STUDY IQ PUBLICATIONS

ADVANCED MATHS IQ

for SSC, Railways & Other Govt Examinations

BASED ON LATEST PATTERN

- 3 Levels of Exercise
- 2000+ Multiple Choice Questions with 100% Solutions
- Includes the Previous Years' Questions of all the Topics
- Also includes the Latest Questions of SSC CGL Exams.

CONTENT

1. LINE, ANGLE AND TRIANGLE 5
2. CIRCLE 49
3. QUADRILATERALS 80
4. CO-ORDINATE GEOMETRY 102
5. ALGEBRA 126
6. TRIGONOMETRY 157
7. HEIGHT AND DISTANCE 193
8. MENSURATION-I 221
9. MENSURATION-II 251

Updated Questions (Based on Latest Pattern)

1. MENSURATION 282
2. ALGEBRA 295
3. TRIGONOMETRY 301
4. GEOMETRY 307

15 Practice Sets (Based on Latest Pattern)

Practice Set – 01 319

Practice Set – 02 324

Practice Set – 03 329

Practice Set – 04 332

Practice Set – 05 337

Practice Set – 06 343

Practice Set – 07 348

Practice Set – 08 353

Practice Set – 09 358
Practice Set – 10 363
Practice Set – 11 368
Practice Set – 12 374
Practice Set – 13 379
Practice Set – 14 383
Practice Set – 15 386

5 Practice Sets SSC CGL Tier-II (Based on Latest Pattern)

Practice Set – 01 390
Practice Set – 02 396
Practice Set – 03 402
Practice Set – 04 409
Practice Set – 05 414

Chapter 1

Line, Angle and Triangle

Line and Angle

Point : An infinitely small figure of whose length breadth and height cannot be measured.

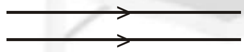
Line : A line is made up of infinite number of points and has length only

Line Segment : The part of a straight line whose both ends are fixed is called a line segment.

Ray : If one point of line is fixed then it called Ray. It extends indefinitely in one direction

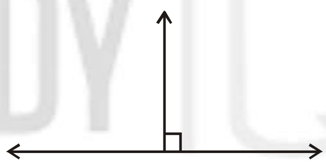
Important Lines

Parallel lines : Two lines, lying in a plane and has no common intersecting point are called parallel lines. They never meet at any point and distance between them is always constant.



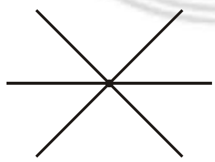
Parallel lines

Perpendicular line : Two line which intersect each other in a plane at 90° are called perpendicular line.



Perpendicular lines

Concurrent line : When more than two lines intersect at a common point, then they are called concurrect lines



Concurrent lines

Important Points to Remember:

- A line is made up of infinitely many points.
- The intersection of two of different lines is called a point.
- Concurrent lines pass through a single point.
- There are infinite no. of planes which pass through a single point.
- When more than three points lie in the same plane, they are called as coplanar else they are called as non-coplanar.
- When more than one line lie in the same plane, then these lines are called as coplanar else they are called as non-coplanar.
- Two lines which are perpendicular to any other line are necessarily parallel to each other in the same plane.

Collinear and Non - Collinear points: If three or more points lie on straight line, they are called collinear point. If three or more points do not lie on straight line, they are called non-collinear points.

Types of Angle:

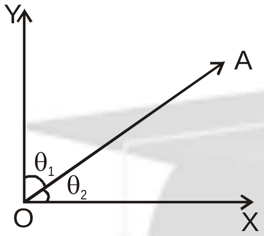
According to Measurement

(i) Acute angle : Angle between two lines lies $0 < \theta < 90°$.
(ii) Right angle : Angle Measurement between two lines lies 90°.
(iii) Obtuse angle : Angle between two line lies $90° < \theta < 180°$.
(iv) Straight angle : Angle Measurement is between two line lies 180°.
(v) Reflex angle : Angle between two line lies $180° < \theta < 360°$.

Complementary and Supplementary angle : If the sum of two angle is equal to 90°. They form a set of complementary angle. If the sum of two angles is equal to 180°, they form a set of supplementary angle

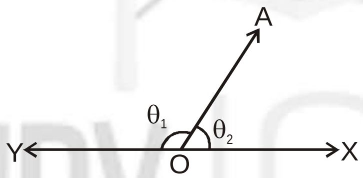
∠YOA and ∠AOX is complementary angle to each other

$\theta_1 + \theta_2 = 90°$
Complementary pair



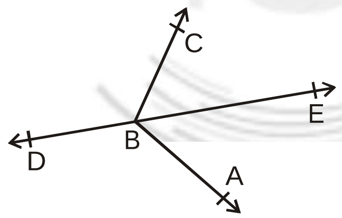
∠YOA and ∠AOX is supplementary angle to each other

$\theta_1 + \theta_2 = 180°$
Supplementary pair

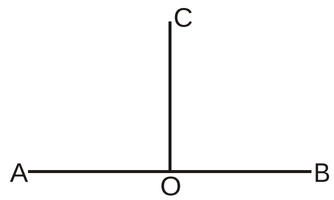


Adjacent angle : If angle having the common vertex, a common side and their uncommon sides are situated at two different side of common side.

∠DBC and ∠DBA are adjacent angles. ∠EBC and ∠DBC are also adjacent angles.

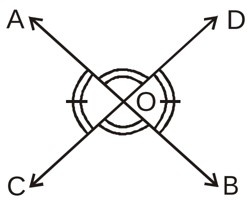


Linear pair : In figure, ∠AOC and ∠COB are adjacent angle and AOB is straight line. One side must be common (OC) and these two angle must be supplementary So, these type of angles are called linear pair of angle.



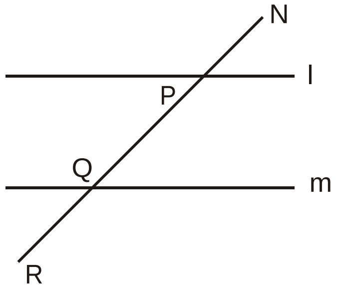
Vertically Opposite angle : If two straight line meet at a point, then angles facing each other are called vertically opposite angle.

∠AOD = ∠COB and ∠AOC = ∠DOB.



Transversal line : A straight line intersecting two or more lines at different points is called a transversal line.

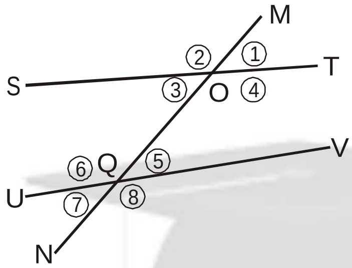
RN = Transversal line



Corresponding angles : When two lines are intersected by a transversal line, then they form four pair of corresponding angles.

Corresponding angles are:

- $\angle SOM$, $\angle UQO$ ($\angle 2$, $\angle 6$)
- $\angle SOQ$, $\angle UQN$ ($\angle 3$, $\angle 7$)
- $\angle TOM$, $\angle VQO$ ($\angle 1$, $\angle 5$)
- $\angle TOQ$, $\angle VQN$ ($\angle 4$, $\angle 8$)



Exterior angles and Interior angles :

Exterior angles

- $\angle SOM$, $\angle 2$
- $\angle TOM$, $\angle 1$
- $\angle UQN$, $\angle 7$
- $\angle VQN$, $\angle 8$

Interior angles

- $\angle SOQ$, $\angle 3$
- $\angle TOQ$, $\angle 4$
- $\angle UQO$, $\angle 6$
- $\angle VQO$, $\angle 5$

Alternate Angle : These two pairs are alternate angles

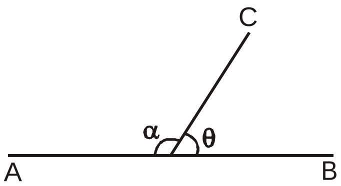
$\angle SOQ$, $\angle VQO$ ($\angle 3$, $\angle 5$)

$\angle UQO$, $\angle TOQ$ ($\angle 6$, $\angle 4$)

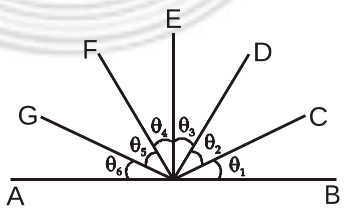
Theorems Based on Angle and Straight line:

Theorem 1 : If a ray is inclined on a line then the sum of linear pair of angle thus formed is equal to 180°

(i) $\alpha + \theta = 180°$

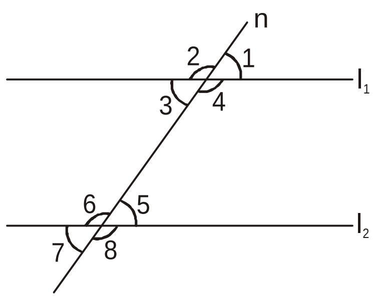


(ii) $\theta_1 + \theta_2 + \theta_3 + \theta_4 + \theta_5 + \theta_6 = 180$



Theorem 2 : If transversal line n, intersect two parallel lines l_1 and l_2 then the pair of corresponding angles thus formed are equal and converse is also true.

$\angle 1 = \angle 5$, $\angle 2 = \angle 6$, $\angle 3 = \angle 7$ and $\angle 4 = \angle 8$ $\rightarrow$ Corresponding angles are equal.



Theorem 3 : If a transversal line intersects two parallel lines then pair of alternate angle are equal.

$\angle 3 = \angle 5$ and $\angle 4 = \angle 6$ $\rightarrow$ Alternate interior angle

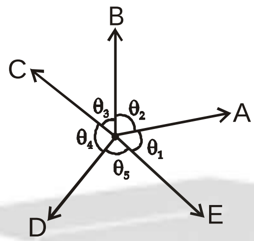
$\angle 1 = \angle 7$ and $\angle 2 = \angle 8$ $\rightarrow$ Alternate exterior angle

Theorem 4 : When a transversal line intersects two parallel lines, sum of consecutive interior angle is 180°.

$\angle 4 + \angle 5 = 180°$ and $\angle 3 + \angle 6 = 180°$

Theorem 5 : Sum of all angles around a point is 360°

$\angle\theta_1 + \angle\theta_2 + \angle\theta_3 + \angle\theta_4 + \angle\theta_5 = 360°$



Polygons : It is a closed plane figure bounded by three or more than three straight lines. There are two types of polygon.

- Convex Polygon: A polygon in which none of its interior angle is more than 180°, then it is known as convex polygon.
- Concave Polygon: A polygon in which atleast one interior angle is more than 180°, then it is called concave polygon.

Regular Polygon : A polygon in which all the sides are equal and all interior angles are also equal, then it is called a regular polygon.

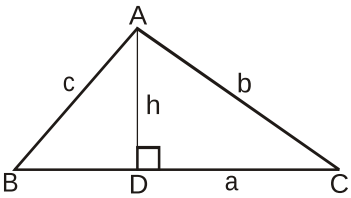
Properties:

- Sum of all interior angle of n sided regular polygon is (n – 2) 180
- Each interior angle is equal to $\frac{(n-2)180°}{n}$ or (180° – exterior angle).
- Sum of all exterior angle is equal to 360°
- Each exterior angle is equal to $\left(\frac{360}{\text{Number of sides}}\right)(\text{in degree})$
- Number of diagonals is equal to $\frac{n(n-3)}{2}$ where, n = number of sides.
- Area of regular polygon is equal to $\frac{na^2}{4}\cot\left(\frac{180°}{n}\right)$; where, n = number of sides, a = length of side.
- Sum of Internal angle and External angle of regular polygon = 180°

Triangle

A triangle is a two dimensional figure enclosed by three sides. In figure given below is a triangle with sides AB, BC and CA measuring c, a and b units respectively. A line from A to BC which is perpendicular to BC is denoted by h.

Properties of a Triangle:



- Sum of all the angles of a triangle is 180°
- The sum of lengths of any two sides is > Length of the third side
- Difference of any two sides of triangle is < length of the third side
- Perimeter of a triangle is always greater than the sum of its median.
- Side opposite to largest angle will be largest and side opposite to smallest angle will be smallest.
- $$\text{If}\begin{cases} a^2 = b^2 + c^2, \text{ triangle is Right angled} \\ a^2 > b^2 + c^2, \text{ triangle is obtuse} \\ a^2 < b^2 + c^2, \text{ triangle is Acute} \end{cases}$$

Area of Triangle:

There are several methods to find the area of triangle

- Area of any triangle = $\frac{1}{2}$ × base × perpendicular to base from opposite vertex
- Area of any triangle = $\sqrt{S(S-a)(S-b)(S-c)}$ where S is semiperimeter of the traingle and a, b, c are sides of a triangle.
- Area of any triangle = $\frac{1}{2}$ × bc sinA, where A = ∠BAC

  = $\frac{1}{2}$ × ac sinB, where B = ∠ABC

  = $\frac{1}{2}$ × ab sinC, where C = ∠ACB
- Area of any triangle = rS, where r is inradius of inscribed circle in triangle and S is semiperimeter of triangle.
- Area of any triangle = $\frac{abc}{4R}$, where R is circumradius of circumscribing circle of the triangle.

Classification of Triangles:

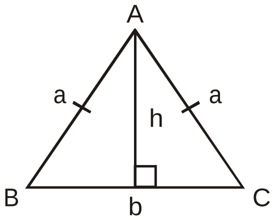
(a) According to side

1. Scalene triangle

   A triangle whose all sides are of different length is called a scalene triangle.
2. Isosceles triangle

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

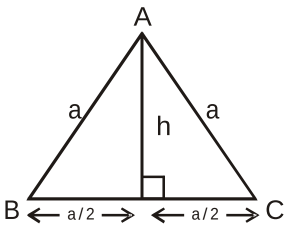
- Area = $\frac{b\sqrt{4a^2 - b^2}}{4}$
- Height = $\frac{\sqrt{4a^2 - b^2}}{2}$



3. Equilateral triangle

A triangle whose all sides are equal in length is called an equilateral triangle a = b = c.

- Area = $\frac{\sqrt{3}}{4}a^2$
- Height = $\frac{\sqrt{3}}{2}a$
- $\angle A = \angle B = \angle C = 60°$
- Inradius of equilateral triangle = $\frac{a}{2\sqrt{3}}$
- Circumradius of equilateral triangle = $\frac{a}{\sqrt{3}}$



(b) According to angle

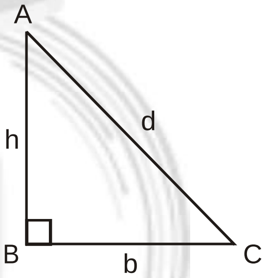
1. Right-angled Triangle

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

- Area = $\frac{1}{2}$ × product of sides containing right angle

  = $\frac{1}{2} \times b \times h$

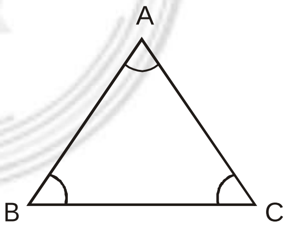
- $d^2 = h^2 + b^2$ (Pythagoras theorem)



2. Acute-Angle Triangle

Each angle of a triangle is less then 90°

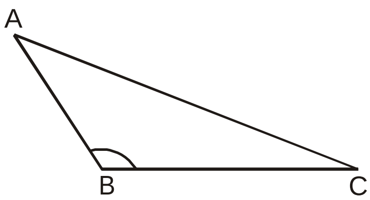
$A < 90°$, $B < 90°$, $C < 90°$



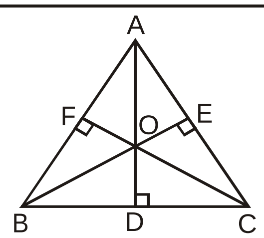
3. Obtuse-Angle Triangle

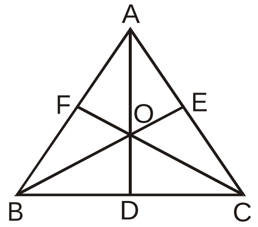
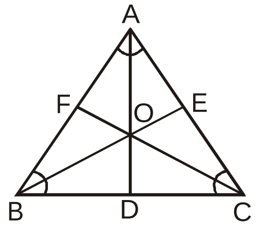
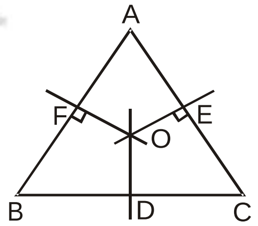
one of the angles is obtuse (i.e. greater than 90°), then it is called obtuse angle triangle.

$\angle B > 90°$



Important Terms

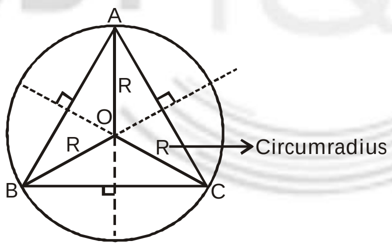
Term	Definition	Diagram
Altitude	The perpendicular drawn to a side from opposite vertex in a triangle is called an altitude of the triangle. AD, BE, CF are the altitudes	

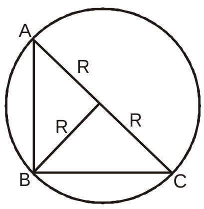
Term	Definition	Diagram
Median	The line segment Joining the mid point of a side of triangle to the vertex opposite to side is called median. Median divides the area of triangle into two equal parts $\text{Area}(\triangle ABD) = \text{area}(\triangle ADC) = \frac{1}{2}\text{area}(\triangle ABC)$	
Angle bisector	A line which bisects the angle of triangle and originates from vertex is called an angle bisector $\angle OBF = \angle OBD = \frac{1}{2}\angle ABC$	
Perpendicular side bisector	A line segment which bisects a side perpendicularly is called perpendicular bisector of side. DO, EO, FO are the perpendicular side bisectors.	

Circumcentre:

Circumcentre is the point of intersection of the perpendicular side bisectors of the triangle. Circumcentre is equidistant from its vertex and distance of circumcentre from vertex of triangle is called circumradius (R) of the triangle

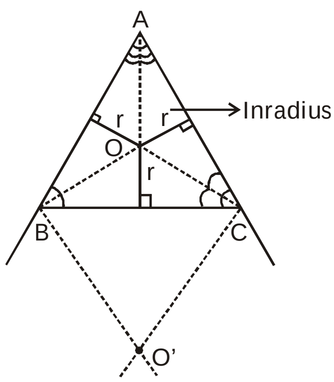
The circle drawn with the circumcentre as the centre and circumradius as the radius is called the circumcircle of the triangle and it touches all the vertex of the triangle





- Circumcentre of acute angle triangle always lie inside the triangle
- Circumcentre of abtuse angle triangle always lie outside the triangle and opposite to the largest angle
- Circumcentre of right angle triangle always lie at the mid point of hypotenuse
- $\angle BOC = 2\angle A$

Incentre:



Incentre is the point of intersection of the internal bisectors of the three angles.

Incentre is equidistant from the three sides of the triangle, i.e. the perpendiculars drawn from the incentre to the three sides are equal in length and are called inradius of the triangle.

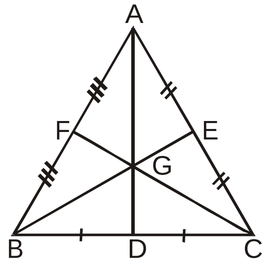
The circle drawn with the incentre as centre and inradius as the radius and it touches all the three sides of triangle from inside.

- $\angle BOC = 90 + \frac{1}{2}\angle A$.
- $\angle BO'C = 90 - \frac{1}{2}\angle A$ (where BO', CO' are external bisectors of $\angle B$ and $\angle C$)
- In right angled triangle, Inradius = semi perimeter – length of Hypotenuse

Centroid:

Point of intersection of three medians of a triangle is called centroid divides median in the ratio 2 : 1

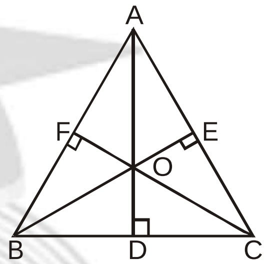
$$\frac{AG}{GD} = \frac{BG}{GE} = \frac{CG}{GF} = \frac{2}{1}$$

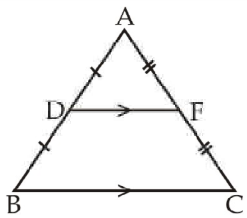
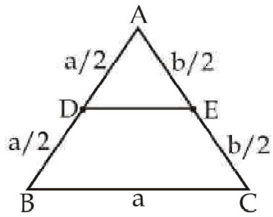
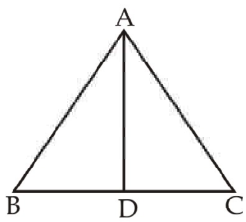
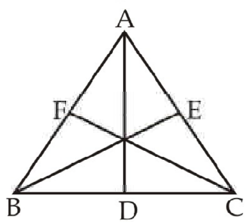


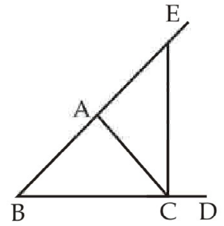
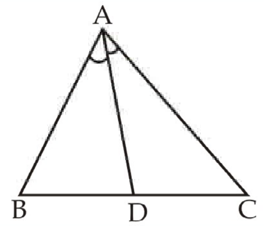
Orthocentre:

Orthocentre is the point of intersection of the altitudes i.e. perpendicular drawn on side from opposite vertex

- $\angle BOC = 180 - \angle A$
- For right triangle orthocentre lies at the vertex containing right angle.
- In obtuse angle triangle it lies opposite to largest side and outside the triangle.



