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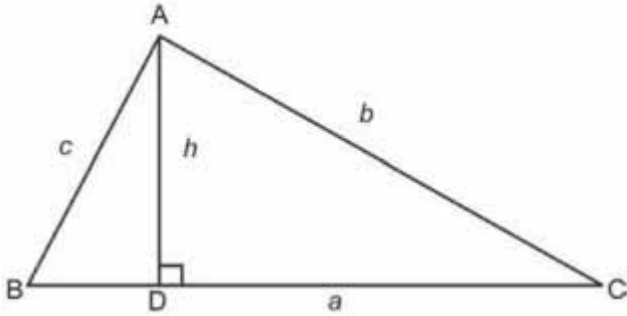


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GEOMETRY

TRIANGLES AND THEIR PROPERTIES

A triangle is a figure enclosed by three sides. In the figure given below, ABC is a triangle with sides AB, BC, and CA measuring c , a , and b units, respectively. Line AD represents the height of the triangle corresponding to the side BC and is denoted by h .



In any triangle ABC,

$$\text{Area} = \frac{1}{2} \times \text{BC} \times \text{AD} = \frac{1}{2} a \times h$$

Properties of a Triangle

- The sum of all the angles of a triangle = 180°
- The sum of lengths of the two sides > length of the third side
- The difference of any two sides of any triangle < length of the third side
- The area of any triangle can be found by several methods:

a) Area of any triangle = $\frac{1}{2} \times \text{base} \times \text{perpendicular to base from the opposite vertex.}$

b) Area of any triangle = $\sqrt{s(s-a)(s-b)(s-c)}$, where s is the semi-perimeter of the triangle and a , b , and c are the sides of a triangle.

c) Area of any triangle = $\left(\frac{1}{2}\right) \times bc \sin A$

Besides, there are some formulae that we use exclusively in some particular cases.

Example 2 What is the number of distinct triangles with integral valued sides and perimeter as 14?

- (a) 6 (b) 5
(c) 4 (d) 3

Solution The sum of the lengths of the two sides > the length of the third side

So, the maximum length of any particular side can be 6 units.

Now, if $a = 6$, then $b + c = 8$, then the possible sets are (6, 6, 2), (6, 5, 3), and (6, 4, 4).

If $a = 5$, then $b + c = 9$, so the possible set is (5, 5, 4).

So, the number of distinct triangles = 4

CLASSIFICATION OF TRIANGLES

Based Upon Sides

1. Scalene Triangle

A triangle whose all sides are of different lengths is a scalene triangle.

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}, \text{ where}$$

$$S (\text{semi-perimeter}) = \frac{a+b+c}{2}$$

Example 3 What is the area of the triangle with side lengths 4 units, 5 units, and 10 units?

Solution This triangle is not possible, as the sum of lengths of the two sides > length of the third side.

2. Isosceles Triangle

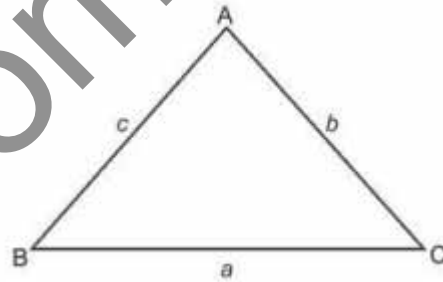
A triangle whose two sides are of equal length is an isosceles triangle.

$$\text{Height} = \frac{\sqrt{4a^2 - b^2}}{2}$$

$$\text{Area} = \frac{b}{4} \sqrt{4a^2 - b^2}$$

3. Equilateral Triangle

A triangle whose all sides are of equal length is called an equilateral triangle.



In any equilateral triangle, all the three sides are of equal length, so $a = b = c$.

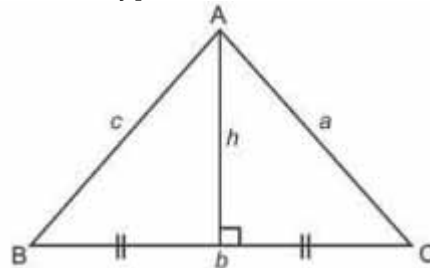
$$\text{Height} = (\text{side}) \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{2} a$$

$$\text{Area} = \frac{\sqrt{3}}{2} (\text{side})^2 = \frac{\sqrt{3}}{2} a^2$$

Based Upon Angles

1. Right-angled Triangle

A triangle whose one angle is of 90° is called a right-angled triangle. The side opposite to the right angle is called the hypotenuse.



$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{perpendicular}$$

Pythagoras Theorem

Pythagoras theorem is applicable in case of right-angled triangle. It says that the square of the hypotenuse is equal to the sum of the squares of the other two sides.

$$(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$$

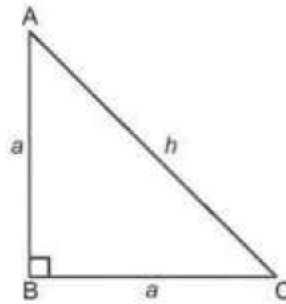
$$a^2 + b^2 = c^2$$

The smallest example is $a = 3$, $b = 4$, and $c = 5$. You can check that

$$3^2 + 4^2 = 9 + 16 = 25 = 5^2$$

Sometimes, we use the notation (a, b, c) to denote such a triple.

Notice that the greatest common divisor of the three numbers 3, 4, and 5 is 1. Pythagorean triples with this property are called primitive.



In this case, Hypotenuse $(h) = a\sqrt{2}$

$$\text{Perimeter} = 2a + h = 2a + a\sqrt{2}$$

$$= a\sqrt{2}(\sqrt{2}+1)$$

$$= h(1+\sqrt{2})$$

$$= \text{Hypotenuse} (1+\sqrt{2})$$

Pythagorean Triplets

A Pythagorean triplet is a set of three positive whole numbers a , b , and c that are the lengths of the sides of a right triangle.

$$a^2 + b^2 = c^2$$

It is noteworthy to see here that all of a , b , and c cannot be odd simultaneously. Either of a or b has to be even and c can be odd or even.

The various possibilities for a , b and c are tabled below:

a	b	c
odd	odd	Even
Even	odd	odd
odd	Even	odd
Even	Even	Even

Some Pythagoras triplets are:

3	4	5	$(3^2 + 4^2 = 5^2)$
5	12	13	$(5^2 + 12^2 = 13^2)$
7	24	25	$(7^2 + 24^2 = 25^2)$
8	15	17	$(8^2 + 15^2 = 17^2)$
9	40	41	$(9^2 + 40^2 = 41^2)$
11	60	61	$(11^2 + 60^2 = 61^2)$
20	21	29	$(20^2 + 21^2 = 29^2)$

2. Obtuse-angled Triangle

If one of the angles of the triangle is more than 90° , then the triangle is known as an obtuse angled triangle. Obviously, in this case, rest of the two angles will be less than 90° .

3. Acute-angled Triangle

If all the angles of the triangle are less than 90° , then the triangle is known as acute angled triangle.

4. Isosceles Right-angled Triangle

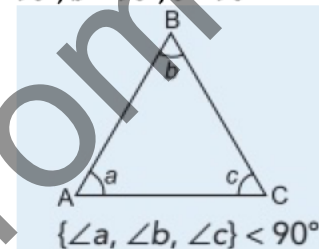
A right-angled triangle, whose two sides containing the right angle are equal in length, is an isosceles right triangle.

Summarizing the above Classification

(a) According to the measurement of angle

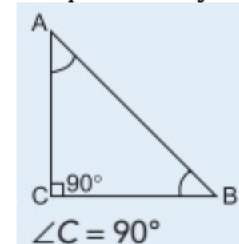
(i) Acute-angled triangle

Each angle of a triangle is less than 90° , that is $a < 90^\circ$, $b < 90^\circ$, $c < 90^\circ$



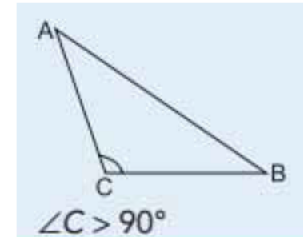
(ii) Right-angled triangle

If one of the angles is equal to 90° , then it is called a right-angled triangle. The rest two angles are complementary to each other.



(iii) Obtuse-angled triangle

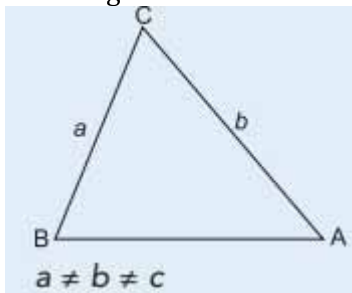
If one of the angles is obtuse (i.e., greater than 90°), then it is called an obtuse-angled triangle.



(b) According to the length of sides

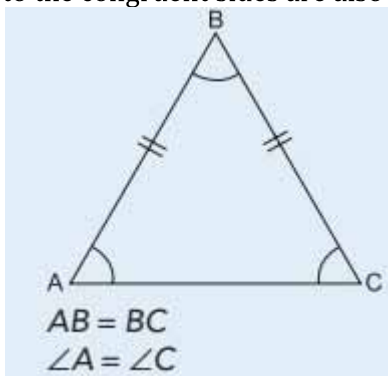
(i) Scalene triangle

A triangle in which none of the three sides are equal is called a scalene triangle. In this triangle, all the three angles are also different.



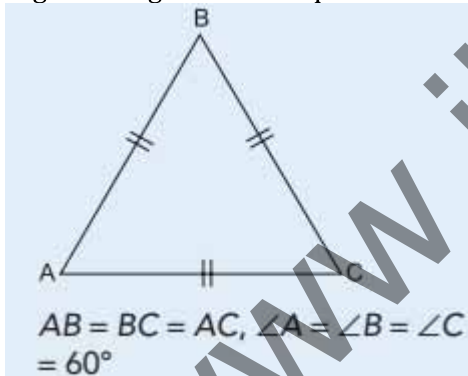
(ii) Isosceles triangle

A triangle in which two sides are equal is called an isosceles triangle. In this triangle, the angles opposite to the congruent sides are also equal.



(iii) Equilateral triangle

A triangle in which all the three sides are equal is called an equilateral triangle. In this triangle, each angle is congruent and equal to 60° .



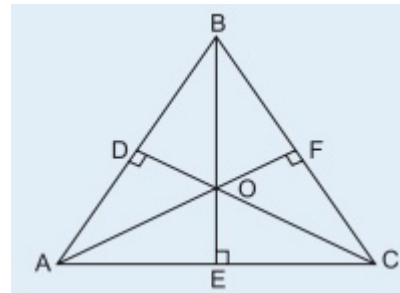
Points of a Triangle

Before we move ahead to discuss different points inside a triangle, we need to be very clear about some of the basic definitions.

Basic Definitions

(i) Altitude (or height)

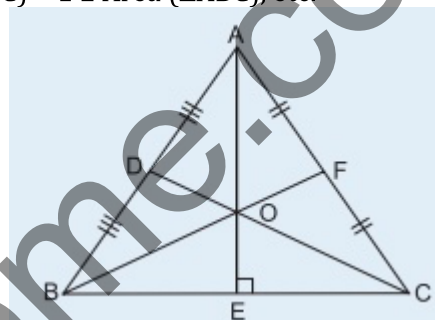
The perpendicular drawn from the opposite vertex of a side in a triangle is called an altitude of the triangle. There are three altitudes in a triangle.



AF, CD, and BE are the altitudes.

(ii) Median

The line segment joining the mid-point of a side to the vertex opposite to the side is called a median. There are three medians in a triangle. A median bisects the area of the triangle. Area (ABE) = Area (AEC) = $\frac{1}{2}$ Area (ΔABC), etc.

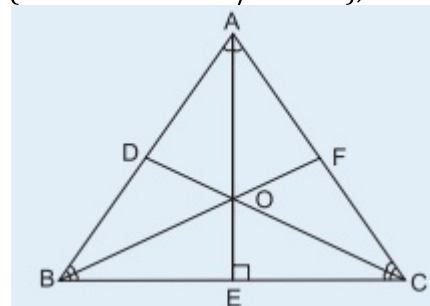


AE, CD, and BF are the medians.

(BE = CE = AD = BD = AF = CF)

(iii) Angle bisector

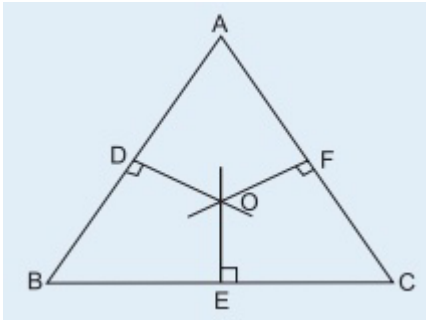
A line segment that originates from a vertex and bisects the same angle is called an angle bisector. ($\angle BAE = \angle CAE = \frac{1}{2} \angle BAC$), etc.



AE, CD, and BF are the angle bisectors.

(iv) Perpendicular bisector

A line segment which bisects a side perpendicularly (i.e., at right angle) is called a perpendicular bisector of a side of triangle. All points on the perpendicular bisector of a line are equidistant from the ends of the line.

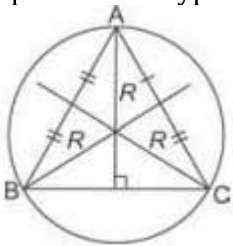


DO, EO, and FO are the perpendicular bisectors.

Circumcentre

Circumcentre is the point of intersection of the three perpendicular bisectors of a triangle. The circumcentre of a triangle is equidistant from its vertices and the distance of the circumcentre from each of the three vertices is called circumradius (R) of the triangle. These perpendicular bisectors are different from altitudes, which are perpendiculars but not necessarily bisectors of the side. The circle drawn with the circumcentre as the centre and circumradius as the radius is called the circumcircle of the triangle and it passes through all the three vertices of the triangle.

The circumcentre of a right-angled triangle is the midpoint of the hypotenuse of a right-angled triangle.



$AB = c$, $BC = a$, $AC = b$

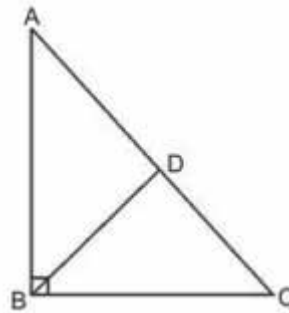
The process to find the circumradius (R) For

any triangle $R = \frac{abc}{4A}$, where a, b, and c are the three sides, and A = area of a triangle.

For equilateral triangle, $R = \frac{Side}{\sqrt{3}}$

Positioning of the Circumcentre

- If the triangle is acute-angled triangle, then the circumcentre will lie inside the triangle.
- If the triangle is obtuse-angled triangle, then the circumcentre will lie outside the triangle.
- If the triangle is a right-angled triangle, then the circumcentre will lie on the mid-point of the hypotenuse. This can be seen through the following diagram:

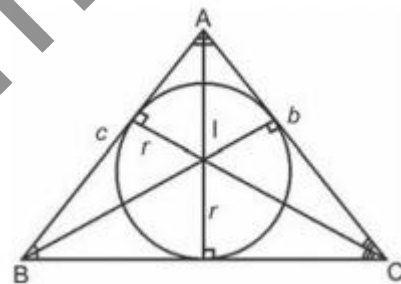


Here, D is the circumcentre. So, $AD = CD = BD$

Incentre

Incentre is the point of intersection of the internal bisectors of the three angles of a triangle. The incentre is equidistant from the three sides of the triangle, that is the perpendiculars drawn from the incentre to the three sides are equal in length and are called the inradius of the triangle.

The circle drawn with incentre as the centre and inradius as the radius is called the incircle of the triangle and it touches all the three sides from the



inside.

$AB = c$, $BC = a$, $CA = b$

To find inradius (r)

For any triangle $r = \frac{A}{S}$, where

A = Area of triangle and

S = Semi-perimeter of the triangle $\frac{(a+b+c)}{2}$

For equilateral triangle, $r = \frac{side}{2\sqrt{3}}$

$\angle BIC = 90^\circ + \angle A/2$

Important derivation In a right-angled triangle, Inradius = Semiperimeter - length of Hypotenuse.

Euler's formula for inradius and circumradius of a triangle Let O and I be the

circumcentre and incentre of a triangle with circumradius R and inradius r. Let d be the distance between O and I. Then

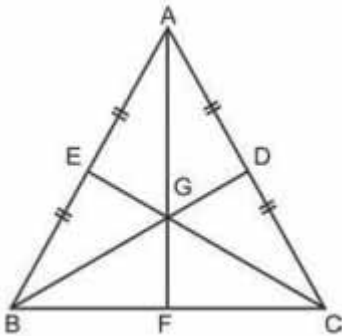
$$d^2 = R(R - 2r)$$

From this theorem, we obtain the inequality $r \geq 2R$.

This is known as Euler's inequality.

Centroid

Centroid is the point of intersection of the three medians of a triangle. The centroid divides each of the medians in the ratio 2:1, the part of the median towards the vertex being twice in length to the part towards the side.



$$\frac{AG}{GF} = \frac{BG}{GD} = \frac{CG}{GE} = \frac{2}{1}$$

Median divides the triangle into two equal parts of the same area.

Orthocentre

The point of concurrency of the altitudes is known as the orthocentre.

Summarizing the above discussion regarding the points of the triangle:

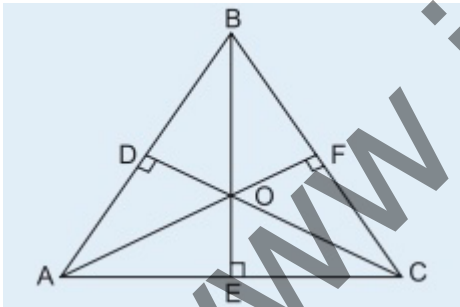
(i) Orthocentre

The point of intersection of the three altitudes of the triangle is known as the orthocentre.

$$\angle BOC = 180^\circ - \angle A$$

$$\angle COA = 180^\circ - \angle B$$

$$\angle AOB = 180^\circ - \angle C$$

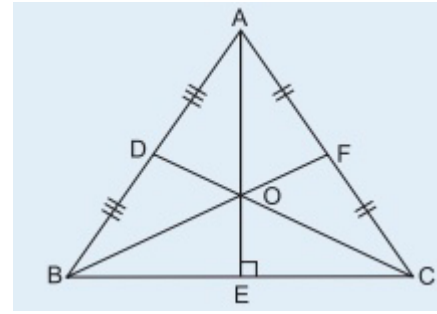


'O' is the orthocenter

(ii) Centroid

The point of intersection of the three medians of a triangle is called the centroid. A centroid divides each median in the ratio 2:1 (vertex: base)

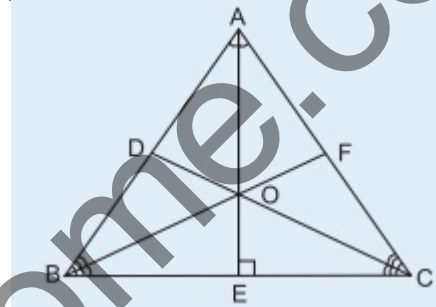
$$\frac{AO}{OE} = \frac{CO}{OD} = \frac{BO}{OF} = \frac{2}{1}$$



'O' is the centroid

(iii) Incentre

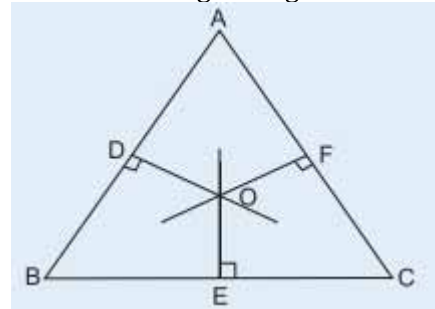
The point of intersection of the angle bisectors of a triangle is known as the incentre. Incentre O is the always equidistant from all three sides, that is the perpendicular distance between the sides.



'O' is the incentre

(iv) Circumcentre

The point of intersection of the perpendicular bisectors of the sides of a triangle is called the circumcentre. $OA = OB = OC =$ (circum radius). Circumcentre O is always equidistant from all the three vertices A, B, and C perpendicular bisectors need not be originating from the vertices.



