Solutions to RSPL/2 (Basic)

1. (d), No value of x

Given: $2^x \times 5^x$

at $x = 0 \Rightarrow 2^0 \times 5^0 = 1$

at $x = 1 \Rightarrow 2^1 \times 5^1 = 10$

at $x = 2 \Rightarrow 2^2 \times 5^2 = 100$

$\therefore$ There is no value of x at which $2^x \times 5^x$ ends in 5.

$\therefore$ Option (d) is correct.

2. (c), The given equations are:

$2x - 3y = 3$ and $-4x + qy = \frac{p}{2}$

The system of equations is inconsistent,

$$\therefore \quad \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

$$\frac{2}{-4} = \frac{-3}{q} \neq \frac{3}{\frac{p}{2}}$$

$$\frac{2}{-4} \neq \frac{3}{\frac{p}{2}}$$

$$\Rightarrow \quad \frac{-1}{2} \neq \frac{6}{p}$$

$$\Rightarrow \quad p \neq -12$$

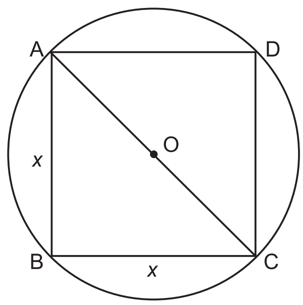
$\therefore$ Option (c) is correct.

3. (d), radius of circle = 1 unit

diameter of circle = 2 unit

In the given figure

Let x be side of square, AC is the diameter of the circle



In rt ΔABC,

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

$$2^2 = x^2 + x^2$$

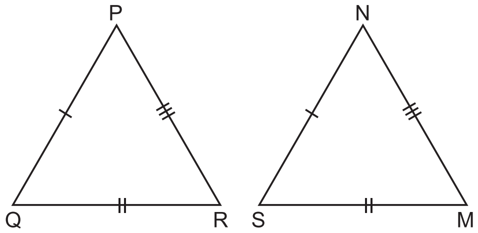
$$x^2 = 2$$

$$x = \sqrt{2}$$

$$\text{Area of square} = x \cdot x = \sqrt{2} \cdot \sqrt{2} = 2 \text{ sq. units}$$

$\therefore$ Option (d) is correct

4. (*d*) In ΔPQR and ΔMNS



$$\frac{PQ}{NS} = \frac{QR}{MS} = \frac{PR}{MN}$$

$\therefore$ $\Delta QRP \sim \Delta SMN$

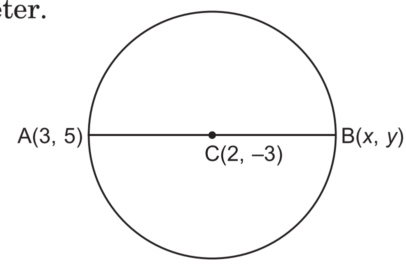
$\therefore$ Option (*d*) is correct

5. (*c*), The sum of the probabilities of all the elementary events of an experiment is 1.

$\Rightarrow$ $p = 1$

$\therefore$ Option (*c*) is correct.

6. (*a*), Let B(*x*, *y*) be the co-ordinate of other end of diameter.



C is the centre, so it is the mid point of AB

$\therefore$ $2 = \frac{3+x}{2}$ and $-3 = \frac{5+y}{2}$

$\Rightarrow$ $x = 1$ and $y = -11$

$\therefore$ Co-ordinates of B are (1, – 11)

$\therefore$ Option (*a*) is correct.

7. (*d*), The given equations are

$$173x + 197y = 149 \quad ...(i)$$

$$197x + 173y = 221 \quad ...(ii)$$

Adding (*i*) and (*ii*), we get

$$370x + 370y = 370$$

$\Rightarrow$ $x + y = 1$ ...(*iii*)

Subtract (*i*) from (*ii*) we get

$$24x - 24y = 72$$

$\Rightarrow$ $x - y = 3$ ...(*iv*)

Adding (*iii*) and (*iv*), we get

$$2x = 4$$

$\Rightarrow$ $x = 2$

Substituting in (*iii*), we get

$$2 + y = 1$$

$\Rightarrow$ $y = -1$

Hence (*x*, *y*) is (2, – 1)

$\therefore$ Option (*d*) is correct.

