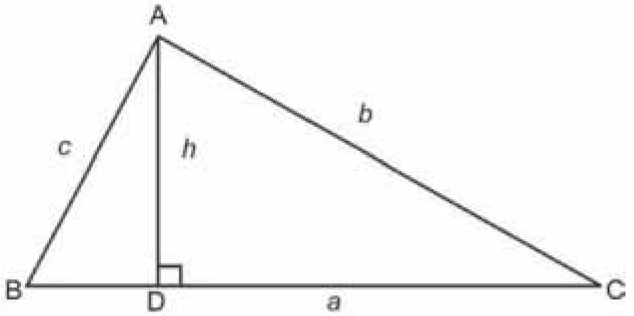
GEOMETRY

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,

Area = $\frac{1}{2}$ × BC × AD = $\frac{1}{2}$ a × 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 = 1/2 × base × 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 = $\left(\frac{1}{2}\right)$ × bc Sin A

Besides, there are some formulae that we use ex clusively 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 diff erent lengths is a scalene triangle.

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

S (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

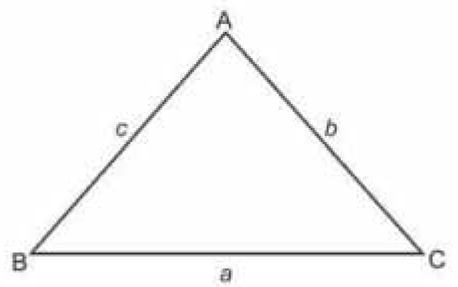
A triangle whose two sides are of equal length is an isosceles triangle.

Height = $\frac{\sqrt{4a^2-b_2}}{2}$

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.

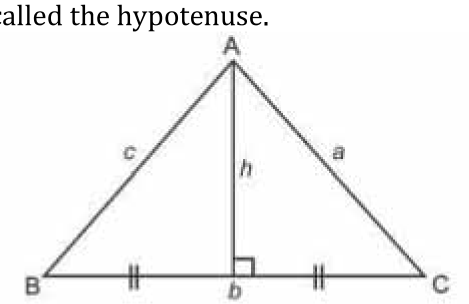
Height = (side) $\frac{\sqrt{3}}{2}$ = $\frac{\sqrt{3}}{2}$ a

Area = $\frac{\sqrt{3}}{2}$ (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.



Area = $\frac{1}{2}$ × base × 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.

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

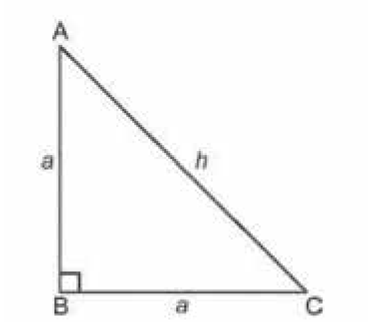
If one of the angles of the triangle is more than 90°, then the triangle is known as an obtuse angled triangle. Obviously, in this case, rest of the two angles will be less than 90°.

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 tri angle.



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

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

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

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

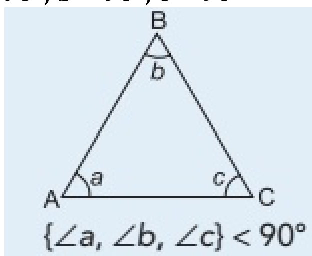
= Hypotenuse $(1+\sqrt{2})$

Summarizing the above Classification

(a) According to the measurement of angle

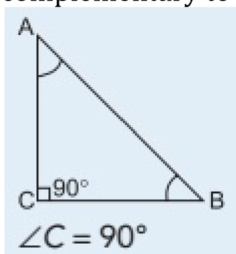
(i) Acute-angled triangle

Each angle of a triangle is less than 90°, that is a < 90°, b < 90°, c < 90°



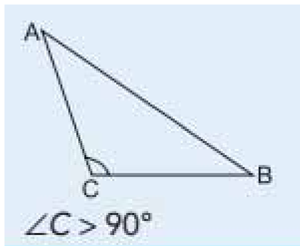
(ii)Right-angled triangle

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

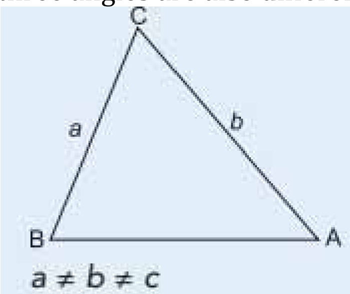
If one of the angles is obtuse (i.e., greater than 90°), then it is called an obtuse-angled triangle.



(b) According to the length of sides

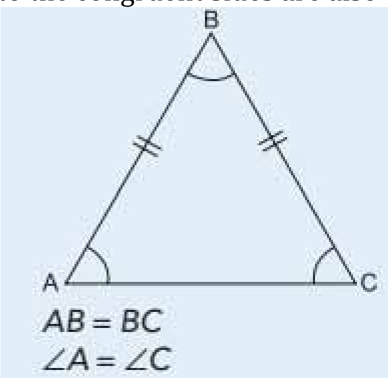
(i) Scalene triangle

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.



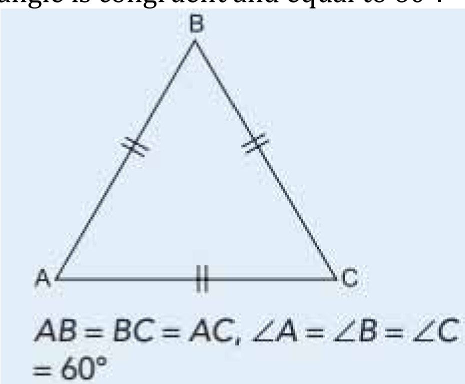
(ii)Isosceles triangle

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°.



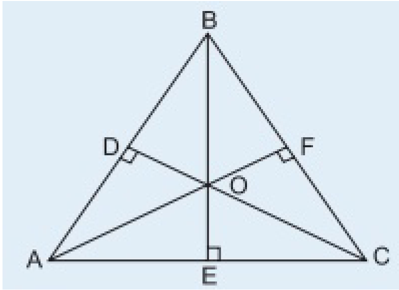
Points of a Triangle

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

Basic Definitions

(i) Altitude (or height)

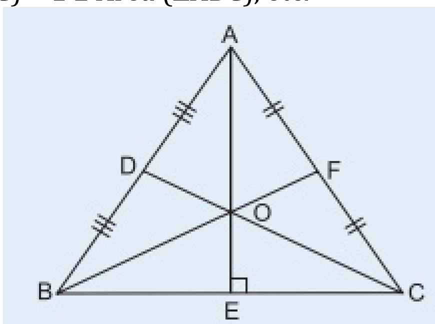
The perpendicular drawn from the opposite vertex of a side in a triangle is called an altitude of the triangle. There are three altitudes in a triangle.



AF, CD, and BE are the altitudes.

(ii) Median

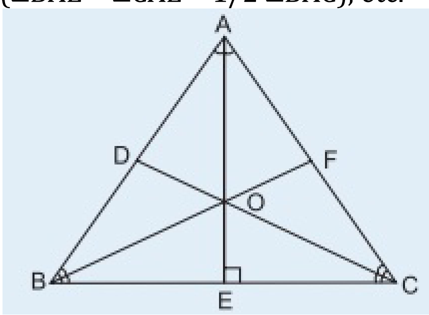
The line segment joining the mid-point of a side to the vertex opposite to the side is called a median. There are three medians in a triangle. A median bisects the area of the triangle. Area (ABE) = Area (AEC) = 1 2 Area (ΔABC), etc.



AE, CD, and BF are the medians.
(BE = CE = AD = BD = AF = CF)

(iii) Angle bisector

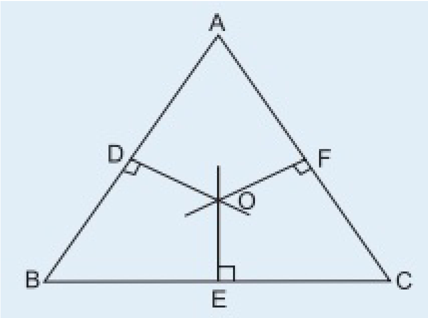
A line segment that originates from a vertex and bisects the same angle is called an angle bisector. (∠BAE = ∠CAE = 1/2 ∠BAC), etc.



AE, CD, and BF are the angle bisectors.

(iv) Perpendicular bisector

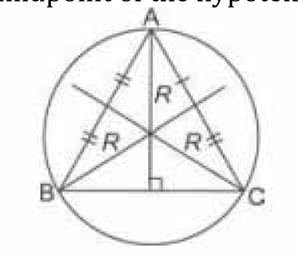
A line segment which bisects a side perpendicularly (i.e., at right angle) is called a perpendicular bisector of a side of triangle. All points on the perpendicular bisector of a line are equidistant from the ends of the line.



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 perpen dicular bisectors are diff erent 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.



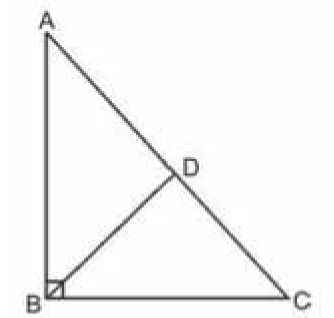
AB = c, BC = a, AC = b

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

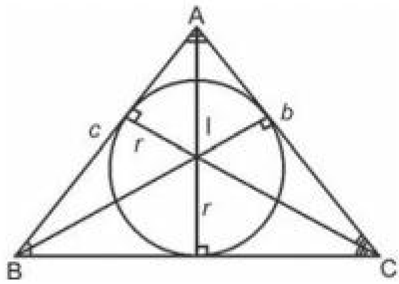
- If the triangle is acute-angled triangle, then the circumcentre will lie inside the triangle.
- If the triangle is obtuse-angled triangle, then the circumcentre will lie outside the triangle.
- If the triangle is a right-angled triangle, then the circumcentre will lie on the mid-point of the hypotenuse. 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 = $\frac{side}{2\sqrt{3}}$

$\angle BIC = 90° + \angle A/2$

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

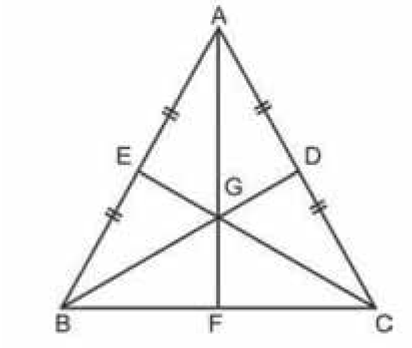
Euler's formula for inradius and circumradius of a triangle Let O and I be the circumcentre and incentre of a triangle with circumradius R and inradius r. Let d be the distance between O and I. Then

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

From this theorem, we obtain the inequality r ≥ 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.