'O' is the circumcentre

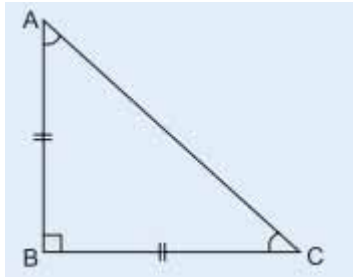
Important Theorems Related to Triangle

(i) $45^\circ - 45^\circ - 90^\circ$

If the angles of a triangle are 45° , 45° , and 90° , then the hypotenuse (i.e., longest side) is $\sqrt{2}$ times of any smaller side. Excluding hypotenuse rest two sides are equal. That is, $AB = BC$ and $AC = \sqrt{2}$

$$AB = \sqrt{2} BC$$

$AB:BC:AC = 1:1:\sqrt{2}$



$\angle A = 45^\circ \angle B = 90^\circ \angle C = 45^\circ$

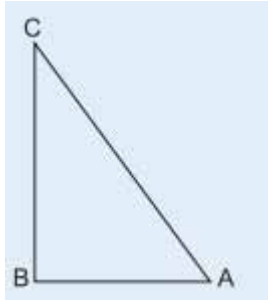
(ii) 30° - 60° - 90°

If the angles of a triangle are 30°, 60°, and 90°, then the sides opposite to 30° angle is half of the

hypotenuse and the side opposite to 60° is $\frac{\sqrt{3}}{2}$

times the hypotenuse, e.g., $AB = \frac{AC}{2}$ and $= \frac{\sqrt{3}}{2} AC$

$AB:BC:AC = 1:\sqrt{3}:2$



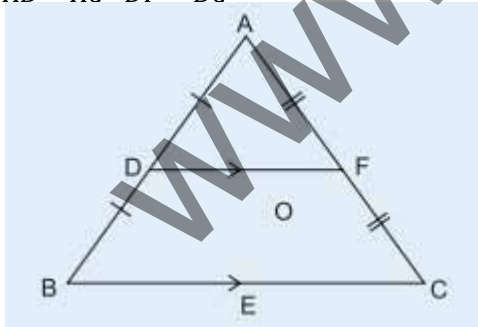
$\angle C = 30^\circ, \angle B = 90^\circ, \angle A = 60^\circ$

(iii) Basic proportionality theorem (BPT)

Any line parallel to one side of a triangle divides the other two sides proportionally. So, if DE is drawn parallel to BC, then it would divide sides AB and AC

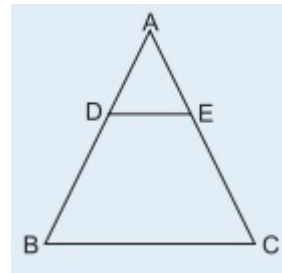
proportionally, i.e., $\frac{AD}{DB} = \frac{AF}{FC}$ Or

$\frac{AD}{AB} = \frac{AF}{AC} \frac{AD}{DF} = \frac{AB}{BC}$



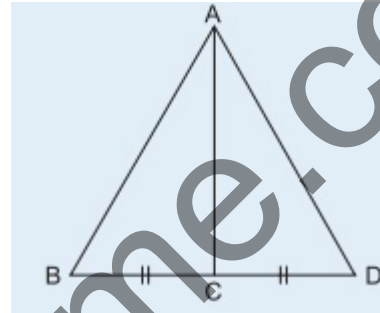
(iv) Mid-point theorem

Any line joining the mid-points of two adjacent sides of a triangle are joined by a line segment, then this segment is parallel to the third side, that is if $AD = BD$ and $AE = CE$, then $DE \parallel BC$.



(v) Apollonius' theorem

In a triangle, the sum of the squares of any two sides of a triangle is equal to twice the sum of the square of the median to the third side and square of half the third side. That is, $AB^2 + AC^2 = 2(AD^2 + BC^2)$

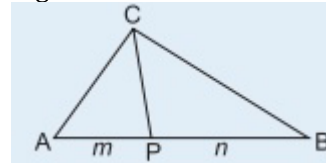


(vi) Stewarts theorem/generalization of Apollonius theorem

If the length of $AP = m$ and $PB = n$, then $m \times CB^2 + n \times AC^2$

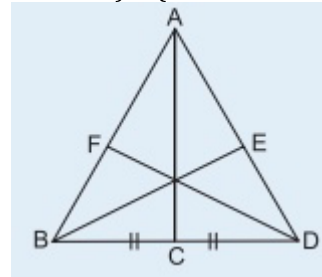
$= (m + n) PC^2 + mn (m + n)$

Here, it is also understood that m and n are length of segments, and not their ratio.



(vii) Extension of Apollonius' theorem

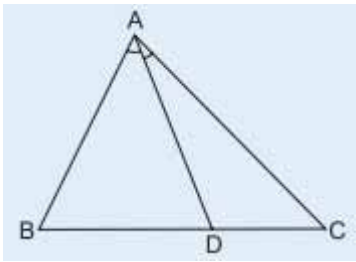
In the given ΔABC , AC, BE, and DF are medians. $3(\text{Sum of squares of sides}) = 4(\text{Sum of squares of medians})$ $3(AB^2 + AC^2 + BC^2) = 4(AD^2 + BE^2 + CF^2)$



(viii) Interior angle Bisector theorem

In a triangle, the angle bisector of an angle divides the opposite side to the angle in the ratio of the

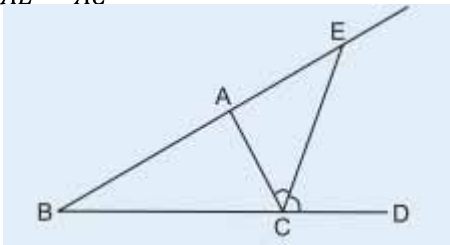
remaining two sides, that is $= \frac{BD}{CD} = \frac{AB}{AC}$ and $BD \times AC = CD \times AB = AD^2$



(ix) Exterior angle Bisector theorem

In a triangle, the angle bisector of any exterior angle of a triangle divides the side opposite to the external angle in the ratio of the remaining two sides, that is

$$\frac{BE}{AE} = \frac{BC}{AC}$$



Congruency of Triangles

Two figures are said to be congruent if, when placed one over the other, they completely overlap each other. They would have the same shape, the same area and will be identical in all respects. So, we can say that all congruent triangles are similar triangles, but vice versa is not always true.

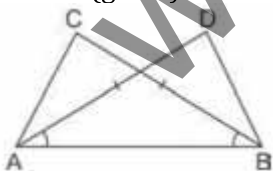
Rules for Two Triangles to be Congruent

1. S - S - S

If in any two triangles, each side of one triangle is equal to a side of the other triangle, then the two triangles are congruent. This rule is S - S - S rule.

2. S - A - S

In $\triangle ABC$ and $\triangle ABD$,
 $AB = AB$ (common side)
 $\angle ABC = \angle BAD$ (given)
 $BC = AD$ (given)



Therefore, by rule S - A - S, the two triangles are congruent.

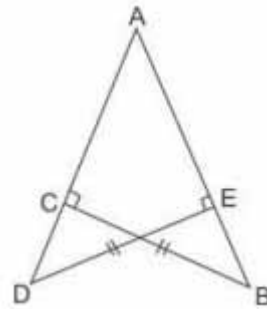
This rule holds true, when the angles that are equal have to be included between the two equal sides (i.e., the angle should be formed between the two sides that are equal).

3. A - S - A

In $\triangle ABC$ and $\triangle ADE$,
 $\angle ACB = \angle AED$ (given)
 $\angle BAC = \angle DAE$ (common angle)
 $BC = DE$ (given)

Therefore, by rule A - S - A the two triangles are congruent.

For this rule, the side need not be the included side.



A - S - A can be written as A - A - S or S - A - A also.

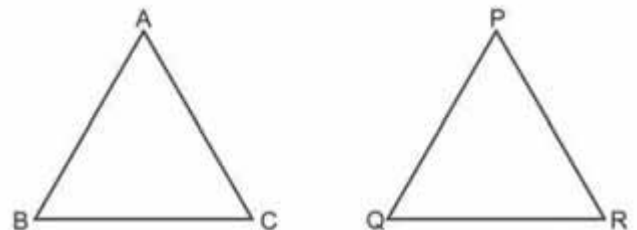
4. R - H - S This rule is applicable only for right-angled triangles. If two right-angled triangles have their hypotenuse and one of the sides as same, then the triangles will be congruent.

Similarity of the Triangles

If we take two maps of India of different sizes (breadths and lengths), then the map of all the 29 states of India will cover proportionally the same percentage area in both the maps.

Lets see this in geometry:

Criteria for Similarity of Two Triangles



Two triangles are similar if (i) their corresponding angles are equal and/or (ii) their corresponding sides are in the same ratio. That is, if in two triangles, ABC and PQR,

(i) $\angle A = \angle P$, $\angle B = \angle Q$, $\angle C = \angle R$, and/or

(ii) $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$, the two triangles are similar.

All regular polygons of the same number of sides such as equilateral triangles or squares, are similar. In particular, all circles are also similar.

Theorems for Similarity

1. If in two triangles, the corresponding angles are equal, then their corresponding sides will also be

proportional (i.e., in the same ratio). Therefore, the two triangles are similar.

This property is referred to as the AAA similarity criterion for two triangles.

Corollary: If two angles of a triangle are, respectively, equal to two angles of another triangle, then the two triangles are similar. This is referred to as the AA similarity criterion for the two triangles. It is true due to the fact that if two angles of one triangle are equal to the two angles of another triangle, then the third angle of both the triangles will automatically be the same.

2. If the corresponding sides of two triangles are proportional (i.e., in the same ratio), their corresponding angles will also be equal and so the triangles are similar. This property is referred to as the SSS similarity criterion for the two triangles.

3. If one angle of a triangle is equal to one angle of the other and the sides including these angles are proportional, then the triangles are similar. This property is referred to as the SAS similarity criterion of the two triangles.

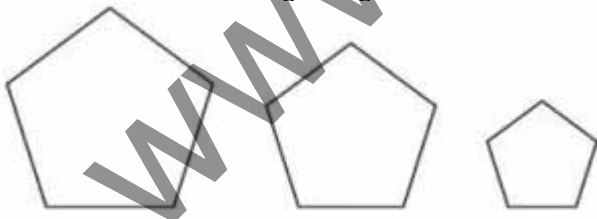
4. The ratio of the areas of the two similar triangles is equal to the ratio of the squares of their corresponding sides.

5. If a perpendicular is drawn from the vertex of the right angle of a right-angled triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.

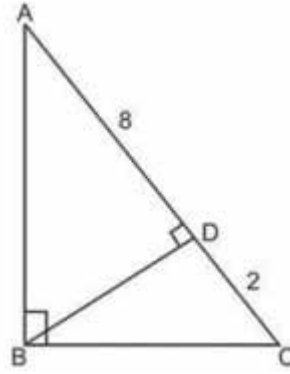
Similar Polygons

Two polygons of the same number of sides are similar, if **(i)** their corresponding angles are equal (i.e., they are equiangular) and **(ii)** their corresponding sides are in the same ratio (or proportional).

This can be seen in the figures given below:



Example 7 $\triangle ABC$ is a right-angled triangle $BD \perp AC$. If $AD = 8$ cm and $DC = 2$ cm, then $BD = ?$



- (a) 4 cm (b) 4.5 cm
(c) 5 cm (d) Cannot be determined

Solution $\triangle ADB \sim \triangle BDC$

$$\therefore \frac{AD}{BD} = \frac{BD}{DC}$$

$$\therefore BD^2 = AD \times DC = 8 \times 2$$

$$\therefore BD^2 = 16$$

$$\therefore BD = 4 \text{ cm}$$

Important Result of this question $BD^2 = AD \times DC$ can be used as a standard result also.

Example 8 Circles with radii 3, 4, and 5 units touch each other externally. If P is the point of intersection of the tangents to these circles at their point of contact, find the distance of P from the point of contacts of the circles.

Solution Let A, B, and C be the centres of the three circles. So, the point P will be the incentre of triangle ABC and distance of P from the point of contacts of the circles will be the inradius (r).

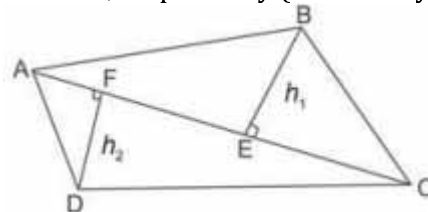
$$\text{So, } r = \frac{A}{S}$$

Sides of triangle ABC will be 7 units, 8 units and 9 units.

$$\text{So, } r = \sqrt{5}$$

QUADRILATERALS AND THEIR PROPERTIES

A quadrilateral is a figure bounded by four sides. In the figure given below, ABCD is a quadrilateral. Line AC is the diagonal of the quadrilateral (denoted by d) and BE and DF are the heights of the triangles ABC and ADC, respectively (denoted by h_1 and h_2).



$$AC = d, BE = h, \text{ and } DE = h_2$$

(i) Area = $\times \frac{1}{2}$ one diagonal \times (sum of perpendiculars to the diagonal from the opposite vertexes) = $\frac{1}{2} d (h_1 + h_2)$

(ii) Area = $\times \frac{1}{2}$ product of diagonals \times sine of the angle between them

(iii) Area of the cyclic quadrilateral = $\sqrt{(s-a)(s-b)(s-c)(s-d)}$ where a, b, c, and d are the sides of quadrilateral and s = semiperimeter = $\frac{a+b+c+d}{2}$

(iv) Brahmagupta's formula: For any quadrilateral with sides of length a, b, c, and d, the area A is given by

$$A = \sqrt{(s-a)(s-b)(s-c)(s-d)} -$$

$$abcd \cos^2 \frac{1}{2}(A+B)$$

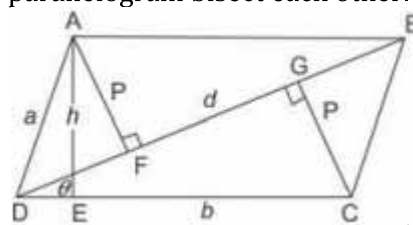
Where $s = \frac{a+b+c+d}{2}$ is known as the semiperimeter,

A is the angle between sides a and d, and B is the angle between the sides b and c.

Different Types of Quadrilaterals

Parallelogram

A parallelogram is a quadrilateral when its opposite sides are equal and parallel. The diagonals of a parallelogram bisect each other.



Given: AD = BC = a and AB = DC = b BD = d
AF (height of $\triangle ABD$) = CG (height of $\triangle CBD$) and AE = height of the parallelogram = h
 $\angle ADC = \theta$

(i) Area = base \times height

(ii) Area = (any diagonal) \times (perpendicular distance to the diagonal from the opposite vertex)

(iii) Area = (product of adjacent sides) \times (sine of the angle between them) Area = AB sin q

(iv) Area = $2\sqrt{s(s-a)(s-b)(s-d)}$

where a and b are the adjacent sides and d is the diagonal.

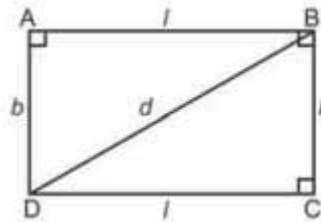
(v) $AC^2 + BD^2 = 2(AB^2 + BC^2)$

(vi) The parallelogram that is inscribed in a circle is a rectangle.

(vii) The parallelogram that is circumscribed about a circle is a rhombus.

(viii) A parallelogram is a rectangle if its diagonals are equal.

Rectangle



A rectangle is a quadrilateral when its opposite sides are equal and each internal angle equals 90° . The diagonals of a rectangle are equal and bisect each other.

Given: AD = BC = b and AB = DC = l, BD = d

(i) Area = length \times breadth Area = lb

(ii) Perimeter = 2 (length + breadth) Perimeter = 2 (l + b)

(iii) Diagonal² = length² + breadth² (Pythagoras Theorem) $d^2 = l^2 + b^2$ $d = \sqrt{l^2 + b^2}$

(iv) Finding area using Brahmagupta's formula: In this case, we know that a = c and b = d, and $A + B = \pi$.

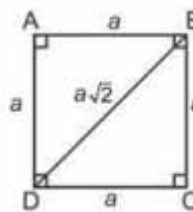
So, area of rectangle

$$= \sqrt{(a+b-a)(a+b-b)(a+b-a)(a+b-b)} - a \cdot b \cdot a \cdot b = ab$$

(v) The quadrilateral formed by joining the mid-points of intersection of the angle bisectors of a parallelogram is a rectangle.

Square

A square is a quadrilateral when all its sides are equal and each internal angle is of 90° . The diagonals of a square bisect each other at right angles (90°)



Given: AB = BC = CD = DA = a

BD (diagonal) = $a\sqrt{2}$

(i) Area = (side)² = $\frac{(\text{diagonal})^2}{2} = \frac{(\text{perimeter})^2}{16}$

$$\text{Area} = a^2 = \frac{d^2}{2} = \frac{p^2}{16}$$

(ii) Using Brahmagupta's formula to find out the area of a square: We know that a = b = c = d and $A + B = \pi$

So, area of square

$$= \sqrt{(s-a)(s-b)(s-c)(s-d) - abcd \cos^2 \frac{1}{2}(A+B)}$$

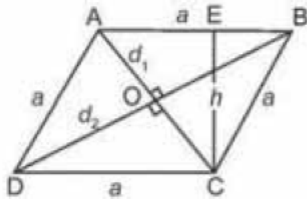
$$= \sqrt{(2a-a)(2a-a)(2a-a)(2a-a) - a \cdot a \cdot a \cdot a \cdot \cos^2 \frac{1}{2}(A+B)}$$

$$= a^2$$

(iii) Perimeter = 4 (side) ⇒ Perimeter = 4a

Rhombus

A rhombus is a quadrilateral when all sides are equal. The diagonals of a rhombus bisect each other at right angles (90°)



Given = AB = BC = CD = DA = a
 ∠AOB = ∠BOC = ∠COD = ∠DOA = 90°
 AC = d, (AO = OC) and BD = d2 (BO = OD) CE (height) = h

(i) Area = $\frac{1}{2}$ × (product of the diagonals)

Area = $\frac{1}{2}$ d₁ d₂

(ii) Area = base × height

Area = a × h

(iii) A parallelogram is a rhombus if its diagonals are perpendicular to each other. Remember, the sum of the square of the diagonals is equal to four times the square of the side, that is d₁² + d₂² = 4a²

Trapezium

A trapezium is a quadrilateral in which only one pair of the opposite sides is parallel

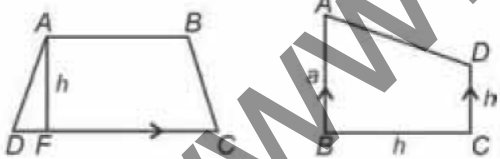


Figure 1

Figure 2

Given: AB = a and CD = b

In Fig. 1, AF (height) = h, and in Fig. 2, BC (height) = h

(i) Area = $\frac{1}{2}$ × (sum of the parallel sides) × (distance between the parallel sides)

Area = $\frac{1}{2}$ (a + b) h

(ii) The line joining the mid-points of the non-parallel sides is half the sum of the parallel sides and is known as median.

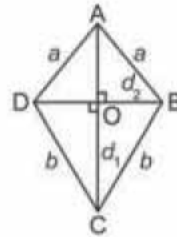
(iii) If we make non-parallel sides equal, then the diagonals will also be equal to each other.

(iv) Diagonals intersect each other proportionally in the ratio of the lengths of the parallel sides. (v) If a trapezium is inscribed inside a circle, then it is an isosceles trapezium with oblique sides being equal.

Kite

Kite is a quadrilateral when two pairs of adjacent sides are equal and the diagonals bisect each other at right angles (90°).

Given: AB = AD = a and BC = DC = b



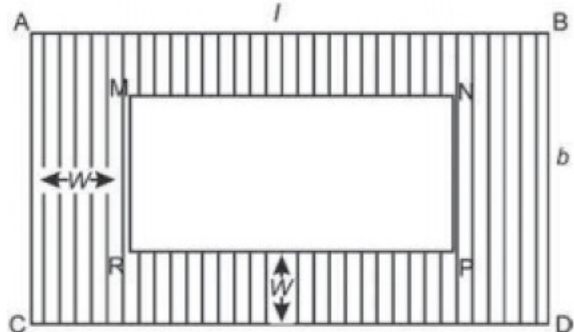
AC = d₁ (AO = OC) and BD = d₂ (BO = OD)
 ∠AOB = ∠BOC = ∠COD = ∠DOA = 90°

(i) Area = $\frac{1}{2}$ × (Product of the diagonals)

Area = $\frac{1}{2}$ d₁ d₂

Area of Shaded Paths

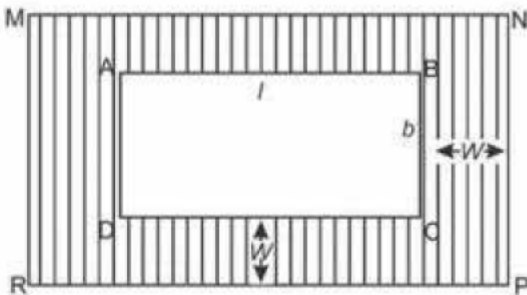
Case I When a pathway is made outside a rectangle having length = l and breadth = b



ABCD is a rectangle with length = l and breadth = b, the shaded region represents a pathway of uniform width = w

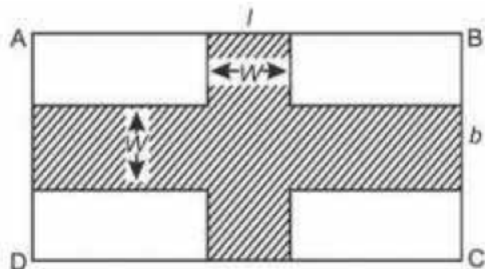
Area of the shaded region/pathway = 2w (l + b - 2w)

Case II When a pathway is made inside a rectangle having length = l and breadth = b



ABCD is a rectangle with length = l and breadth = b , the shaded region represents a pathway of uniform width = w Area of the shaded region/pathway = $2w(l + b + 2w)$

Case III When two pathways are drawn parallel to the length and breadth of a rectangle having length = l and breadth = b



ABCD is a rectangle with length = l and breadth = b , the shaded region represents two pathways of a uniform width = w

Area of the shaded region/pathway = $W(l + b - w)$

From the above figure, we can observe that the area of the paths does not change on shifting their positions as long as they are perpendicular to each other.