8. (*a*) $4x^2 - 6x - m$ is divisible by $x - 2$

$\therefore$ at $x = 2, 4x^2 - 6x - m = 0$

$\therefore$ $4(2)^2 - 6(2) - m = 0$

$16 - 12 - m = 0$

$\Rightarrow$ $4 - m = 0 \Rightarrow m = 4$

Option (*a*) is correct.

9. (*d*) Given OP = 26 cm, PT = 24 cm

Join OT,

$$OT \perp PT \quad [\because \text{ tangents and radius arc perpendicular}]$$

$$OT = r$$

In rt ΔOTP

$$OP^2 = PT^2 + OT^2$$

$$\Rightarrow \quad 26^2 = 24^2 + r^2$$

$$\Rightarrow \quad r^2 = 26^2 - 24^2$$

$$r^2 = 676 - 576$$

$$r^2 = 100$$

$$\therefore \quad r = 10$$

$\therefore$ Radius of circle is 10 cm

$\therefore$ Option (*d*) is correct.

10. (*b*), We know that, area of circle = πr^2.

$$\therefore \quad \pi R_1^2 + \pi R_2^2 = \pi R^2$$

$$\Rightarrow \quad R_1^2 + R_2^2 = R^2$$

$\therefore$ Option (*b*) is correct.

11. Let three numbers are $a - d$, a, $a + d$

$$a - d + a + a + d = 24$$

$$\Rightarrow \quad 3a = 24$$

$$\Rightarrow \quad a = 8$$

$\therefore$ The middle term is 8

12. Frequency of a class = Cumulative frequency of given class – Cumulative frequency of previous class

Frequency (f) = 50 – 30

$$\Rightarrow \quad f = 20$$

OR

The frequency of 12 is more *i.e.* eleven

So mode is 12.

13. Here $a = 10$, $d = -6$

$$a_{15} = a + 14d$$

$$= 10 + 14(-6)$$

$$= -74$$

14.

$$\frac{\sin^4\theta - \cos^4\theta}{\sin^2\theta - \cos^2\theta} = \frac{(\sin^2\theta - \cos^2\theta)(\sin^2\theta + \cos^2\theta)}{(\sin^2\theta - \cos^2\theta)}$$

$$= \sin^2\theta + \cos^2\theta$$

$$= 1$$

15.

$$a = \sec\theta - \tan\theta \quad ...(i)$$

$$b = \sec\theta + \tan\theta \quad ...(ii)$$

Multiplying (*i*) and (*ii*), we get

$$a \cdot b = (\sec\theta - \tan\theta)(\sec\theta + \tan\theta)$$

$$\Rightarrow \quad a \cdot b = \sec^2\theta - \tan^2\theta$$

$$\Rightarrow \quad a \cdot b = 1 \qquad [\because \sec^2 x - \tan^2 x = 1]$$

16. As DE | | BC, then

$$\frac{AD}{DB} = \frac{AE}{EC} \qquad \text{(By using BPT)}$$

$$\frac{1.28}{2.56} = \frac{0.64}{EC}$$

$$\Rightarrow \quad \frac{1}{2} = \frac{0.64}{EC}$$

$$\Rightarrow \quad EC = 1.28 \text{ cm}$$

17.

$$f(x) = x^2 - x - 4$$

$$\alpha + \beta = \frac{-(-1)}{1} = 1$$

$$\alpha\beta = \frac{-4}{1} = -4$$

Now,

$$\left(\frac{1}{\alpha} + \frac{1}{\beta}\right) - \alpha\beta = \left(\frac{\beta + \alpha}{\alpha\beta}\right) - \alpha\beta$$

$$= \frac{1}{-4} - (-4) = \frac{-1}{4} + 4 = \frac{15}{4}.$$

18. Number of Bags to be stored $= \dfrac{\text{Volume of cuboid granary}}{\text{Volume of each bag}}$

$$= \frac{12 \times 6 \times 5}{0.48}$$

$$= \frac{360}{48} \times 100 = 750$$

OR

Here, l be the slant height of frustum. h be the height and r_1 and r_2 be the radii of circular ends of frustum, where $r_2 > r_1$.