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

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:

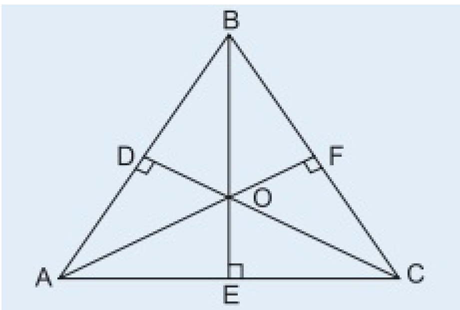
(i) Orthocentre

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

$\angle BOC = 190 - \angle A$

$\angle COA = 190 - \angle B$

$\angle AOB = 180 - \angle B$

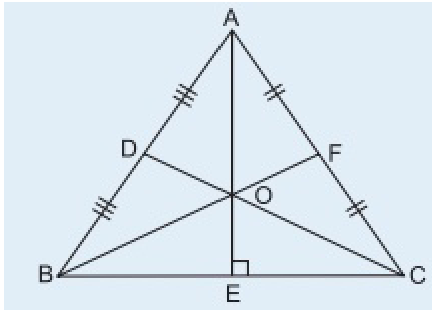


'O' is the orthocenter

(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)

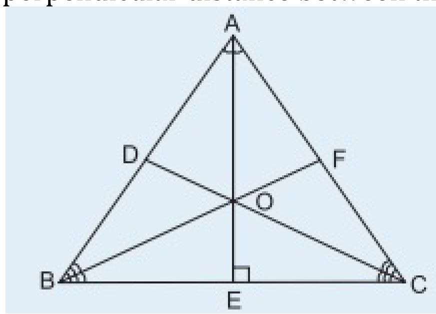
$$\frac{AO}{OE} = \frac{CO}{OD} = \frac{BO}{OF} = \frac{2}{1}$$



'O' is the centroid

(iii) Incentre

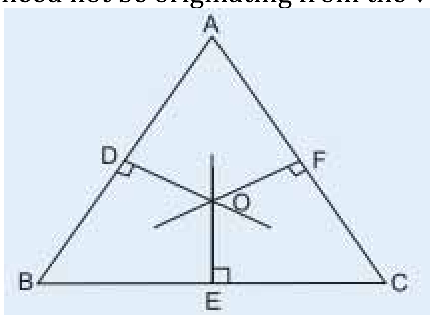
The point of intersection of the angle bisectors of a triangle is known as the incentre. Incentre O is the always equidistant from all three sides, that is the perpendicular distance between the sides.



'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

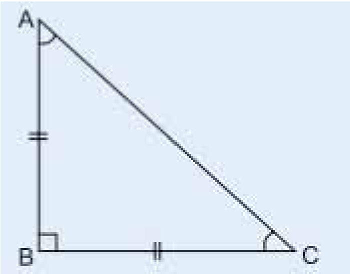
Important Theorems Related to Triangle

(i) 45° - 45° - 90°

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: $\sqrt{2}$

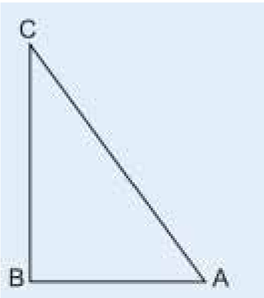


∠A = 45° ∠B = 90° ∠C = 45°

(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

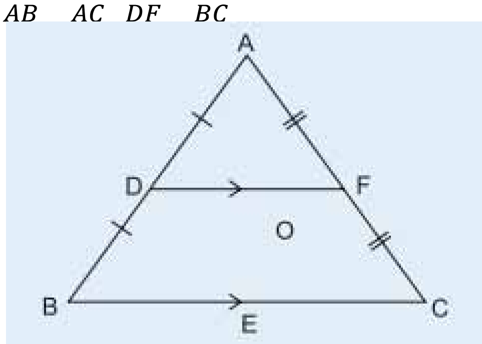
AB:BC:AC = 1: $\sqrt{3}$: 2



∠C = 30°, ∠B = 90°, ∠A = 60°

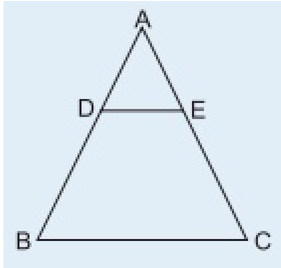
(iii) Basic proportionality theorem (BPT)

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



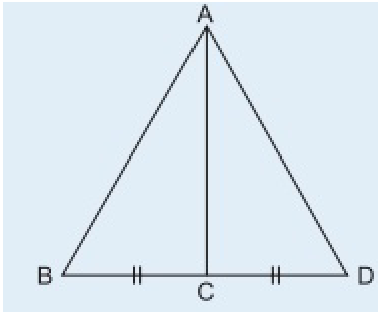
(iv) Mid-point theorem

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||BC.



(v) Apollonius' theorem

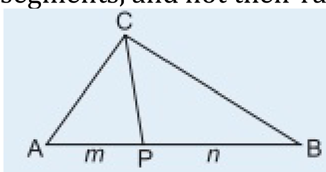
In a triangle, the sum of the squares of any two sides of a triangle is equal to twice the sum of the square of the median to the third side and square of half the third side. That is, $AB^2 + AD^2 = 2\,(AC^2 + BC^2)$



(vi) Stewarts theorem/generalization of Apollonius theorem

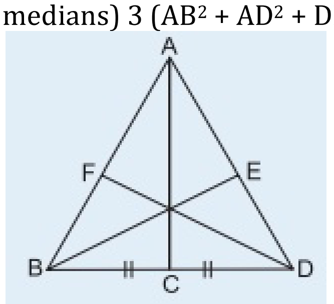
If the length of AP = m and PB = n, then $m \times CB^2 + n \times AC^2$
$= (m + n)\,PC^2 + mn\,(m + n)$

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



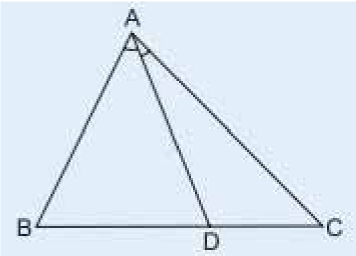
(vii) Extension of Apollonius' theorem

In the given Δ ABC, AC, BE, and DF are medians. 3 (Sum of squares of sides) = 4 (Sum of squares of medians) $3\,(AB^2 + AD^2 + DB^2) = 4\,(AC^2 + EB^2 + FD^2)$



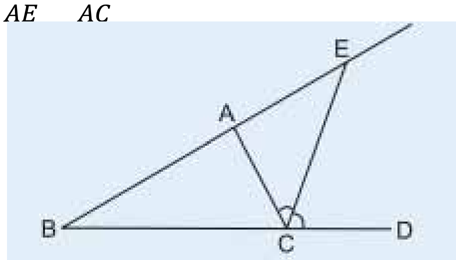
(viii) Interior angle Bisector theorem

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 × AC = CD × 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.

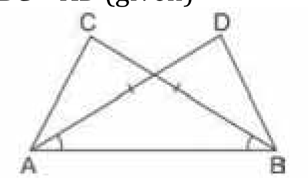
2. S - A - S

In Δ ABC and Δ ABD,

AB = AB (common side)

∠ABC = ∠ 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 Δ ABC and Δ ADE,

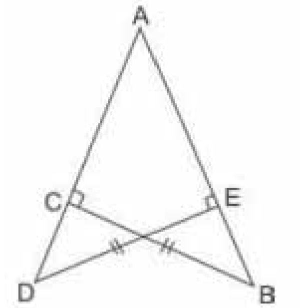
∠ACB = ∠AED (given)

∠BAC = ∠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.

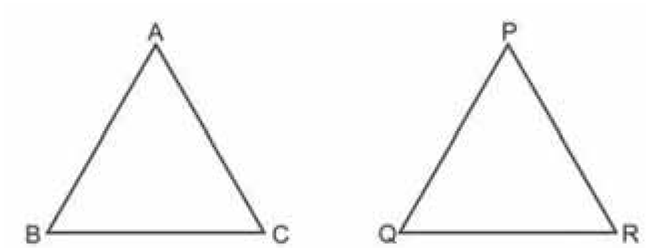
4. R - H - S This rule is applicable only for right-angled triangles. If two right-angled triangles have their hypotenuse and one of the sides as same, then the triangles will be congruent.

Similarity of the Triangles

If we take two maps of India of diff erent 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) ∠A = ∠P, ∠B = ∠Q, ∠C = ∠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 tri angle, 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 correspond ing 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.

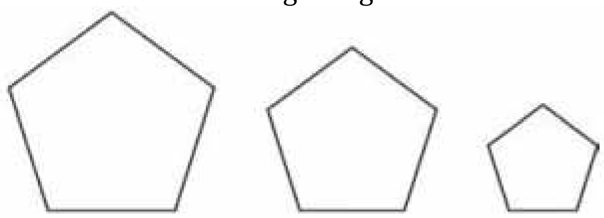
3. If one angle of a triangle is equal to one angle of the other and the sides including these angles are proportional, then the triangles are similar. This property is referred to as the SAS similarity criterion of the two triangles.

