## Chapter - 1

# Line, Angle and Triangle

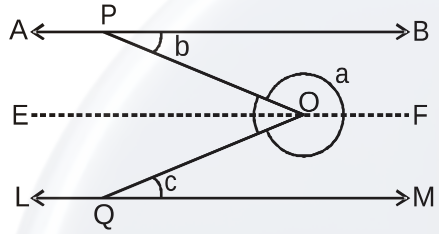
## Foundation

## 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 $\angle CQO = 38°$
$\angle POQ = \angle PON + \angle NOQ$
$= \angle APO + \angle OQC = 42° + 38° = 80°$

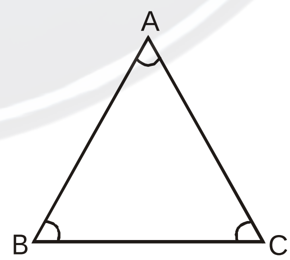
9. (b); $\angle COA + \angle AOD = 180°$
$3AOD + AOD = 180°$
$4AOD = 180°$
$$AOD = \frac{180°}{4} = 45°$$

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);



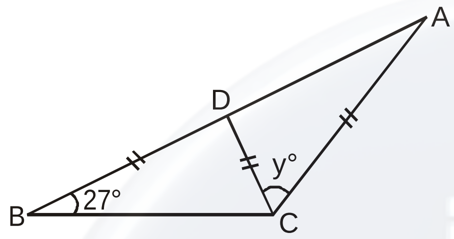

$\angle A = \angle B + \angle C$
We get that
$\angle A + \angle B + \angle C = 180°$
$\Rightarrow \angle A + \angle A = 180°$
$\Rightarrow 2\angle A = 180°, \quad \angle A = 90°$

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)
$x = 180° - 50° - 80° = 180° - 130° = 50°$

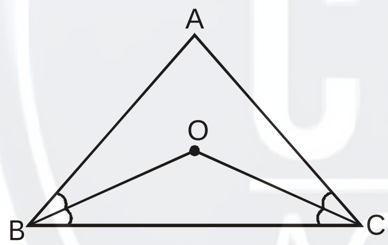
16. (a); $\angle A + \angle B + \angle C = 180°$
$\angle A > 90°$
$\angle B + \angle C < 90°$
Both are acute angles

17. (c);




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

18. (c);




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

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

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

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

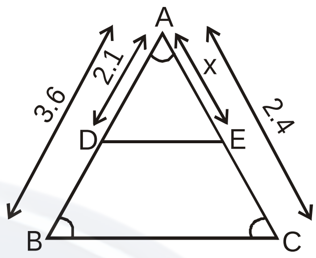
$\angle BOC = 180° - 90° + \frac{1}{2}\angle A$

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

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);

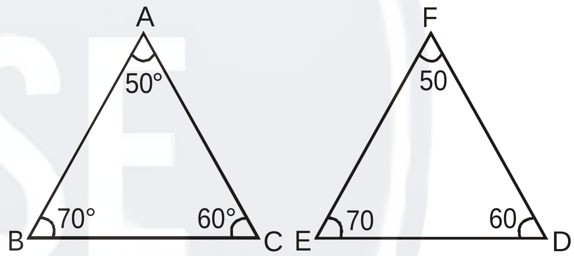



$\frac{AD}{AB} = \frac{AE}{AC} \Rightarrow \frac{2.1}{3.6} = \frac{AE}{2.4}$

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



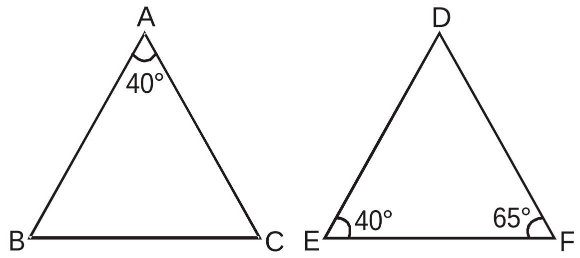

$\angle A = \angle F$, $\angle B = \angle E$, $\angle C = \angle D$
Then $\Delta ABC \sim \Delta FED$

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); $\Delta DEF$ is congruent to each one of the triangles $\Delta AFE$, $\Delta BFD$ and $\Delta CDE$.

