AE}$

$\sqrt{3} = \frac{DE}{16} \Rightarrow DE = 16\sqrt{3}\,m = 27.68\,m$

Height of the tower $CD = 12 + 27.68 = 39.68\,m$

164. (b) $\theta = 9° \Rightarrow 10\,\theta = 9 \times 10 = 90°$

Now, $\cot\theta \cdot \cot2\theta \cdot \cot3\theta \cdot \cot4\theta \cdot \cot5\theta \cdot \cot6\theta \cdot \cot7\theta \cdot \cot8\theta \cdot \cot9\theta.$

$= \cot\theta \cdot \cot2\theta \cdot \cot3\theta \cdot \cot4\theta \cdot \cot(90° - 4\theta) \cdot \cot(90° - 3\theta) \cdot \cot(90° - 2\theta) \cdot \cot(90° - \theta)$

$= \cot\theta \cdot \cot2\theta \cdot \cot3\theta \cdot \cot4\theta \cdot \tan4\theta \cdot \tan3\theta \cdot \tan2\theta \cdot \tan\theta$

$= \frac{1}{\tan\theta} \cdot \frac{1}{\tan2\theta} \cdot \frac{1}{\tan3\theta} \cdot \frac{1}{\tan4\theta} \cdot \tan4\theta \cdot \tan3\theta \cdot \tan2\theta \cdot \tan\theta \cdot = 1.$

165. (a) $\sin(\alpha + \beta) = 1 = \sin 90°$

$\therefore \alpha + \beta = 90°$ ...(i)

and $\cos(\alpha - \beta) = \frac{1}{2} = \cos 60°$

$\alpha - \beta = 60°$ ...(ii)

from (i) and (ii), we get $2\alpha = 90° + 60°$

$\alpha = \frac{150°}{2} = 75°$

$\beta = 90° - \alpha = 90° - 75° = 15°$

166. (d) $\sqrt{\frac{1 - \sin x}{1 + \sin x}} = a - \tan x$

$\sqrt{\frac{(1 - \sin x)(1 - \sin x)}{(1 + \sin x)(1 - \sin x)}} = a - \tan x$

$= \sqrt{\frac{(1 - \sin x)^2}{(1 - \sin^2 x)}} = a - \tan x \quad = \sqrt{\frac{(1 - \sin x)^2}{\cos^2 x}} = a - \tan x$

$\frac{1 - \sin x}{\cos x} = a - \tan x$

$\sec x - \tan x = a - \tan x$

$\therefore a = \sec x.$

167. (a) $\frac{3\sin\theta - 4\cos\theta}{3\sin\theta + 4\cos\theta} = \frac{3.\frac{\sin\theta}{\cos\theta} - 4}{3.\frac{\sin\theta}{\cos\theta} + 4}$

$= \frac{3\tan\theta - 4}{3\tan\theta + 4} = \frac{3 \times \frac{2}{3} - 4}{3 \times \frac{2}{3} + 4} = \frac{2 - 4}{2 + 4} = \frac{-2}{6} = \frac{-1}{3}$

168. (c) We know that $\sec\theta = \frac{1}{\cos\theta}$

and $\csc\theta = \frac{1}{\sin\theta}$

Now, $\sec 4\theta = \csc(\theta + 20°)$

$\frac{1}{\cos 4\theta} = \frac{1}{\sin(\theta + 20°)}$

$\sin(\theta + 20°) = \cos 4\theta$

$\sin(\theta + 20°) = \sin(90° - 4\theta)$

$\theta + 20 = 9° - 4\theta$

$\theta + 20° = 90° - 4\theta$

$5\theta = 90° - 20° \Rightarrow \theta = \frac{70}{5} = 14°$

169. (b) $\sin^2 38° + \sin^2 52° + \sin^2 30° - \tan^2 45°$

$\sin^2 38° + \sin^2 52° + \left(\frac{1}{2}\right)^2 - (1)^2$

$\sin^2 38° + \sin^2 52° + \frac{1}{4} - 1$

$\sin^2 38° + \sin^2(90° - 38°) - \frac{3}{4}$

$\sin^2 38° + \cos^2 38° - \frac{3}{4} = 1 - \frac{3}{4} = \frac{1}{4}$

170. (d) $2\sin\theta = 5\cos\theta \Rightarrow \tan\theta = \frac{5}{2}$

$\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = \frac{\frac{\sin\theta}{\cos\theta} + 1}{\frac{\sin\theta}{\cos\theta} - 1} = \frac{\tan\theta + 1}{\tan\theta - 1}$