We can conclude from here that:

1. Every rhombus is a parallelogram, but the converse is not true.
2. Every rectangle is a parallelogram, but the converse is not true.
3. Every square is a parallelogram, but the converse is not true.
4. Every square is a rhombus, but the converse is not true.
5. Every square is a rectangle, but the converse is not true.

Construction of New Figures by Joining the Mid-points

Lines joining the mid-points of adjacent sides of original figure	Resulting figure
Quadrilateral	Parallelogram
Parallelogram	Parallelogram
Rectangle	Rhombus
Rhombus	Rectangle
Trapezium	Four similar A

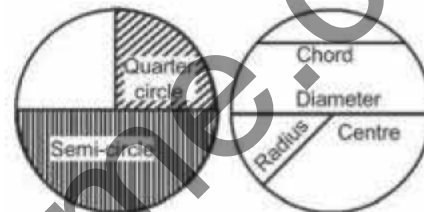
Properties of Diagonals

Properties	Types of Quadrilaterals				
	Square	Rectangle	Parallelogram	Rhombus	Trapezium

Diagonals equal	Y	Y	N	N	N
Diagonals bisect	Y	Y	Y	Y	N
Diagonals bisect vertex angles	Y	N	N	Y	N
Diagonals at rt angles	Y	N	N	Y	N
Diagonals make congruent triangles	Y	N	N	Y	N

CIRCLES AND THEIR PROPERTIES

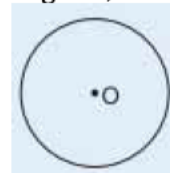
A circle is the path travelled by a point which moves in such a way that its distance from a fixed point remains constant. The fixed point is known as the centre and the fixed distance is called the radius.



Before we move ahead, let us understand the basic definitions of circle.

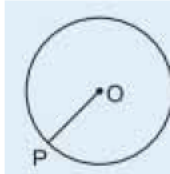
Centre

The fixed point is called the centre. In the given diagram, 'O' is the centre of the circle.



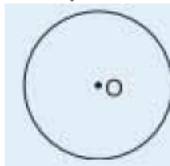
Radius

The fixed distance is called a radius. In the given diagram, OP is the radius of the circle. (point P lies on the circumference)



Circumference

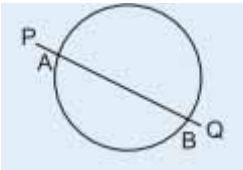
The circumference of a circle is the distance around a circle, which is equal to $2\pi r$. ($r \rightarrow$ radius of the circle)



Secant

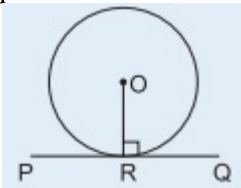
A line segment which intersects the circle in two distinct points is called as secant. In the given

diagram, secant PQ intersects circle at two points at A and B.



Tangent

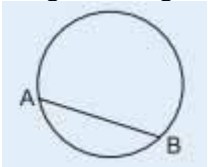
A line segment which has one common point with the circumference of a circle, i.e., it touches only at one point is called as tangent of circle. The common point is called as point of contact. In the given diagram, PQ is a tangent which touches the circle at a point R.



(R is the point of contact) Note: Radius is always perpendicular to tangent.

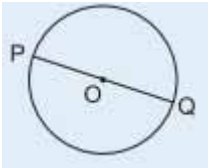
Chord

A line segment whose end points lie on the circle. In the given diagram, AB is a chord.



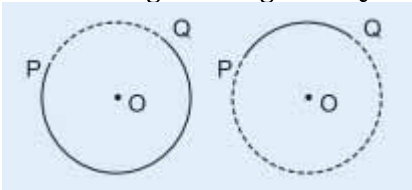
Diameter

A chord which passes through the centre of the circle is called the diameter of the circle. The length of the diameter is twice the length of the radius. In the given diagram, PQ is the diameter of the circle. (O → is the centre of the circle)



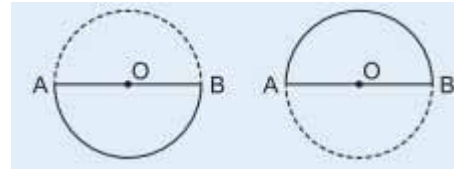
Arc

Any two points on the circle divides the circle into two parts, the smaller part is called as minor arc and the larger part is called as major arc. It is denoted as 'Arc'. In the given diagram PQ is arc.



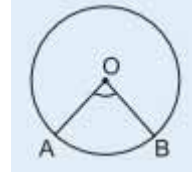
Semicircle

A diameter of the circle divides the circle into two equal parts. Each part is called a semicircle.



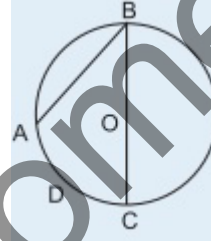
Central angle

An angle formed at the centre of the circle is called the central angle. In the given diagram, $\angle AOB$ in the central angle.



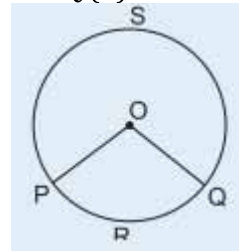
Inscribed angle

When two chords have one common end point, then the angle included between these two chords at the common point is called the inscribed angle. $\angle ABC$ is the inscribed angle by the arc ADC.



Measure of an arc

Basically, it is the central angle formed by an arc. For example (a) measure of a circle = 360° (b) measure of a semicircle = 180° (c) measure of a minor arc = $\angle POQ$ (d) measure of a major arc = $360 - \angle POQ$

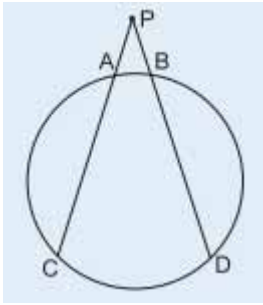


$$m(\text{arc PRQ}) = m \angle POQ$$

$$m(\text{arc PSQ}) = 360^\circ - m(\text{arc PRQ})$$

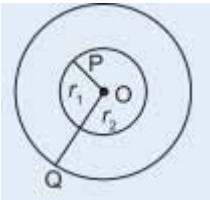
Intercepted arc

In the given diagram, AB and CD are the two intercepted arcs, intercepted by $\angle CPD$. The end points of the arc must touch the arms of $\angle CPD$, i.e., CP and DP.



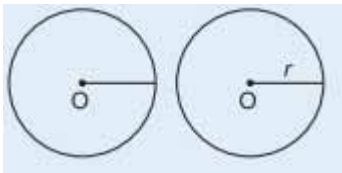
Concentric circles

Circles having the same centre at a plane are called the concentric circles. In the given diagram, there are two circles with radii r_1 and r_2 having the common (or same) centre. These are called as concentric circles.



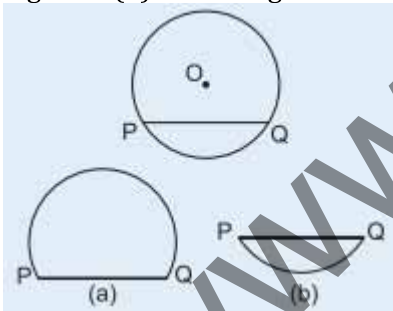
Congruent circles

Circles with equal radii are called as congruent circles.



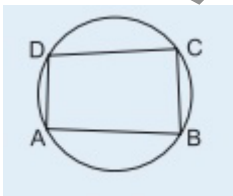
Segment of a circle

A chord divides a circle into two regions. These two regions are called the segments of a circle: (a) major segment (b) minor segment.



Cyclic quadrilateral

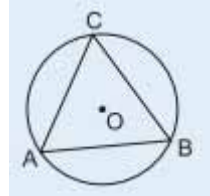
A quadrilateral whose all the four vertices lie on the circle.



Circumcircle

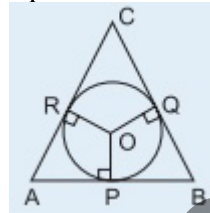
A circle that passes through all the three vertices of a triangle. Therefore, the circumcentre is always

equidistant from the vertices of the triangle. $OA = OB = OC$ (circumradius)



Incircle

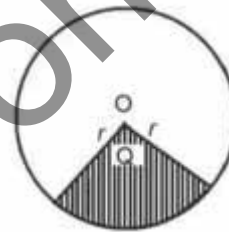
A circle which touches all the three sides of a triangle, i.e., all the three sides of a triangle are tangents to the circle is called an incircle. Incircle is always equidistant from the sides of a triangle.



Now come to different formula and theorems attached to circle:

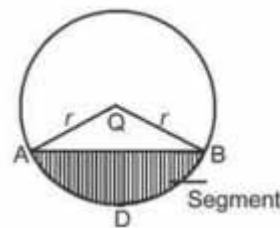
Circumference of a circle = $2\pi r$

Area of a circle = πr^2 , where r is the radius.



Area of a sector = $\pi r^2 \frac{\theta}{360^\circ}$

Perimeter of a sector = $2r \left(\frac{\pi\theta}{360} + 1 \right)$



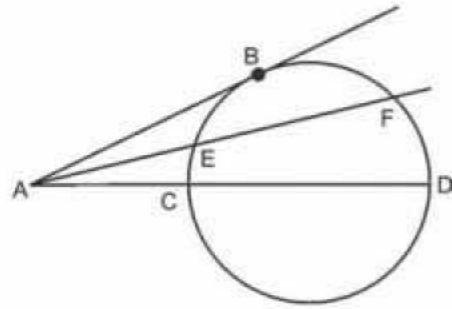
Area of a segment = Area of a sector OADB - Area of triangle OAB

Area of a segment = $\pi r^2 \frac{\theta}{360^\circ} - \frac{1}{2} r^2 \sin\theta$

Common Tangents and Secants of Circles

Depending upon the positioning of the circles, two or more than two circles can have a common tangent. Following is a list indicating the number of common tangents in case of two circles:

Sl. No.	Position of two circles	Number of common tangents
1.	One circle lies entirely inside the other circle	Zero
2.	Two circles touch internally	One
3.	Two circles intersect in two distinct points	Two
4.	Two circles touch externally	Three
5.	One circle lies entirely outside the other circle	Four



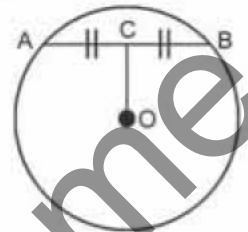
In the figure given above, AB is a tangent and ACD is a secants

(i) $AB^2 = AC \times AD$

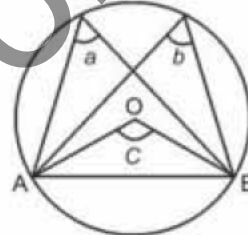
(ii) $AE \times AF = AC \times AD$

Important theorems related to circle

1. If C is the mid-point of AB, then OC is perpendicular to AB. And vice versa is also true.

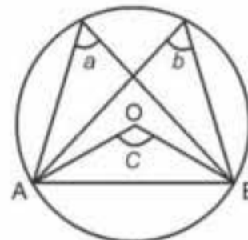


2. Angles in the same segment will be equal.



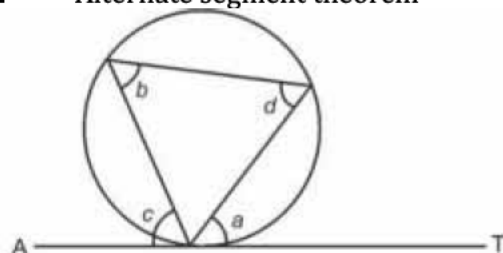
In the figure given above, $a = b$.

3. Angle subtended by a chord at the centre is two times the angle subtended on the circle on the same side. In the figure given below, $2a = 2b = c$.



4. Angle subtended by a diameter of the circle is a right angle.

5. Alternate segment theorem

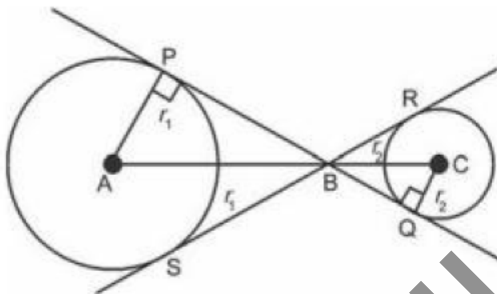


Direct Common Tangents and Transverse Common Tangents

Transverse common tangent In the figure given below, PQ and RS are the transverse common tangents. Transverse common tangents intersect the line joining the centre of the two circles. They divide the line in the ratio $r_1 : r_2$.

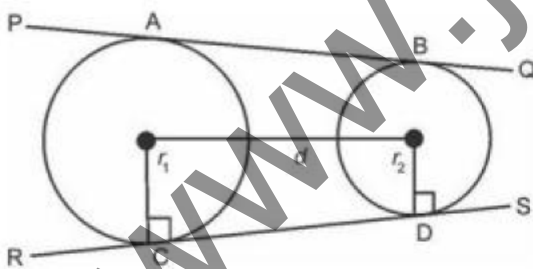
$AB:BC = r_1 : r_2$

Assume $AC = \text{Distance between centres} = d$



$PQ^2 = RS^2 = d^2 - (r_1 + r_2)^2$

1. Direct common tangent



In the figure given above, PQ and RS are direct common tangents.

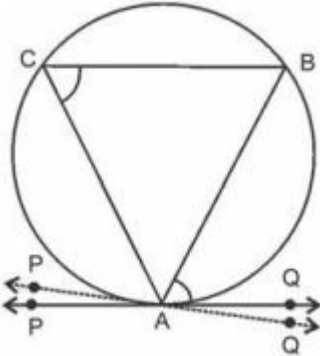
Points A and C are the point of tangency for the first circle and similarly, points B and D are the point of tangency for the second circle. AB and CD are known as lengths of the direct common tangents and they will be same.

$CD^2 = AB^2 = d^2 - (r_1 - r_2)^2$

Secants

In the figure above, AT is the tangent. $\angle a =$ Alternate segment $\angle b$ $\angle c =$ alternate segment $\angle d$

6. Converse of alternate segment theorem: If a line is drawn through an end point of a chord of a circle so that the angle formed by it with the chord is equal to the angle subtended by the chord in the alternate segment, then the line is a tangent to the circle.



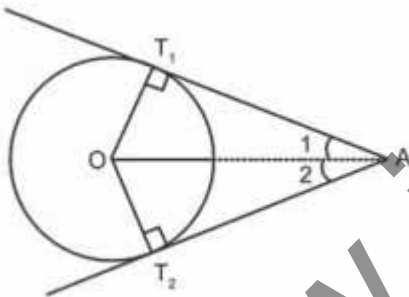
AB is a chord of a circle and a line PAQ such that $\angle BAQ = \angle ACB$, where C is any point in the alternate segment ACB, then PAQ is a tangent to the circle.

7. Tangent drawn to a circle from a point are same in length.

In the figure below, tangents are drawn to the circle from point A and AT_1 and AT_2 are the tangents.

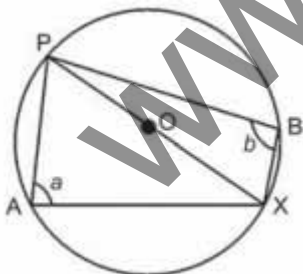
(i) $AT_1 = AT_2$ (ii) $\angle 1 = \angle 2$

(iii) $AT_1^2 + OT_1^2 = AT_2^2 + OT_2^2 = AO^2$



Cyclic Quadrilateral

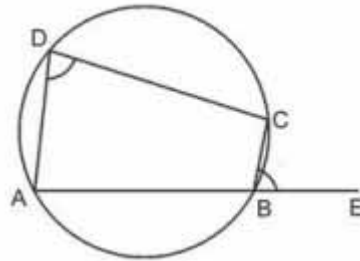
Consider the figure given below:



If we have $a + b = 180^\circ$ and quadrilateral AXBP has all its vertices on a circle, then such a quadrilateral is called a cyclic quadrilateral.

For a cyclic quadrilateral, the sum of the opposite angles of a quadrilateral in a circle is 180° .

It can also be seen that exterior $\angle CBE =$ internal $\angle ADC = 180^\circ - \angle ABC$.



Using Brahmagupta's formula to find out the area of a cyclic quadrilateral

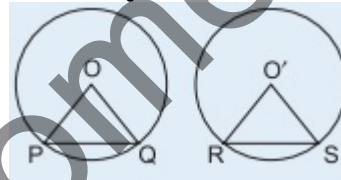
We know that $A + B = p$. So, area of cyclic quadrilateral $= \sqrt{(s - a)(s - b)(s - c)(s - d)}$

Where terms used are having their meaning.

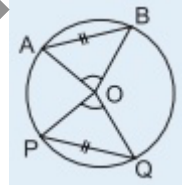
[$\cos 90^\circ = 0$]

Summarizing the discussion regarding circle

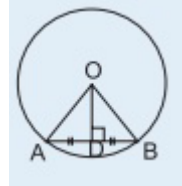
1. In a circle (or congruent circles) equal chords are made by equal arcs. $(OP = OQ) = (O'R = O'S)$ $PQ = RS$ and $PQ = RS$



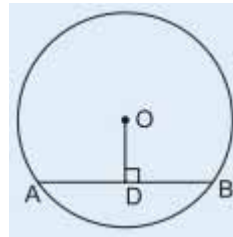
2. Equal arcs (or chords) subtend equal angles at the centre $PQ = AB$ (or $PQ = AB$) $\angle POQ = \angle AOB$



3. The perpendicular from the centre of a circle to a chord bisects the chord, i.e., if $OD \perp AB$ (OD is perpendicular to AB).

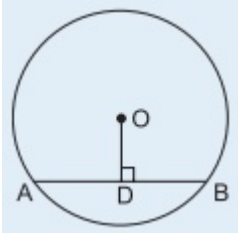


4. The line joining the centre of a circle to the mid-point of a chord is perpendicular to the chord. $AD = DB$ $OD \perp AB$



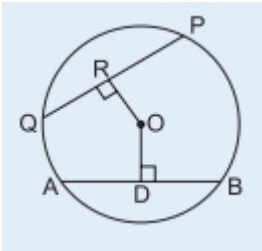
5. Perpendicular bisector of a chord passes through the centre,

i.e., $OD \perp AB$ and $AD = DB$
 $\therefore O$ is the centre of the circle.



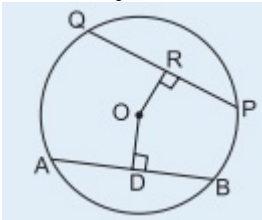
6. Equal chords of a circle (or of congruent circles) are equidistant from the centre.

$\therefore AB = PQ$
 $\therefore OD = OR$

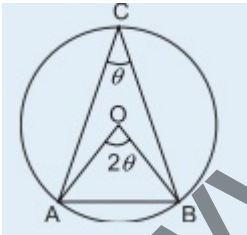


7. Equidistant chords of a circle from the centre are of equal length.

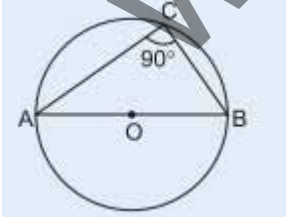
If $OD = OR$, then
 $\therefore AB = PQ$



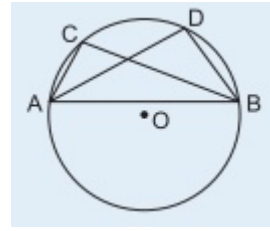
8. The angle subtended by an arc (the degree measure of the arc) at the centre of a circle is twice the angle subtended by the arc at any point on the remaining part of the circle.
 $m \angle AOB = 2 m \angle ACB$.



9. Angle in a semicircle is a right angle.



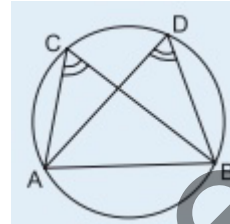
10. Angles in the same segment of a circle are equal, i.e., $\angle ACB = \angle ADB$.



11. If a line segment joining two points subtends equal angle at two other points lying on the same side of the line containing the segment, then the four points lie on the same circle.