Theorem	Statement	Diagram
Basic Proportionality Theorem	Any line parallel to one side of a triangle divides the other two sides proportionally $\frac{AD}{DB} = \frac{AF}{FC}, \frac{AD}{AB} = \frac{AF}{AC}, \frac{AD}{DF} = \frac{AB}{BC}$	
Mid Point theorem	Any line Joining the mid-points of two adjacent sides of a triangle is parallel and half of the third side vice-versa is also true. $DE = \frac{1}{2}a$	
Apollonius Theorem	In a triangle, the sum of the squares of any two adjacent sides of a triangle is equal to twice the sum of square of the median to third side and square of half the third side. $AB^2 + AC^2 = 2(AD^2 + BD^2)$	
Extension of Apollonius theorem	$3(AB^2 + BC^2 + CA^2) = 4(AD^2 + BE^2 + CF^2)$	

Theorem	Statement	Diagram
Exterior Angle Bisector	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 as given below i.e. $\frac{BE}{AE} = \frac{BC}{AC}$	
Interior angle Bisector	In a triangle the angle bisector of an angle divides the opposite side to the angle in the ratio of the remaining two sides, $\frac{AB}{AC} = \frac{BD}{CD}$	

Congruency of Triangles:

Two figure 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 every aspect.

Condition for congruency of two triangles:

1. S – S – S rule

   If each side of one triangle is equal to the side of the other triangle, the two triangles are congruent.

2. S – A – S rule

   If one angle in each triangle and sides containing the angle of each triangle are equal, the two triangles are congruent.

3. A – S – A rule

   If two angles and angles containing the side of two triangles are equal then two triangles are congruent.

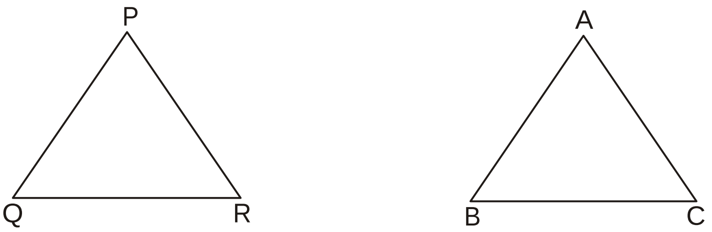
4. R – H – S rule

   This rule is for right angled triangle. If hypotenuse and one of the sides of two triangles are equal, then the triangles are congruent.

Similarity of Triangles

Two Triangles are similar if

(i) their corresponding angles are equal (ii) their corresponding sides are in the same ratio



If ΔPQR and ΔABC are similar

- $\angle A = \angle P, \quad \angle B = \angle Q, \quad \angle C = \angle R$
- $\frac{AB}{PQ} = \frac{BC}{QR} = \frac{CA}{RP}$

Condition for Similarity:

1. A A A rule

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

2. S S S rule

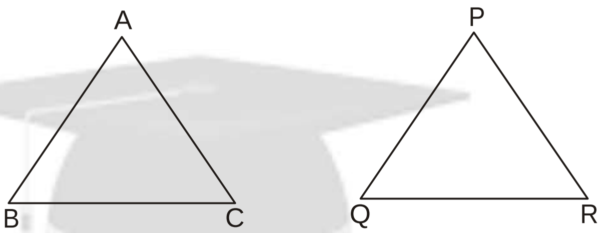
   If the corresponding sides of two triangles are proportional then their corresponding angles will also be equal. So, triangles are similar

3. S A S rule

   If one angle of triangle is equal to one angle of the other triangle and the sides including these angles are proportional then triangles are similar.

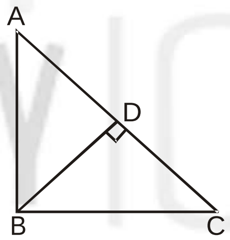
4. The ratio of the areas of the two similar triangles is equal to the ratio of the squares of their corresponding sides.

$$\frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{CA^2}{RP^2} = \frac{ar(\Delta ABC)}{ar(\Delta PQR)}$$



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

- $\Delta ABC \sim \Delta ADB \sim \Delta BDC$

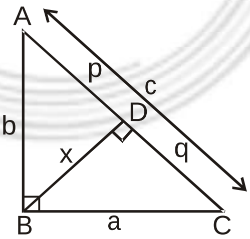


Some important Conclusions

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

  BD = x, AD = p, DC = q

  then,

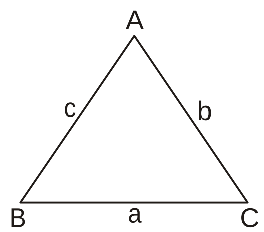


- $a^2 = cq$
- $b^2 = cp$
- $a.b = cx$, $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{x^2}$
- $p.q = x^2$

Sine Rule:

In any ΔABC

$\frac{a}{\text{Sin} A} = \frac{b}{\text{Sin} B} = \frac{c}{\text{Sin} C} = 2R$, where R is circumradius.



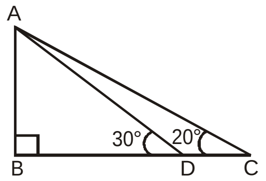
Cosine Rule:

$a^2 = b^2 + c^2 - 2bc \text{ Cos } A$, $b^2 = a^2 + c^2 - 2ac \text{ Cos } B$, $c^2 = a^2 + b^2 - 2ab \text{ Cos } C$

Foundation

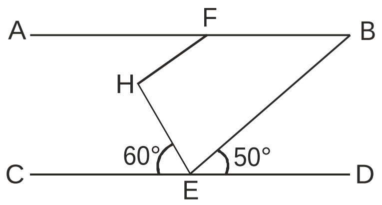
Questions

1. In the given figure, $\angle ABD = 90°$, $\angle BDA = 30°$ and $\angle BCA = 20°$. What is the value of $\angle CAD$?



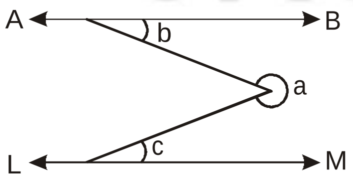
(a) 10° (b) 20°
(c) 30° (d) 15°

2. In the given figure AB is parallel to CD and BE is parallel to FH. Measure of $\angle FHE$ is:



(a) 110° (b) 120°
(c) 125° (d) 130°

3. In the figure given below AB is parallel to LM. Angle a is equal to:



(a) $\pi + b + c$ (b) $2\pi - b + c$
(c) $2\pi - b - c$ (d) $2\pi + b - c$

4. Which angle is two third of its complementary angle?

(a) 36° (b) 45°
(c) 48° (d) 60°

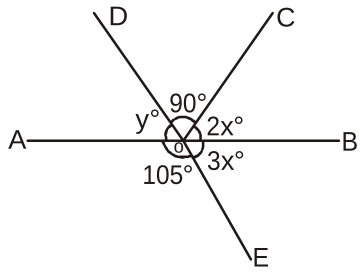
5. What is the measure of the angle which is one fifth of its supplementary part?

(a) 15° (b) 30°
(c) 36° (d) 75°

6. If each interior angle of a regular polygon is 144°, then what is the number of sides in the polygon?

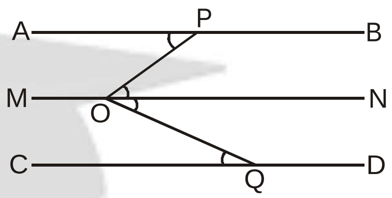
(a) 10 (b) 20
(c) 24 (d) 36

7. In the following figure AB is a straight line. Find (x + y):



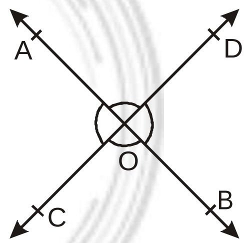
(a) 55° (b) 65°
(c) 75° (d) 80°

8. In the adjoining figure $\angle APO = 42°$ $\angle CQO = 38°$. Find the value of $\angle POQ$:



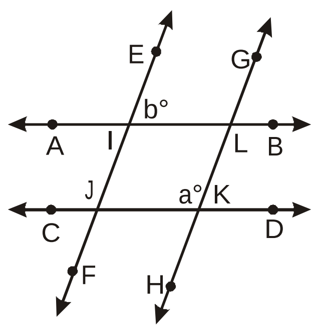
(a) 68° (b) 72°
(c) 80° (d) 126°

9. In the given figure, straight lines AB and CD intersect at O. If $\angle COA = 3\angle AOD$, then $\angle AOD$ is equal to:



(a) 40° (b) 45°
(c) 50° (d) 55°

10. In the given figure, AB | | CD and EF | | GH. Find the relation between a and b.



(a) 2a + b = 180° (b) a + b = 180°
(c) a – b = 180° (d) a + 2b = 180°

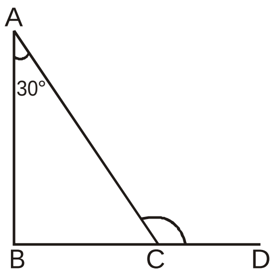
11. A, B, C, are the three angles of a Δ. If A – B = 15° and B – C = 30°, then $\angle A$ is equal to:

(a) 65° (b) 80°
(c) 75° (d) 85°

12. In a Δ ABC, If $2\angle A = 3\angle B = 6\angle C$ then $\angle A$ is equal to:
(a) 60° (b) 30°
(c) 90° (d) 120°

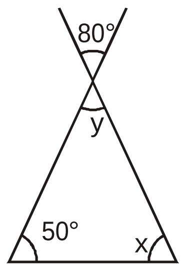
13. If one angle of a triangle is equal to the sum of the other two, then the triangle is:
(a) Right-angled (b) Obtuse-angled
(c) acute-angled (d) None of these

14. In the given figure, if $\angle ABC = 90°$, and $\angle A = 30°$, then $\angle ACD$ =



(a) 120° (b) 100°
(c) 110° (d) None of these

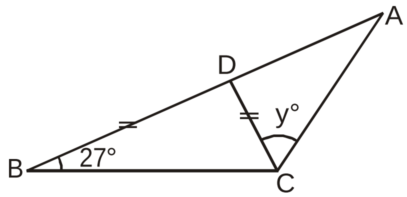
15.



Find the value of x and y
(a) x = 60°, y = 80° (b) x = 80°, y = 50°
(c) x = 50°, y = 80° (d) None of these

16. In ΔABC, $\angle A > 90°$ then $\angle B$ and $\angle C$ must be :
(a) acute (b) obtuse
(c) one acute and one obtuse
(d) Can't be determined

17. In the following figure ADBC, BD = CD = AC, $\angle ABC = 27°$, $\angle ACD = y$. Find the value of y :



(a) 27° (b) 54°
(c) 72° (d) 58°

18. The internal bisectors of the angles B and C of a triangle ABC meet at O. Then, $\angle BOC$ is equal to :
(a) $90° + \angle A$ (b) $2\angle A$
(c) $90° + \frac{1}{2}\angle A$ (d) $180° - \angle A$

19. If the angles of a triangle are in the ratio of 2 : 3 : 4, then the greatest angle of the triangle is :
(a) 75° (b) 80°
(c) 90° (d) 120°

20. Triangle ABC is such that AB = 3 cm, BC = 2 cm and CA = 2.5 cm. Triangle DEF is similar to ΔABC. If EF = 4 cm, then the perimeter of ΔDEF is :
(a) 7.5 cm (b) 15 cm
(c) 22.5 cm (d) 30 cm

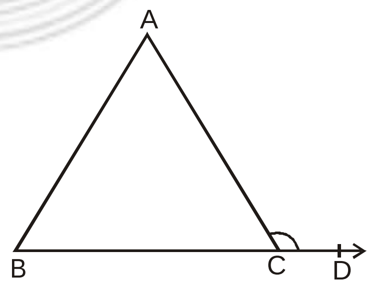
21. ABC is a triangle and DE is drawn parallel to BC cutting the other sides at D and E. If AB = 3.6 cm, AC = 2.4 cm and AD = 2.1 cm, then AE is equal to:
(a) 1.4 cm (b) 1.8 cm
(c) 1.2 cm (d) 1.05 cm

22. The line segments joining the mid points of the sides of a triangle form four triangles each of which is:
(a) similar to the original triangle
(b) congruent to the original triangle
(c) an equilateral triangle
(d) an isosceles triangle

23. In ΔABC and ΔDEF, $\angle A = 50°$, $\angle B = 70°$, $\angle C = 60°$, $\angle D = 60°$, $\angle E = 70°$ $\angle F = 50°$, then ΔABC is similar to:
(a) ΔDEF (b) ΔEDF
(c) ΔDFE (d) ΔFED

24. The hypotenuse of a right angled triangle is 25 cms. The other two sides are such that one is 5 cm longer than the other. Their lengths (in cm) are:
(a) 10, 15 (b) 20, 25
(c) 15, 20 (d) 25, 30

25. ABC is a triangle in which AB = AC. The base BC is produced to D and $\angle ACD = 130°$. Then, $\angle A$ equals:



(a) 80° (b) 60°
(c) 50° (d) 40°

26. D, E, F are the mid points of the sides BC, CA and AB respectively of ΔABC. Then ΔDEF is congruent to triangle:
(a) ABC (b) AEF
(c) BFD, CDE (d) AFE, BFD, CDE

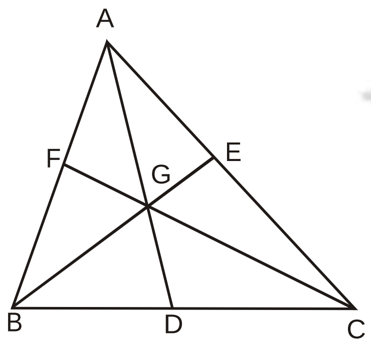
27. In the triangles ABC and DEF, angle A is equal to angle E, both are equal to 40°, AB : ED = AC : EF and angle F is 65°, then angle B is:

(a) 35° (b) 65°
(c) 75° (d) 85°

28. If the medians of a triangle are equal, then the triangle is:
(a) isosceles (b) equilateral
(c) scalene (d) right angled

29. The circumcentre of a triangle is determined by the:
(a) altitudes (b) medians
(c) angle bisectors
(d) perpendicular bisectors of the sides

30. In ΔABC, the medians BE and CF intersect at G. AGD is a line meeting BC in D. If GD is 1.5 cm, then AD is equal to :

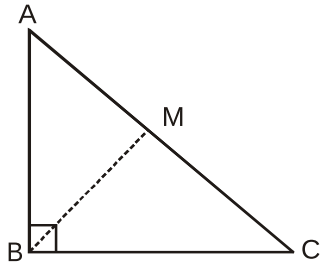


(a) 2.5 cm (b) 3 cm
(c) 4 cm (d) 4.5 cm

31. If S is the circumcentre of ΔABC, then :
(a) S is equidistant from its sides
(b) S is equidistant from its vertices
(c) SA, SB, SC are the angular bisectors
(d) AS, BS, CS produced are the altitudes on the opposite sides.

32. The number of points in the plane of a triangle ABC which is equidistant from the vertices of the triangle is :
(a) 0 (b) 1
(c) 2 (d) 4

33. In the given figure,



$\angle$ABC = 90° and BM is a median, AB = 8 cm and BC = 6 cm. Then, length BM is equal to:
(a) 3 cm (b) 4 cm
(c) 5 cm (d) 7 cm

34. In an equilateral triangle PQR, if p, q and r denote the lengths of perpendiculars from P, Q, R respectively on the opposite sides, then :
(a) $p \neq q \neq r$ (b) $p = q = r$
(c) $p \neq q = r$ (d) $p = q \neq r$

35. The ratio of the length of a side of an equilateral triangle and its height is :
(a) 2 : 1 (b) 1 : 2
(c) $2 : \sqrt{3}$ (d) $\sqrt{3} : 2$

36. If D, E, F are respectively the mid points of the sides BC, CA and AB of ΔABC and the area of ΔABC is 24 sq. cm. then the area of ΔDEF is:
(a) 24 cm^2 (b) 12 cm^2
(c) 8 cm^2 (d) 6 cm^2

37. If O is a point inside a triangle ABC, which of the following is true?
(a) 2(AO + BO + CO) > (AB + BC + CA)
(b) (AO + BO + CO) > (AB + BC + CA)
(c) AO + BO + CO = AB + BC + CA
(d) None of these

38. One side other than the hypotenuse of a right angled isosceles triangle is 4 cm. The length of the perpendicular on the hypotenuse from the opposite vertex is:
(a) 8 cm (b) $4\sqrt{2}$ cm
(c) 4 cm (d) $2\sqrt{2}$ cm

39. In a triangle ABC, the sum of the exterior angles at B and C is equal to :
(a) 180° – $\angle$BAC (b) 180° + $\angle$BAC
(c) 180° – 2 $\angle$BAC (d) 180° + 2 $\angle$BAC

40. In ΔABC, $\angle$B = 3x, $\angle$A = x, $\angle$C = y and 3y – 5x = 30, then the triangle is :
(a) isosceles (b) equilateral
(c) right angled (d) scalenane

41. Consider the following statements:
1. If three sides of a triangle are equal to three sides of another angle, then the triangles are congrunet.
2. If three angles of a triangle are respectively equal to three angle of another triangle, then the two triangle are congruent. Of these statements,
(a) 1 is correct and 2 is false
(b) both 1 and 2 are false
(c) both 1 and 2 are correct
(d) 1 is flase and 2 is correct

42. The internal bisectors of $\angle$B and $\angle$C of ΔABC meet at O. If $\angle$A = 80°, then $\angle$BOC is:
(a) 50° (b) 100°
(c) 130° (d) 160°

43. The medians of a triangle pass through the same point which divides each of the medians in the ratio:
(a) 2 : 1 (b) 1 : 3
(c) 2 : 3 (d) 3 : 2

44. The point in the plane of a triangle which is at equal perpendicular distance from the sides of the triangle is:
(a) incentre (b) circumcentre
(c) orthocentre (d) centroid

45. Incentre of a triangle lies in the interior of
(a) an isosceles triangle only
(b) an equilateral triangle only
(c) a right triangle only
(d) any triangle

46. A man goes to a graden and runs in the following manner:
From the starting, he goes west 25 m, then due north 60 m, then due east 80 m and finally due south 12 m. The distance between the starting point the finishing point is :
(a) 177 m (b) 103 m
(c) 83 m (d) 73 m

47. ABC is a triangle such that AB = 10 and AC = 3. The side BC is:
(a) equal to 7 (b) greater than 7
(c) less than 7 (d) None of these

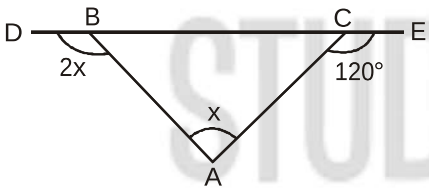
48. O is the circumcentre of ΔABC. $\angle$A = 50°. Find the measure of ΔBOC.
(a) 80° (b) 100°
(c) 120° (d) 110°

49. The four triangle formed by joining the pairs of mid points of the sides of a given triangle are congruent if the given triangle is :
(a) an isosceles triangle
(b) an equilateral triangle
(c) a right angled triangle
(d) of any shape

50. If D, E and F are respectively the mid points of sides BC, CA and AB of a ΔABC. If EF = 3 cm, FD = 4 cm and AB = 10 cm, then DE, BC and CA respectively will be equal to :
(a) 6, 8 and 20 cm (b) $\frac{10}{3}$, 9 and 12 cm
(c) 4, 6 and 8 cm (d) 5, 6 and 8 cm

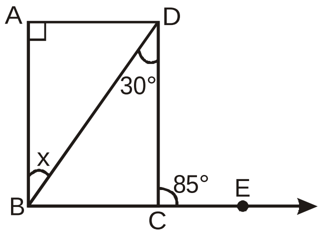
Moderate

1. In the given figure, value of x is:



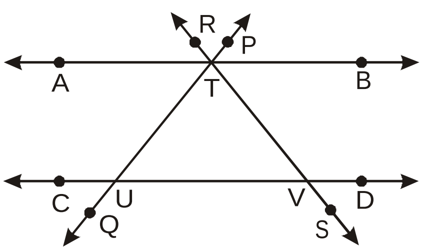
(a) 30° (b) 40°
(c) 45° (d) 60°

2. Given that AD | | BE, AB $\perp$ AD $\angle$DCE = 85°, $\angle$BDC = 30°, What is the value of x?



(a) 30° (b) 35°
(c) 45° (d) 55°

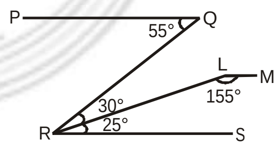
3. In the given figure AB | | CD, $\angle$PTB = 55° and $\angle$DVS = 45°. Sum of $\angle$CUQ and $\angle$RTP is:



(a) 180° (b) 135°
(c) 110° (d) 100°

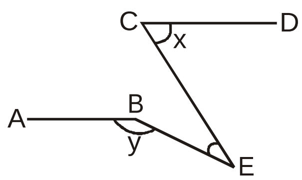
4. Which of the following cannot be number of diagonals of a polygon?
(a) 14 (b) 20
(c) 28 (d) 35

5. In the figure given below RS is parallel to PQ. What is the angle between lines PQ and LM?



(a) 175° (b) 177°
(c) 179° (d) 180°

6. In the figure given below AB is parallel to CD. If $\angle$DCE = x and $\angle$ABE = y, then $\angle$CEB is equal to:



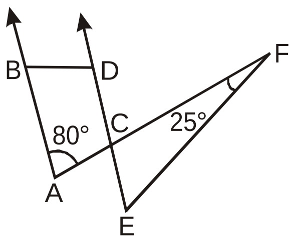
(a) $y - x$ (b) $\frac{(x+y)}{2}$
(c) $x + y - \left(\frac{\pi}{2}\right)$ (d) $x + y - \pi$

7. If difference of interior and external angle at a vertex of a regular polygon is 150°; number of sides in the polygon is:
(a) 10 (b) 15
(c) 24 (d) 30

8. If sum of internal angles of a regular polygon is 1080°, then number of sides in the polygon is:
(a) 6 (b) 8
(c) 10 (d) 12

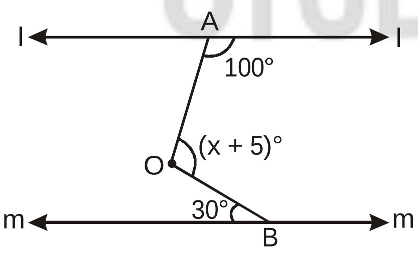
9. If one internal angle of a regular polygon is 135°, then number of diagonals in the polygon is:
(a) 16 (b) 18
(c) 24 (d) 20

10. In the given figure, AB||CD. If ∠CAB = 80° and ∠EFC = 25°, then ∠CEF is equal to:



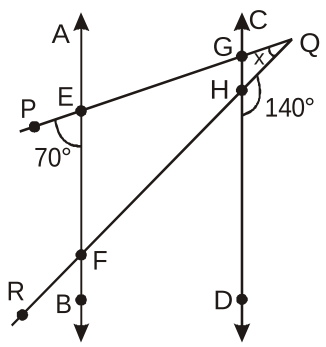
(a) 65° (b) 55°
(c) 45° (d) 75°

11. In the given figure, if l||m, then find the value of x (in degrees)?



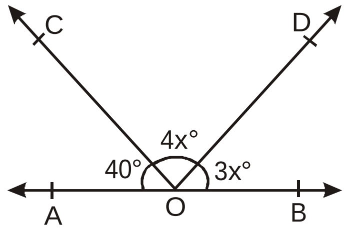
(a) 105° (b) 100°
(c) 110° (d) 115°

12. In the given figure, AB||CD and they cut PQ and QR at E, G and F, H, respectively. If ∠PQR = x, then find the value of x (in degrees)?