$= \frac{\frac{5}{2} + 1}{\frac{5}{2} - 1} = \frac{5 + 2}{5 - 2} = \frac{7}{3}$

171. (c) $\sin^2 32° + \sin^2 58° - \sin 30° + \sec^2 60°$

$\sin^2 32° + \sin^2(90° - 32°) - \left(\frac{1}{2}\right) + (2)^2$

$\sin^2 32° + \cos^2 32° - \left(\frac{1}{2}\right) + 4$

$1 - \left(\frac{1}{2}\right) + 4 = 4.5$

172. (d) $\sec(3\theta - 15°) = \csc 2\theta$

$\sin 2\theta = \cos(3\theta - 15°)$

$\cos(90° - 2\theta) = \cos(3\theta - 15°)$

$90° - 2\theta = 3\theta - 15°$

$5\theta = 90° + 15°$

$\theta = 21°$

173. (a) In first quadrant $0 < A < 90°$ and, $(\sin A, \cos A, \tan A) > 0$

Now, $6 \tan A = 5 \Rightarrow \tan A = \frac{5}{6}$

$$\therefore \frac{8\sin A - 4\cos A}{\cos A + 2\sin A} = \frac{8\cdot\frac{\sin A}{\cos A} - 4\cdot\frac{\cos A}{\cos A}}{\frac{\cos A}{\cos A} + 2\cdot\frac{\sin A}{\cos A}}$$

$$\Rightarrow \frac{8\tan A - 4}{1 + 2\tan A} = \frac{8\left(\frac{5}{6}\right) - 4}{1 + 2\left(\frac{5}{6}\right)} \Rightarrow \frac{\frac{8}{3}}{\frac{8}{3}} = 1$$

174. (a) According to question,

$A + B = 45°$

By adding tan in both sides.

$\tan(A + B) = \tan 45°$

$$\frac{\tan A + \tan B}{1 - \tan A \cdot \tan B} = 1$$

$\tan A + \tan B = 1 - \tan A \cdot \tan B$

$\Rightarrow \tan A + \tan B + \tan A \tan B = 1$

But adding 1 in both sides

$1 + \tan A + \tan B + \tan A \tan B = 1 + 1$

$1(1 + \tan A) + \tan B(1 + \tan A) = 2$

$\therefore (1 + \tan A)(1 + \tan B) = 2$

$\therefore 2(1 + \tan A)(1 + \tan B) = 2 \times 2 = 4$

175. (d) If, $x = 4\cos A + 5\sin A$ and $y = 4\sin A - 5\cos A$ then $x^2 + y^2$ put the value of x and y. On $x^2 + y^2$

$\Rightarrow (4\cos A + 5\sin A)^2 + (4\sin A - 5\cos A)^2$

$\Rightarrow 16\cos^2 A + 25\sin^2 A + 2.4\cos A \cdot 5\sin A + 16\sin^2 A + 25\cos^2 A - 2 \cdot 4\sin A \cdot 5\cos A.$

$\Rightarrow 16\cos^2 A + 16\sin^2 A + 25\sin^2 A + 25\cos^2 A$

$\Rightarrow 16(\cos^2 A + \sin^2 A) + 25(\sin^2 A + \cos^2 A)$

$\Rightarrow 16 \times 1 + 25 \times 1 \Rightarrow 16 + 25 = 41$

176. (b) $\frac{\tan 60° - \tan 15°}{1 + \tan 60°.\tan 15°} = \tan(60° - 15°) = \tan(45°) = 1.$

