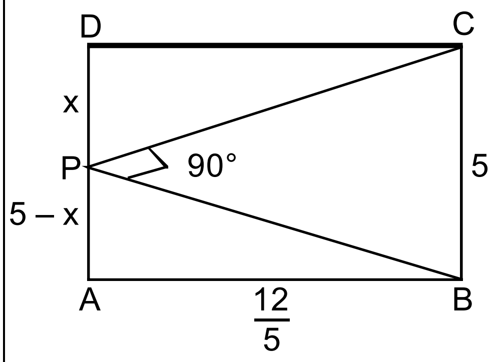
1. (c)



In ΔDPC

$DC^2 + DP^2 = PC^2$ ... (i)

In APB

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

Add (i) and (ii)

$DC^2 + DP^2 + AP^2 + AB^2 = PC^2 + BP^2$

$$\left(\frac{12}{5}\right)^2 + x^2 + (5 - x)^2 + \left(\frac{12}{5}\right)^2 = BC^2$$

$$\frac{144}{25} + x^2 + 25 - 10x + x^2 + \frac{144}{25} = 25$$

$$2x^2 - 10x + \frac{288}{25} = 0$$

$$50x^2 - 250x + 288 = 0$$

$$25x^2 - 125x + 144 = 0$$

$$x = \frac{125 \pm \sqrt{(125)^2 - 4\times25\times144}}{50} = \frac{125 \pm \sqrt{15625 - 14400}}{50}.$$

$$x = \frac{125 \pm \sqrt{1225}}{50}$$

$$x = \frac{125 \pm 35}{50}$$

Taking +ve sign

$$x = \frac{125+35}{50} = \frac{160}{50} = 3.2$$

Taking – ve sign

$$x = \frac{125-35}{50} = \frac{90}{50} = 1.8$$

If x = 3.2, then

$$BP = \sqrt{(AP)^2 + (AB)^2} = \sqrt{(5-3.2)^2 + \left(\frac{12}{5}\right)^2} = \sqrt{(1.8)^2 + \frac{144}{25}} = \sqrt{\frac{81}{25} + \frac{144}{25}} = 3$$

$$PC = \sqrt{(DC)^2 + (DP)^2} = \sqrt{\left(\frac{12}{5}\right)^2 + (3.2)^2} = \sqrt{\frac{144}{25} + \frac{256}{25}} = \frac{20}{5} = 4$$

∴ BP + PC = 3 + 4 = 7 cm.

2. (d) Let the vertices of triangle be A (x_1, y_1), B (x_2, y_2) and C (x_3, y_3).

Given : D (mid -point of AB)

$$\therefore \frac{x_1 + x_2}{2} = -2 \Rightarrow x_1 + x_2 = -4 \quad ...(i)$$

$$\text{And} \quad \frac{y_1 + y_2}{2} = 3 \Rightarrow y_1 + y_2 = 6 \quad ...(ii)$$

E (mid -point of AC)

$$\therefore \frac{x_1 + x_3}{2} = 4 \Rightarrow x_1 + x_3 = 8 \quad ...(iii)$$

$$\text{And} \quad \frac{y_1 + y_3}{2} = -3 \Rightarrow y_1 + y_3 = -6 \quad ...(iv)$$

F (mid- point of BC)

$$\therefore \frac{x_2 + x_3}{2} = 4 \Rightarrow x_2 + x_3 = 8 \quad ..(v)$$

$$\text{And} \quad \frac{y_2 + y_3}{2} = 5 \Rightarrow y_2 + y_3 = 10 \quad ...(vi)$$

Adding equation (i), (iii) and (v)

$2(x_1 + x_2 + x_3) = 12$

$\Rightarrow x_1 + x_2 + x_3 = 6$

Adding equation (ii) (iv) and (vi)

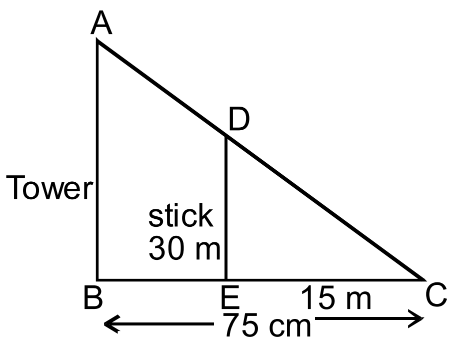
$2(y_1 + y_2 + y_3) = 10$

$\Rightarrow y_1 + y_2 + y_3 = 5$

So, Centroid $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$

$\Rightarrow$ Centroid $\left(\frac{6}{3}, \frac{5}{3}\right)$ or $\left(2, \frac{5}{3}\right)$.