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); $AG : GD = 2 : 1 \Rightarrow GD : AD = 1 : 3$

$\Rightarrow AD : GD = 3 : 1$

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

31. (b);

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

33. (c); $AB = 8 \text{ cm}$ and $BC = 6 \text{ cm}$

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

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

$BM = AM = MC = 5 \text{ cm}$

34. (b);

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

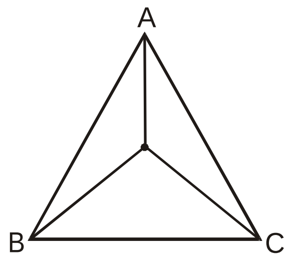
height, $h = \frac{\sqrt{3}}{2}a$

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

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

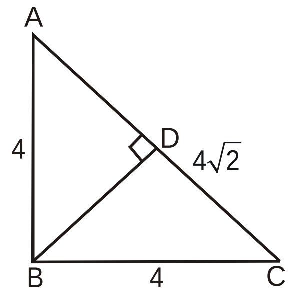
37. (a); Since, sum of two sides of triangle is greater than 3rd side

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




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

38. (d);



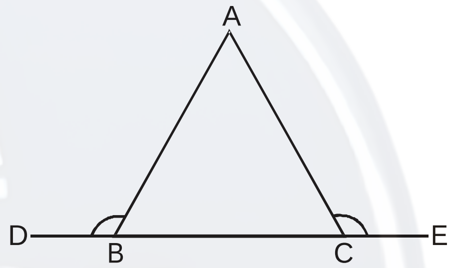

$AC^2 = \sqrt{4^2 + 4^2}, \quad AC = 4\sqrt{2}$

$\Delta ABC$ and $\Delta ADB$ are similar

$BD \times AC = AB \times BC$

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

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

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

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

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

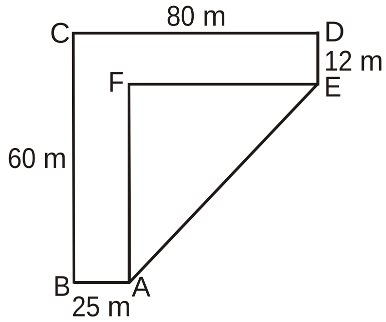
$\angle BOC = 90 + \frac{1}{2}\angle A = 90° + 40° = 130°$

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

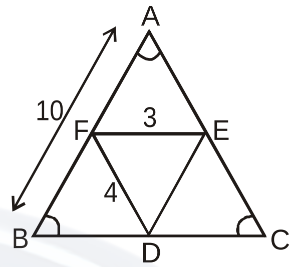
47. (b); Since third side will be greater than the difference between other two sides, so BC must be greater than 7

48. (b); If O is circumcentre of $\Delta ABC$

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); $\angle BTV = \angle DVS = 45°$

$\angle PTB = 55°$

$\angle PTR = 180° - 45° - 55° = 80°$

$\angle UTV = \angle PTR = 80°$

$\angle ATC = \angle PTB = 55°$

$\angle CUQ = 55°$

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

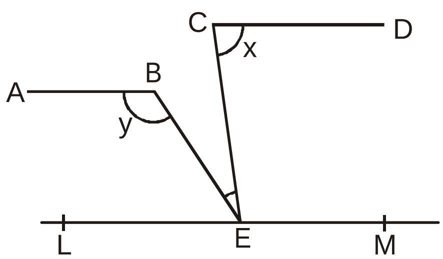
4. (c); When $\frac{n(n-3)}{2} = 28$, no value of n is a whole number

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

$\therefore \quad \angle DCF = \angle CAB = 80°$ (Corresponding angles)

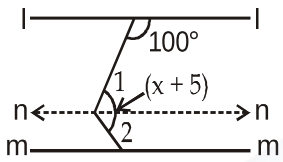
In $\Delta CEF$, side EC has been produced to D.

$\Rightarrow \quad x + 25° = 80° \quad \Rightarrow \quad x = 55°$

11. (a); Draw a line n passing through O and parallel to l and m.