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

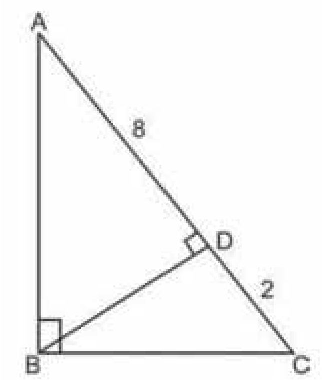
5. If a perpendicular is drawn from the vertex of the right angle of a right-angled triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.

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 ΔABC is a right-angled triangle BD ⊥ 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 Δ ADB ~ ΔBDC

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

∴ $BD^2 = AD \times DC = 8 \times 2$

∴ $BD^2 = 16$

∴ BD = 4 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).

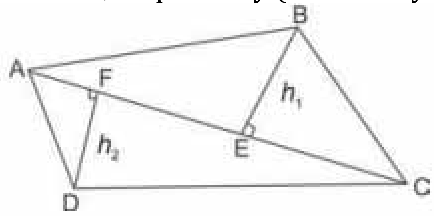
So, $r = \frac{A}{S}$

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

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, and DE = h_2

(i) Area = × $\frac{1}{2}$ one diagonal × (sum of perpendiculars to the diagonal from the opposite vertexes) = $\frac{1}{2}$ d (h1 + h2)

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

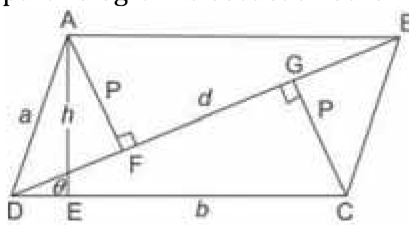
A=$\sqrt{(s-a)(s-b)(s-c)(s-d) - abcd\cos^2\frac{1}{2}(A+B)}$

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 ΔABD) = CG (height of ΔCBD) and AE = height of the parallelogram = h

∠ADC = θ

(i) Area = base × height

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

(iii) Area = (product of adjacent sides) × (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.

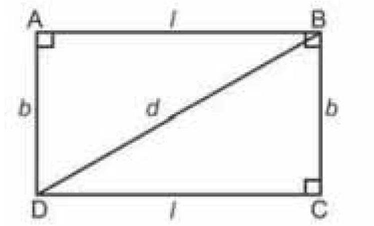
(v) $AC^2 + BD^2 = 2(AB^2 + BC=)$

(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 is diagonals are equal.

Rectangle



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

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

(i) Area = length × breadth Area = lb

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

(iii) $Diagonal^2 = length^2 + breadth^2$ (Pythagoras Theorem) $d^2 = l^2 + b^2$ d = $\sqrt{l^2+b^2}$

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

So, area of rectangle

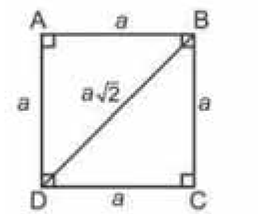
= $\sqrt{(a+b-a)(a+b-b)(a+b-a)(a+b-b) - a.b.a.b}$

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

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 = π

So, area of square

=

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

=

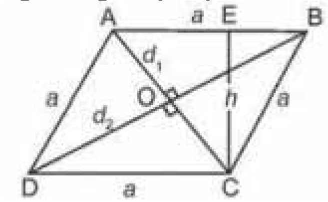
$$\sqrt{(2a-a)(2a-a)(2a-a)(2a-a)-a.a.a.a.\cos^2\frac{1}{2}(A+B)}$$

$=a^2$

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

Rhombus

A rhombus is a quadrilateral when all sides are equal. The diagonals of a rhombus bisects 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 = $\frac{1}{2}$ d_1 d_2

(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 time the square of the side, that is $d_1^{\ 2} + d_2^{\ 2} = 4a^2$

Trapezium

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

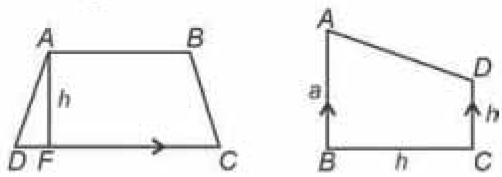


Figure 1 **Figure 2**

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.

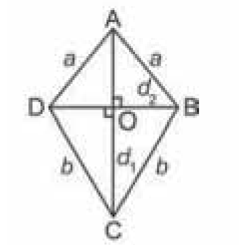
(iii) If we make non-parallel sides equal, then the diagonals will also be equal to each other.

(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 = d_1 (AO = OC) and BD = d_2 (BO = OD)

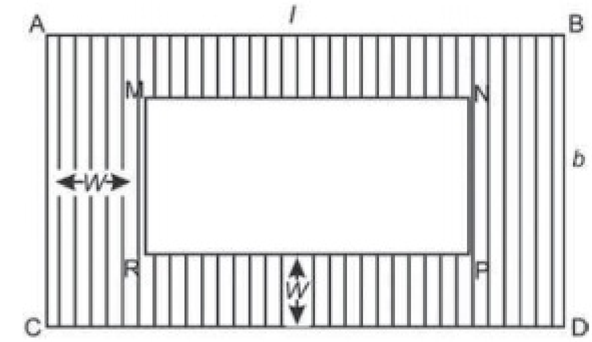
∠AOB = ∠BOC = ∠COD = ∠DOA = 90°

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

Area = $\frac{1}{2}$ d_1 d_2

Area of Shaded Paths

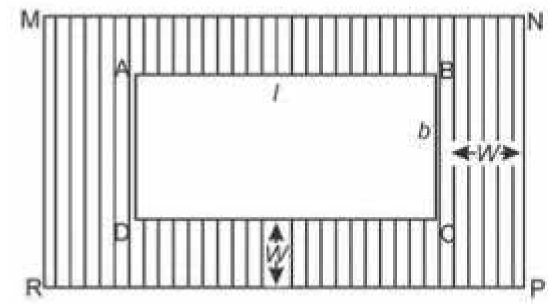
Case I When a pathway is made outside a rectangle having length = l and breadth = b



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

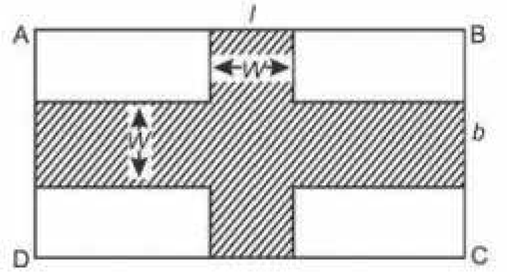
Area of the shaded region/pathway = 2w (l + b - 2w)

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 con verse 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

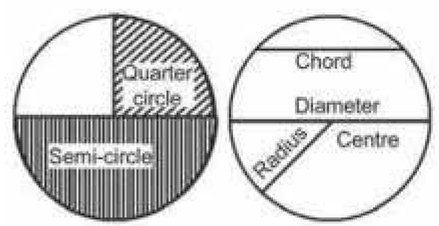
Lines joining the mid-points of adjacent sides of original figure		Resulting figure
Quadrilateral		Parallelogram
Parallelogram	form	Parallelogram
Rectangle		Rhombus
Rhombus		Rectangle
Trapezium		Four similar A

Properties of Diagonals

Properties	Types of Quadrilaterals				
	Square	**Recta ngle**	**Parallel ogram**	**Rhom bus**	**Trape zium**
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

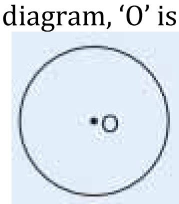
A circle is the path travelled by a point which moves in such a way that its distance from a fixed point remains constant. The fixed point is known as the centre and the fixed distance is called the radius.



Before we move ahead, let us understand the basics defi- nitions of circle.

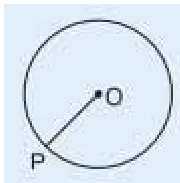
Centre

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



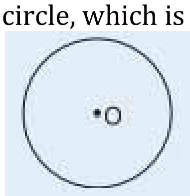
Radius

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



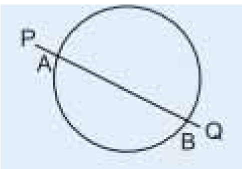
Circumference

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



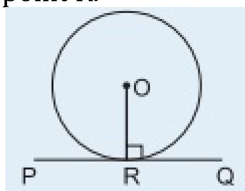
Secant

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

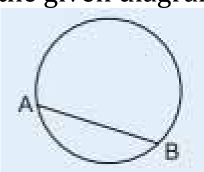
A line segment which has one common point with the circumference of a circle, i.e., it touches only at only one point is called as tangent of circle. The common point is called as point of contact. In the given diagram, PQ is a tangent which touches the circle at a point R.



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

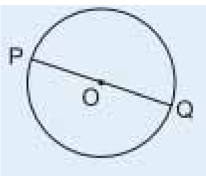
Chord

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



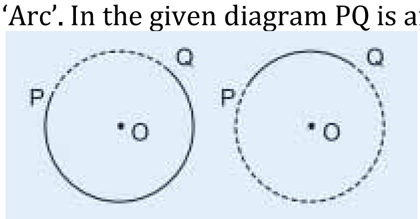
Diameter

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)



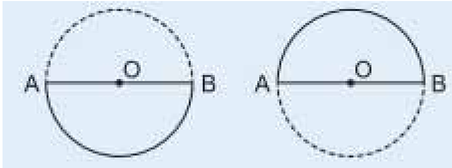
Arc

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.