3. (a)



Let the height of tower is hm.

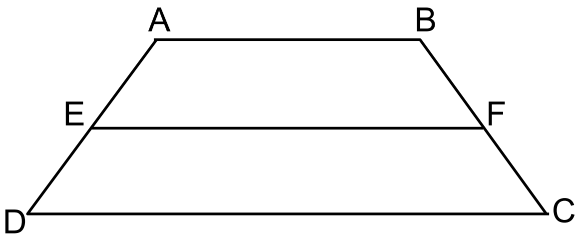
ΔABC ~ ΔDEC

$\therefore \quad \frac{AB}{DE} = \frac{BC}{EC}$

$\Rightarrow \quad \frac{h}{30} = \frac{75}{15}$

$\Rightarrow \quad h = \frac{75 \times 30}{15} = 150$ m.

4. **(b)**



AB || EF || CD

$\therefore \quad \frac{AE}{ED} = \frac{BF}{FC}$

$\Rightarrow \quad \frac{x}{9-x} = \frac{2}{4}$

$\Rightarrow \quad 4x = 18 - 2x$

$\Rightarrow \quad 6x = 18$

$\Rightarrow \quad x = 3$ cm

$\therefore \quad AE = 3$ cm.

5. **(d)** The area of Δ formed is zero

(k, 2k), (3k, 3k), (3, 1)

$\frac{1}{2}$ [k (3k – 1) + 3k(1 – 2k) + (2k – 3k)] = 0

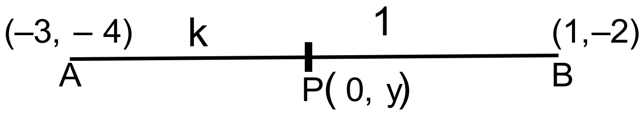
$3k^2 - k + 3k - 6k^2 + 6k - 9k = 0$

$3k^2 + k = 0$

k (3k + 1) = 0 ; k = 0 or $\frac{-1}{3}$.

6. **(b)**

Sol.



Let the point on the y - axis be P(0, y) and the ratio be k : 1.

$0 = \frac{k-3}{k+1}$

$\Rightarrow k = 3$.

So, ratio is 3 : 1.

7. **(a)** A (– a, – b), B (0, 0), C (a, b) and D (a^2, ab).

AB = $\sqrt{a^2+b^2}$, BC = $\sqrt{a^2+b^2}$

CD = $\sqrt{(a^2-a)^2+(ab-b)^2}$ = (a – 1) $\sqrt{a^2+b^2}$

DA = $\sqrt{(a^2+a)^2+(ab+b)^2}$ = (a + 1) $\sqrt{a^2+b^2}$

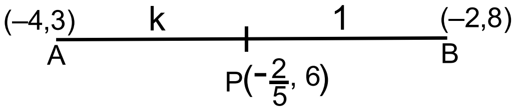
$\therefore \quad$ AB + BC + CD = DA

$\Rightarrow \quad \sqrt{a^2+b^2}\ (1 + 1 + a - 1) = (a + 1)\ \sqrt{a^2+b^2}$

$\Rightarrow \quad (a + 1)\ \sqrt{a^2+b^2} = (a + 1)\ \sqrt{a^2+b^2}$

So, the points are collinear.

8. **(c)** Let the ratio is k : 1.



$\Rightarrow \quad \frac{-2}{5} = \frac{2k-4}{k+1}$

$\Rightarrow \quad -2k - 2 = 10k - 20$

$\Rightarrow \quad -12k = -18$

$\Rightarrow \quad k = .\ \frac{18}{12} = \frac{3}{2}$

So, the ratio is 3 : 2.

9. **(c)** In $\Delta s LMK$ and ONK,

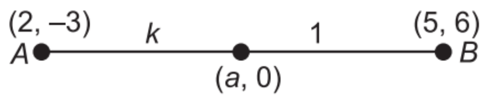
$\angle KML = \angle ONK = 46^\circ$

$\angle K = \angle K$ (Common)

$\Delta LMK - \Delta ONK$ (AA similarity)

$\Rightarrow \frac{KM}{KN} = \frac{LM}{ON} \Rightarrow \frac{b+c}{c} = \frac{a}{x} \Rightarrow x = \frac{ac}{b+c}$

10. Any point on the x - axis is $(a, 0)$.



Let the point $(a, 0)$ divide thejoin of $A(2, -3)$ and $B(5, 6)$ in the ratio k : 1.