Since l | | n, $\quad \angle 1 + 100° = 180°, \quad \angle 1 = 80°$

Since n | | m, $\quad \angle 2 = 30°$ (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, $\angle EGH + \angle HGQ = 180°$

$\angle HGQ = 180° - 70° = 110°$

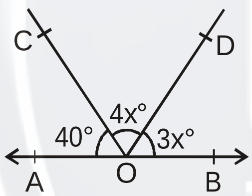
Also, $\angle DHQ + \angle GHQ = 180°$

$\angle GHQ = 180° - 140° = 40°$

In $\Delta$ GQH, $\angle GQH + 40° + 110° = 180°$

$\angle GQH = 180° - 150°$, $\angle GQH = 30°$

13. (a);




$\angle AOC + \angle COD + \angle BOD = 180°$

$40° + 4x° + 3x° = 180°$

$7x° = 140°, \quad x = 20°$

$4x = 4 \times 20° = 80°$

14. (d); $\angle ECD = 70°$

$\angle AOD = 70°$ [Corresponding angle to $\angle ECD$]

In $\Delta BOD$

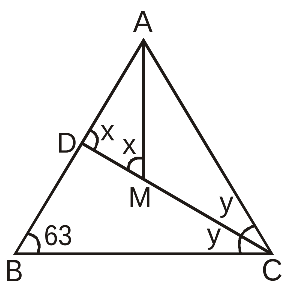
$\angle AOD = \angle OBD + \angle ODB$ (Exterior angle of a triangle is equal to sum of opposite interior angle)

$\angle AOD = \angle OBD + \angle ODB$

$70° = \angle OBD + 20°$

$\angle OBD = 70° - 20° = 50°$

15. (c);




AM = AD

$\angle ADM = \angle AMD = x$

$\angle ADC = \angle ABC + \angle BCD$

$x = 63° + y$ ...(i)

$\angle AMD = \angle ACM + \angle MAC$

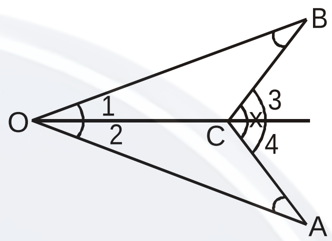
$x = y + \angle MAC$ ...(ii)

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)

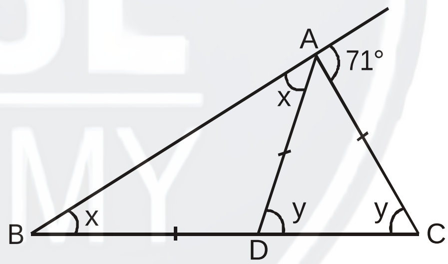
On adding (i) and (ii)

$\angle 3 + \angle 4 = a + b + \angle 1 + \angle 2$

$x = a + b + c$

17. (c);

18. (b);




In $\Delta ABD$

$y = x + x$

$y = 2x$

In $\Delta ABC$

$x + y = 71°$

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

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

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°

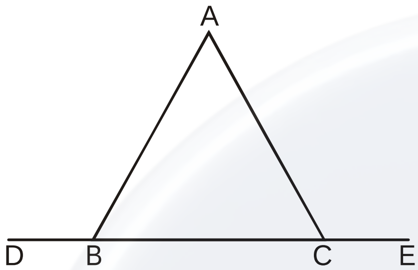
$x + x + 10° + x + 20° = 180°$

$3x + 30° = 180°$

$x = \frac{150°}{3} = 50°$

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)

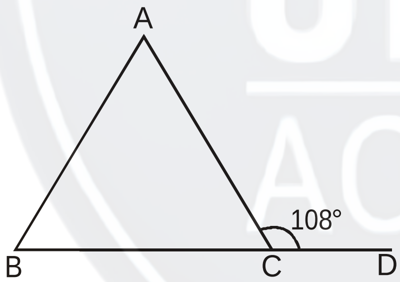
$\angle ABC + \angle ACE = 2\angle BAC + \angle ACB + \angle CAB$

$= 180 + \angle BAC$

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

22. (d);

23. (d);




$\angle A + \angle B = 108°$

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

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

24. (c); Sum of two angle = 80°

$x + y = 80°$

Difference of two angle = 20°

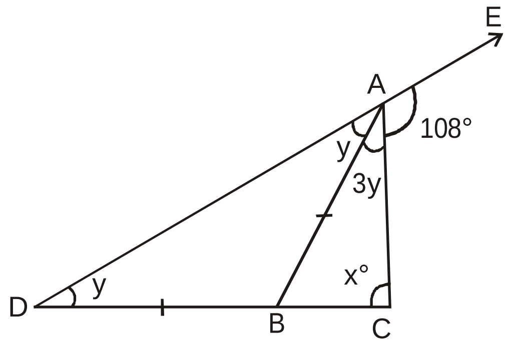
$x - y = 20°$

$2x = 100°$, $x = 50°$

$y = 80° - 50° = 30°$

so, smallest angle is 30°

25. (a);