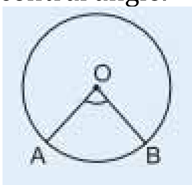
Semicircle

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



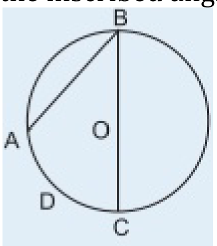
Central angle

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



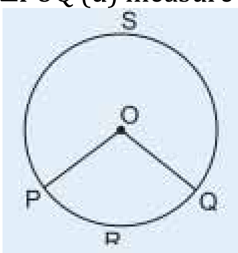
Inscribed angle

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. ∠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 = ∠POQ (d) measure of a major arc = 360 - ∠POQ

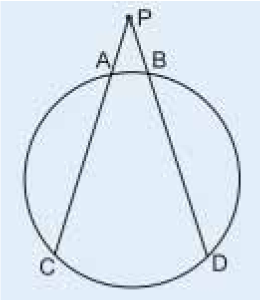


m(arc PRQ) = m ∠POQ

m(arc PSQ) = 360° - m (arc PRQ)

Intercepted arc

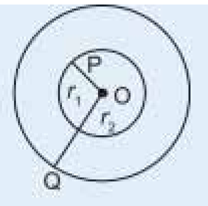
In the given diagram, AB and CD are the two intercepted arcs, intercepted by ∠CPD. The end points of the arc must touch the arms of ∠CPD, i.e., CP and DP.



Concentric circles

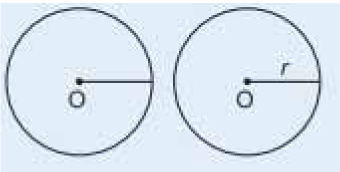
Circles having the same centre at a plane are called the concentric circles.

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.



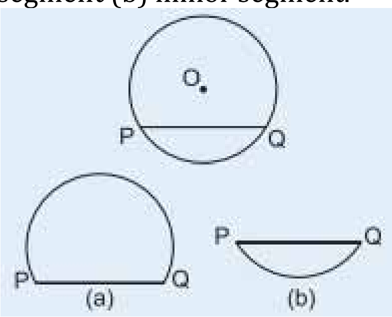
Congruent circles

Circles with equal radii are called as congruent circles.



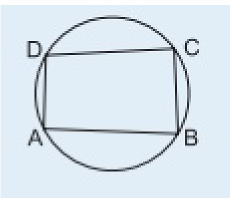
Segment of a circle

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



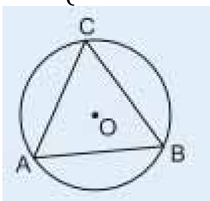
Cyclic quadrilateral

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



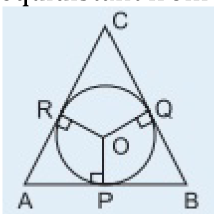
Circumcircle

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

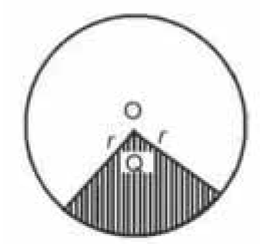
A circle which touches all the three sides of a triangle, i.e., all the three sides of a triangle are tangents to the circle is called an incircle. Incircle is always equidistant from the sides of a triangle.



Now come to diff erent formula and theorems attached to circle:

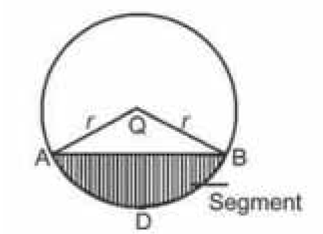
Circumference of a circle = $2\pi r$

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



Area of a sector = $\pi r^2 \frac{0}{360°}$

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 = $\pi r^2 \frac{0}{360°} - \frac{1}{2} r^2 \text{Sin}\theta$

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:

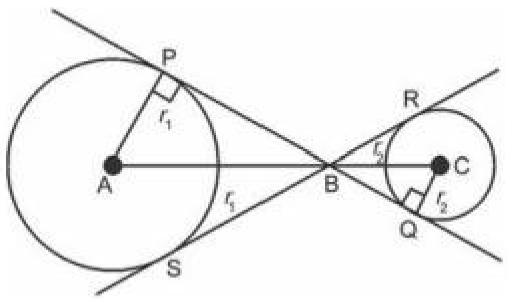
Sl. No.	Position of two circles	Number of common tangents
1.	One circle lies entirely inside the other circle	Zero
2.	Two circles touch internally	One
3.	Two circles intersect in two distinct points	Two
4.	Two circles touch externally	Three
5.	One circle lies entirely outside the other circle	Four

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 $r_1 : r_2$.

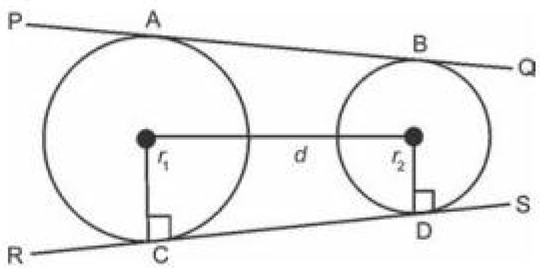
AB:BC = $r_1 : r_2$

Assume AC = Distance between centres = d



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

1. Direct common tangent

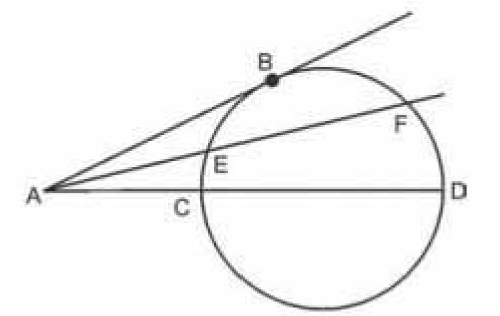


In the figure given above, PQ and RS are direct common tangents.

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



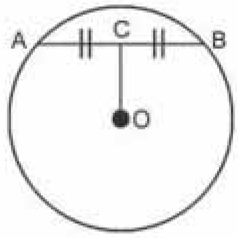
In the figure given above, AB is a tangent and ACD is a secants

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

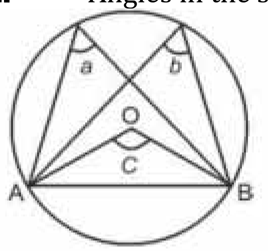
(ii) $AE \times AF = AC \times AD$

Important theorems related to circle

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

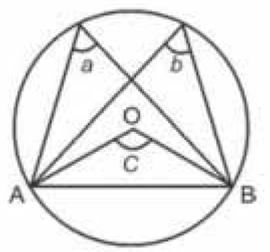


2. Angles in the same segment will be equal.



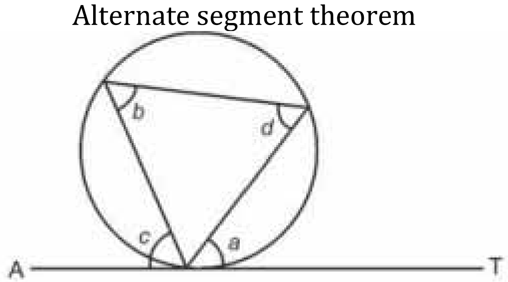
In the figure given above, a = b.

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.



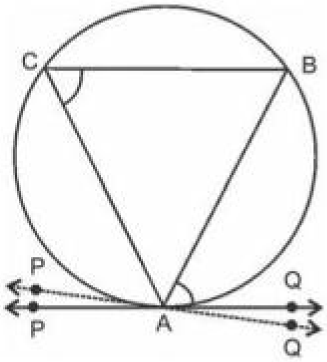
4. Angle subtended by a diameter of the circle is a right angle.

5. Alternate segment theorem



In the figure above, AT is the tangent. ∠a = Alternate segment ∠b ∠c = alternate segment ∠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.



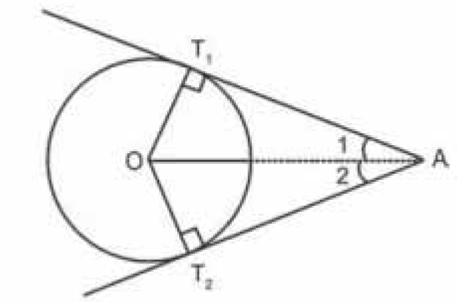
AB is a chord of a circle and a line PAQ such that ∠BAQ = ∠ACB, where C is any point in the alternate segment ACB, then PAQ is a tangent to the circle.

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.

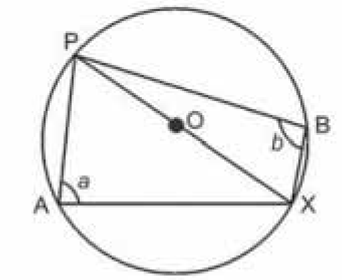
(i) $AT_1 = AT_2$ (ii) ∠I = ∠2

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



Cyclic Quadrilateral

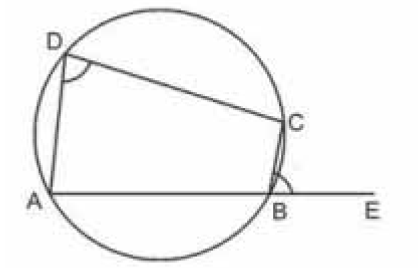
Consider the figure given below:



If we have a + b = 180° 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 ∠CBE = internal ∠ADC = 180° -∠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

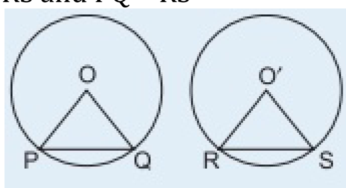
$=\sqrt{(s-a)(s-b)(s-c)(s-d)}$

Where terms used are having their meaning.

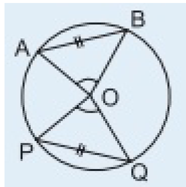
[Cos 90° = 0]

Summarizing the discussion regarding circle

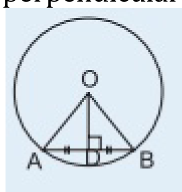
1. In a circle (or congruent circles) equal chords are made by equal arcs. (OP = OQ) = (O'R = O'S) PQ = RS and PQ = RS



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

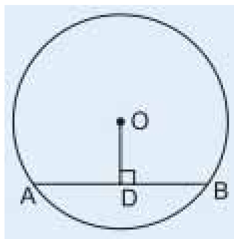


3. The perpendicular from the centre of a circle to a chord bisects the chord, i.e., if OD ⊥ AB (OD is perpendicular to AB).