$$\sqrt{h^2 + (r_2 - r_1)^2} = l$$

$$\Rightarrow \quad \sqrt{64 + (r_2 - r_1)^2} = 10$$

$$\Rightarrow \quad (r_2 - r_1)^2 = 100 - 64$$

$$\Rightarrow \quad (r_2 - r_1)^2 = 36$$

$$\Rightarrow \quad r_2 - r_1 = 6 \text{ cm.}$$

19. Here,

$$a = 21, d = 21, a_n = 420$$

$$a_n = a + (n - 1)d$$

$$\Rightarrow \quad 420 = 21 + (n - 1) \cdot 21$$

$$\Rightarrow \quad 420 = 21 + 21n - 21$$

$$\Rightarrow \quad 21n = 420$$

$$\Rightarrow \quad n = 20$$

20. Yes, $\dfrac{\tan^3\theta - 1}{\tan\theta - 1} = \dfrac{(\tan\theta - 1)(\tan^2\theta + 1 + \tan\theta)}{(\tan\theta - 1)}$

$= [(\tan^2\theta + 1) + \tan\theta]$

$= \sec^2\theta + \tan\theta$

21. $8 = 2^3$

$9 = 3^2$

$25 = 5^2$

$\therefore$ H.C.F. = 1 LCM $= 2^3 \times 3^2 \times 5^2$

$= 1800$

OR

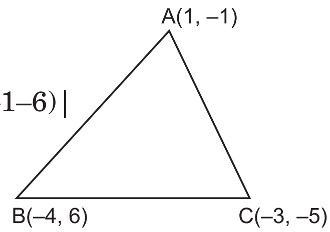
We have $6^n = (2 \times 3)^n = 2^n \times 3^n$

$\because$ Prime factors of 6^n contain prime numbers 2 and 3 only. Therefore 6^n cannot end with digit 0 for any natural number n.

22. Area of $\Delta ABC = \dfrac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

$= \dfrac{1}{2}|1\{6 - (-5)\} + (-4)\{-5 - (-1)\} + (-3)(-1-6)|$

$= \dfrac{1}{2}|11 + 16 + 21| = 24$ sq units.



23. Total number of shirts = 100

Number of ways to select one shirt = 100

Number of shirts with minor defects = 8

Number of ways to select a shirt with minor defects = 8

Number of shirts with major defects = 4

Number of ways to select a shirt with major defects = 4

Number of good shirts = 88

Number of selecting a good shirt = 88

(*i*) Probability of selecting a good shirt $= \dfrac{88}{100} = \dfrac{22}{25}$

$\therefore$ Probability that it is acceptable to Jimmy $= \dfrac{22}{25}$

(*ii*) Probability of selecting one shirt with major defects $= \dfrac{4}{100} = \dfrac{1}{25}$

$\therefore$ Probability that it is acceptable to Sujatha $= 1 - \dfrac{1}{25} = \dfrac{24}{25}$

24. Given linear equation

$2x + 3y - 8 = 0$

(*i*) another equation of the pair to represent intersecting lines is

$2x + 4y - 8 = 0$

(*ii*) Another equation of the pair to represent parallel lines

$2x + 3y - 7 = 0$

OR

Required sum = 1 + 2 + 3 + ... + 1000

These integers are in A.P.