$\angle BAD = \angle BDA$

In $\Delta ACD$

$x + y = 108°$

$4y = 180° - 108°$

$y = 18°$

$x + y = 108°$

$x = 108° - 18°$, $x = 90°$

26. (d); $s + t + 50° = 180°$

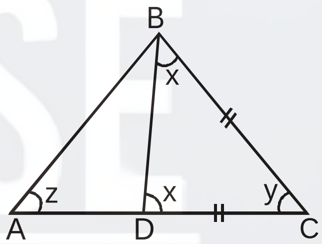
$s + t = 180° - 50°$

$s + t = 130°$

$s < 50°$

$t > 130° - 50°$, $t > 80°$

27. (c);




$BC = CD$

$\angle CBD = \angle CDB = x$

$x = z + \angle ABD$

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

$\angle ABC - \angle BAC = 30°$

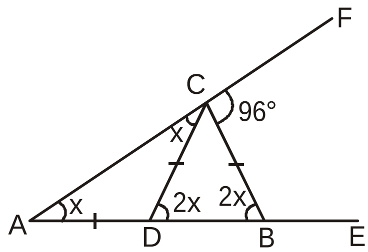
$\angle ABD + x - z = 30°$ ...(ii)

On solving (i) and (ii)

$2\angle ABD = 30°$

$\angle ABD = 15°$

28. (c);




$\angle CAD = \angle ACD = x$

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

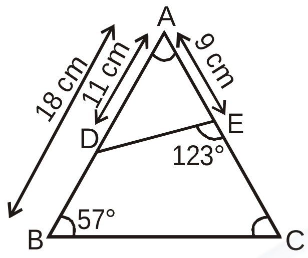
$\angle CDB = 2x = \angle CBD$

In $\Delta ABC$, $x + 2x = 96$

$3x = 96$, $x = \frac{96}{3} = 32°$

$\angle DBC = 2x = 32 \times 2 = 64°$

29. (a);




In $\Delta ADE$ and $\Delta ABC$

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

$\angle ABC = \angle AED = 57°$

$\angle ACB = \angle ADE$

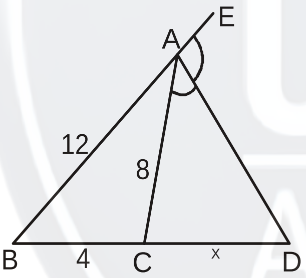
$\Delta ABC \sim \Delta AED$

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

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

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

30. (c);

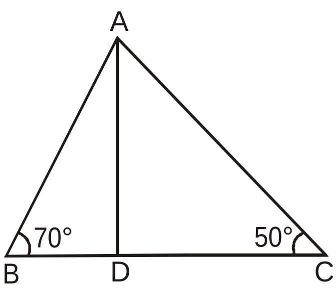



$\frac{AB}{AC} = \frac{BD}{CD}$, $\frac{12}{8} = \frac{4+x}{x}$

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

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

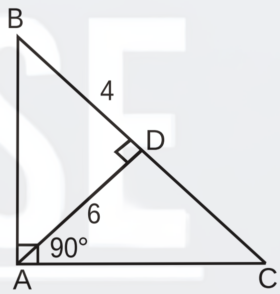
$AD = DE$

$\angle DEA = \angle DAE = x°$

(In $\Delta ADE$), $x + x + 150° = 180°$

$2x = 30°$, $x = 15°$

34. (d);




In $\Delta ABD$, $AB^2 = AD^2 + BD^2$

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

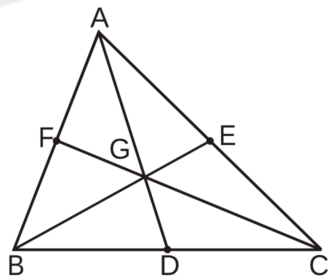
In $\Delta ABD$ and $\Delta ABC$

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



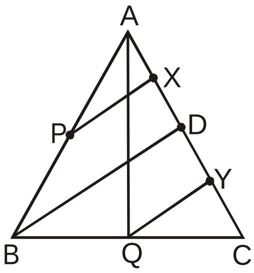

Median divides the triangles into two equal area.

In $\Delta ABC$, the triangle is divided into 6 equal parts.

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

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

36. (b);




In $\Delta ABD$

P and X are the midpoint of AB and AD.