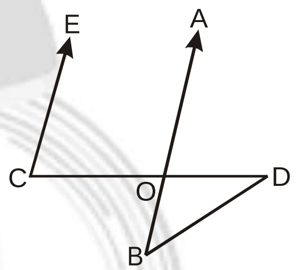
(a) 20° (b) 30°
(c) 24° (d) 32°

13. In the given figure, AOB is straight line if ∠AOC = 40°, ∠COD = 4x° and ∠BOD = 3x°, then ∠COD is equal to:



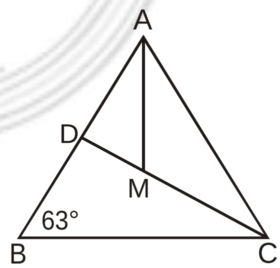
(a) 80° (b) 100°
(c) 120° (d) 140°

14. In the figure given below, EC is parallel to AB, ∠ECD = 70° and ∠BDO = 20°. What is the value of ∠OBD?



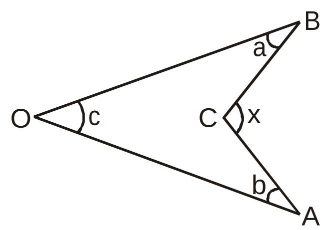
(a) 20° (b) 30°
(c) 40° (d) 50°

15. In the given figure, AM = AD, ∠B = 63° and CD is an angle bisector of ∠C, then ∠MAC = ?



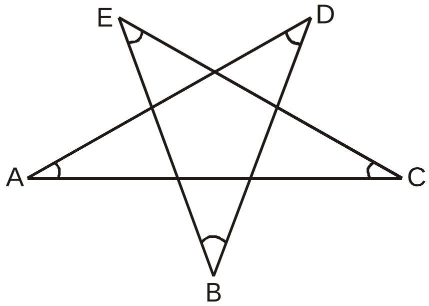
(a) 27° (b) 37°
(c) 63° (d) None of these

16. In the given figure, x = ?



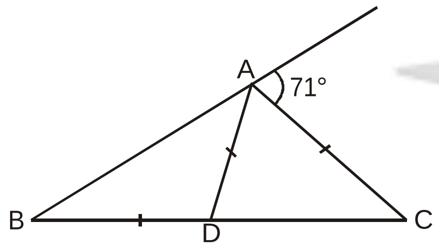
(a) a + b – c (b) a – b + c
(c) a + b + c (d) a + c – b

17. In the given figure, $\angle A + \angle B + \angle C + \angle D + \angle E + \angle F =$



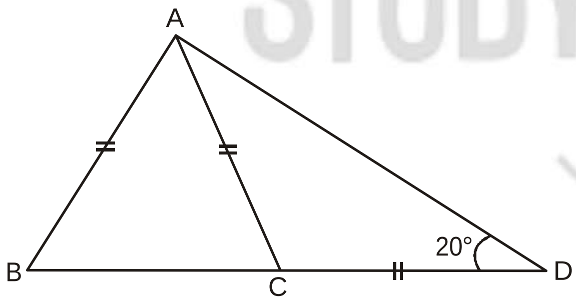
(a) 900° (b) 720°
(c) 180° (d) 540°

18. In the given figure, if AD = BD = AC then the value of $\angle C$ will be:



(a) $\frac{124}{3}^{\circ}$ (b) $\frac{142}{3}^{\circ}$
(c) 39° (d) None of these

19. Consider ΔABD such that $\angle ADB = 20°$ and C is a point on BD such that AB = AC and CD = CA. Then the measure of $\angle ABC$ is:



(a) 40° (b) 45°
(c) 60° (d) 30°

20. The angles of a triangle are arranged in ascending order of magnitude. If the difference between two consecutive angles is 10°, find largest angle:
(a) 60° (b) 100°
(c) 50° (d) 70°

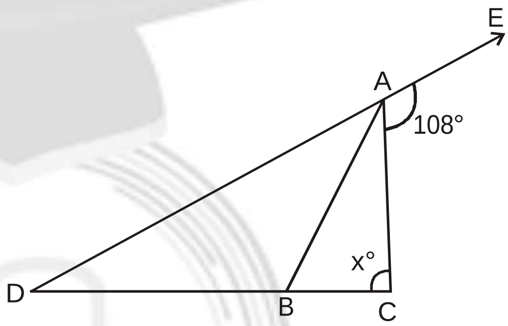
21. If the side BC of a ΔABC is produced on both sides, then the sum of the exterior angles so formed is greater than $\angle A$ by:
(a) one right angle (b) three right angles
(c) two right angles (d) None of these

22. We have an angle of $2\frac{1}{2}^{\circ}$. How big will it look through a glass that magnifies things three times?
(a) $2\frac{1}{2}^{\circ} \times 4$ (b) $2\frac{1}{2}^{\circ} \times 3$
(c) $2\frac{1}{2}^{\circ} \times 2$ (d) None of these

23. The side BC of Δ is produced to D. If $\angle ACD = 108°$ and $\angle B = \frac{1}{2}\angle A$ then $\angle A$ is:
(a) 36° (b) 108°
(c) 59° (d) 72°

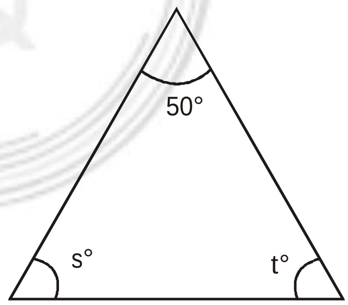
24. The sum of two angles of a triangle is 80° and their difference is 20°, then the smallest angle:
(a) 50° (b) 100°
(c) 30° (d) None of these

25. In the given figure, AB divides $\angle DAC$ in the ratio 1 : 3 and AB = DB. The value of x:



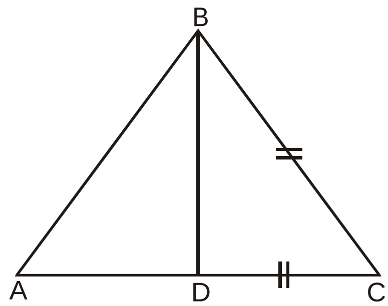
(a) 90° (b) 80°
(c) 100° (d) 110°

26. In the figure below, if s < 50° < t, then



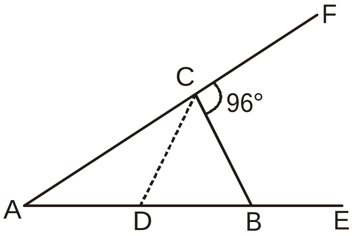
(a) t < 80 (b) s + t < 130
(c) 50 < t < 80 (d) t > 80

27. In the given triangle ABC, BC = CD and ($\angle ABC - \angle BAC$) = 30°. The measure of $\angle ABD$ is:



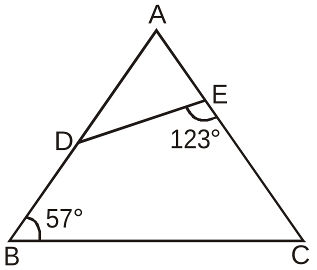
(a) 30° (b) 45°
(c) 15° (d) can't be determined

28. In the given figure below, if AD = CD = BC, and $\angle BCF = 96°$, How much is $\angle DBC$?



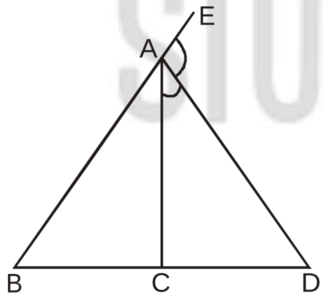
(a) 32° (b) 84°
(c) 64° (d) can't be determined

29. In the given figure, AD = 11 cm, AB = 18 cm and AE = 9 cm. Find EC:



(a) 13 cm (b) 14 cm
(c) 8 cm (d) 11 cm

30. In the given figure AD is the external bisector of $\angle EAC$, intersects BC produced at D. If AB = 12 cm, AC = 8 cm and BC = 4 cm, find CD:

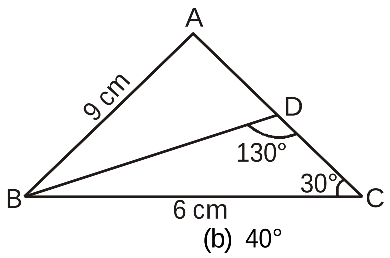


(a) 10 cm (b) 6 cm
(c) 8 cm (d) 9 cm

31. In ΔABC, D is a point on BC such that $\frac{AB}{AC} = \frac{BD}{DC}$. If $\angle B = 70°$, $\angle C = 50°$, then the value of $\angle BAD$:

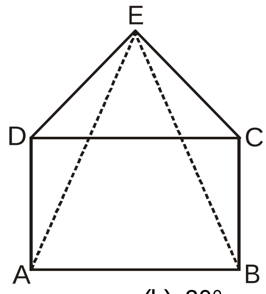
(a) 30° (b) 60°
(c) 40° (d) 50°

32. In the given figure, AD : DC = 3 : 2, then $\angle ABC$:



(a) 30° (b) 40°
(c) 45° (d) 50°

33. In the given figure, ABCD is a square and DCE is an equilateral triangle, then $\angle DAE$ will be:



(a) 45° (b) 30°
(c) 15° (d) $22\frac{1°}{2}$

34. In a triangle ABC, $\angle BAC = 90°$ and AD is perpendicular to BC. If AD = 6 cm and BD = 4 cm, then the length of BC is:

(a) 8 cm (b) 10 cm
(c) 9 cm (d) 13 cm

35. If G is centroid and AD, BE, CF are three medians of ΔABC with area 72 cm^2, then the area of ΔBDG is:

(a) 12 cm^2 (b) 16 cm^2
(c) 24 cm^2 (d) 8 cm^2

36. D is any point on side AC of ΔABC. If P, Q, X, Y are the mid-points 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

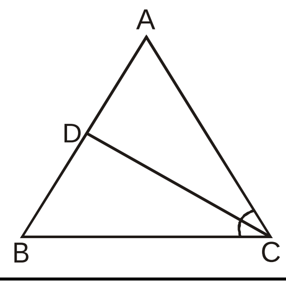
37. ABC is an equilateral triangle. P and Q are two points on $\overline{AB}$ and $\overline{AC}$ respectively such that $\overline{PQ} \| \overline{BC}$. If $\overline{PQ} = 5$ cm the area of ΔAPQ is:

(a) $\frac{25}{4}$ sq. cm (b) $\frac{25}{\sqrt{3}}$ sq. cm
(c) $\frac{25\sqrt{3}}{4}$ sq. cm (d) $25\sqrt{3}$ sq. cm

38. In ΔABC, P and Q are the mid points of the sides AB and AC respectively. R is a point on the segment PQ such that PR : RQ = 1 : 2, If PR = 2 cm, then BC =

(a) 4 cm (b) 2 cm
(c) 12 cm (d) 6 cm

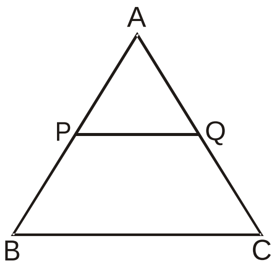
39. In the given figure, $\angle BAC = \angle BCD$, AB = 32 cm and BD = 18 cm, then the ratio of perimeter of ΔBCD and ΔABC is:



(a) 4 : 3 (b) 8 : 5
(c) 5 : 8 (d) 3 : 4

40. A straight line parallel to base BC of the triangle ABC intersects AB and AC at the points D and E respectively. If the area of the ΔACD is 36 sq. cm, then the area of ΔABE is:
(a) 36 sq. cm (b) 18 sq. cm
(c) 12 sq. cm (d) None of these

41. In the given triangle ABC, BP = 3 AP, QC = 3AQ and BC = 36 cm. Find the value of PQ?

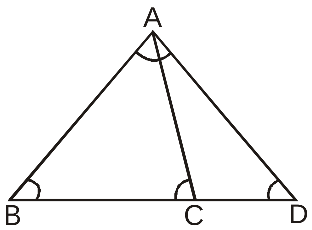


(a) 9 cm (b) 8 cm
(c) 6 cm (d) 7 cm

42. If P and Q are the mid-points of the sides AC and BC respectively of a triangle ABC, right-angled at C, then the value of $4(AQ^2 + BP^2)$ is equal to:
(a) $4 BC^2$ (b) $2 AC^2$
(c) $2 BC^2$ (d) $5 AB^2$

43. If a, b and c are the sides of a triangle and $a^2 + b^2 + c^2 = ab + bc + ca$, then the triangle is:
(a) Equilateral (b) Isosceles
(c) Right-angled (d) Obtuse-angle

44. In the given figure, ∠B = ∠C = 55° and ∠D = 25° then:



(a) BC < CA < CD (b) BC > CA > CD
(c) BC < CA, CA > CD (d) BC > CA, CA < CD

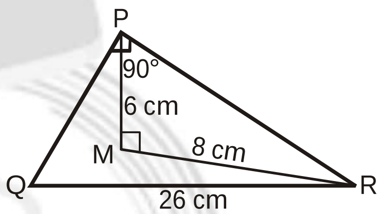
45. In ΔABC, ∠B = 90°, ∠C = 45° and D is the mid-point of AC. If AC = $4\sqrt{2}$ units, then BD is:
(a) $2\sqrt{2}$ units (b) $4\sqrt{2}$ units
(c) $\frac{5}{2}$ units (d) 2 units

46. 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

47. The equidistant point from the vertices of a triangle is called its:
(a) centroid (b) incentre
(c) circumcentre (d) orthocentre

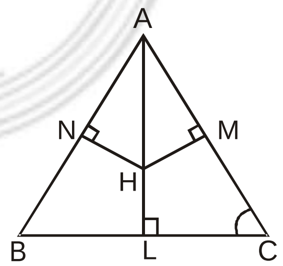
48. The in-radius of an equilateral triangle is 3 cm, Then the length of each of its medians is:
(a) 12 cm (b) $\frac{9}{2}$ cm
(c) 4 cm (d) 9 cm

49. In the given figure ∠QPR = 90°, QR = 26 cm, PM = 6 cm, MR = 8 cm and ∠PMR = 90°, find the area of ΔPQR?



(a) 180 cm^2 (b) 240 cm^2
(c) 120 cm^2 (d) 150 cm^2

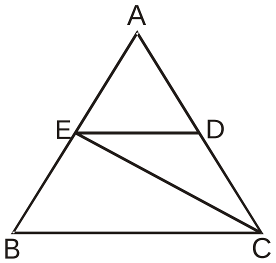
50. If H is the orthocentre of ΔABC, then the orthocentre of ΔHBC is (figure given):



(a) N (b) A
(c) L (d) M

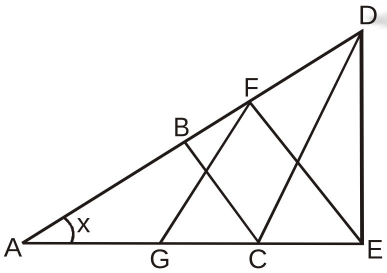
Difficult

1. In the given figure, if $\angle B = \angle C = 78°$, BC = EC, CD = BC and DE not parallel to BC, then $\angle EDB$ =



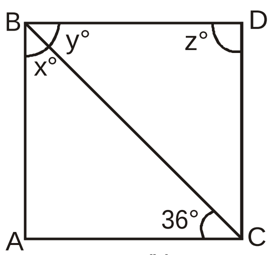
(a) 18° (b) 12°
(c) 22° (d) None of these

2. In the given figure, if AB = BC = CD = EF = DE = GA = FG, then x =



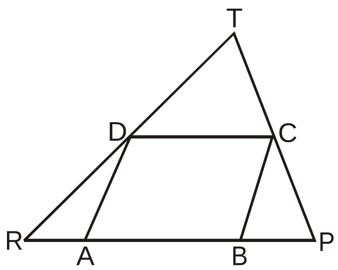
(a) $\frac{153}{7}$ (b) 28°
(c) $\frac{180}{7}$ (d) None of these

3. In the given figure, AB | | DC. If $x = \frac{4}{3}y$ and $y = \frac{3}{8}z$, then $\angle BAC$:



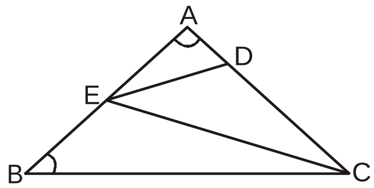
(a) 48° (b) 96°
(c) 108° (d) 84°

4. In the given figure, ABCD is a rhombus and AR = AB = BP, then the value of $\angle RTP$ is:



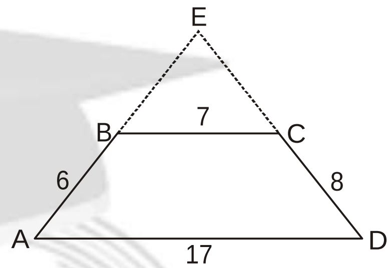
(a) 60° (b) 90°
(c) 120° (d) 75°

5. In the given figure, if AD = DE = EC = BC then $\angle A : \angle B$ =



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

6. In the trapezium ABCD shown below, AD | | BC and AB = 6, BC = 7, CD = 8, AD = 17, If sides AB and CD are extended to meet at E, find the measure of $\angle AED$:



(a) 120° (b) 100°
(c) 80° (d) 90°

7. The lengths of perpendiculars drawn from any point in the interior of an equilateral triangle to the respective side of the triangle are P_1, P_2 and P_3, then the side of triangle is:

(a) $\frac{5}{\sqrt{3}}(P_1 + P_2 + P_3)$ (b) $\frac{1}{\sqrt{3}}(P_1 + P_2 + P_3)$

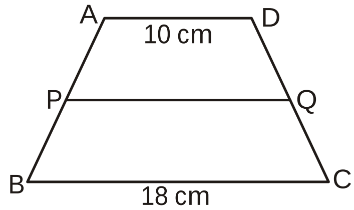
(c) $\frac{2}{3}(P_1 + P_2 + P_3)$ (d) $\frac{2}{\sqrt{3}}(P_1 + P_2 + P_3)$

8. ABC is a right angled triangle, right angled at C and P is the length of perpendicular from C on AB. If a, b and c are the lengths of the sides BC, CA and AB respectively, then:

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

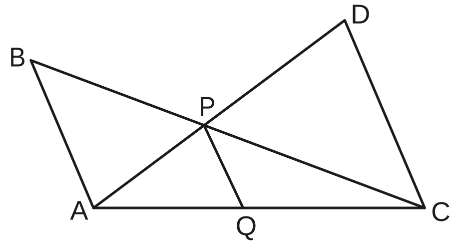
(c) $\frac{1}{p^2} + \frac{1}{a^2} = \frac{1}{b^2}$ (d) $\frac{1}{p^2} = \frac{1}{a^2} - \frac{1}{b^2}$

9. In the given figure, ABCD is a trapezium such that AD | | BC and P, Q are the points on AB and CD respectively such that PQ | | AD and AP : PB = 5 : 3. Then PQ is:



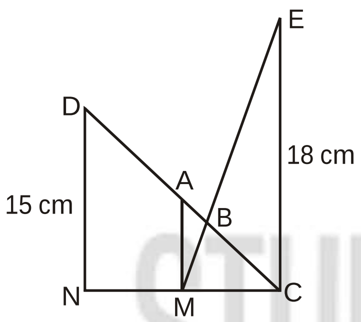
(a) 12.5 cm (b) 15 cm
(c) 17.5 cm (d) 20 cm

10. In the given figure, AB | | CD | | PQ, AB = 12 cm, CD = 18 cm and AC = 6 cm. Then PQ is:



(a) $\frac{36}{5}$ cm (b) $\frac{18}{5}$ cm
(c) 9 cm (d) $\frac{14}{5}$ cm

11. In the given figure, EC | | AM | | DN and AB = 5 cm, BC = 10 cm. Find DC:



(a) 19 cm (b) 20 cm
(c) 25 cm (d) 17.5 cm

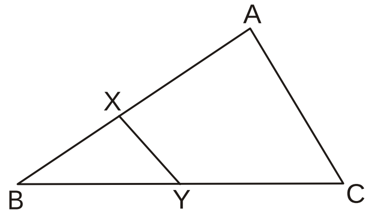
12. Find the maximum area that can be enclosed in a triangle of perimeter 24 cm:

(a) 32 cm^2 (b) $16\sqrt{3}$ cm^2
(c) $16\sqrt{2}$ cm^2 (d) 27 cm^2

13. The lengths of perpendiculars drawn from any point in the interior of an equilateral triangle to the respective sides are 6 cm, 8 cm, and 10 cm. The length of each side of the triangle is:

(a) $24\sqrt{3}$ cm (b) $8\sqrt{3}$ cm
(c) $16\sqrt{3}$ cm (d) 48 cm

14. In the given figure, the line segment XY | | AC and it divides the triangle into two parts of equal area. Find ratio $\frac{AX}{AB}$:



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

15. D and E are the mid-points of AB and AC of ΔABC, BC is produced to any point P; DE , DP and EP are joined. Then, area of:

(a) $\Delta PED = \frac{1}{4}\Delta ABC$ (b) $\Delta PED = \Delta BEC$
(c) $\Delta ADE = \Delta BEC$ (d) $\Delta BDE = \Delta ABC$

16. In a ΔABC, D is the mid-point of BC and E is the mid-point of AD. The line BE is extended and it intersects AC at T. If AB = 18 cm, BC = 17 cm and AC = 15 cm. Find TC?

(a) 8 cm (b) 9 cm
(c) 10 cm (d) 7 cm

17. In ΔABC, G is the centroid, AB = 15 cm, BC = 18 cm, and AC = 25 cm. Find GD, where D is the mid-point of BC:

(a) $\frac{1}{2}\sqrt{86}$ cm (b) $\frac{1}{3}\sqrt{86}$ cm
(c) $\frac{7}{3}\sqrt{86}$ cm (d) $\frac{2}{3}\sqrt{86}$ cm

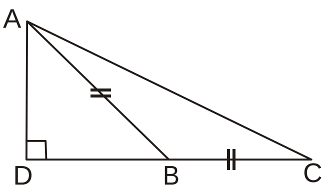
18. If G is the centroid of ΔABC and AG = BC, then $\angle BGC$ is:

(a) 75° (b) 45°
(c) 90° (d) 60°

19. By decreasing 15° each angle of a triangle the ratios of their angles are 2 : 3 : 5, the radian measure for greatest angle is:

(a) $\frac{11\pi}{24}$ (b) $\frac{\pi}{12}$
(c) $\frac{\pi}{24}$ (d) $\frac{5\pi}{24}$

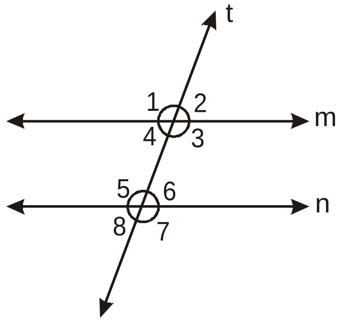
20. In the given figure, AB = BC and $\angle BAC = 15°$, AB = 10 cm. Find the area of ΔABC:



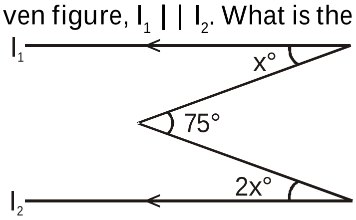
(a) 50 cm^2 (b) 40 cm^2
(c) 25 cm^2 (d) 32 cm^2

Previous Year (Memory Based)

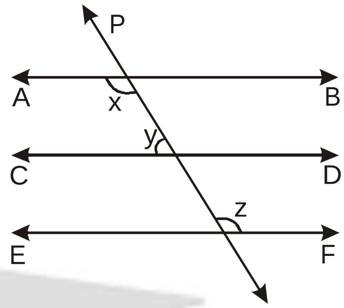
1. The external bisectors of $\angle B$ and $\angle C$ of ΔABC meet at point P. If $\angle BAC = 80°$, then $\angle BPC$ is:
   (a) 50° (b) 40°
   (c) 80° (d) 100°
2. Side BC of ΔABC Produces to D. If $\angle ACD = 108°$ and $\angle B = \frac{1}{2}\angle A$ then $\angle A$ is:
   (a) 108° (b) 59°
   (c) 36° (d) 72°
3. A, O, B are three points on a line segment and C is a point not lying on AOB. If $\angle AOC = 40°$ and OX, OY, are the internal and external bisectors of $\angle AOC$ respectively, then $\angle BOY$ is:
   (a) 72° (b) 68°
   (c) 70° (d) 80°
4. If each interior angle is double of each exterior angle of a regular polygon with n sides, then the value of n is:
   (a) 5 (b) 6
   (c) 8 (d) 10
5. By decreasing 20° of each angle of a triangle, the ratios of their angles are 2 : 3 : 5. The radian measure of original greatest angle is:
   (a) $\frac{\pi}{12}$ (b) $\frac{\pi}{24}$
   (c) $\frac{4\pi}{9}$ (d) $\frac{11\pi}{24}$
6. In the figure given below, lines m and n are parallel and t is the transversal.



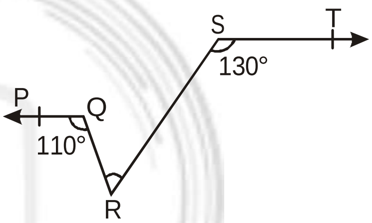
   $\angle 8$ is less than $\angle 3$ by 90°. Which of the following is true?
   (a) $\angle 1 = \angle 3 = \angle 5 = \angle 7 = 135°$
   (b) $\angle 2 = \angle 4 = \angle 6 = \angle 8 = 45°$
   (c) $\angle 1 = \angle 3 = \angle 5 = \angle 7 = 75°$
   (d) $\angle 2 = \angle 4 = \angle 6 = \angle 8 = 105°$
7. In the given figure, $l_1 \,||\, l_2$. What is the value of x?



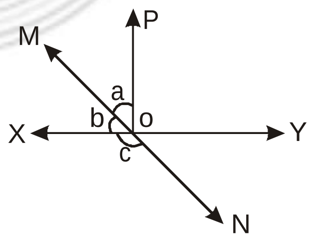
   (a) 15° (b) 20°
   (c) 30° (d) 25°
8. In the given figure AB || CD, CD || EF and Y : Z = 3 : 7 then find x.



   (a) 110° (b) 126°
   (c) 140° (d) 150°
9. In the given figure, if PO || ST, $\angle PQR = 110°$ and $\angle RST = 130°$, find $\angle QRS$.



   (a) 40° (b) 50°
   (c) 60° (d) 70°
10. In the given figure XY and MN Intersects at O. If $\angle POY = 90°$ and a : b = 2 : 3 then find C.



   (a) 113° (b) 54°
   (c) 126° (d) 48°
11. If a and b are two sides adjacent to the right angle of a right angled triangle and p is the perpendicular drawn to the hypotenuse h from the opposite vertex. Then, p^2 is equal to:
   (a) $a^2 + b^2$ (b) $\frac{1}{a^2} + \frac{1}{b^2}$
   (c) $\frac{a^2 b^2}{a^2 + b^2}$ (d) $a^2 - b^2$

12. In a ΔABC, $\angle A + \frac{1}{2}\angle B + \angle C = 140°$, then $\angle B$ is :
(a) 50° (b) 80°
(c) 40° (d) 60°

13. ABC is an isosceles triangle such that AB = AC and AD is the median to the base BC with $\angle ABC = 35°$. Then, $\angle BAD$ is:
(a) 35° (b) 55°
(c) 70° (d) 110°

14. A man goes 24 m due West and then 10 m due North. Then, the distance from the starting point is:
(a) 17 m (b) 26 m
(c) 28 m (d) 34 m

15. In a ΔABC, $\angle A - \angle B = 20°$, $\angle A - \angle C = 52°$. Then, $\angle \frac{A}{2}$ is:
(a) 42° (b) 90°
(c) 75° (d) 80°

16. In ΔABC, $\angle A = 90°$, BP and CQ are two medians. Then, the value of $\frac{BP^2 + CQ^2}{BC^2}$ is:
(a) $\frac{4}{5}$ (b) $\frac{5}{4}$
(c) $\frac{3}{4}$ (d) $\frac{3}{5}$

17. In ΔABC the straight line parallel to the side BC meets AB and AC at the points P and Q, respectively. If AP = QC and the length of AB is 12 units and the length of AQ is 2 units, then the length (in units) of CQ is:
(a) 4 (b) 6
(c) 8 (d) 10

18. The perimeters of two similar triangles ΔABC and ΔPQR are 36 cm and 24 cm respectively. If PQ = 10 cm, then AB is:
(a) 15 cm (b) 12 cm
(c) 14 cm (d) 26 cm

19. 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

20. In a ΔABC, $\frac{AB}{AC} = \frac{BD}{DC}$, $\angle B = 70°$ and $\angle C = 50°$, then $\angle BAD = ?$
(a) 60° (b) 20°
(c) 30° (d) 50°

21. In a ΔABC, AD, BE and CF are three medians. The perimeter of ΔABC is always:
(a) equal to $\left(\overline{AD} + \overline{BE} + \overline{CF}\right)$
(b) greater than $\left(\overline{AD} + \overline{BE} + \overline{CF}\right)$
(c) less than $\left(\overline{AD} + \overline{BE} + \overline{CF}\right)$
(d) None of the above

22. In a ΔABC, $\overline{AD}$, $\overline{BE}$ and $\overline{CF}$ are three medians. Then, the ratio $\left(\overline{AD} + \overline{BE} + \overline{CF}\right) : \left(\overline{AB} + \overline{AC} + \overline{BC}\right)$ is:
(a) equal to $\frac{3}{4}$ (b) less than $\frac{3}{4}$
(c) greater than $\frac{3}{4}$ (d) equal to $\frac{1}{2}$

23. If G be the centroid and AD be the median of ΔABC and AG = 4 cm, then DG is:
(a) 2 cm (b) 3 cm
(c) 4 cm (d) 5 cm

24. If ABC is an isosceles triangle right angled at C, then AB^2 is equal to:
(a) $3AC^2$ (b) $4AC^2$
(c) $2AC^2$ (d) $5AC^2$

25. If ABC is an equilateral triangle and D is a point on BC such that $AD \perp BC$, then:
(a) AB : BD = 1 : 1 (b) AB : BD = 1 : 2
(c) AB : BD = 2 : 1 (d) AB : BD = 3 : 2

26. 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 angles must be:
(a) 60° (b) 30°
(c) 45° (d) 15°

27. If in ΔABC, $\angle ABC = 5x$, $\angle BAC = 3x$, $\angle ACB = x$ then $\angle ABC$ is equal to:
(a) 80° (b) 100°
(c) 120° (d) 130°

28. In ΔABC D, E are points on sides AB and AC, such the DE || BC. If AD = x, DB = x – 2, AE = x + 2, EC = x – 1, then the value of x is:
(a) 4 (b) 2
(c) 1 (d) 8

29. In a ΔABC, if $\angle A = 115°$, $\angle C = 20°$ and D is a point on BC such that $AD \perp BC$ and BD = 7 cm, then AD is of length?
(a) 15 cm (b) 5 cm
(c) 7 cm (d) 10 cm

30. In a right angled triangle $\angle ABC = 90°$; BN is perpendicular to AC, AB = 6 cm, AC = 10 cm. Then AN : NC is:
(a) 3 : 4 (b) 9 : 16
(c) 3 : 16 (d) 1 : 4

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

32. In ΔABC, $\angle B = 80°$ and $\angle C = 60°$. If AD and AE be respectively the internal bisector of $\angle A$ and perpendicular on BC, then the measure of $\angle DAE$ is:
(a) 5° (b) 10°
(c) 40° (d) 60°

33. For a triangle, base is $6\sqrt{3}$ cm and two base angles are 30° and 60°. Then, height of the triangle is:
(a) $3\sqrt{3}$ cm (b) 4.5 cm
(c) $4\sqrt{3}$ cm (d) $2\sqrt{3}$ cm

34. I is the incentre of a ΔABC. If $\angle ABC = 65°$ and $\angle ACB = 55°$, then the value of $\angle BIC$ is:
(a) 130° (b) 120°
(c) 140° (d) 110°

35. In a ΔABC, $AB^2 + AC^2 = BC^2$ and $BC = \sqrt{2}AB$, then $\angle ABC$ is:
(a) 30° (b) 45°
(c) 60° (d) 90°

36. In ΔPQR, points A, B and C are taken on PQ, PR and QR, respectively such that QC = AC and CR = CB. If $\angle QPR = 40°$, then $\angle ACB$ is equal to:
(a) 140° (b) 40°
(c) 70° (d) 100°

37. 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) $1 : \sqrt{2} + 1$

38. Suppose ΔABC be a right angled triangle, where $\angle A = 90°$ and $AD \perp BC$. If area of $\Delta ABC = 40\ cm^2$, area of $\Delta ACD = 10\ cm^2$ and AC = 9 cm, then the length of BC:
(a) 12 cm (b) 18 cm
(c) 4 cm (d) 6 cm

39. AD is the median of a ΔABC and O is the centroid such that AO = 10 cm. The length of OD (in cm) is:
(a) 4 (b) 5
(c) 6 (d) 8

40. The external bisector of $\angle B$ and $\angle C$ of ΔABC (where AB and AC extended to E and F, respectively) meet at point P. If $\angle BAC = 100°$, then the measure of $\angle BPC$ is:
(a) 50° (b) 80°
(c) 40° (d) 100°

41. ABC is an equilateral triangle. P and Q are two points on AB and AC, respectively such that PQ | | BC. If PQ = 4 cm, then area of ΔAPQ is:
(a) $\frac{25}{4}$ sq. cm (b) $\frac{4}{\sqrt{3}}$ sq. cm
(c) $4\sqrt{3}$ sq. cm (d) $16\sqrt{3}$ sq. cm

42. D is any point on side AC of ΔABC. If P, Q, X, Y are the mid-points 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

43. Let O be the incentre of a ΔABC and D be a point on the side BC of ΔABC, such that $OD \perp BC$. If $\angle BOD = 15°$, then $\angle ABC$ is:
(a) 75° (b) 45°
(c) 150° (d) 90°

44. In ΔABC, AD is the internal bisector of $\angle A$, meeting the side BC at D. If BD = 5 cm, BC = 7.5 cm, then AB : AC is:
(a) 2 : 1 (b) 1 : 2
(c) 4 : 5 (d) 3 : 5

45. 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

46. If the lengths 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

47. A straight line parallel to BC of ΔABC intersects AB and AC at points P and Q, respectively. AP = QC, PB = 4 units and AQ = 9 units, then the length of AP is:
(a) 25 units (b) 3 units
(c) 6 units (d) 6.5 units

48. In ΔABC, $\angle BAC = 90°$ and $AB = \frac{1}{2}BC$. Then, the measure of $\angle ACB$ is:
(a) 60° (b) 30°
(c) 45° (d) 15°

49. O is the incentre of ΔABC and $\angle BOC = 110°$. Find $\angle BAC$
(a) 40° (b) 45°
(c) 50° (d) 55°

50. Two triangles ABC and DEF are similar to each other in which AB = 10 cm, DE = 8 cm. Then, the ratio of the areas of triangles ABC and DEF is:
(a) 4 : 5 (b) 25 : 16
(c) 64 : 125 (d) 4 : 7

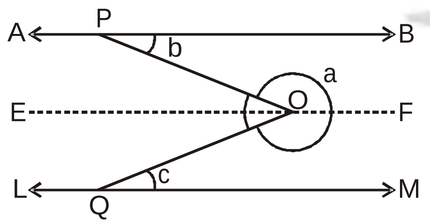
Foundation

Solutions

1. (a); $\angle BAD = 180° - (90° + 30°) = 60°$
$\angle BAC = 180° - (90° + 20°) = 70°$
$\angle CAD = \angle BAC - \angle BAD = 70° - 60° = 10°$

2. (a); $\angle BEH = 180° - (60° + 50°) = 70°$
$\angle FHE = 180° - 70° = 110°$

3. (c);



Draw EF parallel to AB.
$\angle EOP = \angle b$ $\angle EOQ = \angle c$
$\Rightarrow a = 2\pi - (\angle b + \angle c) = 2\pi - b - c$

4. (a); Let the angle be x.
its complementary angle = (90° – x)
$$x = \frac{2}{3}(90 - x)$$
x = 36°

5. (b); Let the angle be x.
According to the question:
$$x = \frac{1}{5}(180° - x) \Rightarrow x = 30°$$

6. (a); Let the number of sides be n.
According to the question:
$$\frac{(n-2)}{n}180 = 144 \Rightarrow n = 10$$

7. (b); $3x + 105° = 180°$
$3x = 75°$
$x = 25°$
$2x + 90 + y = 180°$
$2x + y = 90°$
$y = 90° - 50°, \quad y = 40°$
$x + y = 25° + 40° = 65°$

8. (c); $\angle APO = 42°$ and $\angle CQO = 38°$
$\angle POQ = \angle PON + \angle NOQ$
$= \angle APO + \angle OQC = 42° + 38° = 80°$

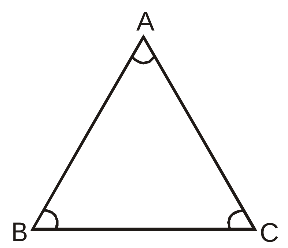
9. (b); $\angle COA + \angle AOD = 180°$
$3AOD + AOD = 180°$
$4AOD = 180°$
$$AOD = \frac{180°}{4} = 45°$$

10. (b); $\angle a + \angle b = 180°$

11. (b); Since A, B and C are the angles of a triangle.
$\angle A + \angle B + \angle C = 180°$
Now, $\angle A - \angle B = 15°, \quad \angle B - \angle C = 30°$
$\angle B = \angle C + 30°$
$\angle A = \angle B + 15 = \angle C + 45°$
$\angle A + \angle B + \angle C = \angle C + 45° + \angle C + 30 + \angle C = 180°$
$3\angle C = 105, \quad \angle C = 35°$
$\angle A = 35° + 45° = 80°$

12. (c); $2\angle A = 3\angle B = 6\angle C$
$$\angle B = \frac{2}{3}\angle A, \quad \angle C = \frac{1}{3}\angle A$$
$\angle A + \angle B + \angle C = 180°$
$$\angle A + \frac{2}{3}\angle A + \frac{1}{3}\angle A = 180°$$
$$\frac{3\angle A + 2\angle A + \angle A}{3} = 180°$$
$$\angle A = \frac{180°}{6} \times 3 = \frac{180°}{2} = 90°$$

13. (a);



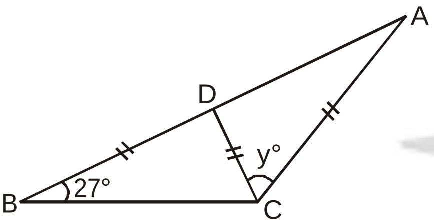
$\angle A = \angle B + \angle C$
We get that
$\angle A + \angle B + \angle C = 180°$
$\Rightarrow \angle A + \angle A = 180°$
$\Rightarrow 2\angle A = 180°, \quad \angle A = 90°$

14. (a); $\angle ACB = 180° - 30° - 90°$
$\angle ACB = 60°$
$\angle ACB + \angle ACD = 180°$
$\angle ACD = 180° - 60° = 120°$

15. (c); $y = 80°$ (Vertically opposite angles)
$x = 180° - 50° - 80° = 180° - 130° = 50°$

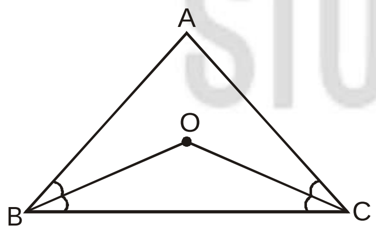
16. (a); $\angle A + \angle B + \angle C = 180°$
$\angle A > 90°$
$\angle B + \angle C < 90°$
Both are acute angles

17. (c);



In ΔBCD
$\angle CBD = \angle BCD$
$\angle BCD = 27°$
$\angle BDC = 180° - (27° - 27°)$
$\angle BDC = 180° - 54° = 126°$
$\angle ACD = 180° - (54° + 54°) = 72°$

18. (c);



$\angle A + \angle B + \angle C = 180°$

$\frac{1}{2}\angle B + \frac{1}{2}\angle C = 180° - \angle BOC$

$\frac{1}{2}\angle B + \frac{1}{2}\angle C = 90° - \frac{1}{2}\angle A$

$180° - \angle BOC = 90° - \frac{1}{2}\angle A$

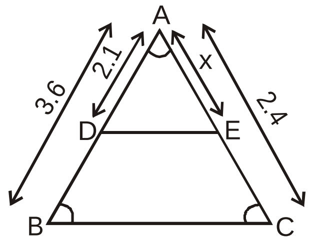
$\angle BOC = 180° - 90° + \frac{1}{2}\angle A$

$\angle BOC = 90° + \frac{1}{2}\angle A$

19. (b); Let the angles be 2x, 3x and 4x. Then,
$2x + 3x + 4x = 180$, $9x = 180°$, $x = 20°$
Greatest angle, $4x = 4 \times 20° = 80°$

20. (b); $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = \frac{2}{4} = \frac{1}{2}$
$DE = 2AB = 6$ cm, $DF = 2AC = 2 \times 2.5 = 5$ cm
$EF = 4$ cm
Perimeter of $\Delta DEF = (DE + EF + DF) = 15$ cm

21. (a);

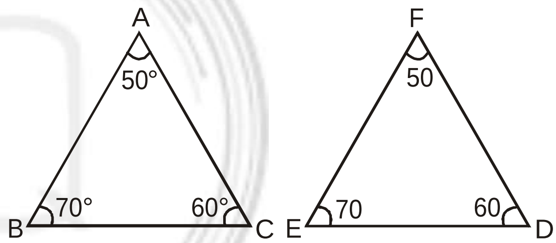


$\frac{AD}{AB} = \frac{AE}{AC} \Rightarrow \frac{2.1}{3.6} = \frac{AE}{2.4}$

$x = \frac{2.1 \times 2.4}{3.6} = 1.4$ cm

22. (a); The line segments joining the mid point of the sides of a triangle form four triangles each of which is similar to the original triangle.