With Ist term = 1, last term = 1000 and number of terms = 1000

$$\therefore \quad S_{1000} = \frac{1000}{2}(1 + 1000)$$
$$= 500500$$

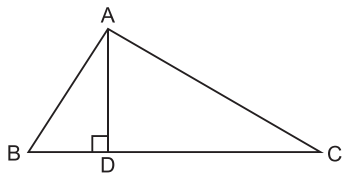
25. **Given:** In ΔABC, $AD \perp BC$ and $BD = \frac{1}{3} CD$

To Prove: $2AC^2 = 2AB^2 + BC^2$

Proof: In right ΔADC, $AC^2 = AD^2 + CD^2$ ...(*i*)

In right ΔADB, $AB^2 = AD^2 + BD^2$ ...(*ii*)

Subtracting (*ii*) from equation (*i*), we get



$$AC^2 - AB^2 = CD^2 - BD^2$$
$$AC^2 = AB^2 + (CD + BD)(CD - BD)$$
$$AC^2 = AB^2 + BC\left(CD - \frac{1}{3}CD\right) \qquad \left(\because BD = \frac{1}{3}CD \text{ given}\right)$$
$$AC^2 = AB^2 + BC \times \frac{2}{3}CD$$
$$AC^2 = AB^2 + BC \times \frac{2}{3} \times \frac{3}{4}BC$$
$$\left(\because BD + CD = BC \Rightarrow \frac{1}{3}CD + CD = BC \Rightarrow CD = \frac{3}{4}BC\right)$$
$$\Rightarrow \quad 2AC^2 = 2AB^2 + BC^2$$

26.
$$\cos\theta + \sin\theta = \sqrt{2}\cos\theta$$
$$\Rightarrow \quad \sin\theta = \sqrt{2}\cos\theta - \cos\theta$$
$$\Rightarrow \quad \frac{\sin\theta}{\sqrt{2}-1} = \cos\theta$$
$$\frac{(\sqrt{2}+1)\sin\theta}{(\sqrt{2}-1)(\sqrt{2}+1)} = \cos\theta$$
$$\Rightarrow \quad \sqrt{2}\sin\theta + \sin\theta = \cos\theta$$
$$\Rightarrow \quad \sqrt{2}\sin\theta = \cos\theta - \sin\theta$$

Hence proved

27.
$$616 = 2 \times 2 \times 2 \times 7 \times 11$$
$$32 = 2 \times 2 \times 2 \times 2 \times 2$$

Maximum number of columns is equal to HCF of 616 and 32.

HCF of 616 and 32 = 8

Hence maximum number of columns = 8

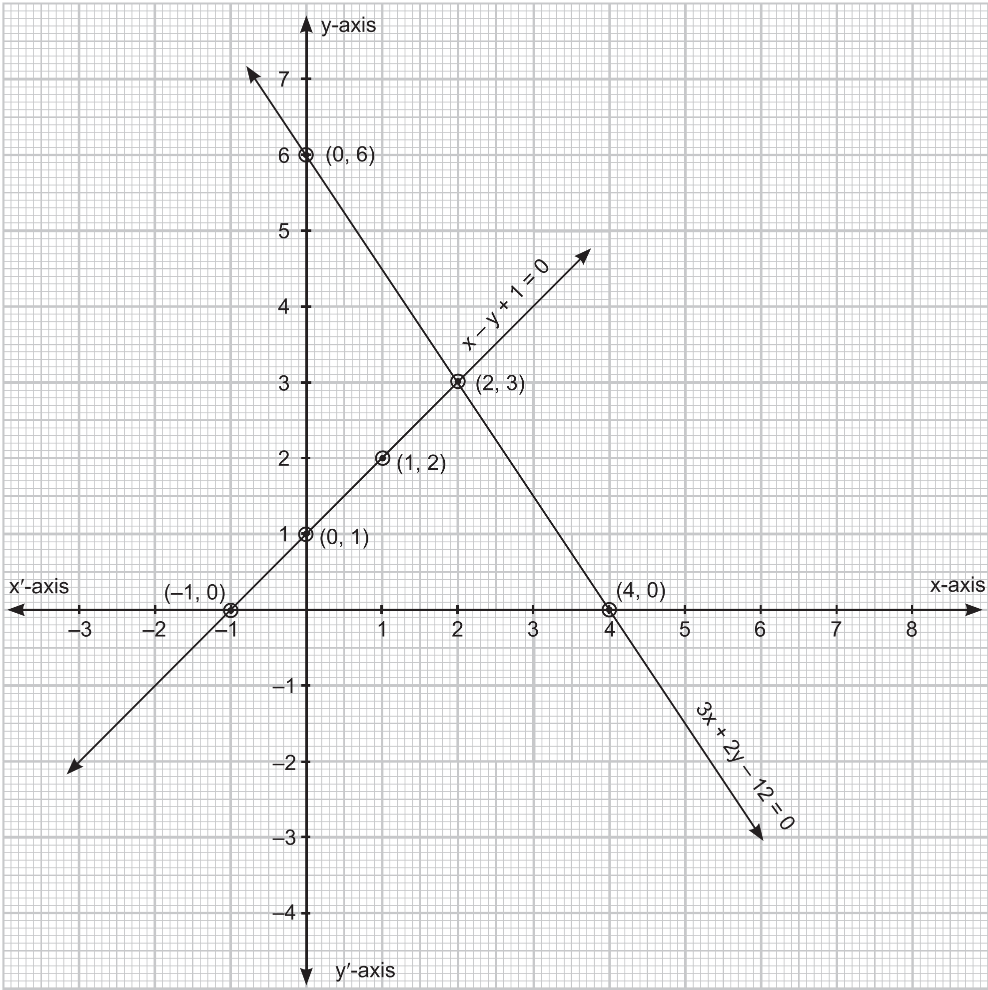
28. $$x - y = -1 \quad \ldots(i)$$
$$3x + 2y - 12 = 0 \quad \ldots(ii)$$