$\angle ACB = \angle ADB$

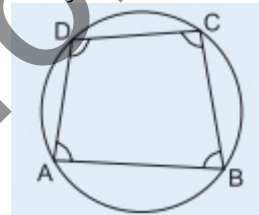
\therefore Points A, C, D, and B are concyclic, i.e., lie on the circle.



12. The sum of pair of opposite angles of a cyclic quadrilateral is 180° .

$\angle DAB + \angle BCD = 180^\circ$

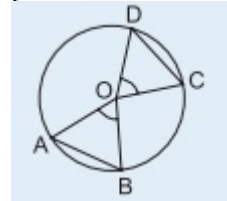
$\angle ABC + \angle CDA = 180^\circ$ (Inverse of this theorem is also true.)



13. Equal chords (or equal arcs) of a circle (or congruent circles) subtended equal angles at the centre.

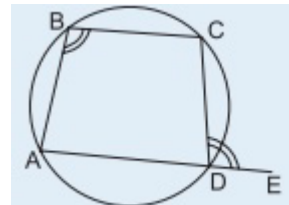
$AB = CD$ (or $AB = CD$) $\angle AOB = \angle COD$

(Inverse of this theorem is also true.)



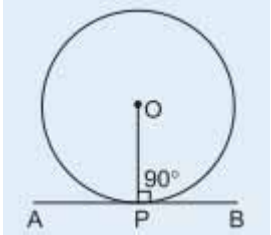
14. If a side of a cyclic quadrilateral is produced, then the exterior angle is equal to the interior opposite angle.

$m \angle CDE = m \angle ABC$

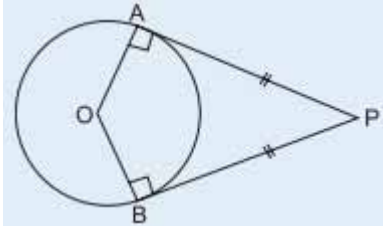


15. A tangent at any point of a circle is perpendicular to the radius through the point of contact.

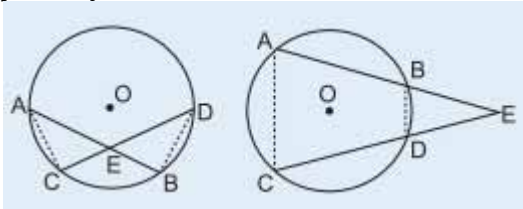
(Inverse of this theorem is also true.)



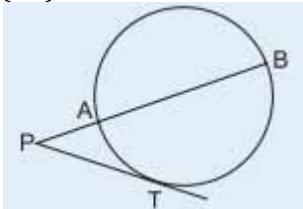
16. The lengths of two tangents drawn from an external point to a circle are equal, that is $AP = BP$.



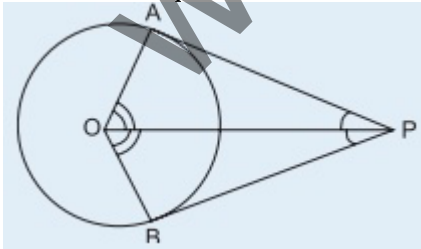
17. If two chords AB and CD of a circle, intersect inside a circle (outside the circle when produced at a point E), then $AE \times BE = CE \times DE$.



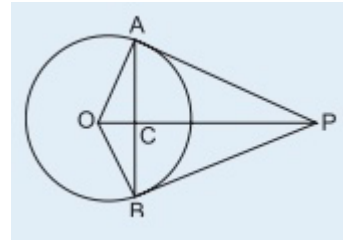
18. If PB be a secant which intersects the circle at A and B and PT be a tangent at T, then $PA \times PB = (PT)^2$.



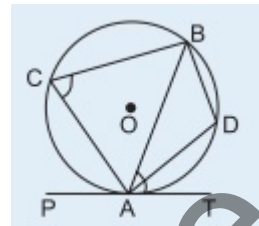
19. From an external point from which the tangents are drawn to the circle with centre O, then (a) they subtend equal angles at the centre (b) they are equally inclined to the line segment joining the centre of that point $\angle AOP = \angle BOP$ and $\angle APO = \angle BPO$.



20. If P is an external point from which the tangents to the circle with centre O touch it at A and B then OP is the perpendicular bisector of AB. $OP \perp AB$ and $AC = BC$

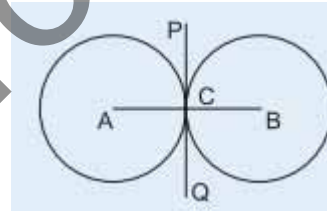


21. If from the point of contact of a tangent, a chord is drawn then the angles which the chord makes with the tangent line are equal respectively to the angles formed in the corresponding alternate segments. In the adjoining diagram, $\angle BAT = \angle BCA$ and $\angle BAP = \angle BDA$

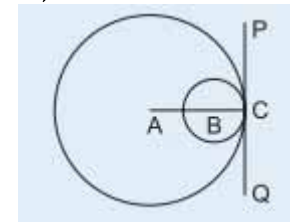


22. The point of contact of two tangents lies on the straight line joining the two centres.

(a) When two circles touch externally then the distance between their centres is equal to sum of their radii, i.e., $AB = AC + BC$.



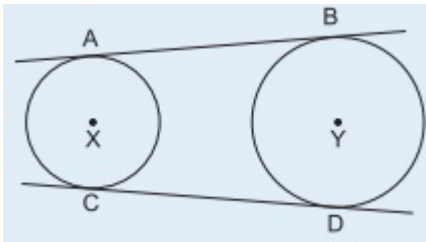
(b) When two circles touch internally the distance between their centres is equal to the difference between their radii, i.e., $AB = AC - BC$.



23. For the two circles with centre X and Y and radii r_1 and r_2 .

AB and CD are two Direct Common Tangents (DCT), then the length of DCT =

$$\sqrt{(\text{distance between centres})^2 - (r_1 - r_2)^2}$$



24. For the two circles with centre X and Y and radii r_1 and r_2 PQ and RS are two transverse common tangent, then length of TCT

$$\sqrt{(\text{distance between centres})^2 - (r_1 - r_2)^2}$$

Previous year questions

- Bhuvnesh has drawn an angle of measure $45^\circ 27'$ when he was asked to draw an angle of 45° . The percentage error in his drawing is
(a) 0.5% (b) 1.0%
(c) 1.5% (d) 2.0%
- In a regular polygon, the exterior and interior angles are in the ratio 1 : 4. The number of sides of the polygon is
(a) 5 (b) 10
(c) 3 (d) 8
- The sides of a triangle are in the ratio 3 : 4 : 6. The triangle is :
(a) acute -angled (b) right- angled
(c) obtuse- angled (d) either acute- angled or right angled
- If the length of the three sides of a triangle are 6 cm, 8 cm and 10 cm, then the length of the median to its greatest side is
(a) 8 cm (b) 6 cm
(c) 5 cm (d) 4.8 cm
- If the circumradius of an equilateral triangle be 10 cm than the measure of its radius is ?
(a) 5 cm (b) 10cm
(c) 20 cm (d) 15 cm
- O and C are respectively the orthocenter and the Circumcenter of an acute-angled triangle PQR. The points P and O are joined and produced to meet the side QR at S. If $\angle PQS = 60^\circ$ and $\angle OCR = 130^\circ$, then $\angle RPS =$
(a) 30° (b) 35°
(c) 100° (d) 60°
- In $\triangle ABC$, AD is the internal bisector of $\angle A$, meeting the side BC at D. If $BD = 5$ cm, $BC = 7.5$ cm, then $AB : AC$ is
(a) 2 : 1 (b) 1 : 2
(c) 4 : 5 (d) 3 : 5
- I is the in center of $\triangle ABC$, $\angle ABC = 60^\circ$ and $\angle ACB = 50^\circ$ Then $\angle BIC$ is
(a) 55° (b) 125°
(c) 70° (d) 65°
- The in-radius of an equilateral triangle length 3 cm. Then the length of each of its medians is
(a) 12 cm (b) $9/2$ cm
(c) 4 cm (d) 9 cm
- Two medians AD and BE of $\triangle ABC$ intersect at G at right angles, If $AD = 9$ cm and $BE = 6$ cm, then the length of BD (in cm) is
(a) 10 (b) 6
(c) 5 (d) 3
- The difference between the interior and exterior angles at a vertex of a regular polygon is 150° , The number of sides of the polygon is
(a) 10 (b) 15
(c) 24 (d) 30
- Each interior angle of a regular polygon is 144° . The number of sides of the polygon is
(a) 8 (b) 9
(c) 10 (d) 11

13. If the sum of the interior angles of a regular polygon be 1080° , the number sides of the polygon is
 (a) 6 (b) 8
 (c) 10 (d) 12
14. The number of sides in two regular polygons 33 are in the ratio of 5 : 4. The difference between their Interior angles of the polygon is 6° . Then the number of sides are
 (a) 15, 12 (b) 5, 4
 (c) 10, 8 (d) 20, 16
15. Each internal angle of regular polygon is two times its external angle. Then the number of sides of the polygon is :
 (a) 8 (b) 6
 (c) 5 (d) 7
16. Ratio of the number of sides of two regular polygons is 5: 6 and the ratio of their each interior angle is 24 : 25. Then the number of sides of these two polygons are
 (a) 10, 12 (b) 20, 24
 (c) 15, 18 (d) 35, 42
17. Measure of each interior angle of a regular polygon can never be :
 (a) 150° (b) 105°
 (c) 108° (d) 144°
18. The length of the diagonal BD of the parallelogram ABCD is 18 cm. If P and Q are the centroid of the ABC and AADC respectively then the length of the line segment PQ is
 (a) 4 cm (b) 6 cm
 (c) 9 cm (d) 12 cm
19. The side AB of a parallelogram ABCD is produced to E in such way that BE = AB, DE intersects BC at Q. The point Q divides BC in the ratio
 (a) 1 : 2 (b) 1 : 1
 (c) 2 : 3 (d) 2 : 1
20. ABCD is a cyclic trapezium such that AD \parallel BC, if $\angle ABC = 70^\circ$, then the value of $\angle BCD$ is :
 (a) 60° (b) 70°
 (c) 40° (d) 80°
21. ABCD is a cyclic trapezium whose sides AD and BC are parallel to each other. If $\angle ABC = 72^\circ$, then the $\angle BCD$ is
 (a) 162° (b) 18°
 (c) 108° (d) 72°
22. If an exterior angle of a cyclic quadrilateral be 50° , then the interior opposite angle is :
 (a) 130° (b) 40°
 (c) 50° (d) 90°
23. ABCD is a rhombus. A straight line through C cuts AD produced at P and AB produced at Q. If DP = $(1/2)$ AB, then the ratio of the length of BQ and AB is
 (a) 2:1 (b) 1:2
 (c) 1:1 (d) 3:1
24. In a quadrilateral ABCD, with unequal sides if the diagonals AC and BD intersect at right angle then
 (a) $AB^2 + BC^2 + CD^2 + DA^2 = AC^2 + BD^2$ (b) $AB^2 + CD^2 = BC^2 + DA^2$
 (c) $AB^2 + AD^2 = BC^2 + CD^2$ (d) $AB^2 + BC^2 = 2(CD^2 + DA^2)$
25. The ratio of the angles $\angle A$ and $\angle B$ of a non-square rhombus ABCD is 4 : 5, then the value of $\angle C$ is :
 (a) 50° (b) 45°
 (c) 80° (d) 95°
26. ABCD is a rhombus whose side AB = 4 cm and $\angle ABC = 120^\circ$, then the length of diagonal BD is equal to :
 (a) 1 cm (b) 2 cm
 (c) 3 cm (d) 4 cm
27. The length of a chord of a circle is equal to the radius of the circle. The angle which this chord subtends in the major segment of the circle is equal to
 (a) 30° (b) 45°
 (c) 60° (d) 90°
28. AB = 8 cm, and CD = 6 cm are two parallel chords on the same side of the center of a circle. The distance between them is 1 cm The radius of the circle is :
 (a) 5 cm (b) 4 cm
 (c) 3 cm (d) 2 cm
29. The length of two chords AB and AC of a circle are 8 cm and 6 cm and $\angle BAC = 90^\circ$, then the radius of circle is
 (a) 25 cm (b) 20 cm
 (c) 4 cm (d) 5 cm
30. The distance between two parallel chords of length 8 cm each in a circle of diameter 10 cm is
 (a) 6 cm (b) 7 cm
 (c) 8 cm (d) 5.5 cm
31. The radius of two concentric circles is 9 cm and 15 cm. If the chord of the greater circle be a tangent to the smaller circle, then the length of that chord is
 (a) 24 cm (b) 12 cm
 (c) 30 cm (d) 18 cm
32. If chord of a circle of radius 5 cm is a tangent to another circle of radius 3 cm, both the circles being concentric, then the length of the chord is
 (a) 10 cm (b) 12.5 cm
 (c) 8 cm (d) 7 cm
33. The two tangents are drawn at the extremities of diameter AB of a circle with center P. If a tangent to the circle at the point C intersects the other two tangents at Q and R, then the measure of the $\angle QPR$ is
 (a) 45° (b) 60°
 (c) 90° (d) 180°
34. AB is a chord of a circle and PAT is the tangent to the circle at A. If $\angle BAT = 75^\circ$ and $\angle BAC = 45^\circ$ and C being a point on the circle, then $\angle ABC$ is equal to
 (a) 40° (b) 45°
 (c) 60° (d) 70°
35. The tangents at two points A and B of the circle with center O intersect at P. If in quadrilateral PAOB, $\angle AOB : \angle APB = 5 : 1$, then measure of $\angle APB$ is :
 (a) 30° (b) 60°
 (c) 45° (d) 15°
36. Two circles touch each other externally at point A and PQ is a direct common tangent which touches the circles at P and Q respectively. Then $\angle PAQ =$
 (a) 45° (b) 90°
 (c) 80° (d) 100°

37. PR is tangent to a circle, with center O and radius 4 cm, at point Q. If $\angle POR = 90^\circ$, $OR = 5$ cm and $OP = 20/3$ cm, then (in cm) the length of PR is :
 (a) 3 (b) $16/3$
 (c) $23/3$ (d) $25/3$
38. Two chords AB and CD of circle whose center is O, meet at the point P and $\angle AOC = 50^\circ$, $\angle BOD = 40^\circ$, Then the value of $\angle BPD$ is
 (a) 60° (b) 40°
 (c) 45° (d) 75°
39. A straight line parallel to BC of ΔABC intersects AB and AC at points P and Q respectively. $AP = QC$, $PB = 4$ units and $AQ = 9$ units, then the length of AP is :
 (a) 25 units (b) 3 units
 (c) 6 units (d) 6.5 units
40. The circumcenter of a triangle ABC is O. If $\angle BAC = 85^\circ$ and $\angle BCA = 75^\circ$ then the value of $\angle OAC$ is
 (a) 40° (b) 60°
 (c) 70° (d) 90°
41. O is the in center of ΔABC and $\angle A = 30^\circ$ then $\angle BOC$ is
 (a) 100° (b) 105°
 (c) 110° (d) 90°
42. Let O be the in-center of a triangle ABC and D be a point on the side BC of ΔABC , such that $OD \perp BC$, If $\angle BOD = 15^\circ$, then $\angle ABC =$
 (a) 75° (b) 45°
 (c) 150° (d) 90°
43. In a triangle ABC, in center is O and then the measure of $\angle BAC$ is :
 (a) 20° (b) 40°
 (c) 55° (d) 110°
44. The points D and E are taken on the sides AB and AC of ΔABC such that $AD = (1/3) AB$, $AE = (1/3) AC$, if the length of BC is 15 cm, then the length of DE is :
 (a) 10 cm (b) 8 cm
 (c) 6 cm (d) 5 cm
45. D is any point on side AC of ΔABC , if P, Q, X, Y are the midpoint of AB, BC, AD and DC respectively, then the ratio of PX and QY is
 (a) 1 : 2 (b) 1 : 1
 (c) 2 : 1 (d) 2 : 3
46. In ΔABC , PQ is parallel to BC. If $AP : PB = 1 : 2$ and $AQ = 3$ cm; AC is equal to (a) 6 cm (b) 9 cm
 (c) 12 cm (d) 8 cm
47. If the orthocenter and the centroid of a triangle are the same, then the triangle is,
 (a) Scalene
 (c) Equilateral (b) Right angled (d) Obtuse angled
48. if in a triangle, the orthocenter lies on vertex, then the triangle is
 (a) Acute angled (b) Isosceles
 (c) Right angled (d) Equilateral
49. if the incenter of an equilateral triangle lies inside the triangle and its radius is 3 cm, then the side of the equilateral triangle is
 (a) $9\sqrt{3}$ cm (b) $6\sqrt{3}$ cm
 (c) $3\sqrt{3}$ cm (d) 6 cm
50. If ΔABC is an isosceles triangle with $\angle C = 90^\circ$ and $AC = 5$ cm, then AB is:
 (a) 5 cm (b) 10 cm
 (c) $5\sqrt{2}$ cm (d) 2.5 cm
51. If the circumcenter of a triangle lies outside it, then the triangle is
 (a) Equilateral (b) Acute angled
 (c) Right angled (d) Obtuse angled
52. I is the incenter of a triangle ABC. If $\angle ACB = 55^\circ$, $\angle ABC = 65^\circ$ If then the value of $\angle BIC$ is
 (a) 130° (b) 120°
 (c) 140° (d) 110°
53. In ΔABC , $\angle BAC = 90^\circ$ and $AB = (1/2) BC$, Then the measure of $\angle ACB$ is :
 (a) 60° (b) 30°
 (c) 45° (d) 15°
54. The length of the three sides of a right angled triangle are $(x-2)$ cm, (x) cm and $(x+2)$ cm respectively. Then the value of x is
 (a) 10 (b) 8
 (c) 4 (d) 0
55. Suppose ΔABC be a right-angled where $\angle A = 90^\circ$ and $AD \perp BC$. If $ar(\Delta ABC) = 40 \text{ cm}^2$, $ar(\Delta ACD) = 10 \text{ cm}^2$ and $AC = 9$ cm, then the length of BC is
 (a) 12 cm (b) 18 cm
 (c) 4 cm (d) 6 cm
56. In a triangle ABC, $\angle BAC = 90^\circ$ and AD is perpendicular to BC. If $AD = 6$ cm and $BD = 4$ cm then the length of BC is:
 (a) 8 cm (b) 10 cm
 (c) 9 cm (d) 13 cm
57. In a right angled triangle ABC, $\angle ABC = 90^\circ$, $AB = 3$ cm, $BC = 4$, $CA = 5$. BN is perpendicular to AC, $AN : NC$ is
 (a) 3:4 (b) 9:16
 (c) 3:16 (d) 1:4
58. For a triangle base is $6\sqrt{3}$ cm and two base angles are 30° and 60° . Then height of the triangle is
 (a) $3\sqrt{3}$ cm (b) 4.5 cm
 (c) $4\sqrt{3}$ cm (d) $2\sqrt{3}$ cm
59. ABC is a right angled triangle, right angled at C and p is the length of the perpendicular from C on AB. If a, b and c are the length of the sides BC, CA and AB respectively, then
 (a) $1/p^2 = 1/b^2 - 1/a^2$ (b) $1/p^2 = 1/a^2 + 1/b^2$
 (c) $1/p^2 + 1/a^2 = 1/b^2$ (d) $1/p^2 = 1/a^2 - 1/b^2$
60. Each interior angle of a regular polygon is three times its exterior angle, then the number of sides of the regular polygon is :
 (a) 9 (b) 8
 (c) 10 (d) 7
61. The sum of an interior angles of a regular polygon is twice the sum of all its exterior angles. The number of sides of the polygon
 (a) 10 (b) 8
 (c) 12 (d) 6
62. The ratio between the number of sides of two regular polygons is 1:2 and the ratio between their interior angles is 2:3. the number of sides of these polygons is respectively