Then the co - ordinates of the point of division are

$\left(\frac{5k+2}{k+1}, \frac{6k-3}{k+1}\right)$

Now, $\frac{5k+2}{k+1} = a$ and $\frac{6k-3}{k+1} = 0$

$6k - 3 = 0 \Rightarrow k = \frac{1}{2}$

Required ratio is $k : 1 \Rightarrow \frac{1}{2} : 1 = 1 : 2$.

11. Let the point be P whose abscissa = ordinate $= a$.

$P \equiv (a, a)$

Given, $PA = PB$

$\Rightarrow (a+1)^2 + a^2 = a^2 + (a-5)^2$

$\Rightarrow 2a^2 + 2a + 1 = 2a^2 - 10a + 25$

$\Rightarrow 12a = 24 \Rightarrow a = 2$.

The point is (2, 2).

12. **(b)** PQ || BC

$\therefore \quad \frac{AQ}{AB} = \frac{AP}{AC}$ ...(i)

PR || CD

$\therefore \quad \frac{AR}{AD} = \frac{AP}{AC}$ ... (ii)

From (i) & (ii) $\frac{AR}{AD} = \frac{AQ}{AB}$.

13. **(b)** $\Delta ABC \sim \Delta PQR$

$\Rightarrow \frac{3}{z} = \frac{y}{4\sqrt{3}} = \frac{6}{8}$

$\Rightarrow \frac{3}{z} = \frac{6}{8}$

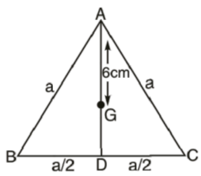
$\Rightarrow z = 4$ cm.

and $\frac{y}{4\sqrt{3}} = \frac{6}{8}$

$\Rightarrow y = 3\sqrt{3}$ cm.

So, $y + z = (3\sqrt{3} + 4)$ cm.

14. **(b)** Let ABC be the equilateral triangle whose centroid G is at a distance 6 cm from vertex A.



Let each side of ΔABC be a cm.

The median AD is also the perpendicular bisector in case of an equilateral Δ so, $\angle ADB = 90^{\circ}$ and $BD = DC = a/2$

Now $AG : GD = 2 : 1$

(Centroid divides a median in the ratio 2: 1)

$\frac{6}{GD} = \frac{2}{1} \Rightarrow GD = 3$ cm

$AD = AG + GD = 6\text{cm} + 3 \text{ cm} = 9$ cm

Now, $AB^2 = AD^2 + BD^2$ (Pythagoras' Theorem)

$\Rightarrow AB^2 - BD^2 = AD^2$

$\Rightarrow a^2 - \left(\frac{a}{2}\right)^2 = 81 \Rightarrow \frac{3a^2}{4} = 81 \Rightarrow a^2 = \frac{81\times 4}{3}$

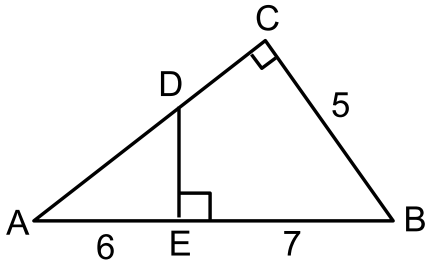
$\Rightarrow a = \sqrt{27\times 4} = 6\sqrt{3}$ cm

Area of the equilateral triangle

$= \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4}\times 6\sqrt{3}\times 6\sqrt{3}\text{cm}^2$

$= 27\sqrt{3}\text{cm}^2$

15. **(a)**



$AC = \sqrt{13^2 - 5^2} = 12$

$\Delta AED \sim \Delta ACB$ (By AA)

$\frac{AE}{AC} = \frac{ED}{CB}$

$\frac{6}{12} = \frac{ED}{5}$

ED = 2.5

area of quadrilateral EBCD = area ΔABC – area $\Delta AED = \frac{1}{2} \times 5 \times 12 - \frac{1}{2} \times 6 \times 2.5 = 30 - 7.5 = 22.5$.