Table for equation (*i*)

x	–1	0	1
y	0	1	2

Table for equation (*ii*)

x	0	4	2
y	6	0	3



Coordinates of the vertices of triangle are (–1, 0), (2, 3) and (4, 0)

29. ABCD is a | | gm, A(1, 2), B(4, y), C(x, 6), D(3, 5) are the vertices taken in order.

Diagonals of | | gm bisect each other, AC and BD bisect each other at O.

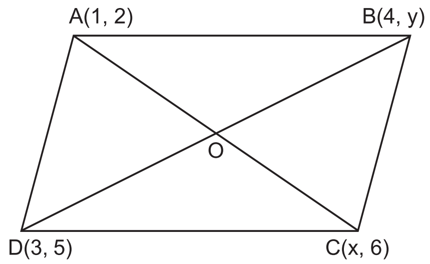
Coordinates of O are $= \left(\dfrac{4+3}{2}, \dfrac{y+5}{2}\right)$

(O is mid-point of BD)

$$= \left(\dfrac{7}{2}, \dfrac{y+5}{2}\right)$$

Also, O is mid-point AC.

Coordinates of O are $\left(\frac{x+1}{2}, \frac{6+2}{2}\right) = \left(\frac{x+1}{2}, 4\right)$

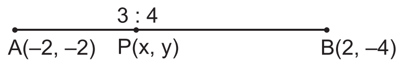


On equating

$$\frac{7}{2} = \frac{x+1}{2} \Rightarrow x = 6$$

$$\frac{y+5}{2} = 4 \Rightarrow y = 3$$

OR



$$AP = \frac{3}{7}AB$$

and $\quad BP = AB - AP$

$$= \frac{AB}{1} - \frac{3}{7}AB = \frac{7AB - 3AB}{7} = \frac{4AB}{7}$$

$$\frac{AP}{BP} = \frac{\frac{3}{7}AB}{\frac{4}{7}AB} = 3 : 4$$

$$x = \frac{3(2)+4(-2)}{3+4} = \frac{6-8}{7} = -\frac{2}{7}$$

$$y = \frac{3(-4)+4(-2)}{3+4} = \frac{-12-8}{7} = -\frac{20}{7}$$

Hence, the coordinates of P are $\left(-\frac{2}{7}, -\frac{20}{7}\right)$.