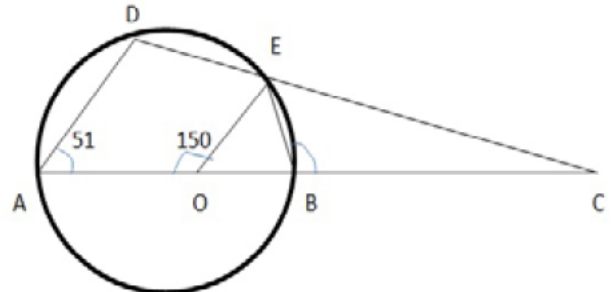
- (a) 6, 12 (b) 5, 10
(c) 4, 8 (d) 7, 14
63. ABCD is a cyclic parallelogram. The angle $\angle B$ is equal to:
(a) 30° (b) 60°
(c) 45° (d) 90°
64. ABCD is a cyclic quadrilateral and O is the center of the circle. If $\angle COD = 140^\circ$ and $\angle BAC = 40^\circ$, then the value of $\angle BCD$ is equal to
(a) 70° (b) 90°
(c) 60° (d) 80°
65. ABCD is a trapezium whose side AD is parallel to BC, Diagonals AC and BD intersect at O. If $AO = 3$, $CO = x - 3$, $BO = 3x - 19$ and $DO = x - 5$, the value(s) of x will be
(a) 7, 6 (b) 12, 6
(c) 7, 10 (d) 8, 9
66. Two equal circles of radius 4 cm intersect each other such that each passes through the center of the other. The length of the common chord is
(a) $2\sqrt{3}$ cm (b) $4\sqrt{3}$ cm
(c) $2\sqrt{2}$ cm (d) 8 cm
67. One chord of a circle is known to be 10.1 cm. The radius of this circle must be ;
(a) 5 cm (b) greater than 5 cm
(c) greater than or equal to 5 cm (d) less than 5 cm
68. The length of the chord of a circle is 8 cm and perpendicular distance between center and the chord is 3 cm, Then the radius of the circle is equal to :
(a) 4 cm (b) 5 cm
(c) 6 cm (d) 8 cm
69. The length of the common chord of two intersecting circles is 24 cm. If the diameter of the circles are 30 cm and 26 cm, then the distance between the center (in cm) is
(a) 13 (b) 14
(c) 15 (d) 16
70. In a circle of radius 21 cm and arc subtends an angle of 72° at the center. The length of the arc is
(a) 21.6 cm (b) 26.4 cm
(c) 13.2 cm (d) 198.8 cm
71. A unique circle can always be drawn through x number of given non-collinear then x must be
(a) 2 (b) 3
(c) 4 (d) 1
72. Two parallel chords are drawn in a circle of diameter 30 cm. The length of one chord is 24 cm and the distance between the two chords 21 cm. the length of the chord is
(a) 10 cm (b) 18 cm
(c) 12 cm (d) 16 cm
73. If two equal circles whose centres are O and O' intersect each other at the point A and B $OO' = 12$ cm and $AB = 16$ cm then the radius of the circle is
(a) 10 cm (b) 8 cm
(c) 12 cm (d) 14 cm
74. Chords AB and CD of a circle intersect externally at P. if $AB = 6$ cm, $CD = 3$ cm and $PD = 5$ cm, then the length of PB is
(a) 5 cm (b) 7.35 cm
(c) 6 cm (d) 4 cm
75. AB and CD are two parallel chords on the opposite sides of the center of the circle. If $AB = 10$ cm, $CD = 24$ cm and the radius of the circle is 13 cm, the distance between the chords is
(a) 17 cm (b) 15
(c) 16 cm (d) 18 cm
76. Two circles touch each other externally at P, AB is a direct common tangent to the two circles, A and B are point of contact and $\angle PAB = 35^\circ$ then $\angle ABP$ is
(a) 35° (b) 55°
(c) 65° (d) 75°
77. If the radii of two circles be 6 cm and 3 cm and the length of the transverse common tangent be 8 cm, then the distance between the two centers is
(a) $\sqrt{145}$ cm (b) $\sqrt{140}$ cm
(c) $\sqrt{150}$ cm (d) $\sqrt{135}$ cm
78. The distance between the center of two equal circles each of radius 3 cm is, 10 cm. The length of a transverse common tangent is
(a) 8 cm (b) 10
(c) 4 cm (d) 6 cm
79. The radii of two circles are 5 cm and 3 cm, the distance between their center is 24 cm. then the length of the transverse common tangent is
(a) 16 cm (b) $15\sqrt{2}$ cm
(c) $16\sqrt{2}$ cm (d) 15 cm
80. AC is diameter of a circum circle of $\triangle ABC$. Chords BD is parallel to the diameter AC if $\angle CBE = 50^\circ$, then the measure of $\angle DEC$ is
(a) 50° (b) 90°
(c) 60° (d) 40°
81. The length of the two sides forming the right angle of a right angled triangle are 6 cm and 8 cm. the length of its circum-radius is :
(a) 5 cm (b) 7 cm
(c) 6 cm (d) 10 cm
82. The length of radius of a circum circle of a triangle having sides 3 cm, 4 cm and 5 cm is :
(a) 2 cm (b) 2.5 cm
(c) 3 cm (d) 1.5 cm
83. P and Q are center of two circles with radii 9 cm and 2 cm respectively, where $PQ = 17$ cm. R is the center of another circle of radius x cm, which touches each of the above two circles externally. If $\angle PRQ = 90^\circ$, then the value of x is
(a) 4 cm (b) 6 cm
(c) 7 cm (d) 8 cm
84. Two line segments PQ and RS intersect at X in such a way that $XP = XR$, If $\angle PSX = \angle RQX$, then one must have
(a) $PR = QS$ (b) $PS = RQ$
(c) $\angle XSQ = \angle XRP$ (d) $\ar(\triangle PXR) = \ar(\triangle QXS)$

85. In a $\triangle ABC$, $AB^2 + AC^2 = BC^2$ AND $BC = \sqrt{2}AB$, THEN $\angle ABC$ IS
 (A) 30° (b) 45°
 (c) 60° (d) 90°
86. Two chords AB and CD of a circle with center O intersect each other at the point P. if $\angle AOD = 20^\circ$ and $\angle BOC = 30^\circ$ then $\angle BPC$ is equal to:
 (a) 50° (b) 20°
 (c) 25° (d) 30°
87. ABCD is a quadrilateral inscribed in a circle with center O. if $\angle COD = 120^\circ$ and $\angle BAC = 30^\circ$ then $\angle BCD$ is:
 (a) 75° (b) 90°
 (c) 120° (d) 60°
88. If $\triangle ABC$ is similar to $\triangle DEF$, such that $\angle A = 47^\circ$ and $\angle E = 63^\circ$ Then $\angle C$ is equal to:
 (a) 40° (b) 70°
 (c) 65° (d) 37°
89. The internal bisectors of $\angle ABC$ and $\angle ACB$ of $\triangle ABC$ meet each other at O. If $\angle BOC = 110^\circ$, then $\angle BAC$ is equal to
 (a) 40° (b) 55°
 (c) 90° (d) 110°
90. In $\triangle ABC$, $\angle B = 60^\circ$ and $\angle C = 40^\circ$. If AD and AE be respectively the internal bisector of $\angle A$ and perpendicular on BC, then the measure of $\angle DAE$ is
 (a) 5° (b) 10°
 (c) 40° (d) 60°
91. Internal bisectors of $\angle B$ and $\angle C$ of $\triangle ABC$ intersect at O. If $\angle BOC = 102^\circ$, then the value of $\angle BAC$ is
 (a) 12° (b) 24°
 (c) 48° (d) 60°
92. The angle between the external bisectors of two angles of a triangle is 60° . Then the third angle of the triangle is
 (a) 40° (b) 50°
 (c) 60° (d) 80°
93. I is the incenter of $\triangle ABC$, if $\angle ABC = 60^\circ$, $\angle BCA = 80^\circ$ then $\angle BIC$ is
 (a) 90° (b) 100°
 (c) 110° (d) 120°
94. In $\triangle ABC$, draw $BE \perp AC$ and $CF \perp AB$ and the perpendicular BE and CF intersect at the point O. If $\angle BAC = 70^\circ$, then the value of $\angle BOC$ is
 (a) 125° (b) 55°
 (c) 150° (d) 110°
95. O is the center and arc ABC subtends an angle of 130° at O. AB is extended to P, then $\angle PBC$ is
 (a) 75° (b) 70°
 (c) 65° (d) 80°
96. Internal bisectors of angles $\angle B$ and $\angle C$ of a triangle ABC meet at O. If $\angle BAC = 80^\circ$, then the value of $\angle BOC$ is (a) 120° (b) 140°
 (c) 110° (d) 130°
97. In triangle PQR, points A, B and C are taken on PQ, PR and QR respectively such that $QA = AC$ and $CR = CB$. If $\angle QPR = 40^\circ$, then $\angle ACB$ is equal
 (a) 140° (b) 40°
 (c) 70° (d) 100°
98. AD is the median of a triangle ABC and O is the centroid such that $AO = 10$ cm. the length of OD (in cm) is
 (a) 4 (b) 5
 (c) 6 (d) 8
99. The external bisector of $\angle B$ and $\angle C$ of $\triangle ABC$ (where AB and AC extended to E and F respectively) meet at point P. if $\angle BAC = 100^\circ$ then the measure of $\angle BPC$ is
 (a) 50° (b) 80°
 (c) 40° (d) 52°
100. In a triangle ABC, $AB + BC = 12$ cm, $BC + CA = 14$ cm and $CA + AB = 18$ cm. Find the radius of the circle (in cm) which has the same perimeter as the triangle
 (a) $5/2$ (b) $7/2$
 (c) $9/2$ (d) $11/2$
101. In $\triangle ABC$ D and E are points on AB and AC respectively such that $DE \parallel BC$ and DE divides the $\triangle ABC$ into two parts of equal areas. Then ratio of AD and BD is
 (a) 1:1 (b) $1:\sqrt{2}-1$
 (c) $1:\sqrt{2}$ (d) $1:\sqrt{2}+1$
102. In a triangle, if three altitudes are equal, then the triangle is (a) obtuse (b) Equilateral
 (c) Right (d) Isosceles
103. If ABC is an equilateral triangle and D is a point on BC such that $AD \perp BC$, then
 (a) $AB : BD = 1 : 1$ (b) $AB : BD = 1 : 2$
 (c) $AB : BD = 2 : 1$ (d) $AB : BD = 3 : 2$
104. The side QR of an equilateral triangle PQR is produced to the point S in such a way that $QR = RS$ and P is joined to S. Then the measure of $\angle PSR$ is
 (a) 30°
 (c) 60° (b) 15° (d) 45°
105. Let ABC be an equilateral triangle and AX, BY, CZ be the altitudes. Then the right statement out of the four given responses is
 (a) $AX = BY = CZ$ (b) $AX \neq BY = CZ$
 (c) $AX = BY \neq CZ$ (d) $AX \neq BY \neq CZ$
106. ABC is an isosceles triangle such that $AB = AC$ and $\angle B = 35^\circ$, AD is the median to the base BC. Then $\angle BAD$ is
 (a) 70° (b) 35°
 (c) 110° (d) 55°
107. ABC is an isosceles triangle with $AB = AC$, A circle through B touching AC at the middle point intersects AB at P. The AP : AB is:
 (a) 4 : 1 (b) 2 : 3
 (c) 3 : 5 (d) 1 : 4
108. In an isosceles triangle, if the unequal angle is twice the sum of the equal angles, then each equal angle is
 (a) 120° (b) 60°
 (c) 30° (d) 90°
109. $\triangle ABC$ is an isosceles triangle and $AB = AC = 2a$ unit, $BC = a$ unit, Draw $AD \perp BC$, and find the length of AD.
 (a) $\sqrt{15}$ a unit (b) $\sqrt{15}/2$ a unit
 (c) $\sqrt{17}$ a unit (d) $\sqrt{17}/2$ a unit
110. An isosceles triangle ABC is right angled at B. D is a point inside the triangle ABC. P and Q are the feet of the perpendiculars drawn from D on the side AB and

- AC respectively of ΔABC . If $AP = a$ cm, $AQ = b$ cm and $\angle BAD = 15^\circ$, $\sin 75^\circ =$
 (a) $2b/\sqrt{3}a$ (b) $a/2b$
 (c) $\sqrt{3}a/2b$ (d) $2a/\sqrt{3}b$
- 111.** ABC is an isosceles triangle with $AB = AC$. The side BA is produced to D such that $AB = AD$. If $\angle ABC = 30^\circ$, then $\angle BCD$ is equal to
 (a) 45° (b) 90°
 (c) 30° (d) 60°
- 112.** In a triangle ABC, $AB = AC$, $\angle BAC = 40^\circ$ then the external angle at B is
 (a) 90° (b) 70°
 (c) 110° (d) 80°
- 113.** Taking any three of the line segments out of segments of length 2cm, 3cm, 5 cm, and 6 cm, the number of triangles that can be formed is :
 (a) 3 (b) 2
 (c) 1 (d) 4
- 114.** If the length of the sides of a triangle are in the Ratio 4 : 5 : 6 and the in radius of the triangle is 3cm, then the altitude of the triangle corresponding to the largest side as base is :
 (a) 7.5 cm (b) 6 cm
 (c) 10 cm (d) 8 cm
- 115.** ABC is a triangle. The bisectors of the internal angle $\angle B$ and external angle $\angle C$ intersect at D. If $\angle BDC = 50^\circ$, then $\angle A$ is
 (a) 100° (b) 90°
 (c) 120° (d) 60°
- 116.** In a triangle ABC, the side BC is extended up to D such that $CD = AC$. If $\angle BAD = 109^\circ$ and $\angle ACB = 72^\circ$ then the value of $\angle ABC$ is
 (a) 35° (b) 60°
 (c) 40° (d) 45°
- 117.** The sum of three altitudes of a triangles is
 (a) equal to the sum of three sides (b) less than the sum of sides
 (c) greater than the sum of sides (d) twice the sum of sides
- 118.** In ΔABC $\angle A = 90^\circ$ and $AD \perp BC$ where D lies on BC. if $BC = 8$ cm, $AC = 6$ cm, then $\Delta ABC : \Delta ACD = ?$
 (a) 4:3 (b) 25 : 6
 (c) 16: 9 (d) 25: 9
- 119.** If the median drawn on the base of a triangle is half its base the triangle will be
 (a) right-angled (b) acute-angle
 (c) obtuse-angle (d) equilateral
- 120.** In a right-angle ΔABC , $\angle ABC = 90^\circ$. $AB = 5$ cm and $BC = 12$ cm. The radius of the circum circle of the triangle ABC is (a) 7.5cm (b) 6cm
 (c) 6.5cm (d) 7cm
- 121.** In a right-angled triangle, the product of two sides is equal to half of the square of the third side i. e., hypotenuse. One of the acute angle must be
 (a) 60° (b) 30°
 (c) 45° (d) 15°
- 122.** A point D is taken from the side BC of a right-angled triangle ABC, where AB is hypotenuse. Then
 (a) $AB^2 + CD^2 = BC^2 + AD^2$ (b) $CD^2 + BD^2 = 2AD^2$
 (c) $AB^2 + AC^2 = 2AD^2$ (d) $AB^2 = AD^2 + BC^2$
- 123.** D and E are two points on the sides AC and BC respectively of ΔABC such that $DE = 18$ cm, $CE = 5$ cm and $\angle DEC = 90^\circ$. If $\tan \angle ABC = 3.6$, then $AC : CD =$
 (a) $BC : 2 CE$ (b) $2CE : BC$
 (c) $2BC : CE$ (d) $CE : 2BC$
- 124.** BL and CM are Medians of ΔABC right-angled at A and $BC = 5$ cm. If $BL = 3\sqrt{5}/2$ cm, then the length of CM is
 (a) $2\sqrt{5}$ cm (b) $5\sqrt{2}$ cm
 (c) $10\sqrt{2}$ cm (d) $4\sqrt{5}$ cm
- 125.** In ΔABC and ΔDEF , $AB = DE$ and $BC = EF$, then one can infer that $\Delta ABC \cong \Delta DEF$, when
 (a) $\angle BAC = \angle EDF$ (b) $\angle ACB = \angle EDF$
 (c) $\angle ACB = \angle DFE$ (d) $\angle ABC = \angle DEF$
- 126.** Q is a point in the interior of a rectangle ABCD, if $QA = 3$ pm, $QB = 4$ cm and $QC = 5$ cm in then the length of QD (in cm) is
 (a) $3\sqrt{2}$ (b) $5\sqrt{2}$
 (c) $\sqrt{34}$ (d) $\sqrt{41}$
- 127.** ABCD is a rectangle where the ratio of the length of AB and BC is 3:2. if P is the midpoint of AB, then the value of $\sin \angle CPB$ is
 (a) $3/5$ (b) $2/5$
 (c) $3/4$ (d) $4/5$
- 128.** Inside a square ABCD, BEC is an equilateral triangle. If CE and BD intersect at O, then $\angle BOC$ is
 (a) 60° (b) 75°
 (c) 90° (d) 120°
- 129.** Each internal angle of regular polygon is two times its external angle. Then the number of sides of the polygon is:
 (a) 8 (b) 6
 (c) 5 (d) 7
- 130.** The sum of interior angles of a regular polygon is 1440° . The number of sides of the polygon is
 (a) 10 (b) 12
 (c) 6 (d) 8
- 131.** ABCD is a cyclic trapezium with $AB \parallel DC$ and AB is a diameter of the circle. If $\angle CAB = 30^\circ$, then $\angle ADC$ is
 (a) 60° (b) 120°
 (c) 150° (d) 30°
- 132.** ABCD is a cyclic quadrilateral. AB and DC are produced to meet at P. if $\angle ADC = 70^\circ$ and $\angle DAB = 60^\circ$, then the $\angle PBC + \angle PCB$ is
 (a) 130° (b) 150°
 (c) 155° (d) 180°
- 133.** A cyclic quadrilateral ABCD is such that $AB = BC$, $AD = DC$, $AC \perp BD$, $\angle CAD = \theta$ then the angle $\angle ABC =$
 (a) θ (b) $\theta/2$
 (c) 2θ (d) 3θ
- 134.** The diagonals AC and BD of a cyclic quadrilateral ABCD intersect each other at the point P. Then, it is always true that
 (a) $BP \cdot AB = CP \cdot CD$ (b) $AP \cdot CP = BP \cdot DP$
 (c) $AP \cdot BP = CP \cdot DP$ (d) $AP \cdot CD = AB \cdot CP$

135. A quadrilateral ABCD circumscribes a circle and $AB = 6$ cm, $CD = 5$ cm and $AD = 7$ cm. The length of side BC is
 (a) 4 cm (b) 5 cm
 (c) 3 cm (d) 6 cm
136. In a cyclic quadrilateral ABCD, $\angle A + \angle B + \angle C + \angle D = ?$
 (a) 90° (b) 360°
 (c) 180° (d) 120°
137. AB and CD are two parallel chords of a circle such that $AB = 10$ cm, and $CD = 24$ cm. If the chords are on the opposite sides of the center and distance between them is 17 cm, then the radius of the circle is:
 (a) 11 cm (b) 12 cm
 (c) 13 cm (d) 10 cm
138. A chord AB of a circle C_1 of radius $(\sqrt{3} + 1)$ cm touches a circle C_2 , which is concentric to C_1 . If the radius of C_2 is $(\sqrt{3} - 1)$ cm. The length of AB is :
 (a) $2\sqrt{3}$ cm (b) $8\sqrt{3}$ cm
 (c) $4\sqrt{3}$ cm (d) $4\sqrt{3}$ cm
139. The length of the common chord of two circles of radii 30 cm, and 40 cm whose centers are 50 cm apart is (in cm)
 (a) 12 (b) 24
 (c) 36 (d) 4
140. Chords AB and CD of a circle intersect at E and are perpendicular to each other. Segments AE, EB and ED are of lengths 2 cm, 6 cm and 3 cm respectively. Then the length of the diameter of the circle (in cm) is
 (a) $\sqrt{65}$ (b) $1/2(\sqrt{65})$
 (c) 65 (d) $65/2$
141. Two circles of same radius 5 cm, intersect each other at A and B. If $AB = 8$ cm, then the distance between the center is ;
 (a) 6 cm (b) 8 cm
 (c) 10 cm (d) 4 cm
142. AD is the chord of a circle with center O and DOC is a line segment originating from a point D on the circle and intersecting AB produced at C such that $BC = OD$. If $\angle BCD = 20^\circ$, then $\angle AOD = ?$ (a) 20° (b) 30°
 (c) 40° (d) 60°
143. In a circle of radius 17 cm, two parallel chords of length 30 cm and 16 cm are drawn. If both chords are on the same side of the center, then the distance between the chords is
 (a) 9 cm (b) 7 cm
 (c) 23 cm (d) 11 cm
144. A square ABCD is inscribed in a circle of 1 unit radius. Semicircles are inscribed on each side of the square. The area of the region bounded by the four semicircles and the circle is
 (a) 1 sq. unit (b) 2 sq. unit
 (c) 1.5 sq. unit (d) 2.5 sq. unit
145. Two circles touch each other internally. Their radii are 2 cm and 3 cm. the biggest chord of the greater circle which is outside the inner circle is of length
 (a) $2\sqrt{2}$ cm (b) $3\sqrt{2}$ cm
 (c) $2\sqrt{3}$ cm (d) $4\sqrt{2}$ cm
146. Two circles touch each other externally. The distance between their centers is 7 cm. If the radius of one circle is 4 cm, then the radius of the other circle is (a) 3.5 cm (b) 3 cm
 (c) 4 cm (d) 2 cm
147. A, B and C are the three points on a circle such that the angles subtended by the chords AB and AC at the center O are 90° and 110° respectively. $\angle BAC$ is equal to
 (a) 70° (b) 80°
 (c) 90° (d) 100°
148. N is the foot of the perpendicular from a point P of a circle with radius 7 cm, on a diameter AB of the circle. If the length of the chord PB is 12 cm, the distance of the point N from the point B is
 (a) $47/7$ cm (b) $86/7$ cm
 (c) $26/7$ cm (d) $72/7$ cm
149. A, B, C, D are four points on a circle, AC and BD intersect at a point E such that $\angle BEC = 130^\circ$ and $\angle ECD = 20^\circ$. $\angle BAC = ?$
 (a) 120° (b) 90°
 (c) 100° (d) 110°
150. If two concentric circles are of radii 5 cm and 3 cm, then the length of the chord of the larger circle which touches the smaller circle is :
 (a) 6 cm (b) 7 cm
 (c) 10 cm (d) 8 cm
151. A chord 12 cm long is drawn in a circle of diameter 20 cm. The distance of the chord from the center is
 (a) 8 cm (b) 6 cm
 (c) 10 cm (d) 16 cm
152. If the chord of a circle is equal to the radius of the circle, then the angle subtended by the chord on center is
 (a) 150° (b) 60°
 (c) 120° (d) 30°
153. In a right angled triangle the Circumcentre of the triangle lies
 (a) inside the triangle (b) outside the triangle
 (c) on midpoint of the hypotenuse (d) on the vertex
154. P and Q are two points on a circle with center at O. R is a point on the minor arc of the circle, between the points P and Q. The tangents to the circle at the points P and Q meet each other at the point S. If $\angle PSQ = 20^\circ$, then $\angle PRQ =$
 (a) 80° (b) 200°
 (c) 160° (d) 100°
155. Two circles intersect at A and B, P is a point on produced BA. PT and PQ are tangents to the circles. The relation of PT and PQ is
 (a) $PT = 2PQ$ (b) $PT < PQ$
 (c) $PT > PQ$ (d) $PT = PQ$
156. The length of the tangent drawn to a circle of radius 4 cm from a point 5 cm away from the center of the circle is
 (a) 3 cm (b) $4\sqrt{2}$ cm
 (c) $5\sqrt{2}$ cm (d) $3\sqrt{2}$ cm
157. From a point P, two tangents PA and PB are drawn to a circle with center O. If OP is equal to diameter of the circle, then $\angle APB$ is
 (a) 45° (b) 90°