177. (c) $3\sec^2 x - 4 = 0$

$$\sec x = \sqrt{\frac{4}{3}} = \frac{2}{\sqrt{3}} = \sec 30°.$$

$\therefore x = 30°.$

178. (b) $4\cos^2\theta - 3\sin^2\theta + 2 = 0$

$$\Rightarrow 4 - 3 \times \frac{\sin^2\theta}{\cos^2\theta} + \frac{2}{\cos^2\theta} = 0 \quad \text{(Dividing by } \cos^2\theta\text{)}$$

$\Rightarrow 4 - 3\tan^2\theta + 2\sec^2\theta = 0$

$\Rightarrow 4 - \tan^2\theta - 2\tan^2\theta + 2\sec^2\theta = 0$

$\Rightarrow 4 - \tan^2\theta + 2(\sec^2\theta - \tan^2\theta) = 0$

$\Rightarrow 4 - \tan^2\theta + 2 = 0 \qquad (\because \sec^2\theta - \tan^2\theta = 1)$

$\therefore \tan^2\theta = 6 \Rightarrow \tan\theta = \sqrt{6}.$

179. (c) $3\tan\theta = 2\sqrt{3}\sin\theta$

$$\Rightarrow 3\frac{\sin\theta}{\cos\theta} = 2\sqrt{3}\sin\theta$$

$$\Rightarrow \cos\theta = \frac{3}{2\sqrt{3}} = \frac{\sqrt{3}}{2}$$

$\Rightarrow \cos\theta = \cos 30°$

$\therefore \theta = 30°$

Now, $2\sin^2 2\theta - 3\cos^2 3\theta = 2\sin^2 60° - 3\cos^2 90°$

$$= 2 \times \left(\frac{\sqrt{3}}{2}\right)^2 - 3 \times 0 = \frac{3}{2}$$

180. (d) $3\sec\theta + 4\cos\theta - 4\sqrt{3} = 0$

Multiply by $\cos\theta$,

$3 + 4\cos^2\theta - 4\sqrt{3}\cos\theta = 0$

$\Rightarrow 4\cos^2\theta - 4\sqrt{3}\cos\theta = 0$

$\Rightarrow (2\cos\theta - \sqrt{3})^2 = 0$

$\Rightarrow 2\cos\theta = \sqrt{3} \Rightarrow \cos\theta = \frac{\sqrt{3}}{2}$

$\Rightarrow \cos\theta = \cos 30° \Rightarrow \theta = 30°$

181. (a) $$\frac{\tan(45° - \alpha)}{\cot(45° - \alpha)} - \frac{\frac{(\cos 19° + \sin 71°)}{(\sec 19° + \operatorname{cosec} 71°)}}{\tan 12° \tan 24° \cdot \tan 66° \tan 78°}$$

$$\frac{\tan(45° - \alpha)}{\cot(45° + \alpha)} - \frac{\frac{[\cos 19° + \sin(90° - 19°)}{[\sec 19° + \operatorname{cosec}(90° - 19°)}}{\tan 12° \tan 24° \cot 24° \cot 12°}$$

$$\Rightarrow 1 - \frac{2\cos 19 : 2\sec 19}{1}$$

$\Rightarrow 1 - 4 \Rightarrow -3$

182. (b) $\tan A + \sec A = \frac{3}{2}$ ...(i)

As we know, $\sec^2 A - \tan^2 A = 1$

$\Rightarrow (\sec A + \tan A)(\sec A - \tan A) = 1$

$\Rightarrow \frac{3}{2} \times (\sec A - \tan A) = 1$

$\Rightarrow \sec A - \tan A = \frac{2}{3}$ ...(ii)

Subtract equation (ii) by equation (i),

$$2\tan A = \frac{3}{2} - \frac{2}{3} = \frac{9 - 4}{6} = \frac{5}{6}$$

$$\Rightarrow \tan A = \frac{5}{12} = \frac{P}{B}$$

So, $H = \sqrt{P^2 + B^2} = \sqrt{25+144} = \sqrt{169} = 13$

$\cot A = \frac{12}{5} = \frac{B}{P}$, $\cos A = \frac{B}{H} = \frac{12}{13}$ and

$\text{cosec } A = \frac{H}{P} = \frac{13}{5}$

Hence, $\frac{10\cot A + 13\cos A}{12\tan A + 5\text{cosec } A} = \frac{10\times\frac{12}{5} + 13\times\frac{12}{13}}{12\times\frac{5}{12} + 5\times\frac{13}{5}}$

$= \frac{24+12}{5+13} = \frac{36}{18} = 2$

183. (d) $\sec\theta - \text{cosec }\theta = 0$

$\sec\theta = \text{cosec }\theta$.