16. **(b)** By the converse of basic proportionality theorem, if $\frac{CD}{DA} = \frac{CB}{EB}$, then $DE \parallel AB$

$\Rightarrow \frac{x+3}{8x+9} = \frac{x}{3x+4}$

$\Rightarrow (3x+4)(x+3) = x(8x+9)$

$\Rightarrow 3x^2 + 13x + 12 = 8x^2 + 9x$

$\Rightarrow 5x^2 - 4x - 12 = 0$

$\Rightarrow 5x^2 - 10x + 6x - 12 = 0$

$\Rightarrow 5x(x-2) + 6(x-2) = 0$

$\Rightarrow (5x+6)(x-2) = 0$

$\Rightarrow x = \frac{-6}{5}$ or 2

Since, x cannot be negative, $x = 2$.

17. Let the line $3x + 4y = 7$ divide thejoin of $(-2,1)$ and $(1,2)$ in the ratio $k:1$. Then the co - ordinates of the point of division are : $\left(\frac{k-2}{k+1}, \frac{2k+1}{k+1}\right)$

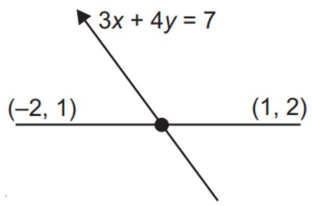
This point lies on the line $3x + 4y = 7$, so satisfies the equation of the given line, *i. e.*,

$3\left(\frac{k-2}{k+1}\right) + 4\left(\frac{2k+1}{k+1}\right) = 7$

$\Rightarrow 3k - 6 + 8k + 4 = 7k + 7$

$4k = 9 \Rightarrow k = \frac{9}{4}$.

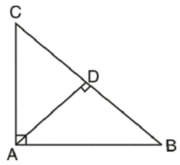
$\Rightarrow$ Required ratio $= \frac{9}{4} : 1 = 9 : 4$.



18. **(b)** In ΔABC and $\Delta DBA, \angle B$ is common

$\angle CAB = \angle BDA = 90^{\circ} \Rightarrow \Delta ABC \sim \Delta DBA$

$\Rightarrow \frac{AB}{AC} = \frac{DB}{DA} \Rightarrow \frac{DB}{DA} = \frac{3}{4}$



$\Rightarrow AD = \frac{4}{3} DB \ldots (i)$

In ΔABD and ΔADC,

$ADAB = AACD$

(Third angles of similar Δs ABC and DBA)

$\angle ADB = \angle ADC = 90^{\circ}$

$\frac{AB}{AC} = \frac{AD}{CD} = \frac{3}{4} \Rightarrow AD = \frac{3}{4} CD \ (ii)$

From (i) and (ii)

$\frac{4}{3} DB = \frac{3}{4} CD \Rightarrow \frac{BD}{CD} = \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}.$

19. For three points to be collinear, area of the triangle formed by the three points should be equal to zero, *i.e.*

$\frac{1}{2}\left[k(3k-1) + 2k(1-2k) + 3(2k-3k)\right] = 0$

$\Rightarrow \frac{1}{2}[3k^2 - k + 2k - 4k^2 - 3k] = 0$

$\Rightarrow k^2 + 2k = 0 \Rightarrow k = 0 \text{ or } -2$

Neglecting $k = 0$, as then $(k, 2k)$ and $(2k, 3k)$ will be the same point, we take $k = -2$.

20. Let $P(x, y), A(a, 0)$ and $B(-a, 0)$ be the given points.

Then, $PA^2 + PB^2 = 2b^2$

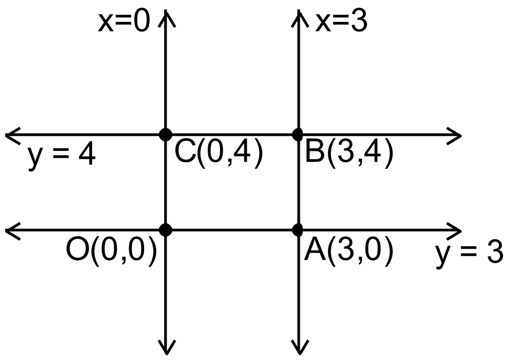
$\Rightarrow (x-a)^2 + (y-0)^2 + (x+a)^2 + (y-0)^2 = 2b^2$