- (c) 30° (d) 60°
- 158.** The radii of two concentric circles are 13 cm, and 8 cm. AB is a diameter of the bigger circle and BD is a tangent to the smaller circle touching it at D and the bigger circle at E. Point A is joined to D. The length of AD is
(a) 20 cm (b) 19 cm
(c) 18 cm (d) 17 cm
- 159.** PQ is a chord of length 8 cm of a circle with center O and radius 5 cm. The tangents at P and Q intersect at a point T. The length of TP is
(a) $20/3$ cm (b) $21/4$ cm
(c) $10/3$ cm (d) $15/4$ cm
- 160.** The maximum number of common tangents drawn to two circles when both the circles touch each other externally is
(a) 1 (b) 2
(c) 3 (d) 0
- 161.** I and O are respectively the incenter and circumcenter of a triangle ABC. The line AI produced intersects the circumcircle of ΔABC the point D. If $\angle ABC = x^\circ$, $\angle BID = y^\circ$, $\angle BOD = z^\circ$, then $(z+x)/y = ?$
(a) 3 (b) 1
(c) 2 (d) 4
- 162.** The radius of the circumcircle of a right angles triangle is 15 cm and the radius of its in- circle is 6 cm. Find the sides of the triangle.
(a) 30, 40, 41 (b) 18, 24, 30
(c) 30, 24, 25 (d) 24, 36, 20
- 163.** If the ΔABC is right angled at B, find its circumradius if the sides AB and BC are 15 cm and 20 cm respectively.
(a) 25cm (b) 20cm
(c) 15cm (d) 12.5cm
- 164.** If the circumradius of an equilateral triangle ABC be 8 cm, then the height of the triangle is
(a) 16cm (b) 6cm
(c) 8cm (d) 12cm
- 165.** Triangle PQR circumscribes a circle with center O and radius r cm such that $\angle PQR = 90^\circ$, if $PQ = 3$ cm, $QR = 4$ cm, then the value of r is ;
(a) 2 (b) 1.5
(c) 2.5 (d) 1
- 166.** The radius of two concentric circles are 17cm and 10cm. a straight line ABCD intersect the larger circle at the point A and D and intersects the smaller circle at the point B and C. if $BC = 12$ cm, then the length of AD (in cm) is (a) 20 (b) 24
(c) 30 (d) 34
- 167.** P and Q are center of two circles with radii 9 cm and 2 cm respectively, where $PQ = 17$ cm, R is the center of another circle of radius X cm, which touches each of the above two circles externally. If $\angle PRQ = 90^\circ$, then the value of x is
(a) 4 cm (b) 6cm
(c) 7 cm (d) 8cm
- 168.** Internal bisectors of angles $\angle B$ and $\angle C$ of a triangle ABC meet at O. If $\angle BAC = 80^\circ$, then the value of $\angle BOC$ is
(a) 120° (b) 140°
(c) 110° (d) 130°
- 169.** The chords AB, CD of a circle with center O intersect each other at P. $\angle ADP = 23^\circ$ and $\angle ACP = 70^\circ$, then the $\angle BCD$ is
(a) 45° (b) 47°
(c) 57° (d) 67°
- 170.** In a ΔABC $\angle A : \angle B : \angle C = 2 : 3 : 4$. A line CD drawn \parallel to AB, then the $\angle ACD$ is:
(a) 40° (b) 60°
(c) 80° (d) 20°
- 171.** In ΔABC , $\angle BAC = 75^\circ$, $\angle ABC = 45^\circ$, BC is produced to D. if $\angle ACD = x^\circ$ then $x/3\%$ of 60° is
(a) 30° (b) 48°
(c) 15° (d) 24°
- 172.** In a ΔABC , $AB = AC$ and BA is produced to D such that $AC = AD$. then the $\angle BCD$ is
(a) 100° (b) 60°
(c) 80° (d) 90°
- 173.** In a ΔABC , $\angle A + \angle B = 65^\circ$, $\angle B + \angle C = 140^\circ$, then find $\angle B$.
(a) 40° (b) 25°
(c) 35° (d) 20°
- 174.** In a triangle ABC, $\angle A = 90^\circ$, $\angle C = 55^\circ$, $AD \perp BC$. What is the value of $\angle BAD$?
(a) 35° (b) 60°
(c) 45° (d) 55°
- 175.** If O be the circumcenter of a triangle PQR and $\angle QOR = 110^\circ$, $\angle OPR = 25^\circ$, then the measure of $\angle PRQ$ is
(a) 65° (b) 50°
(c) 55° (d) 60°
- 176.** In the following figure, AB is the diameter of a circle Whose center is O. If $\angle AOE = 150^\circ$, $\angle DAO = 51^\circ$ then the measure of a $\angle CBE$ is :



- (a) 115° (b) 110°
(c) 105° (d) 120°

- 177.** In a triangle ABC, BC is produced to D so that $CD = AC$. If $\angle BAD = 111^\circ$ and $\angle ACB = 80^\circ$ then the measure of $\angle ABC$ is
(a) 31° (b) 33°
(c) 35° (d) 29°
- 178.** In a ΔABC , $\angle A + \angle B = 145^\circ$ and $\angle C + 2\angle B = 180^\circ$. State which one of the following relations is true?
(a) $CA = AB$ (b) $CA < AB$
(c) $BC < AB$ (d) $CA > AB$
- 179.** $\angle A, \angle B, \angle C$ are three angles of a triangle. if $\angle A - \angle B = 15^\circ$, $\angle B - \angle C = 30^\circ$, then $\angle A, \angle B$ and $\angle C$ are
(a) $80^\circ, 60^\circ, 40^\circ$ (b) $70^\circ, 50^\circ, 60^\circ$
(c) $80^\circ, 65^\circ, 35^\circ$ (d) $80^\circ, 55^\circ, 45^\circ$
- 180.** All sides of a quadrilateral ABCD touch a circle, If $AB = 6$ cm, $BC = 7.5$ cm, $CD = 3$ cm, then DA is
(a) 3.5 cm (b) 4.5 cm

- (c) 2.5 cm (d) 1.5 cm
- 181.** D is a point on the side BC of a triangle ABC such that $AD \perp BC$, E is a point on AD for which $AE : ED = 5 : 1$. If $\angle BAD = 30^\circ$ and $\tan \angle ACB = 6 \tan \angle DBE$, then $\angle ACB =$
 (a) 30° (b) 45°
 (c) 60° (d) 15°
- 182.** If in ΔABC , $\angle ABC = 5 \angle ACB$ and $\angle BAC = 3 \angle ACB$, then $\angle ABC = ?$ (a) 130° (b) 80° (c) 100° (d) 120°
- 183.** The exterior angles obtained on producing the base BC of a triangle ABC in both ways are 120° and 105° , then the vertical $\angle A$ of the triangle is measure
 (a) 36° (b) 40°
 (c) 45° (d) 55°
- 184.** If AD, BE and CF are medians of ΔABC , then which one of the following statements is correct?
 (a) $(AD + BE + CF) < AB + BC + CA$
 (b) $AD + BE + CF > AB + BC + CA$
 (c) $AD + BE + CF = AB + BC + CA$
 (d) $AD + BE + CF = \sqrt{2}(AB + BC + CA)$
- 185.** In ΔABC , the internal bisectors of $\angle ABC$ and $\angle ACB$ meet at I and $\angle BAC = 50^\circ$. The measure of $\angle BIC$ is
 (a) 105° (b) 115°
 (c) 125° (d) 130°
- 186.** Inside a triangle ABC, a straight line parallel to BC intersects AB and AC at the point P and Q respectively. If $AB = 3 PB$, then $PQ : BC$ is (a) 1 : 3 (b) 3 : 4
 (c) 1 : 2 (d) 2 : 3
- 187.** In ΔABC , $DE \parallel AC$, D and E are two points on AB and CB respectively. If $AB = 10$ cm and $AD = 4$ cm, then $BE : CE$ is
 (a) 2 : 3 (b) 2 : 5
 (c) 5 : 2 (d) 3 : 2
- 188.** For a triangle ABC, D and E are two points on AB and AC such that $AD = \frac{1}{4}AB$, $AE = \frac{1}{4}AC$. If $BC = 12$ cm, then DE is
 (a) 5 cm (b) 4 cm
 (c) 3 cm (d) 6 cm
- 189.** If I be the incenter of ΔABC and $\angle B = 70^\circ$ and $\angle C = 50^\circ$, then the magnitude of $\angle BIC$ is (a) 130° (b) 60°
 (c) 120° (d) 105°
- 190.** For a triangle ABC, D, E, F are the mid - points of its sides. if $\Delta ABC = 24$ sq. units then ΔDEF is
 (a) 4 sq. units (b) 6 sq. units
 (c) 8 sq. units (d) 12 sq. units
- 191.** The angle in a semi-circle is
 (a) a reflex angle (b) an obtuse angle
 (c) an acute angle (d) a right angle
- 192.** Angle between the internal bisectors of two angles of a triangle $\angle B$ and $\angle C$ is 120° , then $\angle A$ is
 (a) 20° (b) 30°
 (c) 60° (d) 90°
- 193.** The angles of a triangle are in the ratio 2 : 3 : 7. The measure of the smallest angle is
 (a) 30° (b) 60°
 (c) 45° (d) 90°
- 194.** In a ΔABC , $AB = BC$, $\angle B = x^\circ$ and $\angle A = (2x - 20)^\circ$. Then $\angle B$ is
 (a) 54° (b) 30°
 (c) 40° (d) 44°
- 195.** If AD is the median of the triangle ABC and G be the centroid, then the ratio of $AG : AD$ is
 (a) 1 : 3 (b) 2 : 1
 (c) 3 : 2 (d) 2 : 3
- 196.** Two supplementary angles are in the ratio 2 : 3. The angles are
 (a) $33^\circ, 57^\circ$ (b) $66^\circ, 114^\circ$
 (c) $72^\circ, 108^\circ$ (d) $36^\circ, 54^\circ$
- 197.** In a triangle ABC, in median is AD and centroid is O, $AO = 10$ cm. The length of OD (in cm) is (a) 6
 (b) 4
 (c) 5 (d) 3.3
- 198.** In a triangle, if orthocenter, circumcenter, incentre and centroid coincide, then the triangle must be
 (a) obtuse angled (b) isosceles
 (c) equilateral (d) right angled
- 199.** If ABC is an equilateral triangle and P, Q, R respectively denote the middle points of AB, BC, CA, then
 (a) PQR must be an equilateral triangle (b) $PQ + QR = PR + AB$
 (c) $PQ + QR = PR + 2AB$ (d) PQR must be a right angled
- 200.** Let ABC be an equilateral triangle and AX, BY, CZ be the altitude, Then the right statement out of the four given responses is
 (a) $AX = BY = CZ$ (b) $AX \neq BY = CZ$
 (c) $AX = BY \neq CZ$ (d) $AX \neq BY \neq CZ$
- 201.** ABC is an equilateral triangle and CD is the internal bisector of $\angle C$. If DC is produced to E such that $AC = CE$, then $\angle CAE$ is equal to
 (a) 45° (b) 75°
 (c) 30° (d) 15°
- 202.** G is the centroid of the equilateral ΔABC . If $AB = 10$ cm then length of AG is
 (a) $5\sqrt{3}/3$ cm (b) $10\sqrt{3}/3$ cm
 (c) $5\sqrt{3}$ cm (d) $10\sqrt{3}$ cm
- 203.** The radius of the incircle of the equilateral triangle having each side 6 cm is
 (a) $2\sqrt{3}$ cm (b) $\sqrt{3}$ cm
 (c) $6\sqrt{3}$ cm (d) 2 cm
- 204.** If the three medians of a triangle are same, then the triangle is
 (a) equilateral (b) isosceles
 (c) right-angled (d) obtuse-angle
- 205.** If ΔFGH is isosceles and $FG < 3$ cm, $GH = 8$ cm, then of the following the true relation is.
 (a) $GH = FH$ (b) $GF = GH$
 (c) $FH > GH$ (d) $GH < GF$
- 206.** If angle bisector of a triangle bisects the opposite side, then what type of triangle is it?
 (a) Right angled (b) Equilateral
 (c) Isosceles or equilateral (d) Isosceles
- 207.** If two angles of a triangle are 21° and 38° , then the triangle is
 (a) Right angled triangle (b) Acute angled triangle
 (c) obtuse angled triangle (d) Isosceles triangle

208. In ΔABC , $\angle C$ is an obtuse angle. The bisectors of the exterior angles at A and B meet BC and AC produced at D and E respectively. If $AB=AD=BE$, then $\angle ACB =$
 (a) 105° (b) 108°
 (c) 110° (d) 135°

209. A man goes 24 m due west and then 10 m due north. Then the distance of him from the starting point is
 (a) 17 m (b) 26 m
 (c) 28 m (d) 34 m

210. If the measures of the sides of triangle are (x^2-1) , (x^2+1) and $2x$ cm, then the triangle would be
 (a) equilateral (b) acute - angled
 (c) right-angled (d) isosceles

211. If each angle of a triangle is less than the sum of the other two, then the triangle is
 (a) obtuse angled (b) Acute or equilateral
 (c) acute angled (d) equilateral

212. ABC is a right-angled triangle with $AB=6$ cm and $BC=8$ cm. A circle with center O has been inscribed inside ΔABC . The radius of the circle is
 (a) 1 cm (b) 2 cm
 (c) 3 cm (d) 4 cm

213. If the sides of a right-angled triangle are three consecutive integers, then the length of the smallest side is
 (a) 3 units (b) 2 units
 (c) 4 units (d) 5 units

214. In ΔPQR , S and T are points on sides PR and PQ respectively such that $\angle PQR = \angle PST$. If $PT = 5$ cm, $PS = 3$ cm and $TQ = 3$ cm, then length of SR is
 (a) 5 cm (b) 6 cm
 (c) $31/3$ cm (d) $41/3$ cm

215. If the opposite sides of a quadrilateral and also its diagonals are equal, then each of the angles of the quadrilateral is
 (a) 90° (b) 120°
 (c) 100° (d) 60°

216. Among the angles $30^\circ, 36^\circ, 45^\circ, 50^\circ$ one angle cannot be an external angle of a regular polygon. The angle is
 (a) 30° (b) 36°
 (c) 45° (d) 50°

217. An interior angle of a regular polygon is 5 times its exterior angle. Then the number of sides of the polygon is
 (a) 14 (b) 16
 (c) 12 (d) 18

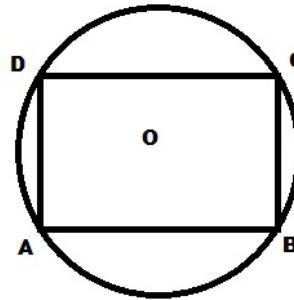
218. In a regular polygon, if one of its internal angles is greater than the external angle by 132° , then the number of sides of the polygon is (a) 14 (b) 12
 (c) 15 (d) 16

219. If the ratio of an external angle and an internal angle of a regular polygon is $1 : 17$, then the number of sides of the regular polygon is
 (a) 20 (b) 18
 (c) 36 (d) 12

220. ABCD is a cyclic quadrilateral. The side AB is extended to E in such a way that $BE = BC$. If $\angle ADC = 70^\circ, \angle BAD = 95^\circ$, then $\angle DCE$ is equal to

(a) 140° (b) 120°
 (c) 165° (d) 110°

In a cyclic quadrilateral $\angle A + \angle C = \angle B + \angle D = ?$



(a) 270°
 (b) 360°
 (c) 90° (d) 180°

221. If ABCD be a cyclic quadrilateral in which $\angle A = 4x^\circ, \angle B = 7x^\circ, \angle C = 5y^\circ, \angle D = y^\circ$, then $x:y$ is
 (a) 3:4 (b) 4:3
 (c) 5:4 (d) 4:5

222. ABCD be a cyclic quadrilateral and AD in a diameter. If $\angle DAC = 55^\circ$ then the value of $\angle ABC$ is
 (a) 55° (b) 35°
 (c) 145° (d) 125°

The angle subtended by a chord at its center is 60, then ratio between chord and radius is (a) 1 : 2 (b) 1 : 1
 (c) $\sqrt{2}:1$ (d) 2 : 1

223. Each of the circles of equal radii with centers A and B pass through the center of one another circle they cut at C and D then $\angle DBC$ is equal to
 (a) 60° (b) 100°
 (c) 120° (d) 140°

224. For a triangle circumcenter lies on one of its sides. The triangle is
 (a) right angled (b) obtused angled
 (c) isosceles (d) equilateral

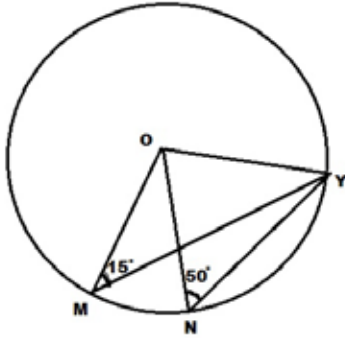
225. The three equal circles touch each other externally, if the centers of these circles are A, B, C, then ABC is
 (a) a right angle triangle (b) an equilateral triangle
 (c) an isosceles triangle (d) a Scalene triangle

226. "O" is the center of the circle, AB is a chord of the circle, $OM \perp AB$. If $AB = 20$ cm, $OM = 2\sqrt{11}$ cm, then radius of the circle is
 (a) 15 cm (b) 12 cm
 (c) 10 cm (d) 11 cm

227. In ΔABC , $\angle ABC = 70^\circ, \angle BCA = 40^\circ$, O is the point of intersection of the perpendicular bisectors of the sides, then the angle $\angle BOC$ is
 (a) 100° (b) 120°
 (c) 130° (d) 140°

228. A, B, C are three points on the circumference of a circle and if $AB = AC = 5\sqrt{2}$ cm and $\angle BAC = 90^\circ$, find the radius
 (a) 10 cm (b) 5 cm
 (c) 20 cm (d) 15 cm