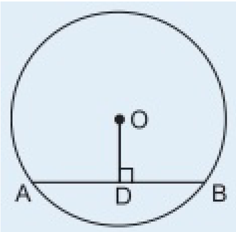
4. The line joining the centre of a circle to the mid-point of a chord is perpendicular to the chord.

AD = DB OD ⊥ AB

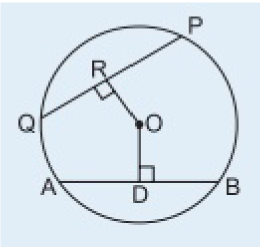


5. Perpendicular bisector of a chord passes through the centre,

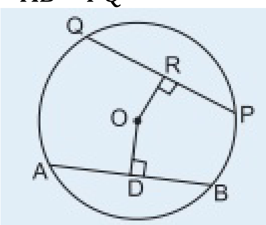
i.e., OD ⊥ AB and AD = DB
∴ O is the centre of the circle.



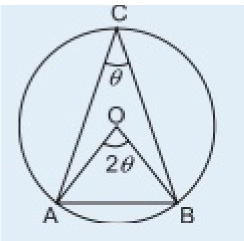
6. Equal chords of a circle (or of congruent circles) are equidistant from the centre.
∴ AB = PQ
∴ OD = OR



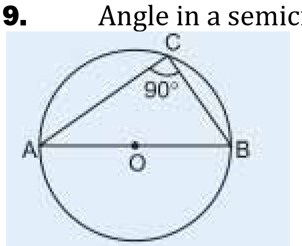
7. Equidistant chords of a circle from the centre are of equal length.
If OD = OR, then
∴ AB = PQ



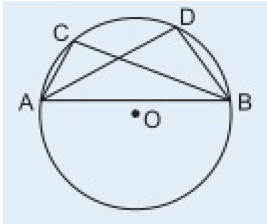
8. The angle subtended by an arc (the degree measure of the arc) at the centre of a circle is twice the angle subtended by the arc at any point on the remaining part of the circle.
m ∠AOB = 2 m ∠ACB.



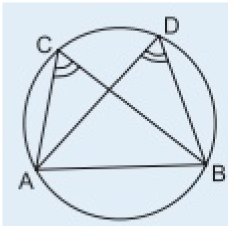
9. Angle in a semicircle is a right angle.



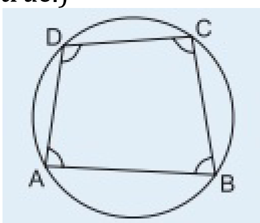
10. 10. Angles in the same segment of a circle are equal, i.e., ∠ACB = ∠ADB.



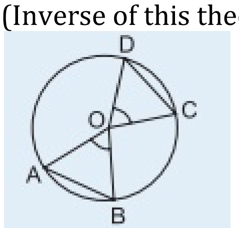
11. If a line segment joining two points subtends equal angle at two other points lying on the same side of the line containing the segment, then the four points lie on the same circle.
∠ACB = ∠ADB
∴Points A, C, D, and B are concyclic, i.e., lie on the circle.



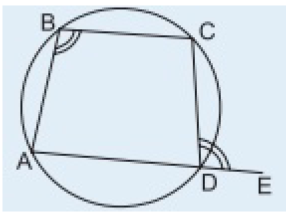
12. The sum of pair of opposite angles of a cyclic quadrilateral is 180°.
∠DAB + ∠BCD = 180°
∠ABC + ∠CDA = 180° (Inverse of this theorem is also true.)



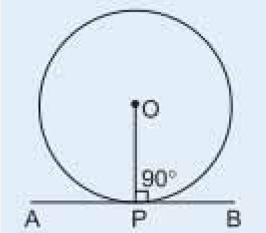
13. Equal chords (or equal arcs) of a circle (or congruent circles) subtended equal angles at the centre.
AB = CD (or AB = CD) ∠AOB = ∠COD
(Inverse of this theorem is also true.)



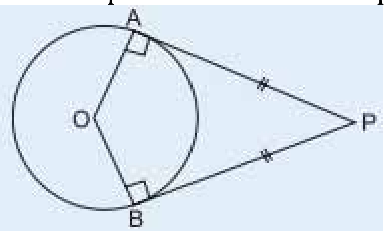
14. If a side of a cyclic quadrilateral is produced, then the exterior angle is equal to the interior opposite angle.
m ∠CDE = m ∠ABC



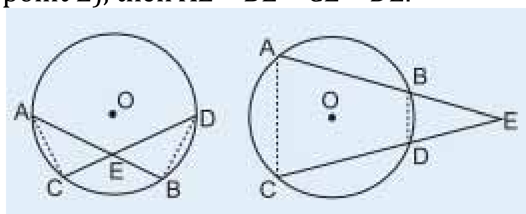
15. A tangent at any point of a circle is perpendicular to the radius through the point of contact.
(Inverse of this theorem is also true.)



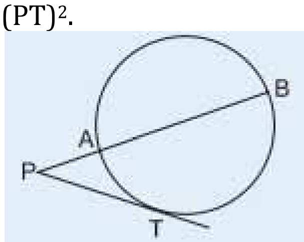
16. The lengths of two tangents drawn from an external point to a circle are equal, that is AP = BP.



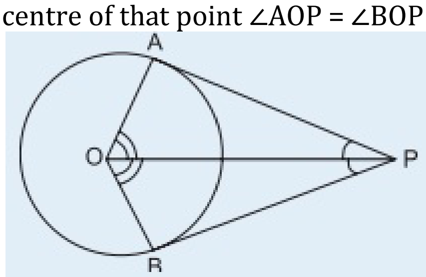
17. If two chords AB and CD of a circle, intersect inside a circle (outside the circle when produced at a point E), then AE × BE = CE × DE.



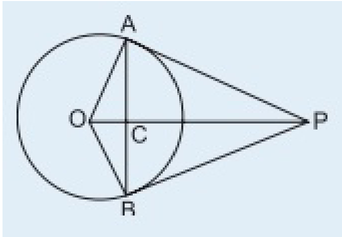
18. If PB be a secant which intersects the circle at A and B and PT be a tangent at T, then PA × PB = $(PT)^2$.



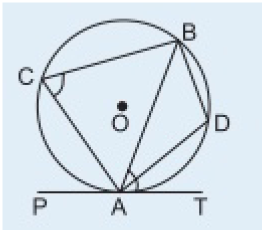
19. From an external point from which the tangents are drawn to the circle with centre O, then (a) they subtend equal angles at the centre (b) they are equally inclined to the line segment joining the centre of that point ∠AOP = ∠BOP and ∠APO = ∠BPO.



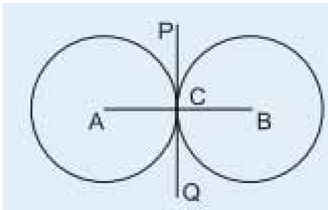
20. If P is an external point from which the tangents to the circle with centre O touch it at A and B then OP is the perpendicular bisector of AB.
OP ⊥ AB and AC = BC



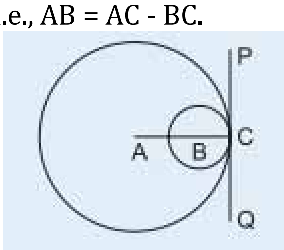
21. If from the point of contact of a tangent, a chord is drawn then the angles which the chord makes with the tangent line are equal respectively to the angles formed in the corresponding alternate segments. In the adjoining diagram,
∠BAT = ∠BCA and ∠BAP = ∠BDA



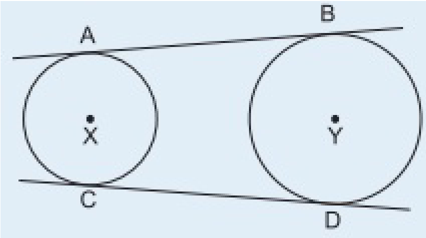
22. The point of contact of two tangents lies on the straight line joining the two centres.
(a) When two circles touch externally then the distance between their centres is equal to sum of their radii, i.e.,
AB = AC + BC.



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



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

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

Previous year questions

1. Bhuvnesh has drawn an angle of measure 45°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%

2. 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

3. 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

4. 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

5. 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

6. 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 a ∠PQS= 60° and ∠ OCR = 130°, then ∠RPS =
(a) 30° (b) 35°
(c) 100° (d)60°

7. In ΔABC, AD is the internal bisector of ∠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

8. I is the in center of ΔABC, ∠ABC=60° and ∠ACB = 50° Then ∠BIC is
(a) 55° (b) 125°
(c) 70° (d) 65°

9. 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

10. Two medians AD and BE of ΔABC 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

11. 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

12. 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 ‖ BC, if ∠ABC = 70°,then the value of ∠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 ∠ABC = 72°, then the *∠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) $AB^2 + BC^2 + = CD^2 + DA^2$ (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 ∠A and ∠B of a non-square rhombus ABCD is 4 : 5, then the value of ∠C is :
(a) 50° (b) 45°
(c) 80° (d) 95°

26. ABCD is a rhombus whose side AB= 4 cm and ∠ABC = 120°, 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) 5cm (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 ∠BAC = 90°, 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) 7cm
(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 ∠QPR is
(a) 45° (b) 60°
(c) 90° (d) 180°

34. AB is a chord to a circle and PAT is the tangent to the circle at A. If ∠ BAT = 75° and ∠BAC = 45° and C being a point on the circle, then ∠ABC is equal to
(a) 40° (b) 45°
(c) 60° (d) 70°

35. The tangents at two points A and B or the circle with center O intersects at P. If in quadrilateral PAOB, ∠AOB : ∠A PB = 5 : 1,then measure of ∠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 ∠ 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 $\angle POR = 90°$, 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 $\angle AOC = 50°$, $\angle BOD = 40°$, Then the value of $\angle BPD$ is
(a) 60° (b) 40°
(c) 45° (d) 75°