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

Similarly, In $\Delta BDC$

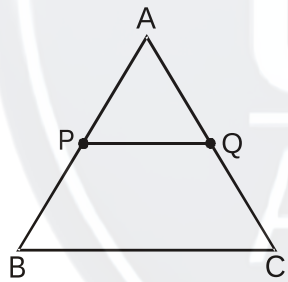
Q and Y are the midpoint of BC and CD

$QY || BD$ 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);




$PQ || BC$

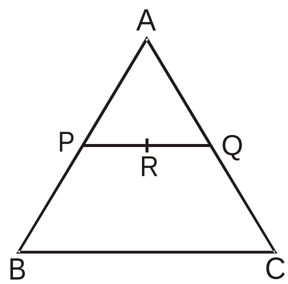
$\angle APQ = \angle AQP = 60°$

$\angle PAQ = 60°$

$\Delta APQ$ 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

$BC = 2\,PQ = 2 \times 6 = 12$ cm

39. (d); In $\Delta ABC$ and $\Delta BDC$

$\angle BAC = \angle BCD$ (given)

and $\angle B = \angle B$ (common)

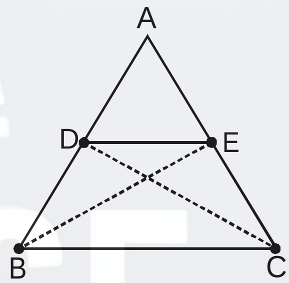
$\angle ABC \sim \angle CBD$

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

$BC^2 = 18 \times 32$, $BC = 24$ 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 $(\Delta ACD) = 36 \text{ cm}^2$

ar $(\Delta ACD)$ = ar $(\Delta ADE)$ + ar $(\Delta DEC)$

Triangle between same parallel lines and having same base have equal areas

ar $(\Delta DEC)$ = ar $(\Delta DEB)$

ar $(\Delta ABE)$ = ar $(\Delta ADE)$ + ar $(\Delta DEB)$

ar $(\Delta ABE)$ = ar $(\Delta ADE)$ + ar $(\Delta DEC)$

ar $(\Delta ABE)$ = ar $(\Delta ACD)$

ar $(\Delta ABE) = 36 \text{ cm}^2$

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

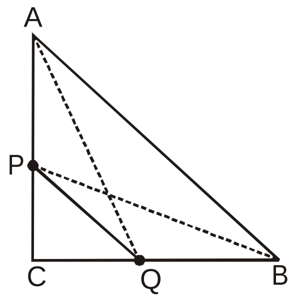
$\frac{BP + AP}{AP} = \frac{4}{1}$

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 $\Delta ACQ$, $AC^2 + CQ^2 = AQ^2$

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

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

In $\Delta BCP$, $BC^2 + CP^2 = BP^2$

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

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

On adding (i) and (ii)

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

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

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

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

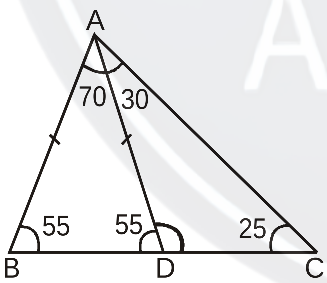
$2a^2 + 2b^2 + 2c^2 - 2ab - 2bc - 2ca = 0$

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

so, $a = b = c$

Therefore it is an equilateral triangle.

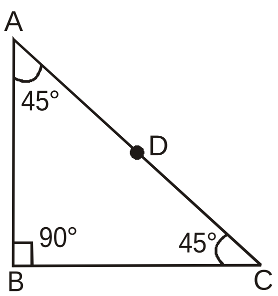
44. (b);




$BC > CA > CD$

Since largest angle corresponds to largest side.

45. (a);




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

In $\Delta ABC$

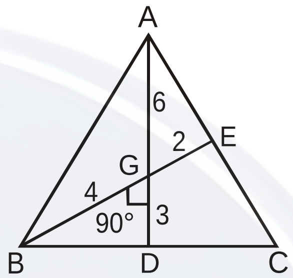
$AB^2 + BC^2 = AC^2$, $2AB^2 = AC^2$

$\Delta ABC$ and $\Delta ADB$ 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 $\Delta BGD$

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

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

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

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

$= 3 \times$ in-radius

$= 3 \times 3 = 9$ cm

49. (c); In $\Delta PMR$

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

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

In $\Delta PQR$

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

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

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

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