229. In the given figure, $\angle ONY = 50^\circ$ and $\angle OMY = 15^\circ$. Then the value of the $\angle MON$ is

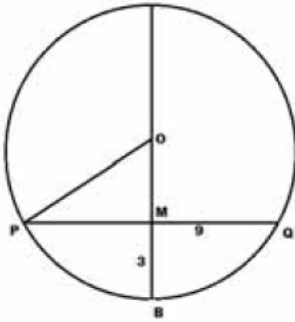


- (a) 30° (b) 40°
(c) 20° (d) 70°
230. Two chords of lengths a meter and b meter subtend angles 60° and 90° at the center of the circle respectively. Which of the following is true?
(a) $b = \sqrt{2}a$ (b) $a = \sqrt{2}b$
(c) $a = 2b$ (d) $b = 2a$
231. Two chords AB and CD of a circle with center O, intersect each other at P. If $\angle AOD = 100^\circ$ and $\angle BOC = 70^\circ$, then the value of $\angle APC$ is
(a) 80° (b) 75°
(c) 85° (d) 95°
232. Chords AC and BD of a circle with center O intersect at right angles at E. If $\angle OAB = 25^\circ$, then the value of $\angle EBC$ is
(a) 30° (b) 25°
(c) 20° (d) 15°
233. Two circles touch externally at P. QR is a common tangent of the circles touching the circles at Q and R. Then measure of a $\angle QPR$ is
(a) 120° (b) 60°
(c) 90° (d) 45°
234. Two circles intersect each other at the points A and B. A straight line parallel to AB intersects the circles at C, D, E and F. If $CD = 4.5$ cm, then the measure of EF is
(a) 1.50 cm (b) 2.25 cm
(c) 4.50 cm (d) 2.00 cm
235. Two circles C_1 and C_2 touch each other internally at P. Two lines in PCA and PDB meet the circle C_1 in C, D and C_2 in AB respectively, if $\angle BDC = 120^\circ$ then the value of $\angle ABP$ is equal to
(a) 60° (b) 80°
(c) 100° (d) 120°
236. Two circles having radii r units intersect each other in such a way that each of them passes through the center of the other. Then the length of their common chord is (a) $\sqrt{2}r$ units (b) $\sqrt{3}r$ units
(c) $\sqrt{5}r$ units (d) r units
237. Two circles with centers A and B of radii 5 cm and 3 cm respectively touch each other internally. If the perpendicular bisector of AB meets the bigger circle in P and Q, then the value of PQ is
(a) $\sqrt{6}$ cm (b) $2\sqrt{6}$ cm
(c) $3\sqrt{6}$ cm (d) $4\sqrt{6}$ cm
238. The length of a tangent from external point to a circle is $5\sqrt{3}$ unit. If radius of the circle is 5 units, then the distance of the point from the circle is
(a) 5 units (b) 15 units
(c) -5 units (d) -15 units
239. Two circles of radii 7 cm and 2 cm their centers being 13 cm apart. then the length of direct common tangent to the circles between the points of contact is
(a) 12 cm (b) 15 cm
(c) 10 cm (d) 5 cm
240. The radius of a circle is 6 cm. The distance of a point lying outside the circle from the center is 10 cm. The length of the tangent drawn from the outside point to the circle is
(a) 5 cm (b) 6 cm
(c) 7 cm (d) 8 cm
241. DE is a tangent to the circumcircle of $\triangle ABC$ at the vertex A such that $DE \parallel BC$. If $AB = 17$ cm, then the length of AC is equal to
(a) 16.0 cm (b) 16.8 cm
(c) 17.3 cm (d) 17 cm
242. The distance between the centers of two circles with radii 9 cm and 16 cm is 25 cm. The length of the segment of the tangent between them is
(a) 24 cm (b) 25 cm
(c) $50/3$ cm (d) 12 cm
243. ST is a tangent to the circle at P and QR is a diameter of the circle. $\angle RPT = 50^\circ$, then the value of $\angle SPQ$ is
(a) 40° (b) 60°
(c) 80° (d) 100°
244. If PA and PB are two tangents to a circle with center O such that $\angle AOB = 110^\circ$, then $\angle APB$ is
(a) 90° (b) 70°
(c) 60° (d) 55°
245. ABC is an equilateral triangle and O is its circumcenter, then the $\angle BOC$ is
(a) 100° (b) 110°
(c) 120° (d) 130°
246. If the angles of a triangle ABC are in the ratio 2: 3: 1, then the angles $\angle A$, $\angle B$ and $\angle C$ are
(a) $\angle A = 60^\circ$, $\angle B = 90^\circ$, $\angle C = 30^\circ$ (b) $\angle A = 40^\circ$, $\angle B = 120^\circ$, $\angle C = 20^\circ$
(c) $\angle A = 20^\circ$, $\angle B = 60^\circ$, $\angle C = 60^\circ$ (d) $\angle A = 45^\circ$, $\angle B = 90^\circ$, $\angle C = 45^\circ$
247. In a $\triangle ABC$, $\angle A + \angle B = 118^\circ$, $\angle A + \angle C = 96^\circ$, Find the value of $\angle A$.
(a) 36° (b) 40°
(c) 30° (d) 34°
248. In $\triangle ABC$, if $AD \perp BC$, then $AB^2 + CD^2$ is equal
(a) $2BD^2$ (b) $BD^2 + AC^2$
(c) $2AC^2$ (d) None of these
249. $\angle A + \frac{1}{2}(\angle B) + \angle C = 140^\circ$, then $\angle B$ is
(a) 50° (b) 80°
(c) 40° (d) 60°
250. In triangle ABC a straight line parallel to BC intersects AB and AC at D and E respectively, If $AB = 2AD$, then $DE : BC$ is
(a) 2 : 3 (b) 2 : 1
(c) 1 : 2 (d) 1 : 3

251. In a ΔABC , D and E are two points on AB and AC respectively such that $DE \parallel BC$. DE bisects the ΔABC in two equal areas. Then the ratio $BD : AB$ is
 (a) $1 : \sqrt{2}$ (b) $1 : 2$
 (c) $(\sqrt{2} - 1) : \sqrt{2}$ (d) $\sqrt{2} : 1$
252. In a ΔABC , If $2\angle A = 3\angle B = 6\angle C$, value of $\angle B$ is
 (a) 60° (b) 30°
 (c) 45° (d) 90°
253. If in a triangle ABC, D and E are on the sides AB and AC, such that DE is parallel to BC and $AD/BD = 3/5$. If $AC = 4$ cm, then AE is
 (a) 1.5 cm (b) 2.0 cm
 (c) 1.8 cm (d) 2.4 cm
254. The measure of the angle between the internal and external bisectors of an angle is
 (a) 60° (b) 70°
 (c) 80° (d) 90°
255. The internal bisectors of the angles B and C of a triangle ABC meet at I. If $\angle BIC = \angle A/2 + X$ then X is equal to
 (a) 60° (b) 30°
 (c) 90° (d) 45°
256. A tree of height 'h' meters is broken by a storm in such a way that its top touches the ground at a distance of 'x' meters from its foot. Find the height at which the tree is broken. (Here $h > x$)
 (a) $(h^2+x^2)/2h$ meter (b) $(h^2-x^2)/2h$ meter
 (c) $(h^2+x^2)/4h$ meter (d) $(h^2-x^2)/4h$ meter
257. The side BC of triangle ABC is extended to D. If $\angle ACD = 120^\circ$ and $\angle ABC = \frac{1}{2}(\angle CAB)$, then the value of $\angle ABC$ is
 (a) 30° (b) 40°
 (c) 60° (d) 20°
258. In ΔABC , D is the mid-point of BC. Length AD is 27 cm. N is a point in AD such that the length of DN is 12 cm. The distance of N from the centroid of ΔABC is equal to
 (a) 3 cm (b) 6 cm
 (c) 9 cm (d) 15 cm
259. Internal bisectors of $\angle Q$ and $\angle R$ of ΔPQR intersect at O. If $\angle ROQ = 96^\circ$ then the value of $\angle RPQ$ is :
 (a) 12 (b) 24
 (c) 36 (d) 6
260. If D, E and F are the mid point of BC, CA and AB respectively of the ΔABC . The ratio of area of the parallelogram DEFE and area of the trapezium CAFD is:
 (a) 1 : 2 (b) 3 : 4
 (c) 3 : 3 (d) 2 : 3
261. If the measure of three angles of a triangle are in the ratio 2 : 3 : 5 then the triangle is :
 (a) obtuse angle (अधिक कोण त्रिभुज) (b) Equilateral (समबाहु त्रिभुज)
 (c) right angled (समकोण त्रिभुज) (d) isosceles समद्विबाहु
262. If the three angles of a triangle are : $(x+15)^\circ$, $((6x/5)+6)^\circ$ and $((2x/3)+30)^\circ$ then the triangle is :
 (a) isosceles (b) equilateral
 (c) right angled (d) scalene
263. G is the centroid of ΔABC . The medians AD and BE intersect at right angles. If the lengths of AD and BE are 9 cm and 12 cm respectively then the length of AB (in cm) is?
 (a) 11 (b) 10
 (c) 10.5 (d) 9.5
264. Among the equations $x + 2y + 9 = 0$; $5x - 4 = 0$; $2y - 13 = 0$; $2x - 3y = 0$, The equation of the straight line passing through origin is:
 (a) $2y - 13 = 0$ (b) $x + 2y + 9 = 0$
 (c) $2x - 3y = 0$ (d) $5x - 4 = 0$
265. The area of the triangle formed by the graphs of the equations $x = 0$, $2x + 3y = 6$ and $x + y = 3$ is;
 (a) 1 sq. unit (b) 3 sq. units
 (c) $9/2$ sq. units (d) $3/2$ sq. units
266. In ΔABC , D and E are two mid points of sides AB and AC respectively. If $\angle BAC = 60^\circ$ and $\angle ABC = 65^\circ$ then $\angle CED$ is:
 (a) 125° (b) 75°
 (c) 105° (d) 130°
267. Given that : $\Delta ABC \sim \Delta PQR$, $(\text{area } \Delta PQR) / (\text{area } \Delta ABC) = 256/441$ and $PR = 12$ cm, then AC is equal to?
 (a) $12\sqrt{2}$ cm (b) 15.5 cm
 (c) 16 cm (d) 15.75 cm
268. The internal angle bisectors of the $\angle B$ and $\angle C$ of the ΔABC intersect at O, If $\angle A = 100^\circ$, then the measure of $\angle BOC$ is:
 (a) 110° (b) 140° (c) 130° (d) 120°
269. O is the Incenter of ΔPQR and $\angle QOR = 50^\circ$, then the measure of $\angle QOR$ is
 (a) 125° (b) 100°
 (c) 130° (d) 115°
270. O is the circumcenter of ΔABC . If $\angle BAC = 85^\circ$, $\angle BCA = 75^\circ$, the $\angle OAC$ is equal to:
 (a) 70° (b) 60°
 (c) 50° (d) 40°
271. AC is a transverse common tangent to two circle with centers P and Q and radii 6 cm and 3 cm at the point A and C respectively. If AC cuts PQ at the point B and $AB = 8$ cm, then the length of PQ is:
 (a) 12 cm (b) 15 cm
 (c) 13 cm (d) 10 cm
272. AB and CD are two parallel chords of a circle lying on the opposite side of the center and the distance between them is 17 cm. The length of AB and CD are 10 cm 24 cm respectively. The radius (in cm) of the circle is:
 (a) 13 (b) 18
 (c) 9 (d) 15
273. ABCD is a cyclic quadrilateral. Diagonals AC and BD meet at P. If $\angle APB = 110^\circ$ and $\angle CBD = 30^\circ$, then $\angle ADB$ measures:
 (a) 70° (b) 55°

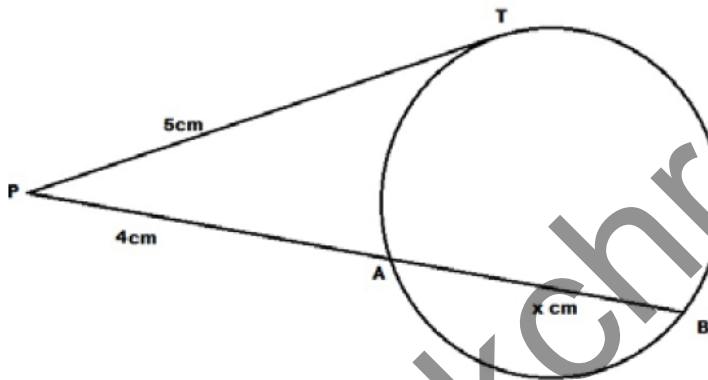
- (c) 30° (d) 80°
274. The area of the triangle formed by the graphs of the equations $x = 4$, $y = 3$ and $3x + 4y = 12$ is:
 (a) 6 sq. units (b) 4 sq. units
 (c) 3 sq. units (d) 12 sq. units
275. If a clock started at noon, then the angle turned by hour hand at 3:45 PM is:
 (a) $209/2^\circ$ (b) $95/2^\circ$
 (c) $225/2^\circ$ (d) $235/2^\circ$
276. In ΔABC , a line through A cuts the side BC at D such that $BD:DC = 4:5$ if the area of $\Delta ABD = 60\text{cm}^2$ then the area of ΔADC is: गुना है?
 (a) 50cm^2 (b) 60cm^2
 (c) 75cm^2 (d) 90cm^2
277. The measure of an angle whose supplement is three times as large as its complement, is
 (a) 30° (b) 45°
 (c) 60° (d) 75°
278. A tangent is drawn to a circle of radius 6 cm from a point situated at a distance of 10 cm from the center of the circle. The length of tangent will be
 (a) 4 cm (b) 5 cm
 (c) 8 cm (d) 7 cm
279. A square is inscribed in a quarter circle in such a manner that two of its adjacent vertices lie on the two radii at an equal distance from the center, while the other two vertices lie on the circular arc. If the square has sides of length x, then the radius of the circle is:
 (a) $16x/(\pi + 4)$ (b) $2x/\sqrt{x}$
 (c) $\sqrt{5x}/\sqrt{2}$ (d) $\sqrt{2x}$
280. Two chords of length a unit and b unit of a circle make angles 60° and 90° at the center of a circle respectively, then the correct relation is:
 (a) $b = \sqrt{2}a$ (b) $b = 2a$
 (c) $b = \sqrt{3}a$ (d) $b = 3/2a$
281. The measures of two angles of a triangle is in the ratio 4 : 5. If the sum of these two measures is equal to the measure of the third angle. Find the smallest angle.
 (a) 90° (b) 50°
 (c) 10° (d) 40°
282. ABC is a triangle and the sides AB, BC and CA are produced to E, F and G respectively. If $\angle CBE = \angle ACF = 130^\circ$, then the value of $\angle GAB$ is:
 (a) 100° (b) 80°
 (c) 130° (d) 90°
283. If two medians BE and CF of a triangle ABC, intersect each other at G and if $BG = CG$, $\angle BGC = 60^\circ$, $BC = 8$ cm then area of the triangle ABC is:
 (a) $96\sqrt{3}\text{cm}^2$ (b) $43\sqrt{3}\text{cm}^2$
 (c) 48cm^2 (d) $54\sqrt{3}\text{cm}^2$
284. Internal bisectors of $\angle Q$ and $\angle R$ of ΔPOR intersect at O. If $\angle ROQ = 96^\circ$ then the value of $\angle RPQ$ is :
 (a) 12° (b) 24°
 (c) 36° (d) 6°
285. ABC is a cyclic triangle and the bisectors of $\angle BAC$, $\angle ABC$ and $\angle BCA$ meet the circle at P, Q and R respectively. Then the angle $\angle RPQ$ is :
 (a) $90^\circ - (B/2)$ (b) $90^\circ + (C/2)$
 (c) $90^\circ - (A/2)$ (d) $90^\circ + (B/2)$
286. The ratio of each interior angle to each exterior angle of a regular polygon is 3:1. The number of sides of the polygon is:
 (a) 6 (b) 7
 (c) 8 (d) 9
287. Two circles touch externally. the sum of their areas is 130cm^2 and the distance between their centers is 14 cm. the radius of the smaller circle is :
 (a) 2cm (b) 3cm
 (c) 4cm (d) 5cm
288. XY and XZ are tangents to a circle. ST is another tangent to the circle at the point R on the circle which intersects XY and XZ at S and T respectively, If $XY = 9$ cm and $TX = 15$ cm, then RT is :
 (a) 4.5 cm. (b) 3 cm
 (c) 7.5 cm (d) 6 cm
289. In a rhombus ABCD, $\angle A = 60^\circ$ and $AB = 12$ cm, Then the diagonal BD is
 (a) $2\sqrt{3}$ cm (b) 6 cm
 (c) 12 cm (d) 10 cm
290. If PQRS is a rhombus and $\angle SPQ = 50^\circ$, then $\angle RSQ$ is:
 (a) 75° (b) 45°
 (c) 55° (d) 65°
291. Two isosceles triangles have equal vertical angles and their areas are in the ratio 9 : 16. Then the ratio of their corresponding heights is
 (a) 4.5:8 (b) 3:4
 (c) 4:3 (d) 8:4.5
292. The perimeter of two similar triangles are 30cm and 20cm respectively. If one side of the first triangle is, 9 cm. Determine the corresponding side of the second triangle.
 (a) 15 cm (b) 6 cm
 (c) 13.5 cm (d) 5 cm
293. If in a triangle ABC, BE and CF are two medians perpendicular to each other and if $AB = 19$ cm and $AC = 22$ cm then the length of BC is
 (a) 20.5 cm (b) 19.5 cm
 (c) 26cm (d) 13cm
294. 'O' is the circumcenter of triangle ABC. If $\angle BAC = 50^\circ$ then $\angle OBC$ is
 (a) 100° (b) 130°
 (c) 40° (d) 50°
295. Two circles of radii 10 cm and 8 cm intersect and the length of the common chord is 12 cm, Then the distance between their centers is :
 (a) 13.3 (b) 15
 (c) 10 (d) 8
296. The diagonal of a quadrilateral shaped field is 24m and the perpendiculars dropped on it from the remaining opposite vertices are 8 m and 13 m. The area of the field is?
 (a) 252m^2 (b) 1152m^2
 (c) 96m^2 (d) 156m^2
297. The angle between the graph of the linear equation $239x - 239y + 5 = 0$ and the x-axis is (a) 30° (b) 0° (c) 45° (d) 60°

298. In a given circle, the chord PQ is of length 18 cm. AB is the perpendicular bisector of PQ at M. If MB = 3. find



the length of AB

299. (a) 25 cm (b) 30 cm
(c) 28 cm (d) 27 cm
300. The chord of a circle is equal to its radius. The angle subtended by this chord at the minor arc of the circle is
301. (a) 150° (b) 60° (c) 75° (d) 120°
302. In the given figure, PAB is a secant and PT is a tangent to the circle from P. If $PT = 5$ cm and $PA = 4$ cm and $AB = x$ cm then x .