$\Rightarrow x^2 - 2ax + a^2 + y^2 + x^2 + 2ax + a^2 + y^2 = 2b^2$

$= \Rightarrow x^2 + a^2 + y^2 = b^2$

$\Rightarrow x^2 + a^2 = b^2 - y^2.$

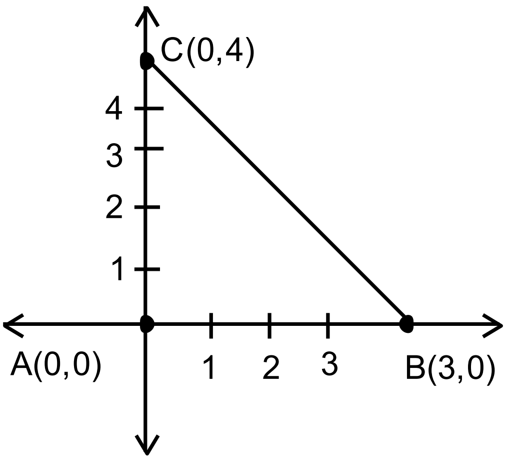
21. **(d)**



Area = 3 × 4 = 12 sq. units.

22. **(d)**

Sol.



CA = 4

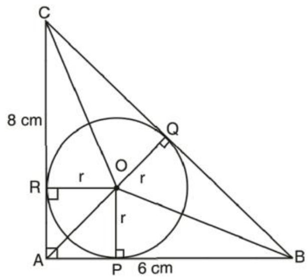
AB = 3

AC = 5

Perimeter =12

23. **(b)** Let ΔABC be right angled at A.

Since the incentre is equidistant from the sides, let the radius of the incircle be r.



$OP = OQ = OR = r$ cm

By Pythagoras' Theorem

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

$\Rightarrow BC^2 = 6^2 + 8^2 = 36 + 64 = 100$

$\Rightarrow BC = 10$ cm. Now,

Area of $\Delta ABC =$ Area of ΔOAB

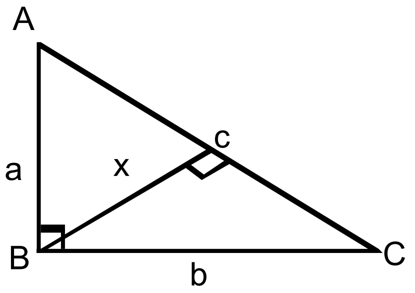
$+$ Area of $\Delta OBC +$ Area of $\Delta OCA \Rightarrow \frac{1}{2} \times AB \times AC$

$= \frac{1}{2} \times r \times AB + \frac{1}{2} \times r \times BC + \frac{1}{2} \times r \times CA$

$\Rightarrow \frac{1}{2}\times 6\times 8=\frac{1}{2}\times r\times 6+\frac{1}{2}\times r\times 10+\frac{1}{2}\times r\times 8$

$\Rightarrow 12r=24\Rightarrow r=2$ cm.

24. (d) $\frac{1}{2}$ ab = $\frac{1}{2}$ cx



$x = \frac{ab}{c}$

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

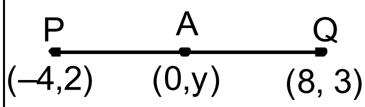
$a^2 + b^2 = \frac{a^2b^2}{x^2}$

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

25. (b) 4

26. (d) Let the ratio 1 : k

$x = \frac{1(8)+k(-4)}{1+k} = 0$



$x = \frac{8-4k}{k+1} = 0 \Rightarrow$ k = 2.

So, ratio 1 : k = [1 : 2]

27. (c) Let the shortest side of the triangle be xm

Then, hypotenuse $=\left(2x+6\right)$m

Third side $=\left(2x+6\right)-2=\left(2x+4\right)$m

By Pythagoras' Theorem,

$\left(2x+6\right)^2=\left(2x+4\right)^2+x^2$

$\Rightarrow 4x^2+24x+36=4x^2+16x+16+x^2$

$\Rightarrow x^2-8x-20=0$

$\Rightarrow x^2-10x+2x-20=0$

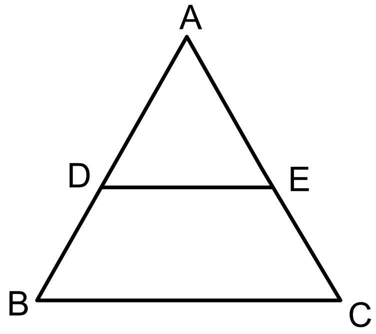
$\Rightarrow \left(x-10\right)\left(x+2\right)=0$