39. A straight line parallel to BC of Δ ABC intersects AB and AC at points P and Q respectively. AP = QC, PB = 4 units and AQ = 9units, 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 $\angle BAC = 85°$ and $\angle BCA$ 75° then the value of $\angle OAC$ is
(a) 40° (b) 60°
(c) 70° (D) 90°

41. O is the in center of Δ ABC and $\angle A=30°$ 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 Δ ABC, such that OD ⊥ BC, If ∠ BOD = 15°, then ?*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 Δ ABC such that AD = (1/3) AB, AE =(1/3)AC . if the length of BC is 15cm, 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 Δ ABC. 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 Δ ABC, 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) 6cm

50. If Δ ABC is an isosceles triangle with $\angle C = 90°$ 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 $\angle ACB = 55°$, $\angle ABC = 65°$ If then the value of ∠ BIC is
(a) 130° (b) 120°
(c) 140° (d) 110°

53. In Δ ABC, $\angle BAC = 90°$ 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 Δ ABC be a right-angled where $\angle A = 90°$ and AD ⊥ BC. If ar (Δ ABC) = 40cm^2, ar(Δ ACD) = 10 cm^2 and AC = 9 cm, then the length of BC is
(a) 12cm (b) 18cm
(c) 4cm (d) 6cm

56. In a triangle ABC, $\angle BAC = 90°$ and AD is perpendicular to BC. If AD= 6cm and BD =4cm then the length of BC is:
(a)8cm (b) 10cm
(c)9 cm (d)13 cm

57. In a right angled triangle ABC, $\angle ABC = 90°$,AB=3cm ,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)4.5cm
(c) $4\sqrt{3}$ cm (d)$2\sqrt{3}$cm

59. ABC is a right angled triangled , 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/p2=1/b2-1/a2 (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 there 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 ∠ 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 ∠ COD = 140° and ∠ BAC = 40°,then the value of ∠ BCD is equal to
(a) 70° (b) 90°
(c) 60° (d) 80°

65. 66 .ABCD is a trapezium whose side AD is parallel to BC, Diagonals AC and BD intersects 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)8cm

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 21cm . the length of the chord is
(a)10cm (b)18cm
(c) 12cm (d)16cm

73. If two equal circles whose centres are O and O′ intersect each other at the point A and B OO′=12cm and AB =16cm then the radius of the circle is
(a)10cm (b)8cm
(c) 12cm (d)14cm

74. Chords AB and CD of a circle intersect externally at P. if AB =6 cm , CD =3cm and PD=5cm ,then the length of PB is
(a)5cm (b) 7.35cm
(c)6cm (d) 4cm

75. AB and CD are two parallel chords on the opposite sides of the center of the circle . If AB = 10cm ,CD=24cm and the radius of the circle is 13 cm , the distance between the chords is
(a)17cm (b)15
(c)16cm (d)18cm

76. Two circle touch each other externally at P, AB is a direct common tangent to the two circle , A and B are point of contact and ∠PAB= 35° then ∠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 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 must have two equal circles each of radius 3cm is, 10 cm. The length of a trans verse common tangent is
(a) 8 cm (b) 10
(c) 4cm (d) 6 cm

79. The radii of two circle 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)15cm

80. AC is diameter of a circum circle of ΔABC. Chords BD is parallel to the diameter AC if ∠ CBE =50° , then the measure of ∠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 tri angle are 6cm and 8cm . 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, 4cm and 5cm is :
(a) 2 cm (b) 2.5 cm
(c) 3cm (d)1.5cm

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 ∠ PRQ = 90°, then the value of x is
(a) 4cm (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 ∠ PSX = ∠ RQX , then one must have
(a)PR=QS (b) PS = RQ
(c) ∠XSQ = ∠XRP (d) ar (ΔPXR) = ar (ΔQXS)

85. In a ΔABC, $AB^2 + AC^2 = BC^2$ AND BC =$\sqrt{2}$AB,THEN ∠ 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 ∠ AOD=20° and ∠ BOC =30° then ∠ 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 ∠COD = 120° and ∠ BAC =30° then ∠BCD is :
(a)75° (b)90°
(c)120° (d)60°

88. If ΔABC is similar to ΔDEF , such that ∠A = 47° and ∠E = 63°Then ∠C is equal to :
(a) 40° (b) 70°
(c)65° (d) 37°

89. The internal bisectors of ∠ABC and ∠ACB of ΔABC meet each other at O. If ∠BOC = 110° , then ∠ BAC is equal to
(a) 40° (b) 55°
(c) 90° (d) 110°

90. In Δ ABC, ∠B = 60° and ∠C = 40°. If AD and AE be respectively the internal bisector of ∠A and perpendicular on BC, then the measure of ∠DAE is
(a) 5° (b) 10°
(c) 40° (d) 60°

91. Internal bisectors of ∠B and ∠C of Δ ABC intersects at O. If ∠BOC = 102°, then the value of ∠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 Δ ABC, if ∠ ABC = 60°, ∠BCA =80° then ∠ BIC is
(a) 90° (b) 100°
(c) 110° (d) 120°

94. In Δ ABC, draw BE ⊥ AC and CF ⊥ AB and the perpendicular BE and CF intersect at the point O. If ∠ BAC = 70°,then the value of ∠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 ∠ PBC is
(a) 75° (b) 70°
(c) 65° (d) 80°

96. Internal bisectors of angles ∠ B and ∠C of a triangle ABC meet at O. If ∠BAC = 80°, then the value of ∠ 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 QC= AC and CR = CB . If ∠QPR = 40° , then ∠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 = 10cm. the length of OD (in cm) is
(a)4 (b) 5
(c)6 (d)8

99. The external bisector of ∠B and ∠C of ΔABC (where AB and AC extended to E and F respectively) meet at point P. if ∠BAC= 100° then the measure of ∠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 ΔABC D and E are points on AB and AC respectively such that DE ||BC and DE divides the ΔABC 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 ⊥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 ∠ 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 ≠ BY = CZ
(c) AX = BY ≠ CZ (d) AX ≠ BY ≠ CZ

106. ABC is an isosceles triangle such that AB = AC and ∠B = 35°, AD is the median to the base BC. Then ∠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. Δ ABC is an isosceles triangle and AB = AC = 2a unit, BC = a unit, Draw AD ⊥ 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 Δ ABC. If AP = a cm ,AQ = b cm and $\angle$ BAD = 15 ° , sin75° =
(a)2b /√3a (b)a/2b
(c) √3a/2b (d) 2a/√3b

111. ABC is an isosceles triangle with AB = AC. The side BA is produced to D such that AB = AD. If $\angle$ ABC =30° , then $\angle$BCD is equal to
(a) 45° (b) 90°
(c) 30° (d) 60°

112. In a triangle ABC, AB =AC , $\angle$ BAC=40° 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 a $\angle$C intersect at D. If $\angle$BDC = 50°, 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° and $\angle$ACB = 72° them 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 Δ ABC $\angle$ A=90° and AD⊥ BC where D lies on BC. if BC = 8cm , AC=6cm ,then Δ ABC : Δ 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 Δ ABC, $\angle$ABC =90°. 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 Δ ABC such that DE = 18 cm, CE = 5cm and $\angle$DEC = 90°. 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 Δ ABC right-angled at A and BC = 5 cm. If BL=3√5/2 cm, then the length of CM is
(a) 2 √5 cm (b) 5 √2 cm
(c) 10√2 cm (d) 4√5 cm

125. In Δ ABC and Δ DEF , AB = DE and BC = EF, then one can infer that Δ ABC ≅ Δ DEF, when
(a) $\angle$ BAC = $\angle$ EDF (b) $\angle$ACB = $\angle$EDF
(c) $\angle$ACB = $\angle$DFE (d) $\angle$A B C = $\angle$ 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√2 (b) 5√2
(c) √34 (d) √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 || DC and AB is a diameter of the circle. If $\angle$ CAB = 30°, 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° and $\angle$ DAB =60°, 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⊥BD , $\angle$ CAD= θ then the angle $\angle$ ABC =
(a) θ (b) θ /2
(c) 2 θ (d)3 θ

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. AB = CD. CP (b) AP. CP = BP. DP
(c) AP. BP = CP. DP (d) AP. CD = AB. 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, ∠A + ∠B+∠C + ∠ D = ?
(a) 90° (b) 360°
(c) 180° (d) 120°

137. AB and CD are two parallel chords of a circles such that AB = 10 cm, and CD= 24cm. 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)$2\sqrt[4]{3}$ cm (b) $8\sqrt{3}$ cm
(c)$4\sqrt[4]{3}$ 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 ∠BCD =20°, then ∠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 semi-circles 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 2cm and 3cm. 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 circle touch each other externally The distance between their center 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. ∠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 ∠BEC =130° and ∠ECD =20 °. ∠BAC=?
(a) 120° (b) 90°
(c) 100° (d) 110°

150. If two concentric circles are of radii 5 cm and 3 cm, them 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 ∠PSQ = 20°, then a ∠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 ∠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 Δ ABC the point D. If ABC = x° , BID= y°, BOD= z°, 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 Δ ABC 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 PQR=90° .if PQ =3cm,QR=4cm,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 =12cm , 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 PRQ = 90°, then the value of x is
(a) 4 cm (b)6cm
(c) 7 cm (d)8cm

168. Internal bisectors of angles B and *C of a triangle ABC meet at O. If BAC = 80°, then the value of 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. ∠ADP=23° and ∠ACP=70°, then the ∠BCD is
(a)45° (b)47°
(c)57° (d)67°