- (a) $4/9$ cm (b) $2/3$ cm
(c) $9/4$ cm (d) 5 cm
303. Two circles with their center at O and P and radii 8 cm and 4 cm respectively touch each other externally. The length of their common tangent is
(a) 8 cm (b) 8.5 cm
(c) $8\sqrt{2}$ cm (d) $8\sqrt{3}$ cm
304. Two circles of diameters 10 cm and 6 cm have the same center. A chord of the larger circle is a tangent of the smaller one. The length of the chord is
(a) 8 cm (b) 10 cm
(c) 6 cm (d) 4 cm
305. The centroid of a ΔABC is G. The area of ΔABC is 60 cm^2 . The area of ΔGBC is
(a) 30 cm^2 (b) 40 cm^2
(c) 10 cm^2 (d) 20 cm^2
306. In trapezium ABCD, $AB \parallel CD$ and $AB = 2$ CD is diagonals intersect at O. if the area of $\Delta AOB = 84$ cm^2 then the area of ΔCOD is equal to
(a) 21 cm^2 (b) 72 cm^2
(c) 42 cm^2 (d) 26 cm^2
307. If O is the Circumcenter of a triangle ABC lying inside the triangle, the $\angle OBC + \angle BAC$ is equal to
(a) 120° (b) 110°
(c) 90° (d) 60°
308. AD is perpendicular to the internal bisector of $\angle ABC$ of ΔABC . DE is drawn through D and parallel to BC to meet AC at E. If the length of AC is 12 cm, then the length of AE (in cm.) is
(a) 8 (b) 3
(c) 4 (d) 6
309. The interior angle of regular polygon exceeds its exterior angle by 108° . The number of sides of the polygon is
(a) 10 (b) 14
(c) 12 (d) 16
310. quadrilateral ABCD is circumscribe about a circle. If the lengths of AB, BC, CD are 7 cm, 8.5 cm and 9.2 cm respectively, then the length (in cm) of DA is
(a) 16.2 (b) 7.7
(c) 10.2 (d) 7.2
311. Given that the ratio of altitudes of two triangles is 4:5, ratio of their areas is 3 : 2, The ratio of their corresponding bases is
(a) 5: 8 (b) 15: 8
(c) 8 : 5 (d) 8: 15
312. In ΔABC , $\angle BAC = 90^\circ$ and $AD \perp BC$. If $BD = 3$ cm and $CD = 4$ cm, then length of AD is
(a) $2\sqrt{3}$ cm (b) 3.5 cm
(c) 6 cm (d) 5 cm
313. A and B are centers of two circles of radii 11 cm and 6 cm, respectively, PQ is a direct common tangent to the circle. If $AB = 13$ cm, then length of PQ will be
(a) 12 cm (b) 13 cm
(c) 8.5 cm (d) 17 cm
314. In triangle ABC, $DE \parallel BC$ where D is a point on AB and E is point on AC. DE divides the area of ΔABC into two equal parts. Then $DB : AB$ is equal to
(a) $\sqrt{2} : (\sqrt{2} + 1)$ (b) $(\sqrt{2} - 1) : \sqrt{2}$
(c) $\sqrt{2} : (\sqrt{2} - 1)$ (d) $(\sqrt{2} + 1) : \sqrt{2}$
315. ABCD is a cyclic quadrilateral. AB and DC when produced meet at P, if $PA = 8$ cm, $PB = 6$, $PC = 4$ cm, then the length (in cm) of PD is
(a) 10 cm (b) 6 cm
(c) 12 cm (d) 8 cm
316. ABC is a triangle in which $DE \parallel BC$ and $AD : DB = 5 : 4$. Then $DE : BC$ is
(a) 4: 5 (b) 9 : 5
(c) 4: 9 (d) 5: 9
317. The radii of two concentric circles are 17 cm and 25 cm, a straight line PQRS intersects the larger circle at the points P and S and intersects the smaller circle at the points Q and R. If $QR = 16$ cm, then the length (in cm.) of PS is
(a) 41 (b) 33
(c) 32 (d) 40
318. AB is a diameter of a circle with center O. the tangents at C meets AB produced at Q. if $\angle CAB = 34^\circ$, then the measure of $\angle CBA$ is
(a) 56° (b) 68°
(c) 34° (d) 124°

319. For an equilateral triangle, the ratio of the in-radius and the outer radius is
 (a) 1:2 (b) 1:3
 (c) $1:\sqrt{2}$ (d) $1:\sqrt{3}$
320. If a and b are the lengths of the sides of a right triangle whose hypotenuse is 10 and whose area is 20, then the value of $(a + b)^2$ is
 (a) 140 (b) 120
 (c) 180 (d) 160
321. Let P and Q be two points on a circle with center O. If two tangents of the circle through P and Q meet at A with $\angle PAQ = 48^\circ$, then $\angle APQ$ is
 (a) 96° (b) 66°
 (c) 48° (d) 60°
322. If the sides of a triangle are in the ratio $3:5/4:13/4$, then the triangle is
 (a) right triangle (b) isosceles triangle
 (c) obtuse triangle (d) Acute triangle
323. If the ratio of the angles of a quadrilateral is $2:7:2:7$, then it is a
 (a) trapezium (b) square
 (c) parallelogram (d) rhombus
324. The length of two parallel chords of a circle of radius 5 cm are 6 cm and 8 cm in the same side of the center. The distance between them is
 (a) 1 cm (b) 2 cm
 (c) 3 cm (d) 1.5 cm
325. AB is a diameter of a circle having center at O. P is a point on the circumference of the circle. If $\angle POA = 120^\circ$, then measure of $\angle PBO$ is
 (a) 75° (b) 60°
 (c) 68° (d) 70°
326. If the angles of a triangle are in the ratio $2:3:5$ then the measure of the least angle of the triangle is
 (a) 20° (b) 90°
 (c) 18° (d) 36°
327. ABC is a triangle in which $\angle A = 90^\circ$. Let P be any point on side AC. If $BC = 10$ cm, $AC = 8$ cm and $BP = 9$ cm, then $AP =$
 (a) $2\sqrt{5}$ cm (b) $3\sqrt{5}$ cm
 (c) $2\sqrt{3}$ cm (d) $3\sqrt{3}$ cm
328. ABCD is a cyclic quadrilateral, AB is the diameter of the circle. If $\angle ACD = 50^\circ$, measure the $\angle BAD$ is
 (a) 130° (b) 40°
 (c) 50° (d) 140°
329. BE, CF are the two medians of ΔABC and G is their point of intersection. EF cuts AG at O. ratio of $AO:OG$ is equal to
 (a) 3 : 1 (b) 1:2
 (c) 2 : 3 (d) 1 : 3
330. AB is the diameter of the circle with center O. P be a point on it. If $\angle POA = 120^\circ$. then $\angle PBO = ?$
 (a) 60° (b) 50°
 (c) 120° (d) 45°
331. A circle touches the four sides of a quadrilateral ABCD. The value of $\frac{AB+CD}{CB+DA}$ is equal to
 (a) $1/3$ (b) 1
 (c) $1/4$ (d) $1/2$
332. D and E are mid-points of sides AB and AC respectively of the ΔABC . A line drawn from A meets BC at H and DE at K. $AK : KH = ?$
 (a) 2 : 1 (b) 1 : 1
 (c) 1 : 3 (d) 1 : 2
333. Let ABC be an equilateral triangle and AD perpendicular to BC, Then $AB^2 + BC^2 + CA^2 = ?$
 (a) $3AD^2$ (b) $5AD^2$
 (c) $2AD^2$ (d) $4AD^2$
334. AB and AC are tangents to a circle with center O, A is the external point of the circle. The line AO intersect the chord BC at D. The measure of the $\angle BDO$ is:
 (a) 45° (b) 75°
 (c) 90° (d) 60°
335. In ΔABC , the external bisectors of the angles $\angle B$ and $\angle C$ meet at the point o. If $\angle A = 70^\circ$, then the measure of $\angle BOC$ is: (a) 75° (b) 50° (c) 55° (d) 60°
336. ABCD is a cyclic Trapezium whose sides AD and BC are parallel to each other; if $\angle ABC = 75^\circ$ then the measure of $\angle BCD$ is (a) 75° (b) 95° (c) 45° (d) 105°
337. The distance between the centers of two circles of radii 6 cm and 3 cm is 15 cm. The length of the transverse common tangent to the circle is (a) $7\sqrt{6}$ cm (b) 12 cm
 (c) $6\sqrt{6}$ cm (d) 18 cm
338. $\angle A$ of ΔABC is a right angle, AD is perpendicular on BC. If $BC = 14$ cm and $BD = 5$ cm, then measure of AD is:
 (a) $\sqrt{5}$ cm (b) $3\sqrt{5}$ cm
 (c) $3.5\sqrt{5}$ cm (d) $2\sqrt{5}$ cm
339. In a circle with center at O and radius 5 cm, AB is a chord of length 8 cm. if OM is perpendicular to AB then, the length of OM is:
 (a) 3 cm (b) 4 cm
 (c) 1 cm (d) 2.5 cm
340. In ΔABC , $AD \perp BC$ and $AD^2 = BD \cdot DC$ the measure of $\angle BAC$ is:
 (a) 75° (b) 90°
 (c) 45° (d) 60°
341. Let $AX \perp BC$ of an equilateral triangle ABC. Then the sum of the perpendicular distances of the sides of ΔABC from any point inside the triangle is
 (a) Greater than AX (b) Less than AX
 (c) Equal to BC (d) Equal to AX
342. The centroid of an equilateral triangles ABC is G and $AB = 10$ cm. The length of AG (in Cm) is:
 (a) $\sqrt{3}/3$ (b) $10/3$
 (c) $10\sqrt{3}/3$ (d) $10\sqrt{3}$
343. AB is a diameter of a circle having center at O. PQ is a chord which does not intersect AB. Join AP and BQ. If $\angle PAB = \angle ABQ$, then ABQP is a:
 (a) Cyclic rhombus (b) Cyclic rectangle
 (c) cyclic trapezium (d) cyclic square
344. In ΔABC , the internal bisectors of $\angle B$ and $\angle C$ meet at point O. If $\angle A = 80^\circ$ then $\angle BOC$ is of:
 (a) 120° (b) 140°
 (c) 130° (d) 100°
345. The distance between centers of two circles of radii 3 cm and 8 cm is 13 cm. If the points of contact of a

direct common tangent the circles are P and Q, then the length of the line segment PQ is:

- (a) 11.9cm (b) 12 cm
- (c) 11.5 cm (d) 11.58 cm

346. AB and AC are two chords of a circle. The tangents at B and C meet at P. If $\angle BAC = 54^\circ$, then the measure of $\angle BPC$ is

- (a) 54° (b) 108°
- (c) 72° (d) 36°

347. The length of the diagonal BD of the parallelogram ABCD is 12 cm. P and Q are the centroids of the $\triangle ABC$ and $\triangle ADC$ respectively. The length (in cm) of the line segment PQ is

- (a) 4 (b) 6
- (c) 3 (d) 5

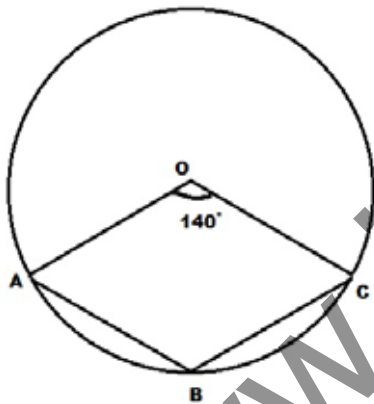
348. PQRS is a cyclic quadrilateral, such that ratio of measures of $\angle P$, $\angle Q$ and $\angle R$ is 1: 3:4 then the measure of $\angle S$ is

- (a) 72° (b) 36°
- (c) 108° (d) 144°

349. A chord of length 24cm is at distance of 5 cm from the center of a circle the length of the chord of the same circle which is at a distance of 12 cm from the center is

- (a) 17 cm (b) 12 cm
- (c) 10 cm (d) 11 cm

350. In the the adjoining figure $\angle AOC = 140^\circ$ where O is the center of the circle then $\angle ABC$ is equal to:

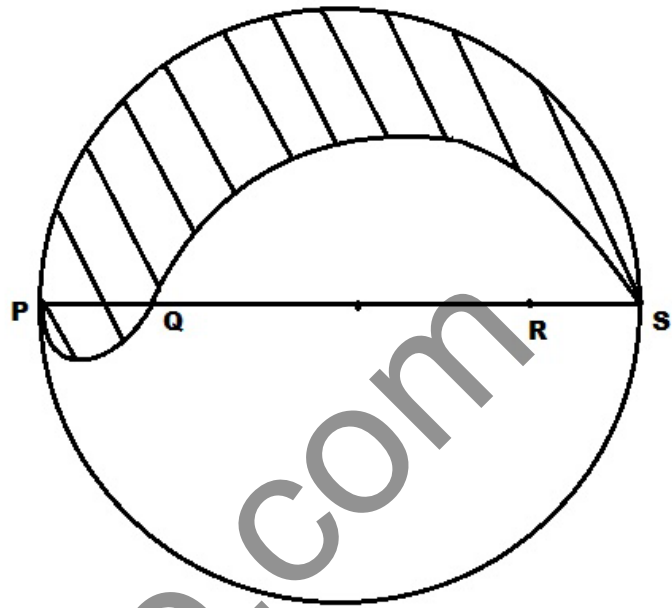


- (a) 90° (b) 110°
- (c) 100° (d) 40°

351. The ratio of in radius and circumradius of an equilateral triangle is:

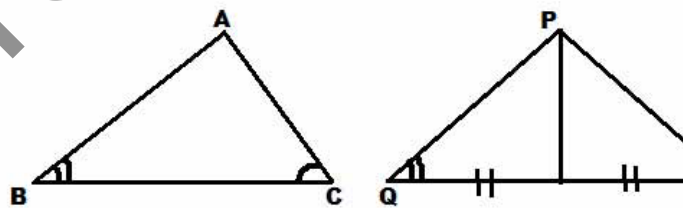
- (a) 1:2 (b) 2:1
- (c) $1:\sqrt{2}$ (d) $\sqrt{2}:1$

352. PS is a diameter of a circle of radius 6cm. in the diameter PS, Q and R are two points such that PQ, QR, RS are all equal. semicircle are drawn on PQ, QR and QS as diameter (as shown in the fig.) the perimeter of shaded portion is :



- (a) $528/7$ cm (b) $264/7$ cm
- (c) $1056/7$ cm (d) $132/7$ cm

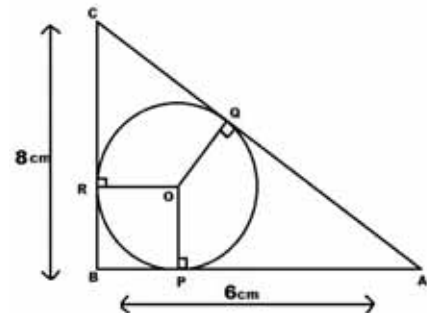
353. In $\triangle ABC$ and $\triangle PQR$, $\angle B = \angle Q$, $\angle C = \angle R$. M is the midpoint on QR, If $AB:PQ = 7:4$ area, then area ($\triangle ABC$)/area ($\triangle PMR$) is : 7 : 4,



- (a) $35/8$ (b) $35/16$
- (c) $49/16$ (d) $49/8$

354. In $\triangle ABC$, the line parallel to BC interest AB & AC at P & Q respectively. If $AB : AP = 5 : 3$, then $AQ : QC$ is: (a) 3 : 2 (b) 1 : 2 (c) 3 : 5 (d) 2:3

355. $\triangle ABC$ is right angled triangle with $AB = 6$ cm, $BC = 8$ cm. O is the in-center of the triangle. The radius of the



- incircle is:
- (a) 5 cm (b) 3 cm
 - (c) 2 cm (d) 4 cm

ANSWER :

1 b 2 b 3 c 4 c 5 a 6 b
 7 a 8 b 9 d 10 c 11 c 12 c
 13 b 14 a 15 b 16 a 17 b 18 b
 19 b 20 b 21 d 22 c 23 a 24 b
 25 c 26 d 27 a 28 a 29 d 30 a
 31 a 32 c 33 c 34 c 35 a 36 b
 37 d 38 c 39 c 40 c 41 b 42 c
 43 b 44 d 45 b 46 b 47 c 48 c
 49 b 50 c 51 d 52 b 53 b 54 b
 55 b 56 d 57 b 58 b 59 b 60 b
 61 d 62 c 63 d 64 a 65 d 66 b
 67 b 68 b 69 b 70 b 71 b 72 b
 73 a 74 d 75 a 76 b 77 a 78 a
 79 c 80 d 81 a 82 b 83 b 84 b
 85 b 86 c 87 b 88 b 89 a 90 b
 91 b 92 c 93 c 94 d 95 c 96 d
 97 d 98 b 99 c 100 b 101 b 102 b
 103 c 104 a 105 a 106 d 107 d 108 c
 109 b 110 c 111 b 112 c 113 b 114 a
 115 a 116 a 117 b 118 c 119 a 120 c
 121 c 122 a 123 a 124 a 125 d 126 a
 127 d 128 b 129 b 130 a 131 b 132 a
 133 c 134 b 135 a 136 b 137 c 138 c
 139 d 140 a 141 a 142 d 143 b 144 b
 145 d 146 b 147 b 148 d 149 d 150 d
 151 a 152 b 153 c 154 d 155 d 156 a
 157 d 158 b 159 a 160 c 161 c 162 b
 163 d 164 d 165 d 166 c 167 b 168 d
 169 b 170 a 171 d 172 d 173 b 174 d

175 d 176 c 177 d 178 d 179 c 180 d
 181 c 182 c 183 c 184 a 185 b 186 d
 187 d 188 c 189 c 190 b 191 d 192 c
 193 a 194 d 195 d 196 c 197 c 198 c
 199 a 200 a 201 d 202 b 203 b 204 a
 205 a 206 c 207 c 208 b 209 b 210 c
 211 b 212 b 213 a 214 c 215 a 216 d
 217 c 218 c 219 c 220 a 221 d 222 b
 223 b 224 b 225 c 226 a 227 b 228 b
 229 d 230 b 231 d 232 a 233 d 234 b
 235 c 236 c 237 a 238 b 239 d 240 a
 241 a 242 d 243 d 244 a 245 a 246 b
 247 c 248 a 249 d 250 b 251 b 252 c
 253 c 254 a 255 a 256 d 257 c 258 b
 259 b 260 a 261 a 262 d 263 c 264 b
 265 b 266 c 267 d 268 a 269 d 270 b
 271 d 272 a 273 b 274 a 275 d 276 a
 277 c 278 c 279 b 280 c 281 c 282 a
 283 d 284 a 285 b 286 a 287 a 288 c
 289 b 290 d 291 c 292 d 293 b 294 b
 295 d 296 c 297 a 298 a 299 c 300 b
 301 a 302 c 303 c 304 a 305 d 306 a
 307 c 308 d 309 a 310 b 311 b 312 a
 313 a 314 b 315 c 316 d 317 d 318 a
 319 a 320 c 321 b 322 a 323 c 324 a
 325 b 326 d 327 b 328 b 329 a 330 a
 331 b 332 b 333 d 334 c 335 c 336 a
 337 b 338 b 339 a 340 b 341 d 342 c
 343 c 344 c 345 b 346 c 347 a 348 a
 349 c 350 b 351 a 352 b 353 d 354 a
 355 c



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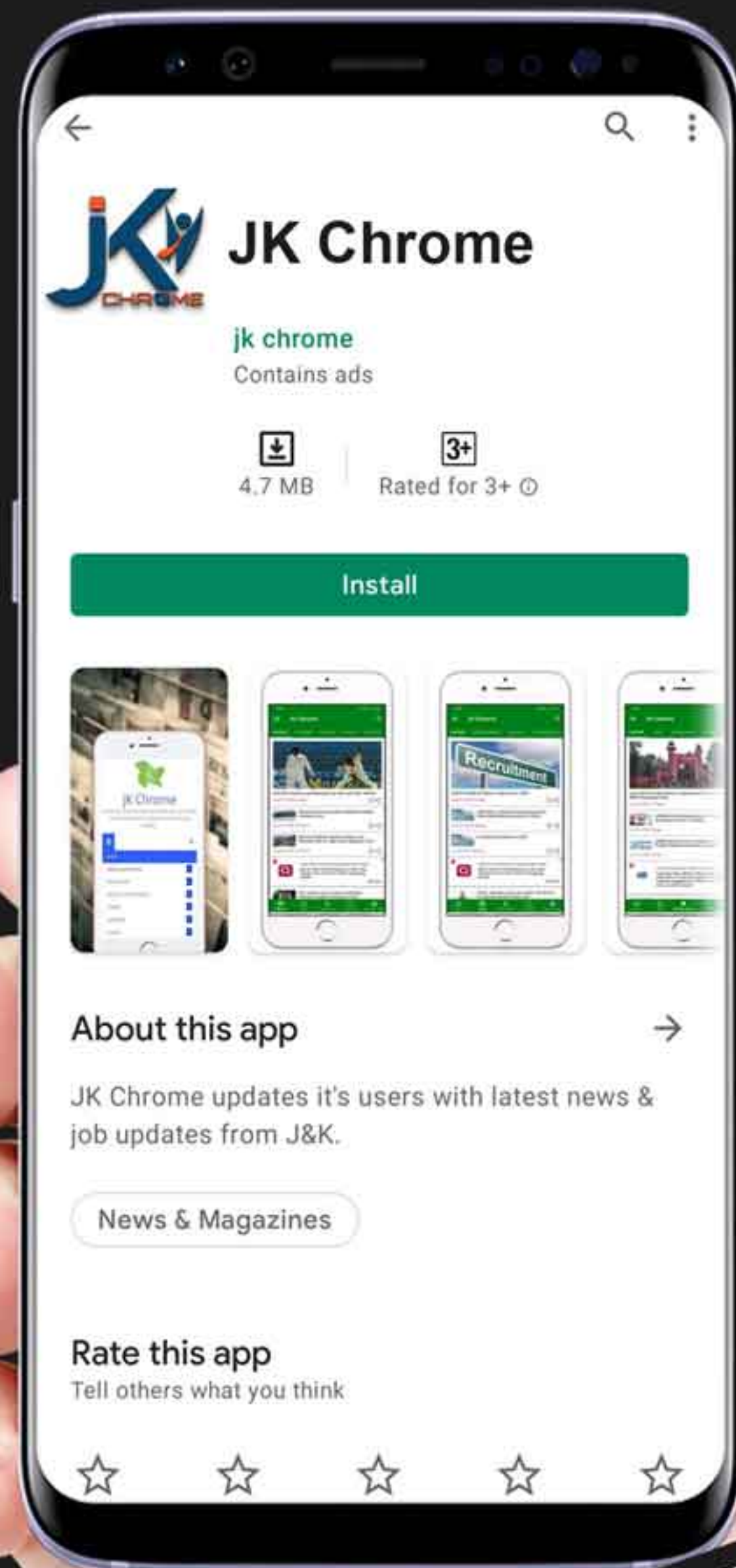
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