23. (d);



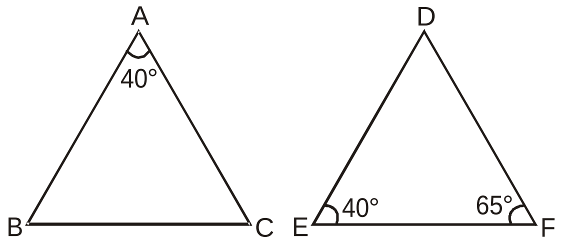
$\angle A = \angle F$, $\angle B = \angle E$, $\angle C = \angle D$
Then $\Delta ABC \sim \Delta FED$

24. (c); Let the other two sides are x and x + 5
$x^2 + (x + 5)^2 = 25^2$
$x^2 + x^2 + 25 + 10x = 625$
$2x^2 + 10x - 600 = 0$
$x^2 + 5x - 300 = 0$
$x^2 + 20x - 15x - 300 = 0$
$x(x + 20) - 15(x + 20) = 0$
$(x - 15)(x + 20) = 0$
$x = 15$ cm
The other side, $x + 5 = 15 + 5 = 20$ cm

25. (a); $\angle B = \angle C$ (Isosceles triangle)
$\angle ACD = 130°$
$\angle ACB = 180° - 130° = 50°$
$\angle ABC = 50°$
$\angle A = 180° - (50° + 50°) = 80°$

26. (d); ΔDEF is congruent to each one of the triangles ΔAFE, ΔBFD and ΔCDE.

27. (c);



$\frac{AB}{ED} = \frac{AC}{EF} \Rightarrow \frac{AB}{AC} = \frac{ED}{EF}$

$\angle F = 65°$

$\angle D = 180° - 105° = 75°$

$\angle B = \angle D = 75°$

28. (b);

29. (d); The circumcentre of a triangle is point of intersection of the perpendicular besectors of the sides.

30. (d); $AG : GD = 2 : 1 \Rightarrow GD : AD = 1 : 3$

$\Rightarrow AD : GD = 3 : 1$

$\frac{AD}{GD} = \frac{3}{1} \Rightarrow \frac{AD}{1.5} = 3,\quad AD = 3 \times 1.5 = 4.5$ cm

31. (b);

32. (b); Clearly one point namely the circumcentre of the triangle is equidistant from the vertices.

33. (c); $AB = 8$ cm and $BC = 6$ cm

$AC = \sqrt{AB^2 + BC^2} = \sqrt{8^2 + 6^2} = 10$ cm

Since the midpoint of hypotenuse of a right triangle is equidistant from its vertices, so

$BM = AM = MC = 5$ cm

34. (b);

35. (c); Side of equilateral triangle be 'a'.

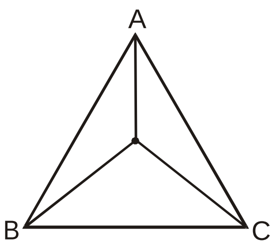
height, $h = \frac{\sqrt{3}}{2}a$

$\frac{a}{h} = \frac{2}{\sqrt{3}},\quad a : h = 2 : \sqrt{3}$

36. (d); $ar(\Delta DEF) = \frac{1}{4} ar(\Delta ABC) = \frac{1}{4} \times 24 = 6\ cm^2$

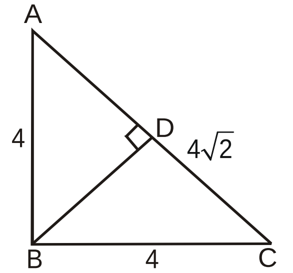
37. (a); Since, sum of two sides of triangle is greater than 3rd side

$OA + OB > AB,\quad OA + OC > AC,\quad OB + OC > BC$



$2(OA + OB + OC) > AB + BC + CA$

38. (d);



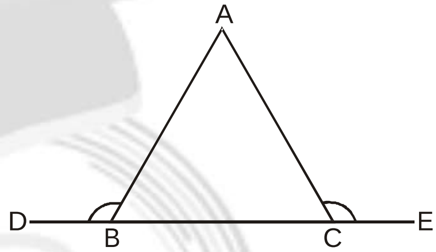
$AC^2 = \sqrt{4^2 + 4^2},\quad AC = 4\sqrt{2}$

ΔABC and ΔADB are similar

$BD \times AC = AB \times BC$

$BD = \frac{4 \times 4}{4\sqrt{2}} = 2\sqrt{2}$ cm

39. (b);



$\angle ABD = \angle BAC + \angle ACB$

$\angle ACE = \angle BAC + \angle ABC$

On adding above equation

$\angle ABD + \angle ACE = 2\angle BAC + \angle ACB + \angle ABC$

$= 180° + \angle BAC$

40. (c); $x + 3x + y = 180°$

$\Rightarrow 4x + y = 180°$

$3y - 5x = 30°$

$4x + y = 180°$

$x = 30°$ and $y = 60°$

$\angle A = 30°,\ \angle B = 90°$ and $\angle C = 60°$

41. (a);

42. (c); $\angle A + \angle B + \angle C = 180°$

$\frac{1}{2}\angle B + \frac{1}{2}\angle C = 90 - \frac{1}{2}\angle A$

$\frac{1}{2}\angle B + \frac{1}{2}\angle C + \angle BOC = 180°$

$\angle BOC = 180° - \left(90° - \frac{1}{2}\angle A\right)$

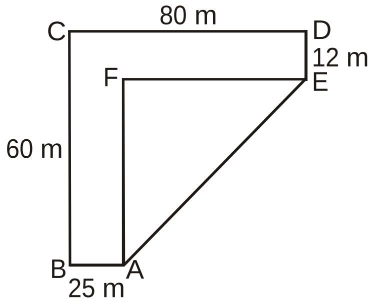
$\angle BOC = 90 + \frac{1}{2}\angle A = 90° + 40° = 130°$

43. (a);

44. (a); Incentre of a triangle is equidistant from its sides.

45. (d); Incentre of a triangle always lies inside the triangle.

46. (d);



$AE^2 = (DC - AB)^2 + (BC - DE)^2$

$AE^2 = 55^2 + 48^2$

$AE = \sqrt{55^2 + 48^2} = 73$ m

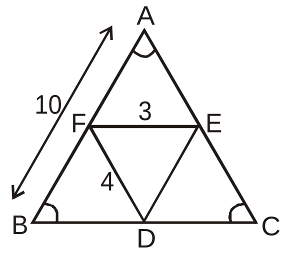
47. (b); Since third side will be greater than the difference between other two sides, so BC must be greater than 7

48. (b); If O is circumcentre of ΔABC

than, $\angle BOC = 2\angle A = 2 \times 50° = 100°$

49. (d); The four triangles made by joining the mid points of the sides of a given triangle are congruent if the given triangle is of any shape.

50. (d);



$\frac{AB}{DE} = \frac{BC}{EF} = \frac{CA}{DF}$, $DE = \frac{1}{2} \times 10 = 5$ cm

$BC = 2 \times EF = 2 \times 3 = 6$ cm

$AC = 2 \times DF = 2 \times 4 = 8$ cm

Moderate

1. (d); $\angle ABC = 180° - 2x$

$\angle ACB = 180° - 120° = 60°$

$\angle BAC = x$

$180 - 2x + 60 + x = 180° \Rightarrow 240 - x = 180°$

$x = 60°$

2. (b); AD | | BE

$\Rightarrow \angle ADC = \angle DCE = 85°$

$\Rightarrow \angle ADB = 85° - 30° = 55°$

$x = 180° - 90° - 55° = 35°$

3. (b); $\angle BTV = \angle DVS = 45°$

$\angle PTB = 55°$

$\angle PTR = 180° - 45° - 55° = 80°$

$\angle UTV = \angle PTR = 80°$

$\angle ATC = \angle PTB = 55°$

$\angle CUQ = 55°$

$\angle CUQ + \angle RTP = 55° + 80° = 135°$

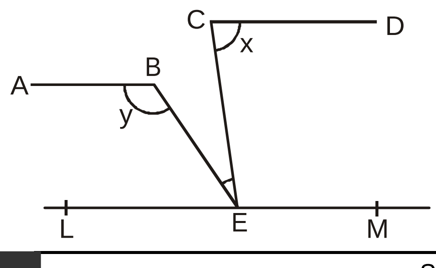
4. (c); When $\frac{n(n-3)}{2} = 28$, no value of n is a whole number

5. (d); and $\angle MLR + \angle SRL = 180°$

So, RS | | LM, PQ | | LM

Angle between PQ and LM is 180°

6. (d);



Here, AB | | CD (given)

Construct LM | | AB

$\angle ABE + \angle LEB = 180°$

$\angle LEB = 180° - y$

$\angle LEC = \angle DCE$

$\angle LEC = x$

$\angle CEB = x - 180° + y = x + y - 180° = x + y - \pi$

7. (c); If number of sides in regular polygon be n then

$\left(\frac{2n-4}{n}\right) \times 90° - \frac{360°}{n} = 150°$

$\frac{(2n-4) \times 3}{n} - \frac{12}{n} = 5$

$6n - 12 - 12 = 5n$, $n = 24$

8. (b); By using formula,

$1080° = (2n - 4) \times 90°$

$2n - 4 = 12$

$2n = 16$

$n = 8$

9. (d); Each interior angle of polygon $= \frac{n-2}{n} \times 180°$

$\frac{n-2}{n} \times 180° = 135°$ $4(n - 2) = 3x$

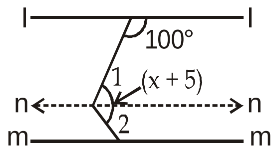
$4x - 8 = 3x$

$x = 8$

Number of diagonals $= \frac{n(n-3)}{2} = \frac{8 \times 5}{2} = 20$

10. (b); Let $\angle CEF = x°$
Now, AB | | CD and AF is a transversal
$\therefore$ $\angle DCF = \angle CAB = 80°$ (Corresponding angles)
In ΔCEF, side EC has been produced to D.
$\Rightarrow$ $x + 25° = 80°$ $\Rightarrow$ $x = 55°$

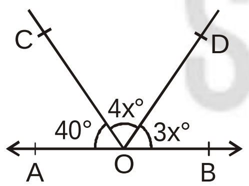
11. (a); Draw a line n passing through O and parallel to l and m.
Since l | | n, $\angle 1 + 100° = 180°$, $\angle 1 = 80°$
Since n | | m, $\angle 2 = 30°$ (alternate angles)



Now, $\angle AOB = \angle 1 + \angle 2 = (80 + 30)° = 110°$
But $\angle AOB = (x + 5)° = 110°$
$x = 110° – 5° = 105°$

12. (b); Since, AB | | CD and PQ is transveral.
$\angle PEF = \angle EGH$ [Corresponding angles]
$\angle EGH = 70°$
Now, $\angle EGH + \angle HGQ = 180°$
$\angle HGQ = 180° – 70° = 110°$
Also, $\angle DHQ + \angle GHQ = 180°$
$\angle GHQ = 180° – 140° = 40°$
In Δ GQH , $\angle GQH + 40° + 110° = 180°$
$\angle GQH = 180° – 150°$, $\angle GQH = 30°$

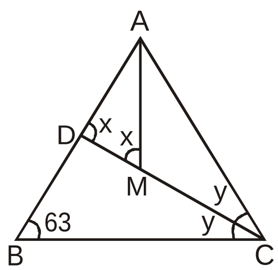
13. (a);



$\angle AOC + \angle COD + \angle BOD = 180°$
$40° + 4x° + 3x° = 180°$
$7x° = 140°$, $x = 20°$
$4x = 4 \times 20° = 80°$

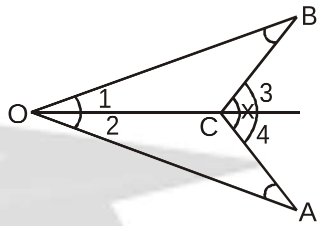
14. (d); $\angle ECD = 70°$
$\angle AOD = 70°$ [Corresponding angle to $\angle ECD$]
In ΔBOD
$\angle AOD = \angle OBD + \angle ODB$ (Exterior angle of a triangle is equal to sum of opposite interior angle)
$\angle AOD = \angle OBD + \angle ODB$
$70° = \angle OBD + 20°$
$\angle OBD = 70° – 20° = 50°$

15. (c);



AM = AD
$\angle ADM = \angle AMD = x$
$\angle ADC = \angle ABC + \angle BCD$
$x = 63° + y$ ...(i)
$\angle AMD = \angle ACM + \angle MAC$
$x = y + \angle MAC$ ...(ii)
On comparing (i) and (ii)
$63° + y = y + \angle MAC$
$\angle MAC = 63°$

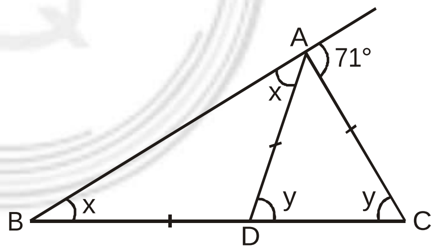
16. (c);



$c = \angle 1 + \angle 2$
$x = \angle 3 + \angle 4$
$\angle 3 = a + \angle 1$ ... (i)
$\angle 4 = b + \angle 2$ ... (ii)
On adding (i) and (ii)
$\angle 3 + \angle 4 = a + b + \angle 1 + \angle 2$
$x = a + b + c$

17. (c);

18. (b);



In ΔABD
$y = x + x$
$y = 2x$
In ΔABC
$x + y = 71°$

$x + 2x = 71°$, $3x = 71°$, $x = \frac{71°}{3}$

$\angle C = y = 2x = 2 \times \frac{71°}{3} = \frac{142°}{3}$

19. (a); $\angle ADB = 20°$
$\angle CAD = \angle CDA = 20°$
$\angle CAD = 20°$

$\angle ACD = 180° - 40° = 140°$

$\angle ACB = 40°$

$\angle ACB = \angle ABC = 40°$

20. (d); Let the angle be x, x + 10° and x + 20°

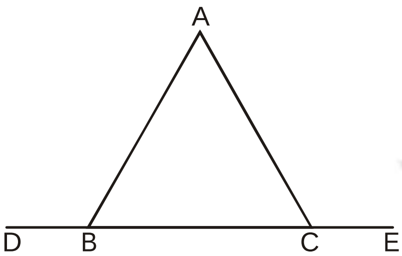
$x + x + 10° + x + 20° = 180°$

$3x + 30° = 180°$

$$x = \frac{150°}{3} = 50°$$

Largest angle, $x + 20° = 50° + 20° = 70°$

21. (c);



$\angle ABD = \angle ACB + \angle BAC$ ... (i)

$\angle ACE = \angle BAC + \angle CAB$ ... (ii)

on adding (i) and (ii)

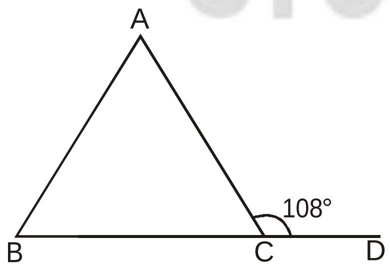
$\angle ABC + \angle ACE = 2\angle BAC + \angle ACB + \angle CAB$

$= 180 + \angle BAC$

so some of exterior angles so formed is greater than $\angle A$ by two right angles

22. (d);

23. (d);



$\angle A + \angle B = 108°$

$$\angle A + \frac{1}{2}\angle A = 108°$$

$$\frac{3\angle A}{2} = 108°, \quad \angle A = \frac{108°}{3} \times 2 = 72°$$

24. (c); Sum of two angle = 80°

$x + y = 80°$

Difference of two angle = 20°

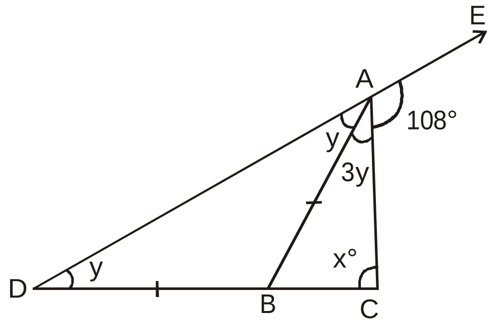
$x - y = 20°$

$2x = 100°, \quad x = 50°$

$y = 80° - 50° = 30°$

so, smallest angle is 30°

25. (a);



$\angle BAD = \angle BDA$

In ΔACD

$x + y = 108°$

$4y = 180° - 108°$

$y = 18°$

$x + y = 108°$

$x = 108° - 18°, \quad x = 90°$

26. (d); $s + t + 50° = 180°$

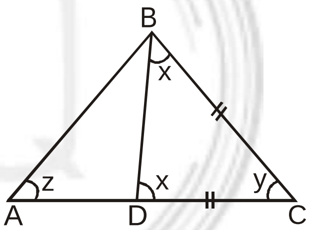
$s + t = 180° - 50°$

$s + t = 130°$

$s < 50°$

$t > 130° - 50°, \quad t > 80°$

27. (c);



$BC = CD$

$\angle CBD = \angle CDB = x$

$x = z + \angle ABD$

$x - z = \angle ABD$ ...(i)

$\angle ABC - \angle BAC = 30°$

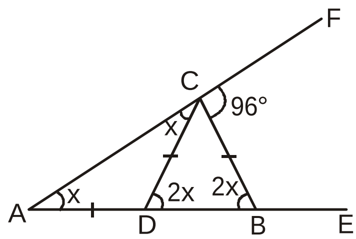
$\angle ABD + x - z = 30°$ ...(ii)

On solving (i) and (ii)

$2\angle ABD = 30°$

$\angle ABD = 15°$

28. (c);



$\angle CAD = \angle ACD = x$

$\angle CDB = \angle CAD + \angle DCA = 2\angle CAD$

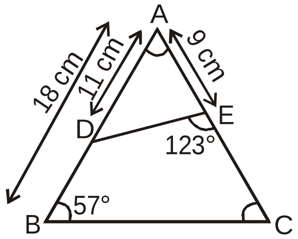
$\angle CDB = 2x = \angle CBD$

In ΔABC, $x + 2x = 96$

$3x = 96$, $x = \frac{96}{3} = 32°$

$\angle DBC = 2x = 32 \times 2 = 64°$

29. (a);