170. In a Δ ABC ∠A:∠B:∠C = 2:3:4. A line CD drawn || to AB, then the ∠ACD is:
(a)40° (b)60°
(c) 80° (d) 20°

171. In Δ ABC, ∠BAC=75°, ∠ ABC=45°,BC is produced to D. if ∠ACD= x° then x/3% of 60° is
(a) 30° (b) 48°
(c) 15° (d) 24°

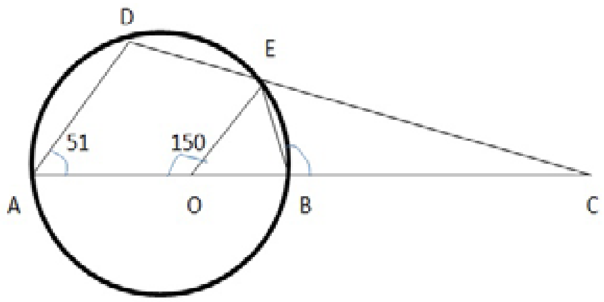
172. In a Δ ABC, AB =AC and BA is produced to D such that AC =AD. then the ∠ BCD is
(a) 100° (b) 60°
(c) 80° (d) 90°

173. In a Δ ABC, ∠A+ ∠B =65° , ∠B+∠C=140 °, then find ∠B.
(a) 40° (b) 25°
(c) 35° (d) 20°

174. In a triangle ABC, ∠A = 90°, ∠C =55°, AD ⊥ BC. What is the value of BAD?
(a) 35° (b) 60°
(c) 45° (d) 55°

175. If O be the circumcenter of a triangle PQR and QOR = 110°, OPR = 25°, then the measure of 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 AOE = 150°, DAO = 51° then the measure of a 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 BAD = 111° and ACB = 80° then the measure of ABC is
(a) 31° (b) 33°
(c) 35° (d) 29°

178. In a Δ ABC, ∠A+ ∠B=145° and ∠C+2∠B =180°. State which one of the following relations is true?
(a) CA = AB (b) CA < AB
(c) BC < AB (d) CA>AB

179. ∠A, ∠B, ∠C are three angles of a triangle. if ∠A - ∠B =15° , ∠B- ∠C =30°, then ∠A,∠B and ∠C are
(a) 80° ,60° ,40° (b) 70° ,50° ,60°
(c) 80°,65°,35° (d) 80°, 55°, 45°

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 ⊥ BC, E is a point on AD for which AE : ED = 5 : 1. If ∠BAD = 30° and tan ∠ACB = 6 tan ∠ DBE , then ∠ACB =
(a) 30° (b) 45°
(c) 60° (d)15°

182. If in Δ ABC, ∠ABC=5 ∠ACB and ∠BAC=3 ∠ACB, then ∠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 ∠A of the triangle is measure
(a) 36° (b) 40°
(c) 45° (d) 55°

184. If AD, BE and CF are medians of Δ ABC, 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 = √2 (AB+BC+CA)

185. In Δ ABC, the internal bisectors of ∠ABC and ∠ACB meet at I and ∠ BAC = 50°. The measure of ∠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 Δ ABC, DE || 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 =1/4AB,AE=1/4AC. If BC=12cm, then DE is
(a) 5 cm (b) 4 cm
(c) 3 cm (d) 6 cm

189. If I be the incenter of Δ ABC and ∠ B=70° and a ∠C=50°, then the magnitude of ∠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 Δ ABC = 24 sq. units then Δ DEF 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 ∠B and ∠C is 120°, then ∠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 Δ ABC, AB = BC, ∠ B = x° and ∠ A = (2x—20)°, Then ∠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°,57° (b) 66°, 114°
(c) 72°, 108° (d) 36°, 54°

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 ≠ BY= CZ
(c) Ax = BY≠CZ (d) AX ≠BY ≠ CZ

201. ABC is an equilateral triangle and CD is the internal bisector of ∠C. If DC is produced to E such that AC = CE, then ∠CAE is equal to
(a) 45° (b) 75°
(c) 30° (d)15°

202. G is the centroid of the equilateral Δ ABC. If AB = 10 cm then length of AG is
(a)5 √3 /3 cm (b) 10√3 /3 cm
(c) 5 √3 cm (d) 10√3 cm

203. The radius of the incircle of the equilateral triangle having each side 6 cm is
(a) 2 √3 cm (b) √3 cm
(c) 6 √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 Δ FGH 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 Δ ABC , ∠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 ∠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=6cm and BC =8 cm. a circle with center O has been inscribed inside Δ ABC, 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 Δ PQR, S and T are point on sides PR and PQ respectively such that ∠PQR = ∠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°, 36°, 45°, 50° one angles cannot be an external angle of a regular polygon. The angle is
(a) 30° (b) 36°
(c) 45° (d) 50°

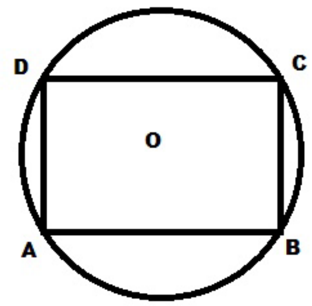
217. An interior angle Of a regular polygon is 5 times its exterior angle. Then the number of sides of the polygon is
(a) 14 (b)16
(c) 12 (d) 18

218. In a reguly polygon, if one of its internal angle 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 ∠ADC = 70°, ∠BAD = 95°, then ∠DCE is equal to
(a) 140° (b) 120°
(c) 165° (d) 110°

In a cyclic quadrilateral ∠A + ∠C = ∠B + ∠D = ?



(a) 270° (b) 360°
(c) 90° (d) 180°

221. If ABCD be a cyclic quadrilateral in which ∠A =4x°, ∠B =7x°, ∠C=5y°, ∠d =y°, 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 ∠DAC=55° then the value of ∠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 ∠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

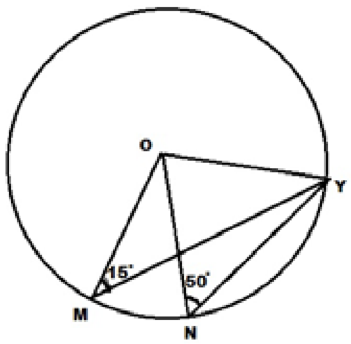
225. The three equal circles touch each other externally, if the centers of these circles are A, B, C, then ABC is
(a) a right angle triangle (b) an equilateral triangle
(c) an isosceles triangle (d) a Scalene triangle

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

227. In Δ ABC, ∠ABC = 70°, ∠BCA = 40°, O is the point of intersection of the perpendicular bisectors of the sides, then the 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 ∠ BAC = 90°, find the radius
(a) 10 cm (b) 5 cm
(c) 20 cm (d) 15 cm

229. In the given figure, ∠ONY=50° and ∠OMY = 15°. Then the value of the ∠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 ∠AOD = 100° and ∠BOC = 70°, then the value of ∠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 ∠OAB = 25°, then the value of ∠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 ∠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)2.25cm
(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 ∠BDC=120° then the value of ∠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 5units, then the distance of the point from the circle is
(a)5 units (b)15 units
(c)-5 units (d) -15 units

239. Two circle of radii 7 cm and 2 cm their centers being 13cm 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 draw In 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 circum circle of Δ ABC at the vertex. A such that DE ||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. ∠RPT=50°, then the value of ∠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 ∠AOB = 110°, then ∠APB is
(a) 90° (b)70°
(c) 60° (d) 55°

245. ABC is an equilateral triangle and O is its circumcenter, then the ∠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 ∠A , ∠B and ∠C are
(a) ∠A = 60°, ∠B = 90°, ∠C = 30° (b) ∠A = 40°, ∠B = 120°, ∠ C = 20°
(c) ∠A = 20°, ∠B = 60°, ∠ C = 6O° (d) ∠A = 45°, ∠B = 90°, ∠C = 45°

247. In a Δ ABC , ∠A +∠B = 118°,∠A + ∠C = 96°, Find the value of ∠A.
(a) 36° (b) 40°
(c) 30° (d) 34°

248. In Δ ABC, if AD ⊥ BC, then $AB^2 + CD^2$ is equal
(a) $2\ BD^2$ (b) BD^2+AC^2
(c) $2\ AC^2$ (d) None of these

249. $\angle A + \frac{1}{2}(\angle B) + \angle C = 140°$, then ∠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 **Δ** ABC, D and E are two points on AB and AC respectively such that DE || BC . DE bisects the **Δ** ABC in two equal areas. Then the ratio BD : AB is
(a) 1 : √2 (b)1:2
(c) (√2 -1): √2 (d) √2:1

252. In a **Δ** ABC , If 2□ A = 3□B = 6□C ,value of □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)2.0cm
(c) 1.8cm (d) 2.4cm

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 □BIC = □*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 □ACD= 120° and □ABC= $\frac{1}{2}$ (□CAB), then the value of □ABC is
(a)30° (b)40°
(c)60° (d) 20°

258. In **Δ** ABC, 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 **Δ** ABC is equal to
(a) 3 cm (b) 6 cm
(c) 9 cm (d) 15 cm

259. Internal bisectors of □Q and □R of **Δ** PQR intersect at O. If □ROQ = 96° then the value of □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 **Δ** ABC. The ratio of area of the parallelogram DEFE and area of the trapezium CAFD is:
(a) 1 : 2 (b) 3 : 4
(c) : 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) isoscelesसमद्विबाहु

262. If the three angles of a triangle are : (x+15) ° , ((6x/5)+6) ° and ((2x/3)+30) ° then the triangle is :
(a) isosceles (b) equilateral
(c) right angled (d) scalene

263. G is the centroid of **Δ** ABC. 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 + 3 y = 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 **Δ** ABC, D and E are two mid points of sides AB and AC respectively. If □BAC = 60° and □ABC =65° then □CED is:
(a) 125° (b) 75°
(c) 105° (d) 130°

267. Given that **: Δ ABC** □ **Δ** PQR, (area **Δ** PQR)/ (area **ΔABC) = 256/441** and PR = 12 cm, then AC is equal to?
(a) 12 √2 cm (b) 15.5 cm
(c) 16 cm (d) 15.75 cm

268. The internal angle bisectors of the □B and □C of the **Δ** ABC intersect at O, If □A = 100°, then the measure of □BOC is:
(a) 110° (b) 140 ° © 130° (d) 120°