$\Rightarrow x=10$ or -2

x cannot be negative, $x=10$

Hypotenuse $=\left(2\times 10+6\right)$m $=26$m

28. (b) $\Delta ADE \sim \Delta ABC$



$\therefore \quad \frac{\text{Area of } \Delta \text{ ADE}}{\text{Area of } \Delta \text{ ABC}} = \frac{DE^2}{BC^2}$

Given : $\frac{\text{Area of } \Delta \text{ ADE}}{\text{Area of } \Delta \text{ ABC}} = \frac{1}{5}$

$\frac{1}{5} = \frac{DE^2}{100}$

$DE^2 = 20 \Rightarrow DE = 2\sqrt{5}$ cm.

29. (c) Equilateral triangles are similar triangles.
In similar triangles, the ratio of their corresponding sides is the same as the ratio of their medians.

30. Area of $\Delta ABC=0$ for collinearity of A,B,C.

$\Rightarrow \frac{1}{2}\left[1\left(4-a\right)+2\left(a-2\right)+3\left(2-4\right)\right]=0$

$\Rightarrow 4-a+2a-4+6-12=0$

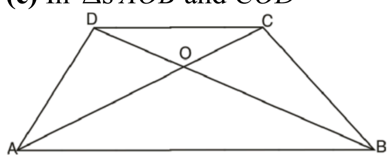
$> a-6=0xa=6.$

Point $C\equiv\left(3,6\right)$

j$\Rightarrow BC=\sqrt{\left(3-2\right)^2+\left(6-4\right)^2}$

$=\sqrt{1+4}=\sqrt{5}$ units.

31. (c) In Δs AOB and COD



$\angle AOB=\angle COD$ (vert. opp. $\angle s$)

$\angle OAB=\angle DCO$ ($DC \parallel AB$, alt.$\angle s$ are equal)

ΔAOB □ ΔCOD (AA similarity)

$\Rightarrow \frac{ar\left(\Delta AOB\right)}{ar\left(\Delta COD\right)}=\frac{AB^2}{CD^2}$

{Ratio of areas oftwo similar Δs is equal to the ratio of the squares of the corresponding sides}

$=\frac{\left(2CD\right)^2}{CD^2}=\frac{4CD^2}{CD^2}=\frac{4}{1}$.

32. (c) In ΔEFG and ΔGCD,

$\angle EFG = \angle GDC$ ($EF \parallel CD$, alt. $\angle s$ are equal)

$\angle EGF = \angle CGD$ (vert. opp. $\angle s$)

$\Delta EFG \sim \Delta GCD$ (By AA similarity)

$$\frac{EG}{GC} = \frac{EF}{DC} \Rightarrow \frac{EF}{18} = \frac{5}{10} \Rightarrow EF = 9 \text{ cm}$$

Now in Δs ABC and EFC,

$\angle ACB = \angle ECF$ (common)

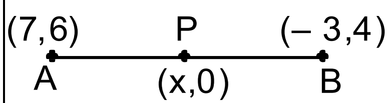
$A \angle ABC = \angle EFC$ ($AB \parallel EF$, corr. $\angle s$ are equal)

$\Delta ABC \sim \Delta EFC$ (By AA similarity)

$$\Rightarrow \frac{AC}{EC} = \frac{AB}{BF} \Rightarrow \frac{AC}{(EG+GC)} = \frac{AB}{EF}$$

$$\Rightarrow \frac{AC}{(5+10)} = \frac{15}{9} \Rightarrow AC = 25 \text{ cm.}$$

33. (c)



Condition of equidistant

AP = BP

$AP^2 = BP^2$

$(7 - x)^2 + (6 - 0)^2 = (x + 3)^2 + (4 - 0)^2$

$(49 + x^2 - 14x + 36) = x^2 + 9 + 6x + 16$

$85 + x^2 - 14x = x^2 + 25 + 6x$

$85 + x^2 - 14x = x^2 + 25 + 6x$

$60 = 20x$

$x = 3$

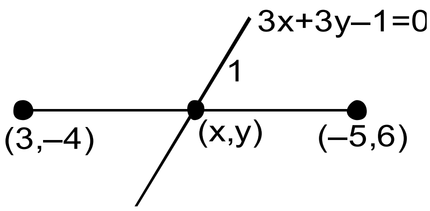
P(3 , 0)

34. (d) Line $\rightarrow$ $3x + 3y - 1 = 0$

$$(x,y) \equiv \left(\frac{-5\lambda + 3}{\lambda + 1}, \frac{6\lambda - 4}{\lambda + 1}\right)$$

(x,y) satisfy the line $3x + 3y - 1 = 0 \Rightarrow \lambda = 2$

$\therefore$ 2 : 1



35. (c) AD is the bisector of $\angle$A.