In ΔADE and ΔABC

$\angle A = \angle A$ (common)

$\angle ABC = \angle AED = 57°$

$\angle ACB = \angle ADE$

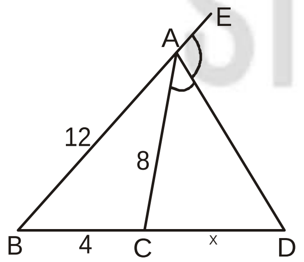
$\Delta ABC \sim \Delta AED$

$\frac{AD}{AE} = \frac{AC}{AB}$, $\frac{11}{9} = \frac{AC}{18}$

$AC = \frac{11}{9} \times 18 = 22$ cm

$EC = AC - AE = 22 - 9 = 13$ cm

30. (c);

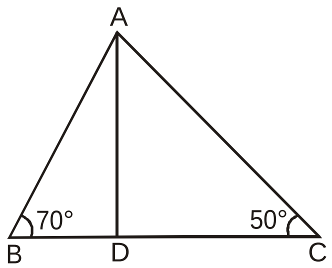


$\frac{AB}{AC} = \frac{BD}{CD}$, $\frac{12}{8} = \frac{4+x}{x}$

$\frac{3}{2} = \frac{4+x}{x}$

$3x = 8 + 2x$, $x = 8$ cm

31. (a);



$\angle A + 70° + 50° = 180°$, $\angle A = 60°$

Given, $\frac{AB}{AC} = \frac{BD}{DC}$

This is the condition for internal angle bisector so, AD is bisector of $\angle BAC$

$\angle BAD = \frac{1}{2} \angle BAC = \frac{1}{2} \times 60° = 30°$

32. (b); $\frac{AD}{DC} = \frac{3}{2}$, $\frac{AB}{BC} = \frac{9}{6} = \frac{3}{2}$

$\frac{AD}{DC} = \frac{AB}{BC}$

So, BD is the bisector of $\angle B$

$\angle CBD = 180° - 130° - 30° = 180° - 160° = 20°$

$\angle B = 2\angle CBD = 2 \times 20° = 40°$

33. (c); $\angle ADE = (90° + 60°) = 150°$

$DE = DC = EC$ ...(i) Equilateral triangle

and $AD = DC = AB = BC$ ...(ii) (Square)

From (i) and (ii)

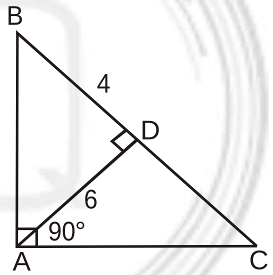
$AD = DE$

$\angle DEA = \angle DAE = x°$

(In ΔADE), $x + x + 150° = 180°$

$2x = 30°$, $x = 15°$

34. (d);



In ΔABD, $AB^2 = AD^2 + BD^2$

$AB^2 = 36 + 16 = 52$, $AB = 2\sqrt{13}$

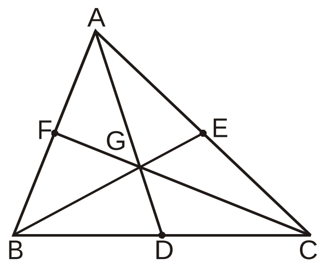
In ΔABD and ΔABC

$\angle ABD = \angle ABC$ (common)

$\angle ADB = \angle BAC$ (90°)

$\frac{AB}{BC} = \frac{BD}{AB}$, $BC = \frac{AB^2}{BD} = \frac{2\sqrt{13} \times 2\sqrt{13}}{4} = 13$ cm

35. (a);



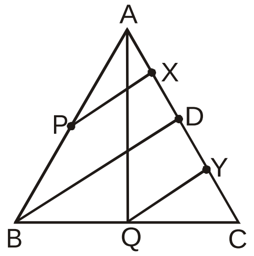
Median divides the triangles into two equal area.

In ΔABC, the triangle is divided into 6 equal parts.

$ar(\Delta BDG) = \frac{1}{6} ar(\Delta ABC)$

$ar(\Delta BDG) = \frac{1}{6} \times 72 = 12\ cm^2$

36. (b);



In ΔABD
P and X are the midpoint of AB and AD.

Therefore, PX | | BD and $PX = \frac{1}{2} BD$ ...(i)

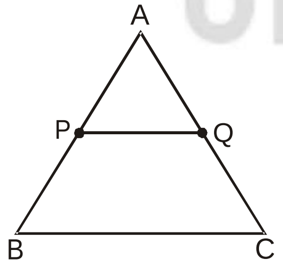
Similarly, In ΔBDC
Q and Y are the midpoint of BC and CD

Q Y | | BD and $QY = \frac{1}{2} BD$ ...(ii)

From (i) and (ii)

$PX = \frac{1}{2} BD = QY$, $PX = QY$, $\frac{PX}{QY} = \frac{1}{1} = 1:1$

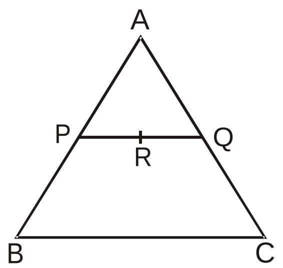
37. (c);



PQ | | BC
$\angle APQ = \angle AQP = 60°$
$\angle PAQ = 60°$
ΔAPQ is an equilateral triangle

Area of $\Delta APQ = \frac{\sqrt{3}}{4}(PQ)^2 = \frac{\sqrt{3}}{4} \times 5^2 = \frac{25\sqrt{3}}{4}$

38. (c);



$\frac{PR}{RQ} = \frac{1}{2}$, $\frac{2}{RQ} = \frac{1}{2}$

RQ = 4 cm
PQ = 2 + 4 = 6 cm
BC = 2 PQ = 2 × 6 = 12 cm

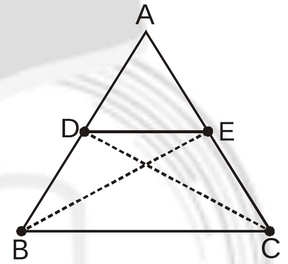
39. (d); In ΔABC and ΔBDC
$\angle BAC = \angle BCD$ (given)
and $\angle B = \angle B$ (common)
$\angle ABC \sim \angle CBD$

$\frac{AB}{BC} = \frac{BC}{BD} \Rightarrow \frac{32}{BC} = \frac{BC}{18}$

$BC^2 = 18 \times 32$, BC = 24 cm

$\frac{\text{Perimeter of } \Delta BCD}{\text{Perimeter of } \Delta ABC} = \frac{BC}{AB} = \frac{24}{32} = \frac{3}{4} = 3:4$

40. (a);



ar (ΔACD) = 36 cm^2
ar (ΔACD) = ar (ΔADE) + ar (ΔDEC)
Triangle between same parallel lines and having same base have equal areas
ar (ΔDEC) = ar (ΔDEB)
ar (ΔABE) = ar (ΔADE) + ar (ΔDEB)
ar (ΔABE) = ar (ΔADE) + ar (ΔDEC)
ar (ΔABE) = ar (ΔACD)
ar (ΔABE) = 36 cm^2

41. (a); $\frac{BP}{AP} = \frac{3}{1}$

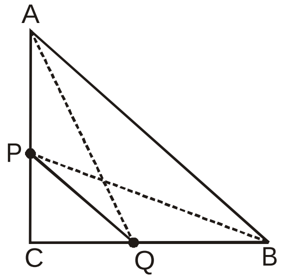
$\frac{BP + AP}{AP} = \frac{4}{1}$

Similarly, $\frac{QC}{AQ} = \frac{3}{1}$, $\frac{AC}{AQ} = \frac{QC + AQ}{AQ} = \frac{3+1}{1} = \frac{4}{1}$

Therefore, the ratio of $\frac{BC}{PQ} = \frac{4}{1}$

$\frac{36}{PQ} = \frac{4}{1}$, PQ = 9 cm

42. (d);



In ΔACQ, $AC^2 + CQ^2 = AQ^2$

$$AC^2 + \left(\frac{BC}{2}\right)^2 = AQ^2$$

$4AC^2 + BC^2 = 4AQ^2$ ...(i)

In ΔBCP, $BC^2 + CP^2 = BP^2$

$$BC^2 + \left(\frac{AC}{2}\right)^2 = BP^2$$

$4BC^2 + AC^2 = 4BP^2$ ...(ii)

On adding (i) and (ii)

$4AC^2 + BC^2 + 4BC^2 + AC^2 = 4AQ^2 + 4BP^2$

$5(AC^2 + BC^2) = 4(AQ^2 + BP^2)$

$4(AQ^2 + BP^2) = 5AB^2$

43. (a); $a^2 + b^2 + c^2 = ab + bc + ca$

This equation is satisfy only when a = b = c

$a^2 + b^2 + c^2 - ab - bc - ca = 0$

Multiply and divide by 2

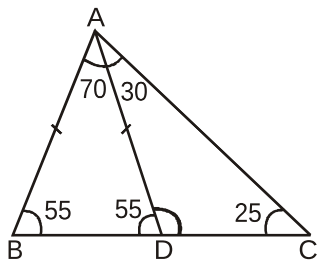
$2a^2 + 2b^2 + 2c^2 - 2ab - 2bc - 2ca = 0$

$(a - b)^2 + (b - c)^2 + (c - a)^2 = 0$

so, a = b = c

Therefore it is an equilateral triangle.

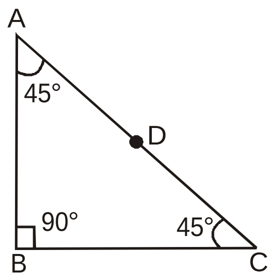
44. (b);



BC > CA > CD

Since largest angle corresponds to largest side.

45. (a);



$\angle A = \angle C$, $AB = BC$

In ΔABC

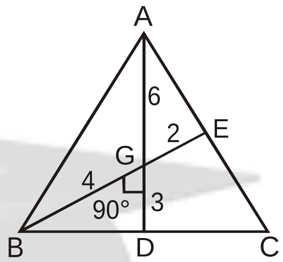
$AB^2 + BC^2 = AC^2$, $2AB^2 = AC^2$

ΔABC and ΔADB are similar

$$\frac{AC}{BC} = \frac{BC}{BD}, \quad \frac{4\sqrt{2}}{4} = \frac{4}{BD}$$

$$BD = \frac{16}{4\sqrt{2}} = 2\sqrt{2}$$

46. (c);



Centroid divides the triangle in the ratio of 2 : 1.

AD = 9

$$\frac{AG}{GD} = \frac{2}{1}, \quad AG = 6, \quad GD = 3,$$

BE = 6

$$\frac{BG}{GE} = \frac{2}{1} = BG = 4, \quad GE = 2$$

In ΔBGD

$BD^2 = BG^2 + GD^2$

$BD^2 = 4^2 + 3^2 = 5^2$, $BD = 5$

47. (c); Circumcentre is the point which is equidistant from the vertices of triangle.

48. (d); length of median of equilateral triangle

= 3 × in-radius

= 3 × 3 = 9 cm

49. (c); In ΔPMR

$PM^2 + MR^2 = PR^2$

$PR^2 = 6^2 + 8^2 = 10^2$, $PR = 10$

In ΔPQR

$PQ^2 + PR^2 = QR^2$

$PQ^2 = QR^2 - PR^2$

$PQ^2 = 26^2 - 10^2 = 676 - 100$

$PQ = \sqrt{576} = 24$ cm

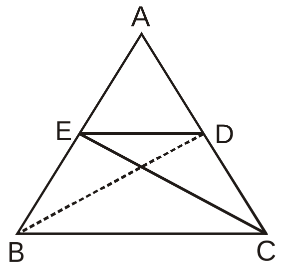
$$ar(\Delta PQR) = \frac{1}{2} \times PQ \times PR = \frac{1}{2} \times 24 \times 10$$

$ar(\Delta PQR) = 120$

50. (b); Orthocentre is the point of intersection of perpendicular drawn from the vertices of a triangle.

Difficult

1. (b);



$\angle B = \angle C$, AB = AC

In ΔBCD

CD = BC

$\angle BDC = \angle CBD$

$\angle BDC + \angle CBD + \angle BCD = 180°$

$2\angle BDC + 78° = 180°$

$2\angle BDC = 102°$, $\angle BDC = 51°$

In ΔBEC

$\angle BEC + \angle EBC + \angle ECB = 180°$

$\angle ECB = 180° - 78° - 78° = 24°$

$\angle ECD = 78° - 24° = 54°$

BC = EC = CD

In ΔECD

$\angle DEC + \angle DCE + \angle EDC = 180°$

$2\angle DEC + 54° = 180°$

$$\angle DEC = \frac{180° - 54°}{2} = \frac{126°}{2} = 63°$$

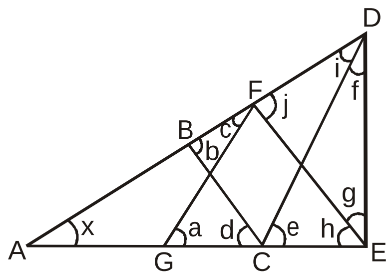
$\angle EDC = \angle DEC = 63°$

$\angle EDC = \angle EDB + \angle BDC$

$63° = \angle EDB + 51°$

$\angle EDB = 12°$

2. (c);



AB = BC, d = x

b = x + d, b = 2x

BC = CD, i = b = 2x

EF = FG, a = h = 2x

e = x + i = x + 2x = 3x

CD = DE, g + h = e

g = 3x – 2x = x

j = x + 2x = 3x

$\therefore$ DE = EF, i + f = j

f = 3x – 2x = x

Now, In ΔADE

$\angle A + \angle D + \angle E = 180°$

x + 3x + 3x = 180°

$7x = 180°$, $x = \frac{180°}{7}$

3. (b); AB | | CD

$\angle ABC = \angle BCD = x°$

In ΔBCD

$x° + y° + z° = 180°$

$$\frac{4}{3}y + \frac{8}{3}y + y = 180°$$

$$\frac{4y + 8y + 3y}{3} = 180°$$

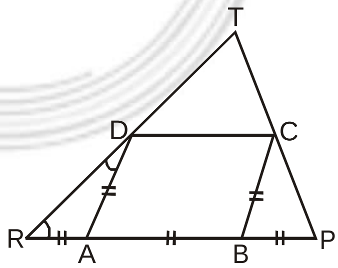
$5y = 180°$, $y = 36°$

$$x = \frac{4}{3}y = \frac{4}{3} \times 36 = 48°$$

$\angle BAC = 180° - 48° - 36°$

$\angle BAC = 180° - 84° = 96°$

4. (b);



AR = AB = BP (Given)

AR = AD

$\angle ARD = \angle ADR$

BP = BC

$\angle BPC = \angle BCP$

$\angle DAB = 2\angle ARD$

$\angle CBA = 2\angle BPC$

$\angle DAB + \angle CBA = 180°$ (ABCD is a rhombus)

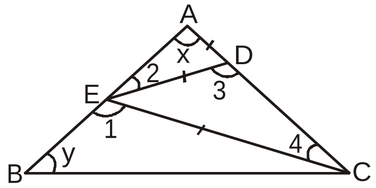
$2(\angle ARD + \angle BPC) = 180°$

$\angle ARD + \angle BPC = 90°$

In ΔTRP

$\angle RTP + 90° = 180°$, $\angle RTP = 90°$

5. (a);



AD = DE, $x = \angle 2$

$\angle 3 = x + \angle 2$, $\angle 3 = x + x = 2x$

DE = CE, $\angle 3 = \angle 4 = 2x$

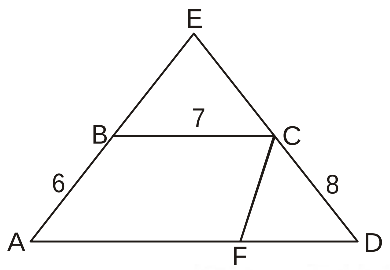
In ΔAEC

$\angle 1 = x + \angle 4$, $\angle 1 = 3x$

EC = BC, $\angle 1 = y = 3x$

$$\frac{x}{y} = \frac{x}{3x} = \frac{1}{3} = 1:3$$

6. (d);



Draw CF||BA

CF = BA = 6 and

FD = AD – BC = 17 – 7 = 10

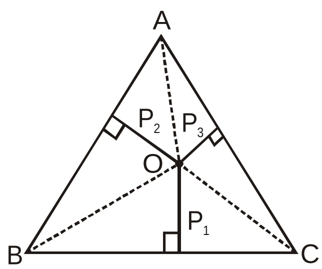
In ΔCFD,

CF = 6, FD = 10, CD = 8

These are the corresponding sides of right angled triangle.

$\angle FCD = \angle AED = 90°$

7. (d);



Let the side of equilateral triangle be 'a' then area of triangle

$$\text{ar}(\Delta ABC) = \frac{\sqrt{3}}{4}a^2 \quad \text{...(i)}$$

$\text{ar}(\Delta ABC) = \text{ar}(\Delta BOC) + \text{ar}(\Delta BOA) + \text{ar}(\Delta AOC)$

$$= \frac{1}{2}P_1 a + \frac{1}{2}P_2 a + \frac{1}{2}P_3 a$$

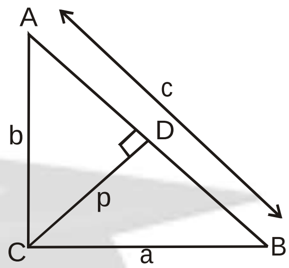
$$\text{ar}(\Delta ABC) = \frac{1}{2}a(P_1 + P_2 + P_3) \quad \text{...(ii)}$$

From (i) and (ii)

$$\frac{\sqrt{3}}{4}a^2 = \frac{1}{2}a(P_1 + P_2 + P_3)$$

$$a = \frac{2}{\sqrt{3}}(P_1 + P_2 + P_3)$$

8. (b);



$\Delta ABC \sim \Delta CBD$

$$\frac{AB}{AB} = \frac{BC}{BD} = \frac{AC}{CD}, \quad \frac{AB}{CB} = \frac{AC}{CD}$$

$$\frac{c}{a} = \frac{b}{p}, \quad c = \frac{ab}{p}$$

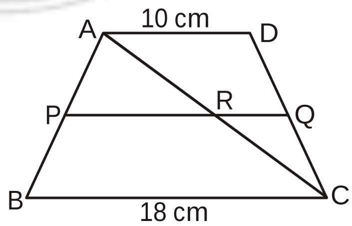
In ΔABC

$AC^2 + BC^2 = AB^2$, $a^2 + b^2 = c^2$

$$a^2 + b^2 = \frac{a^2b^2}{p^2}, \quad \frac{a^2 + b^2}{a^2b^2} = \frac{1}{p^2}$$

$$\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2}$$

9. (b);



Join A and C, AC cuts PQ at R

Now In ΔAPR and ΔABC

$\angle APR = \angle ABC$

and $\angle ARP = \angle ACB$

$\Delta APR \sim \Delta ABC$

$$\frac{AP}{AB} = \frac{PR}{BC} \Rightarrow PR = \frac{AP}{AB} \times BC$$

$$PR = \frac{AP}{AP + PB} \times BC, \quad PR = \frac{5}{8} \times 18 = \frac{45}{4} \text{ cm}$$

and $\frac{AP}{PB} = \frac{AR}{RC} = \frac{5}{3}$

Similarly, $\Delta RCQ \sim \Delta ACD$

$$\frac{RQ}{AD} = \frac{RC}{AC}$$

$$RQ = \frac{RC}{AR + RC} \times AD = \frac{3}{8} \times 10 = \frac{15}{4} \text{ cm}$$

$$PQ = PR + RQ = \frac{45}{4} + \frac{15}{4} = \frac{60}{4} = 15 \text{ cm}$$

10. (a); In ΔABC

$AB || PQ$

$\Delta ABC \sim \Delta QPC$

$$\frac{AB}{PQ} = \frac{AC}{QC}$$

$$PQ = \frac{AB}{AC} \times QC \quad ...(i)$$

$\therefore$ $PQ || CD$

$\Delta ACD \sim \Delta AQP$

$$\frac{CD}{PQ} = \frac{AC}{AQ}$$

$$PQ = \frac{CD}{AC} \times AQ \quad ...(ii)$$

From (i) and (ii)

$$\frac{AB}{AC} \times QC = \frac{CD}{AC} \times AQ$$

$AB \times QC = CD \times AQ$

$12 \times (AC - AQ) = 18 \times AQ$

$2AC - 2AQ = 3AQ$

$12 = 5AQ$

$$AQ = \frac{12}{5}, \quad PQ = \frac{18}{6} \times \frac{12}{5} = \frac{36}{5} \text{ cm}$$

11. (c); In ΔABM and ΔBEC

$\angle BAM = \angle BCE$

$\angle BMA = \angle BEC$ (AM || EC)

$\Delta ABM \sim \Delta CBE$

$$\frac{AB}{BC} = \frac{AM}{EC} \Rightarrow \frac{5}{10} = \frac{AM}{18} \Rightarrow AM = 9 \text{ cm}$$

$AM || DN$

$\Delta AMC \sim \Delta DNC$

$$\frac{DN}{AM} = \frac{DC}{AC} \Rightarrow \frac{15}{9} = \frac{DC}{15}, \quad DC = \frac{15 \times 15}{9} = 25 \text{ cm}$$

12. (b); For maximum area all three sides must be equal.