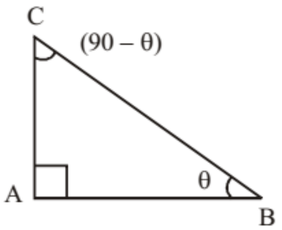
[$\because$ ($\sec\theta = \text{cosec }\theta$) and θ is acute angle]

$\therefore \theta = 45^\circ$

$\therefore \sec^2\theta + \text{cosec}^2\theta = \sec^2(45°) + \text{cosec}^2(45°)$

$= (\sqrt{2})^2 + (\sqrt{2})^2 = 2 + 2 = 4$

184. (d)



$\angle A = 90^\circ$

$\therefore \angle B + \angle C = 90^\circ$

$\because$ In a triangle the sum of all three interior angles is 180º.

$\therefore \sin\frac{B+C}{2}\cdot\cos\frac{B+C}{2} = \sin\frac{90°}{2}\cdot\cos\frac{90°}{2}$

$= \sin 45^\circ \cdot \cos 45^\circ$

$= \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} = \frac{1}{2}$

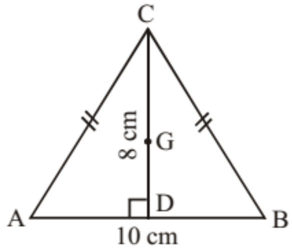
185. (b) $3a = 15\sqrt{3}$ cm (where, a is the side of equilateral Δ)

$a = 5\sqrt{3}$ cm

Let, height of equilateral triangle is h.

Then, $h = \frac{\sqrt{3}}{2}a = \frac{\sqrt{3}}{2} \times 5\sqrt{3} = 7.5$ cm

186. (a)



In triangle ADC,

$CD = 12$ cm $\quad$ ($\because$ CG : GD = 2 : 1)

$AD = 5$ cm

$\therefore AC^2 = AD^2 + CD^2$

$= 5^2 + 12^2 = 25 + 144$

$AC^2 = 169$

$\Rightarrow AC = 13$ cm

187. (a) $4(\text{cosec}^2 57 - \cot^2 57) - 0 - y = \frac{y}{2}$

$\Rightarrow \quad 4 = \frac{3y}{2}$

$\Rightarrow \quad y = \frac{8}{3}$

188. (b) $2\sin^2\theta + 5\cos\theta - 4 = 0$

$2(1 - \cos^2\theta) + 5\cos\theta - 4 = 0$

$\Rightarrow 2 - 2\cos^2\theta + 5\cos\theta - 4 = 0$

$\Rightarrow 2\cos^2\theta - 5\cos\theta + 2 = 0$

$\Rightarrow 2\cos^2\theta - 4\cos\theta - \cos\theta + 2 = 0$

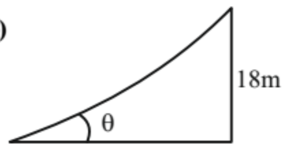
$\Rightarrow 2\cos(\cos\theta - 2) - 1(\cos\theta - 2) = 0$

$\Rightarrow 2\cos\theta - 1 = 0 \quad \cos\theta - 2 = 0$

$\Rightarrow \cos\theta = \frac{1}{2} \qquad \theta = 60°$

$\Rightarrow \cos 60° + \tan 60° = \frac{1}{2} + \sqrt{3} = \frac{1+2\sqrt{3}}{2}$

189. (b)



Distance of foot from wall $= \frac{18}{12} \times 5 = 7.5$ m