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

$\Rightarrow \frac{10}{6} = \frac{x}{12 - x}$

$\Rightarrow 120 - 10x = 6x$

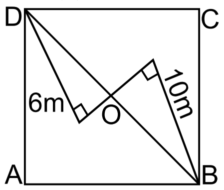
$\Rightarrow 16x = 120$

$\Rightarrow x = \frac{120}{16} \Rightarrow x = 7.5$ cm.

36. (D) Rohit's son is Sunita's brother. Soniya and Sunita are sisters. Rohit's son is Sunita's brother. How is Rohan related to Soniya

37. (C)
38. (D)
39. (B)
40. (D)
41. (C)
42. (C)
43. (D)
44. (D)
45. (C)

46. (a)



$\Rightarrow$ Join BD

$\Rightarrow$ $\Delta DOE \sim \Delta BOF$ (AA)

$\Rightarrow \therefore \frac{DE}{BF} = \frac{OE}{OF}$

$\Rightarrow \frac{6}{10} = \frac{OE}{OF}$

$\Rightarrow \frac{3}{5} = \frac{OE}{OF}$

$\Rightarrow$ As EF = 8m

$\therefore$ OE = 3m, OF = 5m

$\Rightarrow$ In ΔDOE

$\Rightarrow$ By pyth. Th m

$\Rightarrow$ DO = $\sqrt{45} = 3\sqrt{5}$m

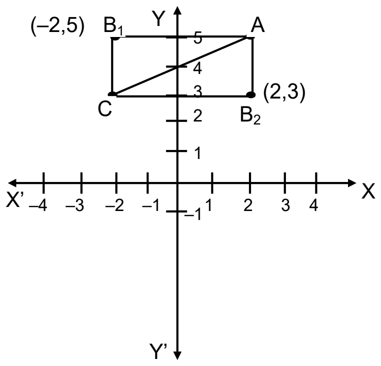
$\Rightarrow$ BO = $\sqrt{125} = 5\sqrt{5}$m

$\therefore$ BD = $8\sqrt{5}$m

$\Rightarrow$ Hence Ar(ABCD) = $\frac{1}{2}(d)^2$

$= \frac{1}{2}(8\sqrt{5})^2 = 160m^2$

47. (a)



By observation possible coordinates of B are (–2, 5)

(2, 3)

48. (a) $x^2 = 5x + 7$

'P' is a root.

$\therefore P^2 - 5P + 7 = 0$ ……….(i)

Radius $= \sqrt{(P-1)^2 + (P-4)^2}$

$= \sqrt{P^2 + 1 - 2P + P^2 + 16 - 5P}$

$= \sqrt{2P^2 - 10P + 17}$

$= \sqrt{2P^2 - 10P + 14 + 3}$

$= \sqrt{2(P^2 - 5P + 7) + 3}$

$= \sqrt{3}$

Area $= \pi(\sqrt{3})^2 = 3\pi$

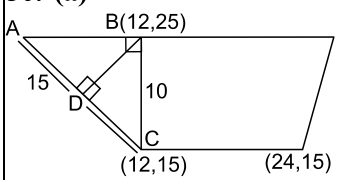
49. (b) $\Delta ADB \sim \Delta ABC$

$\Rightarrow \frac{AD}{AB} = \frac{AB}{AC}$

$\Rightarrow \frac{8}{b} = \frac{b}{18} \Rightarrow b^2 = 144$

$b = 12cm$

50. (a)



$\Rightarrow \Delta ABC \sim \Delta BDC$

$\Rightarrow \frac{BC}{DC} = \frac{AC}{BC}$

$\Rightarrow 100 = AC. DC$

$\Rightarrow 100 = (m + 15)m$

$\Rightarrow 100 = m^2 + 15$

$\Rightarrow m^2 + 15m - 100 = 0$

$\Rightarrow m^2 + 20m - 5m - 100 = 0$

$\Rightarrow m(m + 20) -5 (m + 20) = 0$

$\Rightarrow m = -20, m = 5$