269. O is the Incenter **of Δ** PQR and □QOR= 50° ,then the measure of□ QOR is
(a) 125° (b) 100°
(c) 130° (d) 115°

270. O is the circumcenter of **Δ** ABC. If □ BAC = 85°, □ BCA = 75°, the □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 □APB = 110° and □CBD = 30°,then □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° (b) 95/ 2°
(c)225/2° (d) 235/2 °

276. In **Δ** ABC, a line through A cuts the side BC at D such that BD: DC = 4:5 if the area of **Δ** ABD=60cm^2 then the area of **Δ** ADC is: गुना है?
(a)50cm^2 (b) 60 cm^2
(c) 75 cm^2 (d) 90 cm^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/√x
(c) √5x/√2 (d) √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 =√ 2 a (b) b = 2a
(c) b = √ 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 ∠CBE = ∠ACF =130°, then the value of ∠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, ∠BGC = 60°, BC = 8 cm then area of the triangle ABC is:
(a)96√3 cm^3 (b)43√3 cm^3
(c) 48 cm^3 (d)54√3 cm^3

284. Internal bisectors of ∠Q and ∠R of **Δ** POR intersect at O. If ∠ROQ=96° then the value of ∠RPQ is :
(a) 12° (b) 24°
(c) 36° (d) 6°

285. ABC is a cyclic triangle and the bisectors of ∠ BAC , ∠ABC and ∠BCA meet the circle at P, Q and R respectively. Then the angle ∠RPQ is :
(a)90°-(B/2) (b)90°+(C/2)
(c)90°-(A/2) (d)90°+(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, ∠A = 60° and AB = 12 cm, Then the diagonal BD is
(a) 2√3 cm (b) 6 cm
(c) 12 cm (d) 10 cm

290. If PQRS is a rhombus and ∠SPQ = 50°, then ∠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

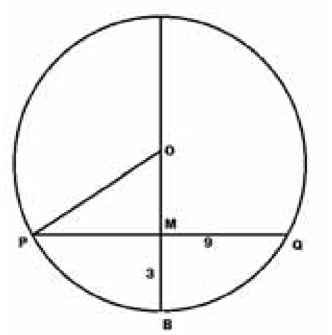
294. 'O' is the circumcenter of triangle ABC. If ∠BAC = 50° then ∠OBC is
(a) 100° (b) 130°
(c) 40° (d) 50°

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) 252 m^2 (b) 1152 m^2
(c) 96 m^2 (d) 156 m^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



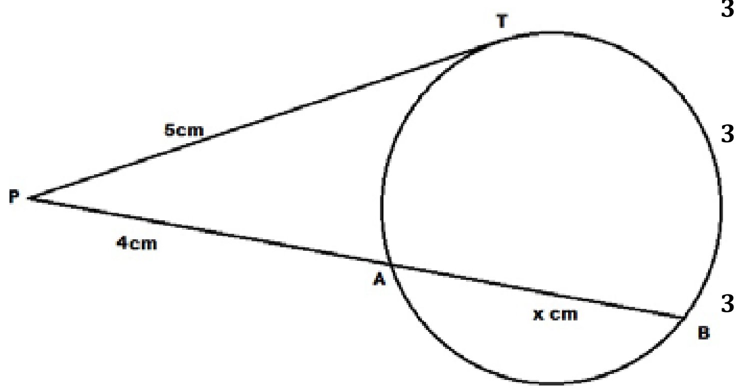
the length of AB

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 =4cm and AB = x cm then x .



(a) 4/9 cm (b)2/3cm
(c) 9/4 cm (d) 5cm

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√2cm (d)8√3cm

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) 8cm (b) 10 cm
(c) 6cm (d) 4 cm

305. The centroid of a **Δ** ABC is G. The area of **Δ** ABC is 60 cm^2. The area of **Δ** GBC is
(a) 30 cm^2 (b)40 cm^2
(c) 10 cm^2 (d) 20 cm^2

306. In trapezium **ABCD ,** AB || CD and AB=2 CD is diagonals intersect at O. if the area of **Δ** AOB = 84 cm^2 then the area of **Δ** COD 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 ∠OBC + ∠ BAC is equal to
(a) 120° (b) 110°
(c) 90° (d) 60°

308. AD is perpendicular to the internal bisector of ∠ABC of **Δ** ABC. 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 **Δ** ABC, ∠ BAC =90° and AD ⊥BC. If BD = 3 cm and CD = 4 cm, then length of AD is
(a)2√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) 13cm
(c) 8.5 cm (d) 17 cm

314. In triangle ABC, DE || BC where D is a point on AB and E is point on AC. DE divides the area of **Δ** ABC into two equal parts. Then DB : AB is equal to
(a) √2: (√2 + 1) (b) (√2 - 1): √2
(c) √2: (√2-1) (d) (√2 + 1): √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 || 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 ∠CAB =34°,then the measure of ∠*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°, 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 ration 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)1cm (b)2cm
(c)3cm (d)1.5cm

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°, 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°, 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°, measure the $\angle$BAD is*
(a) 130° (b) 40°
(c) 50° (d) 140°

329. BE, CF are the two medians of **Δ** ABC 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°.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 **Δ** ABC. 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 **Δ** ABC, the external bisectors of the angles $\angle$B and $\angle$C Meet at the point o. If $\angle$A = 70°, 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° 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 **Δ** ABC is a right angle, AD is perpendicular on BC. If BC = 14cm 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)3cm (b) 4cm
(c)1cm (d)2.5 cm

340. In **Δ** ABC ,AD ⊥ BC and AD^2 = BD. DC the measure of $\angle$BAC is:
(a) 75° (b) 90°
(c) 45° (d) 60°

341. Let AX⊥ BC of an equilateral triangle ABC. Then the sum of the perpendicular distances of the sides of **Δ** ABC 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 **Δ** ABC, the internal bisectors of $\angle$ B and $\angle$ C meet at point O. If $\angle$ A = 80° 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

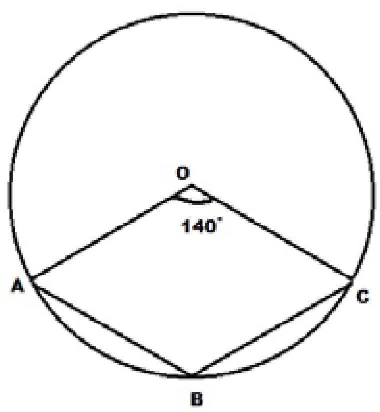
346. AB and AC are two chords of a circle. The tangents at B and C meet at P. If ∠BAC = 54°, then the measure of ∠BPC is
(a) 54° (b) 108°
(c) 72° (d) 36°

347. The length of the diagonal BD of the parallelogram. ABCD is 12 cm. P and Q are the centroids of the **Δ** ABC and **Δ** 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 ∠P, ∠ Q and ∠R is 1: 3:4 then the measure of ∠ 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

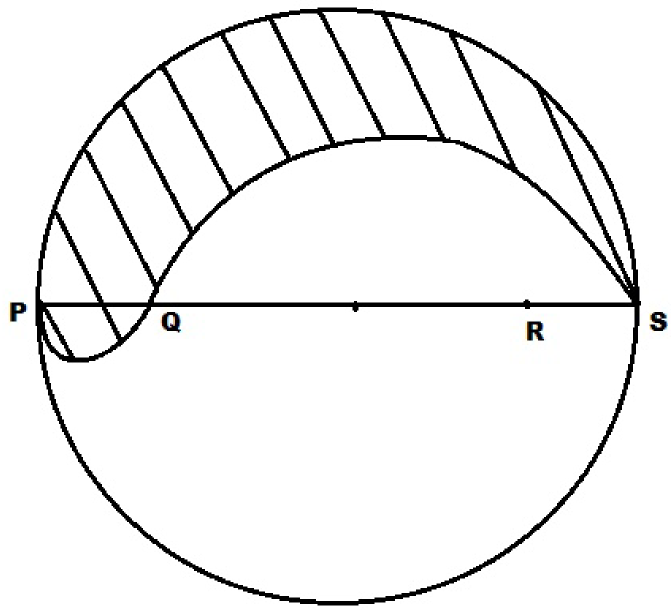
350. In the the adjoining figure ∠AOC = 140° where O is the center of the circle then ∠ABC is equal to:



(a) 90° (b) 110°
(c) 100° (d) 40°

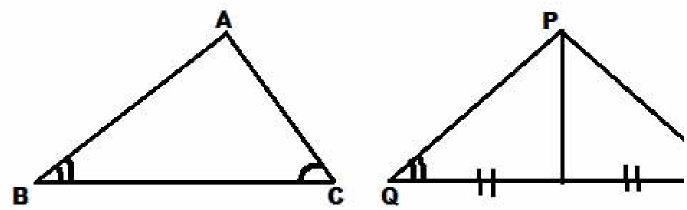
351. The ratio of in radius and circumradius of an equilateral triangle is:
(a) 1:2 (b) 2:1
(c)1: √2 (d) √2:1

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 and QS as diameter (as shown in the fig.) the perimeter of shaded portion is :



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

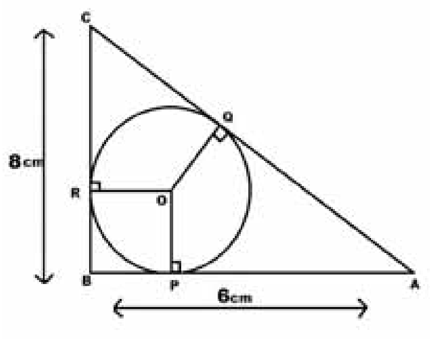
353. In **Δ** ABC and **Δ** PQR, ∠ B = ∠Q, ∠C =∠R .M is the midpoint on QR, If AB:PQ = 7:4 area, then area (**Δ** ABC)/area (**Δ** PMR) is :7 : 4,



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

354. In **Δ** 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. **Δ** ABC is right angled triangle with AB = 6 cm, BC = 8cm. 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					