Perimeter = 24

3a = 24, a = 8cm

$$\text{Area} = \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4} \times 8 \times 8 = 16\sqrt{3} \text{ cm}^2$$

13. (c); Length of each side, $a = \frac{2}{\sqrt{3}}(P_1 + P_2 + P_3)$

$$a = \frac{2}{\sqrt{3}}(6 + 8 + 10) = \frac{2 \times 24}{\sqrt{3}}, \quad a = \frac{48}{3}\sqrt{3} = 16\sqrt{3}$$

14. (d); Here $XY || AC$

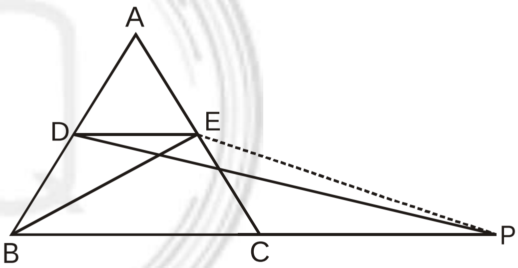
$\Delta BXY \sim \Delta BAC$

$$\frac{ar(\Delta ABC)}{ar(XBY)} = \frac{AB^2}{XB^2}, \quad \frac{2}{1} = \frac{AB^2}{XB^2}$$

$$\frac{AB}{XB} = \frac{\sqrt{2}}{1}, \quad \frac{XB}{AB} = \frac{1}{\sqrt{2}}$$

$$\frac{AX}{AB} = \frac{AB - XB}{AB} = \frac{\sqrt{2} - 1}{\sqrt{2}}$$

15. (a);



Here $DE || BC$

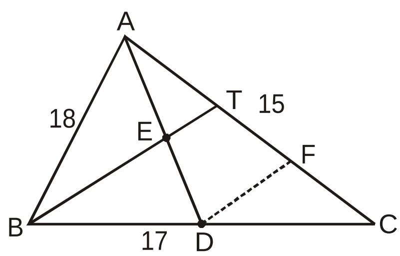
and $DE = \frac{1}{2}BC$ (mid point theoram)

$$ar(\Delta BDE) = \frac{1}{4} \times ar(\Delta ABC)$$

and $\Delta BDE = \Delta PED$

(Triangle between same parallel line and having same base have equal area)

16. (c);



Draw $DF || ET$

In ΔADF, E is the midpoint of AD

T will be the mid-point of AF

$AT = TF$ ...(i)

Now, in ΔBTC

D is the mid-point of BC

and DF | | ET | | BT

F is the mid-point of TC

$TF = FC$ ...(ii)

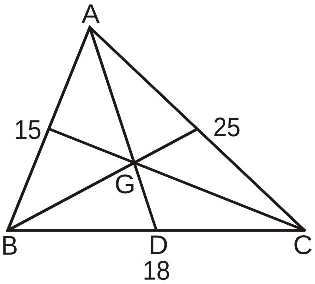
From (i) and (ii)

$AT = TF = FC$

$AC = 15$ cm, $AT = TF = FC = \frac{AC}{3} = 5$ cm

$TC = TF + FC = 5 + 5 = 10$ cm

17. (d);



We know that

$AB^2 + AC^2 = 2(AD^2 + BD^2)$

$15^2 + 25^2 = 2(AD^2 + 9^2)$

$225 + 625 = 2(AD^2 + 81)$

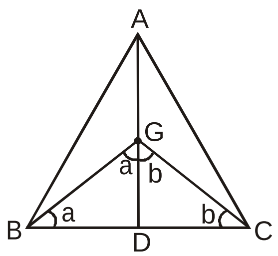
$\frac{850}{2} = AD^2 + 81$

$AD^2 + 81 = 425, \quad AD^2 = 344$

$AD = 2\sqrt{86}$

$GD = \frac{1}{3}AD = \frac{1}{3} \times 2\sqrt{86} = \frac{2}{3}\sqrt{86}$

18. (c);



Let $AD = 3x$

the $AG = 2x, \quad GD = x$

$AG = BC = 2x$

D is the mid-point of BC

then $BD = DC = GD = x$

Now, In ΔBGD

$\angle DBG = \angle DGB = a$

In ΔDGC, $\angle GCD = \angle DGC = b$

In ΔBGC

$a + a + b + b = 180°, \quad 2(a + b) = 180°$

$a + b = 90°, \quad \angle BGC = 90°$

19. (a); By decreasing 15° in each angle the ratio becomes 2 : 3 : 5.

$2x + 3x + 5x = 180° - 3 \times 15°$

$10x = 135°$

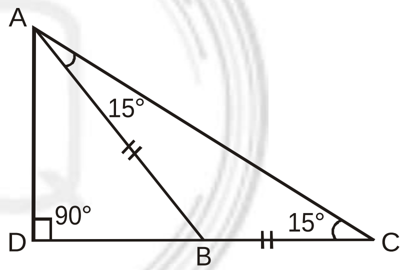
$x = \frac{135°}{10} = \frac{27°}{2}, \quad 5x = 5 \times \frac{27°}{2} = \frac{135°}{2}$

Greatest angle $= \frac{135°}{2} + 15° = \frac{165°}{2}$

In radian the greatest angle

$= \frac{165°}{2} \times \frac{\pi}{180} = \frac{11\pi}{24}$

20. (c);



In ΔABC

$\angle ABC = 180° - 2 \times 15° = 180° - 30°$

$\angle ABC = 150°$

$\angle ABD = 180° - 150° = 30°$

$AB = 10$ cm

$\text{Sin } 30° = \frac{AD}{AB}, \quad \frac{1}{2} = \frac{AD}{10}$

$AD = 5$ cm

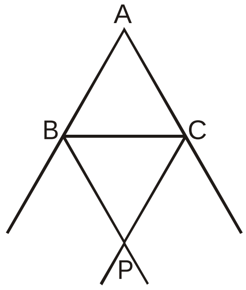
$AB = BC$ (Given)

In ΔABC

$ar(\Delta ABC) = \frac{1}{2} \times BC \times AD = \frac{1}{2} \times 10 \times 5 = 25 \text{ cm}^2$

Previous Year (Memory Based)

1. (a);



$\angle BAC = 80°$

$\angle CBP = \frac{180° - \angle ABC}{2}$

$\angle CBP + \angle BCP = 180° - \frac{\angle ABC - \angle ACB}{2}$

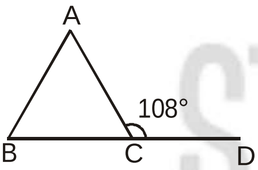
$= 180° - \frac{100}{2} = 180° - 50° = 130°$

$\therefore \ \angle ABC + \angle ACB = 180 - 80$

$\angle ABC + \angle ACB = 100$

$\angle BPC = 180° – 130° = 50°$

2. (d);

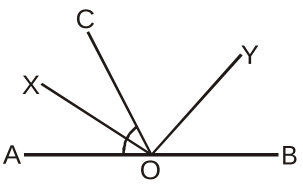


$\angle A + \angle B = 108°$

$\angle A + \frac{1}{2}\angle A = 108°$, $\frac{3\angle A}{2} = 108°$

$\angle A = \frac{108° \times 2}{3} = 72°$

3. (c);



$\angle BOC = 180° - 40° = 140°$

$\angle BOY = \frac{1}{2}\angle BOC = \frac{1}{2} \times 140° = 70°$

4. (b); Each interior angle of polygon $= \frac{(n-2)\pi}{n}$

According to question

$\left(\frac{n-2}{n}\right)\pi = 2 \times \frac{2\pi}{n}$

$(n-2)\pi = 4\pi$

$n - 2 = 4$, $n = 6$

5. (c); Let the angle after decreasing 20° are 2x, 3x and 5x

$2x + 3x + 5x = 180° - (3 \times 20°)$

$= 180° - 60° = 120°$

$10x = 120°$, $x = 12$

Greatest angle $= 5x + 20 = 12 \times 5 + 20 = 80°$

Greatest angle (In radian) $= 80° \times \frac{\pi}{180°} = \frac{4}{9}\pi$

6. (a); $\angle 1 = \angle 3$, $\angle 5 = \angle 7$, $\angle 2 = \angle 4$ and $\angle 6 = \angle 8$

(Vertically opposite angles)

$\angle 1 + \angle 8 = 180°$ (sum of all extractor angles)

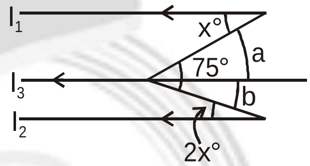
$\angle 3 - \angle 8 = 90°$ (Given)

$\angle 1 - \angle 8 = 90°$ ($\angle 1 = \angle 3$) ... (ii)

On solving (i) and (ii)

Weget $\angle 1 = \angle 3 = \angle 5 = \angle 7 = 135°$

7. (d);



Draw a line l_3 parallel to l_1 or l_2.

$a = x$ and $b = 2x$

$a + b = 75°$

but $a + b = x + 2x = 3x$

$3x = 75°$, $x = 25°$

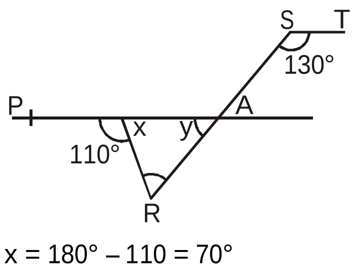
8. (b); Let $y = 3a$ and $z = 7a$

$3a + 7a = 180$, $10a = 180°$, $a = 18°$

$y = 3 \times 18° = 54°$

$x = 180° - 54° = 126°$

9. (c);



$x = 180° - 110 = 70°$

$y = 180° – 130° = 50°$

$\angle QRS + x + y = 180°$

$\angle QRS + 180° - 70° - 50°$

$\angle QRS = 60°$

10. (c); Let $a = 2x$ and $b = 3x$

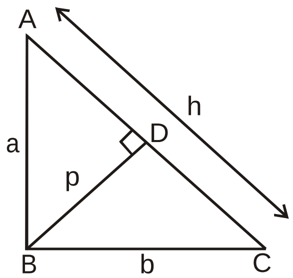
$a + b = 90°$

$2x + 3x = 90°$, $5x = 90°$, $x = 18°$

$b = 3x = 3 \times 18 = 54°$

$c = 180° - 54° = 126°$

11. (c); In ΔABC



$a^2 + b^2 = h^2$ ...(i)

$\angle ABC \sim \angle BDC$

$\frac{AB}{BD} = \frac{BC}{DC} = \frac{AC}{BC}$, $\frac{h}{b} = \frac{a}{p}$, $h = \frac{ab}{p}$

In $\angle ABC$

$AB^2 + BC^2 = CA^2$, $a^2 + b^2 = h^2$

$a^2 + b^2 = \frac{a^2b^2}{p^2}$, $p^2 = \frac{a^2b^2}{a^2+b^2}$

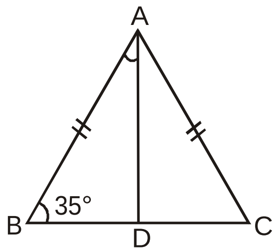
12. (b); We know that $\angle A + \angle B + \angle C = 180°$ ...(i)

$\angle A + \frac{1}{2}\angle B + \angle C = 140°$ ...(ii)

On solving (i) and (ii)

$\frac{1}{2}\angle B = 40°$, $\angle B = 80°$

13. (b);



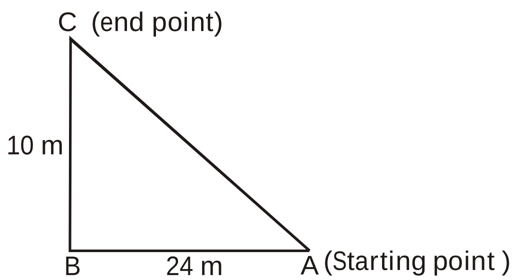
In ΔABC

$\angle A = 180° - \angle B - \angle C = 180° - 35° - 35° = 110°$

Since AD is the median.

$\angle BAD = \frac{\angle A}{2} = \frac{110}{2} = 55°$

14. (b);



In ΔABC

$AC^2 = AB^2 + BC^2 = 24^2 + 10^2 = 676$

AC = 26 m

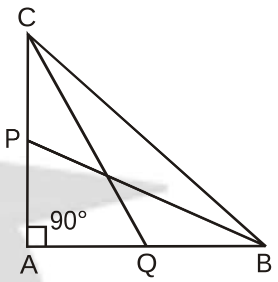
15. (a); Given $\angle A - \angle B = 20°$, $\angle A - \angle C = 52°$

And we know that $\angle A + \angle B + \angle C = 180°$

$\angle A + \angle A - 20 + \angle A - 52 = 180°$

$3\angle A = 252°$, $\angle\frac{A}{2} = \frac{252°}{6} = 42°$

16. (b); In ΔABC



AQ = BQ and AP = CP

From ΔBAP, we have

$BP^2 = AB^2 + AP^2$ ...(i)

From ΔCAQ, we have

$CQ^2 = AQ^2 + AC^2$ ...(ii)

From ΔABC, we have

$BC^2 = AB^2 + AC^2$ ...(iii)

$$\frac{BP^2 + CQ^2}{BC^2} = \frac{AB^2 + AP^2 + AQ^2 + AC^2}{BC^2}$$

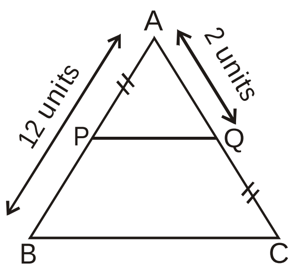
$$= \frac{AB^2 + AC^2 + \left(\frac{1}{2}AB\right)^2 + \left(\frac{1}{2}AC\right)^2}{BC^2}$$

$$= \frac{BC^2 + \frac{1}{4}\left(AB^2 + AC^2\right)}{BC^2}$$

$$= \frac{BC^2 + \frac{1}{4}BC^2}{BC^2} = \frac{\frac{5}{4}BC^2}{BC^2} = \frac{5}{4}$$

17. (a); Given, AP = CQ

and AB = 12 units



$$\frac{AP}{AB} = \frac{AQ}{AC}$$

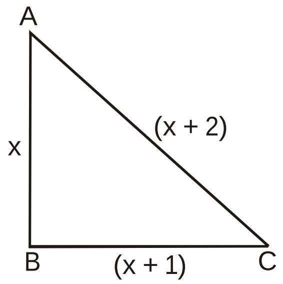
$$\frac{x}{12} = \frac{2}{x+2}, \quad x = 4$$

CQ = 4 units

18. (a); $\frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta PQR} = \frac{AB}{PQ}$

$$\frac{36}{24} = \frac{AB}{10}, \quad AB = \frac{36 \times 10}{24} = 15 \text{ cm}$$

19. (a); In right angle triangle



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

Now, let sides of a right angle triangle are x units, (x + 1) units and (x + 2) units respectively.

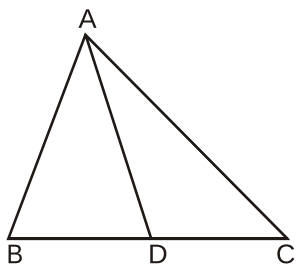
Then, $x^2 + (x + 1)^2 = (x + 2)^2$

$x^2 - 2x - 3 = 0$

Solving, x = + 3, – 1

So, length of smallest side is 3 units.

20. (c);



Given,

$\frac{AB}{AC} = \frac{BD}{DC}$ (AD is angle bisector of $\angle BAC$)

$\angle BAD = \angle CAD = \frac{1}{2}\angle BAC$

Now, In ΔABC

$\angle ABC + \angle ACB + \angle BAC = 180°$

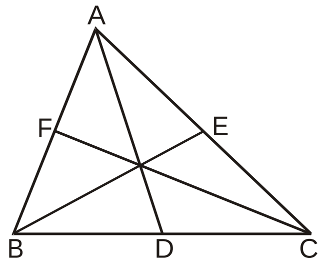
(angle sum property of a triangle)

$70° + 50° + \angle BAC = 180°$

$\angle BAC = 180° - 120° = 60°$

$\angle BAD = 30°$

21. (b);



Let sides AB, BC and CA be denoted by a, b and c respectively and median AD, BE and CF be denoted by mb, mc and ma.

we know that

$3(a^2 + b^2 + c^2) = 4\,(ma^2 + mb^2 + mc^2)$

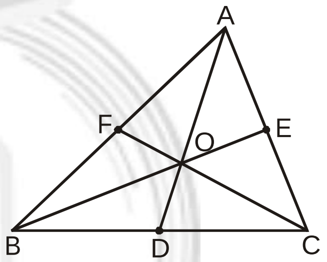
On analysing

a + b + c > ma + mb + mc

$\therefore$ Perimeter of ΔABC is greater than

$$\left(\overline{AD} + \overline{BE} + \overline{CF}\right)$$

22. (c); Let sides AB, BC and CA be denoted by a, b and c respectively.



BO + CO > BC, AO + OC > AC

and, AO + BO > AB

2 (AO + BO + CO) > AB + BC + CA

Since $AO = \frac{2}{3}AD$

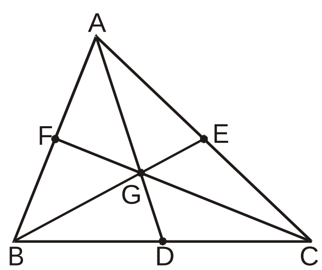
Similarly, $CO = \frac{2}{3}CF$ and $BO = \frac{2}{3}BE$

So, $\frac{2}{3} \times 2\,(AD + BE + CF) > AB + BC + CA$

4 (AD + BE + CF) > 3AB + BC + CA

$$\frac{AD + BE + CF}{AB + BC + CA} > \frac{3}{4}$$

23. (a); G is the centroid i.e G is the point of intersection of medians as shown in the figure below.



In ΔABC, AD is the median and G is centroid we know that, medians intersect each other such that each median split in the ratio of 1 : 2 from the base side.

$\frac{DG}{AG} = \frac{1}{2}$, $DG = \frac{1}{2} \times AG = \frac{1}{2} \times 4 = 2$ cm

Value of DG = 2 cm

24. (c); Given that, ΔABC is isosceles triangle right angled at C,

Since, given triangle is isosceles, then

$AC = BC$

By pythagorus theoram

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

$AB^2 = AC^2 + AC^2 = 2AC^2$

25. (c); ΔABC is equilateral and $AD \perp BC$

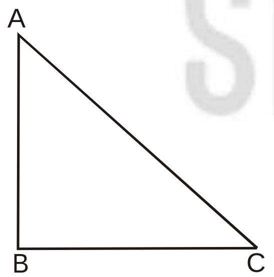
$BD = DC = \frac{1}{2} BC$

Now, $AB : BD = AB : \frac{1}{2} BC$ $(\because AB = AC)$

$AB : BD = 1 : \frac{1}{2}$

$AB : BD = 2 : 1$

26. (c);



According to question

$AB \cdot BC = \frac{1}{2} AC^2$

$2AB \cdot BC = AC^2$

$2AB \cdot BC = AB^2 + BC^2$

$AB^2 + BC^2 - 2AB \cdot BC = 0$

$(AB - BC)^2 = 0$

$AB = BC$

$\angle BAC = \angle BCA = 45°$

27. (b); $\angle ABC = 5x$, $\angle BAC = 3x$ and $\angle ACB = x$

$\angle ABC + \angle BCA + \angle BAC = 180°$

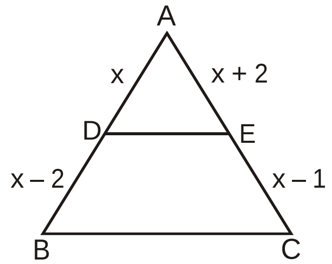
$5x + x + 3x = 180°$

$9x = 180°$

$x = \frac{180°}{9} = 20°$, $\angle ABC = 5 \times 20 = 100°$

28. (a); DE | | BC

$\frac{AD}{DB} = \frac{AE}{EC}$ (By Proportionality theorem)



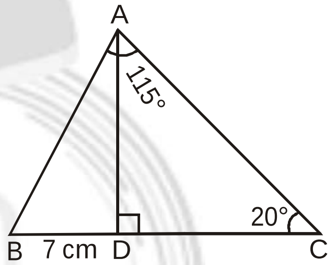
$\frac{x}{x-2} = \frac{x+2}{x-1}$

$x^2 - x = x^2 - (2)^2$

$x^2 - x = x^2 - 4$

$-x = -4$, $x = 4$

29. (c); In ΔABC



Given, $\angle A = 115°$

$\angle C = 20°$

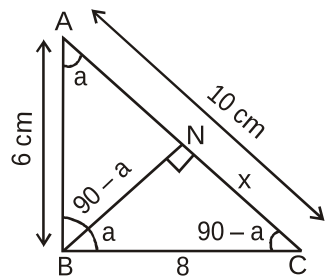
$\angle B = 180° - (115° + 20°) = 45°$

Now, in ΔABD

$\tan 45° = \frac{AD}{BD}$

$AD = BD = 7$ cm

30. (b);



In ΔBAC

$BC = \sqrt{10^2 - 6^2} = 8$ cm

Area of $\Delta BAC = \frac{1}{2} \times AB \times BC = \frac{1}{2} BN \times AC$

$BN = \frac{6 \times 8}{10} = 4.8$ cm

In ΔABN and ΔBNC

$\Delta ABN \sim \Delta BCN$

$$\frac{AB}{AN} = \frac{BC}{BN}$$

$$AN = \frac{AB \times BN}{BC} = \frac{6 \times 4.8}{8} = 3.6 \text{ cm}$$

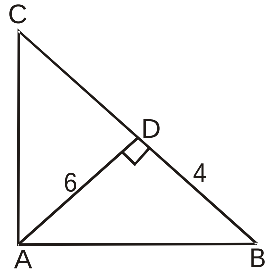
NC = 10 – 3.6 = 6.4

$$\frac{AN}{NC} = \frac{3.6}{6.4} = \frac{9}{16} = 9:16$$

31. (d); In ΔABC

$\angle BAC = 90°$ (By Pythagoras Theoram)

$$AB = \sqrt{AD^2 + BD^2} = \sqrt{36+16} = \sqrt{52}$$

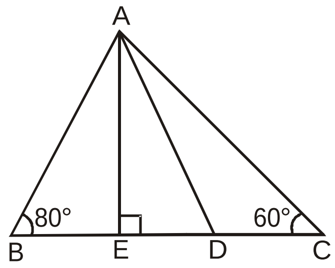


$BD = \frac{AB^2}{BC}$, $AB^2 = BD \times BC$ [From similarity]

52 = BC × 4

$$BC = \frac{52}{4} = 13 \text{ cm}$$

32. (b); In ΔABC



$\angle A + \angle B + \angle C = 180°$ (Angle sum property)

$\angle A = 180° – (\angle B + \angle C)$

$\angle A = 180° – (80° + 60°)$

$\angle A = 180° – 140° = 40°$

$$\angle BAD = \angle DAC = \frac{40°}{2} = 20°$$

Now, In triangle BAE

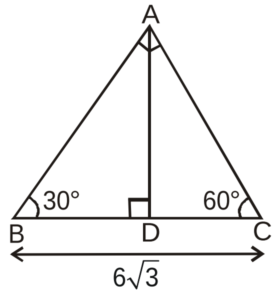
$\angle B + \angle AEB + \angle BAE = 180°$

$\angle BAE = 180° – (90° + 80°) = 10°$

$\angle EAD = \angle BAD – \angle BAE$

$= 20° – 10° = 10°$

33. (b); Let AD be the height of ΔABC



$\angle A + \angle B + \angle C = 180°$

$\angle A = 180° – (\angle B + \angle C)$

$\angle A = 180° – 90° = 90°$

$\text{Sin } 30° = \frac{AC}{BC}$, $\frac{1}{2} = \frac{AC}{6\sqrt{3}}$

$AC = 3\sqrt{3}$ ...(i)

Now, In ΔADC, $\text{Sin } 60 = \frac{AD}{AC}$

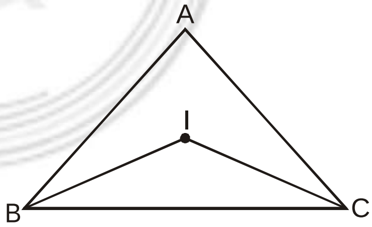
$\Rightarrow \frac{\sqrt{3}}{2} = \frac{AD}{3\sqrt{3}}$ (From (i))

$$AD = \frac{3\sqrt{3} \times \sqrt{3}}{2} = 4.5 \text{ cm}$$

34. (b); In ΔABC,

$\angle ABC + \angle ACB + \angle BAC = 180°$

$\angle BAC = 180° – (65° + 55°)$

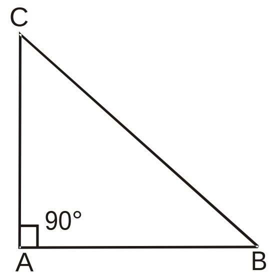


$\angle BAC = 60°$

In ΔABC if the bisectors of $\angle B$ and $\angle C$ meet at I.

$$\angle BIC = 90 + \frac{1}{2} \times \angle BAC = 90° + \frac{1}{2} \times 60° = 120°$$

35. (b); Given, $AB^2 + AC^2 = BC^2$



$\angle BAC = 90°$, Now $AB^2 + AC^2 = \left(\sqrt{2}AB\right)^2$

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

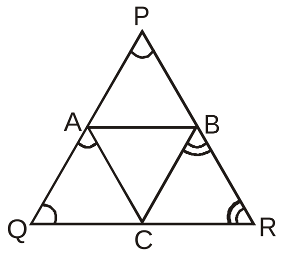
$\angle ABC = \angle ACB$

(angle opposite to equal sides are equal)

$\angle B + \angle C = 90°$

$2\angle B = 90°, \quad \angle B = 45°$

36. (d);



In ΔAQC, $AC = QC$

$\angle QAC = \angle CQA = a$

In ΔBCR, $CR = BC$

$\angle CBR = \angle CRB = b$

In ΔPQR,

$\angle a + \angle b + 40° = 180°$

$\angle a + \angle b = 140°$

Now, $\angle ACQ + \angle ACB + \angle BCR = 180°$

But, $\angle ACQ = 180° - 2a$

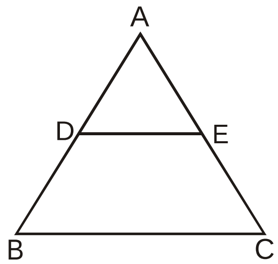
and $\angle BCR = 180° - 2b$

$\angle ACB = 180° - (180° - 2a) - (180° - 2b)$

$= 2(a + b) - 180° = 280° - 180°$

$\angle ACB = 100°$

37. (b);



Since, $DE || BC$

$\Delta ADE \sim \Delta ABC$

$$\frac{\text{Area of quadrilateral (BCED)}}{\text{Area of } (\Delta ADE)} = \frac{1}{1}$$

$$\frac{\text{Area of quadrilateral (BCED)} + \text{Area of } (\Delta ADE)}{\text{Area of } (\Delta ADE)}$$

$$= \frac{1+1}{1}$$

$$\frac{ar(\Delta ABC)}{ar(\Delta ADE)} = \frac{2}{1} = \frac{AB^2}{AD^2}$$

$$\frac{AB}{AD} = \frac{\sqrt{2}}{1}$$

$$\frac{BD}{AD} = \frac{AB - AD}{AD} = \frac{\sqrt{2}-1}{1}, \quad \frac{BD}{AD} = \frac{\sqrt{2}-1}{1}$$

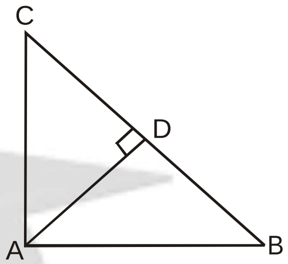
$AD : BD = 1 : \sqrt{2} - 1$

38. (b); ΔABC and ΔACD

$\Rightarrow \quad \angle CAB = \angle CDA = 90°$

$\angle C = \angle C$ (common)

$\Delta ABC \sim \Delta ACD$ (by AA similarity)

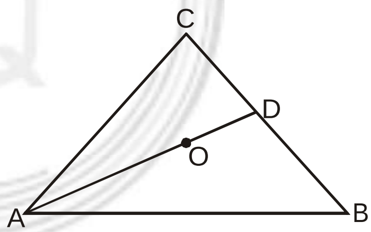


$$\therefore \quad \frac{ar(\Delta ACD)}{ar(\Delta ABC)} = \frac{AC^2}{BC^2}$$

$$\Rightarrow \quad \frac{10}{40} = \frac{9^2}{BC^2} \Rightarrow BC^2 = 4 \times 9^2$$

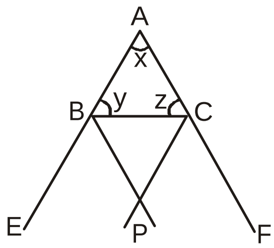
$BC = \sqrt{4 \times 9^2} = 18$ cm

39. (b); Point O is the centroid and we know that centroid divides the median in ratio 2 : 1.



$$OD = \frac{AO}{2} = \frac{10}{2} = 5 \text{ cm}$$

40. (c); In ΔABC, side AB and AC are produced to E and F, respectively and the external bisector $\angle EBC$ and $\angle FCB$ intersect at P.

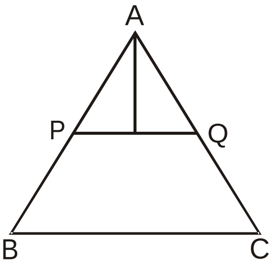


Since, angles are external bisectors

$$\therefore \quad \angle BPC = 90 - \frac{1}{2}\angle A$$

$$\angle BPC = 90 - \frac{1}{2} \times 100°, \quad \angle BPC = 90° - 50° = 40°$$

41. (c); Since, PQ | | BC



$\angle APQ = \angle ABC = 60°$

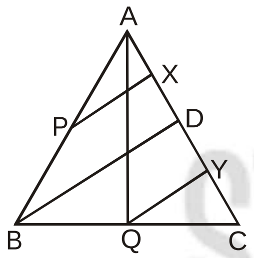
$\angle AQP = \angle ACB = 60°$

Area of an equilateral triangle $= \frac{\sqrt{3}}{4}(\text{Side})^2$

Area of $\Delta APQ = \frac{\sqrt{3}}{4} \times PQ^2$

$= \frac{\sqrt{3}}{4} \times 4 \times 4 = 4\sqrt{3}$ sq. cm

42. (b);

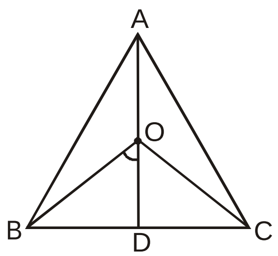


Here, PX | | BD and $PX = \frac{1}{2}BD$

QY | | BD = $QY = \frac{1}{2}BD$

PX : QY = 1 : 1

43. (c);



O is incentre of ΔABC

$\angle ABO = \angle DBO$

$\angle BOD = 15°$

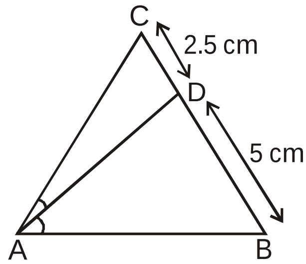
$\angle BOD + \angle ODB + \angle OBD = 180°$

$\angle OBD = 180° - (90° + 15°) = 75°$

OB is angle bisector of $\angle B$

Then, $\angle ABC = 2 \times \angle OBC = 2 \times 75° = 150°$

44. (a);

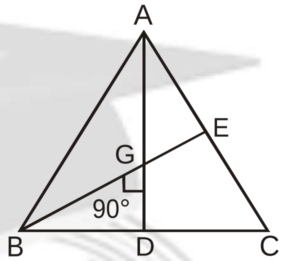


AD is the internal bisector of $\angle A$

$\frac{AB}{AC} = \frac{BD}{DC}$, $\frac{AB}{AC} = \frac{5}{2.5} = \frac{2}{1}$

AB : AC = 2 : 1

45. (c);



AD = 9 cm

$\therefore$ A centroid divides the median in the ratio 2 :1.

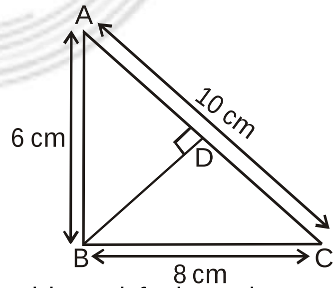
$\therefore$ $GD = \frac{1}{3} \times 9 = 3$ cm

and $BG = \frac{2}{3} \times BE = 4$ cm

$BD^2 = GD^2 + BG^2 = 3^2 + 4^2$

BD = 5 cm

46. (c); Here $6^2 + 8^2 = 10^2$



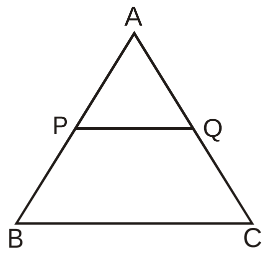
Since, sides satisfy the pythagoras theorem

ΔABC is a right angled triangle

AC = 10

AD = BD = CD = 5 cm

47. (c);



PQ | | BC

and ΔAPQ and ΔABC are similar

$\therefore$ By basic proportionality

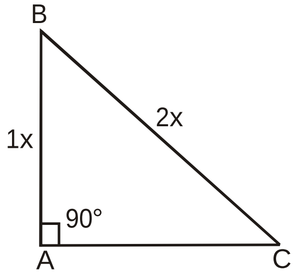
$$\frac{AP}{PB} = \frac{AQ}{QC}$$

$AP \times QC = AQ \times PB \qquad (AP = QC)$

$AP^2 = 4 \times 9$

$AP = 6$ units

48. (b);



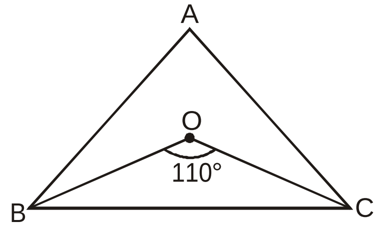
$$\text{Sin C} = \frac{AB}{BC} = \frac{x}{2x} = \frac{1}{2}$$

$$\text{Sin C} = \frac{1}{2} = \sin 30$$

Sin C = Sin 30°

$\angle ACB = 30°$

49. (a); Since, O is incentre

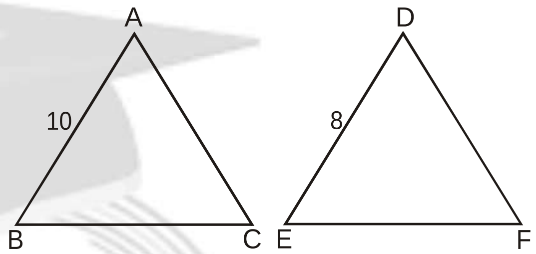


$$\angle BOC = 90° + \frac{1}{2}\angle A$$

$$110° = 90° + \frac{1}{2}\angle A$$

$\angle A = 2 \times 20° = 40°$

50. (b);



$$\frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \frac{AB^2}{DE^2} = \frac{10^2}{8^2} = \frac{100}{64} = \frac{25}{16}$$

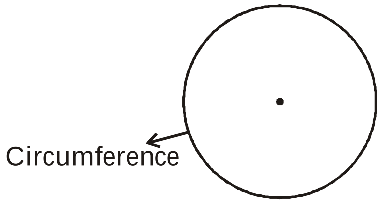
Required ratio = 25 : 16

Chapter 2

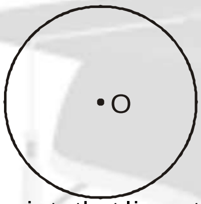
Circle

Circle : A circle is a set of points on a plane which lie at a fixed distance from a fixed point.

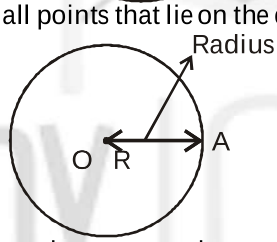
Circumference : The circumference of a circle is the distance around a circle which is equal to $2\pi r$. It is also called the perimeter of circle.



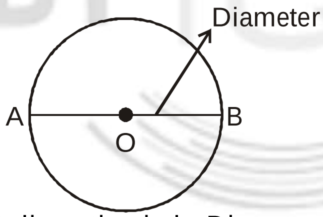
Centre : Fixed point is called the centre which is equidistant from all the points on the circumference. Here O is the center.



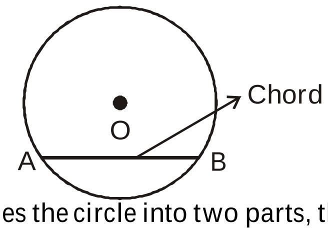
Radius : Fixed distance from the centre to all points that lie on the circumference.



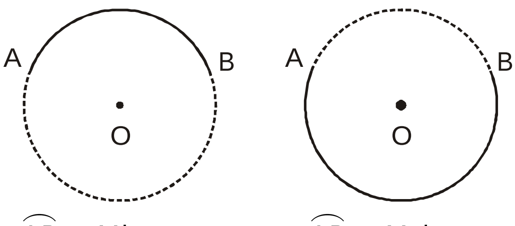
Diameter : A straight line which passes from the centre and connects two points of the circumference



Chord : A line segment whose end points lie on the circle. Diameter is also a largest chord.

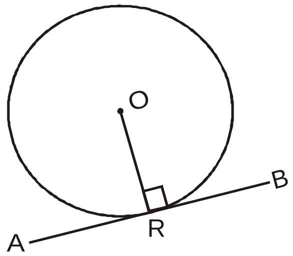


Arc : Any two points on the circle divides the circle into two parts, the smaller part is called as minor arc and the larger part is called as major arc.

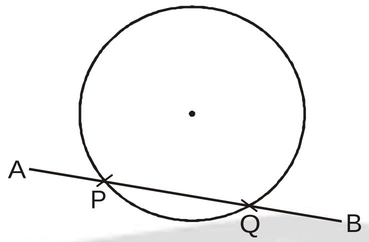


$\overset{\frown}{AB} \rightarrow$ Minor arc $\quad$ $\overset{\frown}{AB} \rightarrow$ Major arc

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. AB $\rightarrow$ Tangent to circle at R.

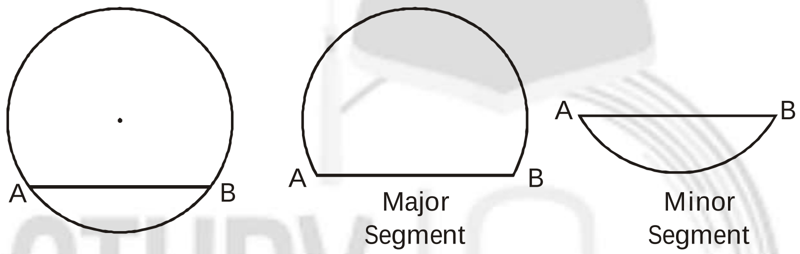


Secant : A line segment which intersects the circle in two distinct points, is called as secant. AB $\rightarrow$ Secant.

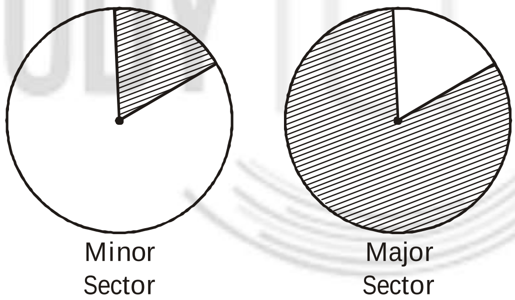


Segment : A chord divides a circle into two regions. These two regions are called the segments of a circle.

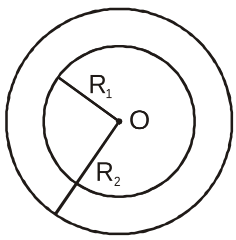
(a) major segment (b) minor segment



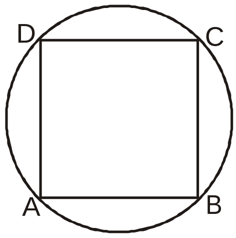
Sector : An area of circle enclosed by 2 radii and the circumference is called sector of circle.



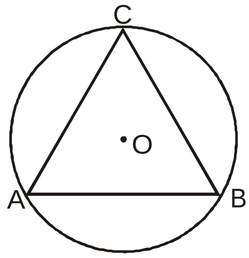
Concentric circles : Two circles having the same centre at a plane are called the concentric circles



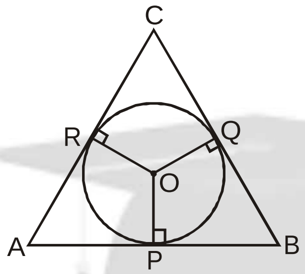
Cyclic Quadrilateral : A quadrilateral whose all the four vertices lie on the circle.

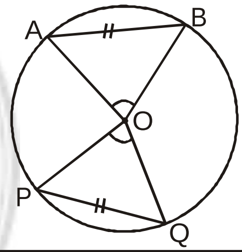
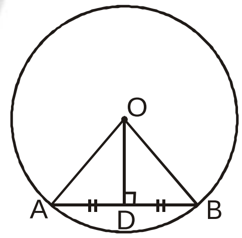
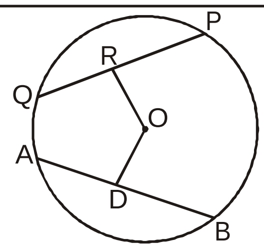


Circum-circle : A circle which passes through all the three vertices of a triangle.



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



S. No.	Theorem	Diagram
1.	Equal Chords or Arc subtends equal angles at the centre $\widehat{PQ} = \widehat{AB}$ $\angle POQ = \angle AOB$	
2.	The perpendicular from the centre of a circle to a chord bisects the chord $OD \perp AB$ AB = 2AD= 2BD	
3.	Equal chords of circle are equidistant from the centre. AB = PQ OD = OR	
4.	The angle subtended by an arc at the centre of a circle is twice the angle subtended by the arc at any point on remaining part of the circle $\angle AOB = 2m \angle ACB$