30. LHS = $(\sin A + \text{cosec } A)^2 + (\cos A + \sec A)^2$

$= \sin^2 A + \text{cosec}^2 A + 2 \sin A \text{ cosec } A + \cos^2 A + \sec^2 A + 2 \cos A \sec A$

$= \sin^2 A + \text{cosec}^2 A + 2 \sin A \cdot \frac{1}{\sin A} + \cos^2 A + \sec^2 A + 2 \cos A \cdot \frac{1}{\cos A}$

$= \sin^2 A + \text{cosec}^2 A + 2 + \cos^2 A + \sec^2 A + 2$

$= (\sin^2 A + \cos^2 A) + \text{cosec}^2 A + \sec^2 A + 4$

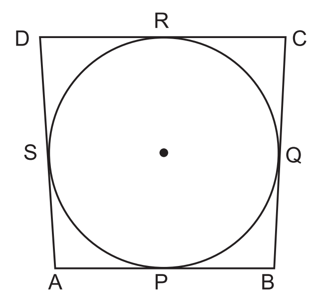
$= 1 + (1 + \cot^2 A) + (1 + \tan^2 A) + 4$

$= 7 + \cot^2 A + \tan^2 A$ = R.H.S.

LHS = RHS Hence proved

31. Given: ABCD is drawn to circumscribe a circle.

To Prove: AB + CD = AD + BC



Proof: AP = AS ...(*i*)

[Lengths of tangents from an external point are equal]

BP = BQ ...(*ii*)

CR = CQ ...(*iii*)

DR = DS ...(*iv*)

Adding equations (*i*), (*ii*), (*iii*) and (*iv*), we get

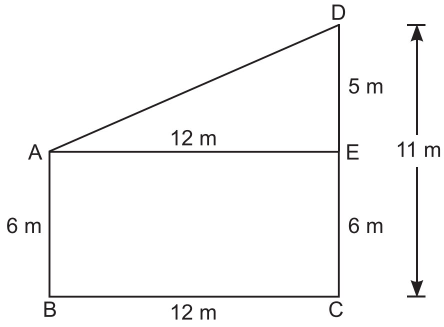
$$AP + BP + CR + DR = AS + BQ + CQ + DS$$

$$\Rightarrow \quad (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)$$

$$\Rightarrow \quad AB + CD = AD + BC$$

32. Here,

Pole AB = 6 m and Pole CD = 11 m the distance between the foot of poles = BC = 12 m



By, using Pythagores, ΔADE

$$AD^2 = AE^2 + DE^2$$

$$AD^2 = (12)^2 + (5)^2$$

$$AD^2 = 144 + 25$$

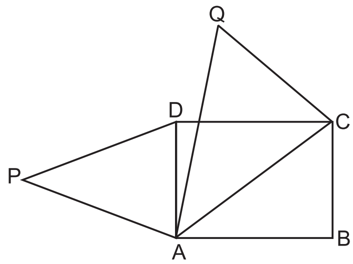
$$AD^2 = 169$$

$$AD = 13 \text{ m}$$

Distance between their tops, AD = 13 m

OR

Given: ΔPAD is described on the side AD of square ABCD and DQAC is described on side AC.



To Prove: ar $\Delta PAD = \frac{1}{2}$ ar ΔQAC

Proof: Let the side of the square ABCD be a

$\therefore$ In ΔABC, $\quad AC^2 = AB^2 + BC^2 = a^2 + a^2 = 2a^2$

$$AC = \sqrt{2}a$$

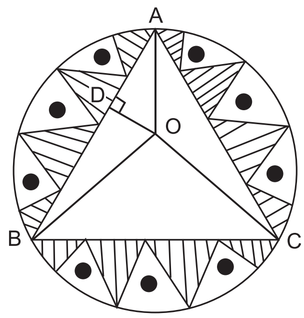
$\Delta PAD \sim \Delta QAC$ [AA similarity each angle = 60°]

$$\Rightarrow \quad \frac{\text{ar } \Delta PAD}{\text{ar } \Delta QAC} = \frac{AD^2}{AC^2} = \frac{a^2}{(\sqrt{2}a)^2} = \frac{1}{2}$$

$$\Rightarrow \quad \text{ar } \Delta PAD = \frac{1}{2} \text{ ar } \Delta QAC$$

33. Radius of the circle (r) = 32 cm

Area of the circle = πr^2



$$= \frac{22}{7} \times 32 \times 32 = \frac{22528}{7} \text{ cm}^2$$

$\because$ An equilateral triangle is formed in the circle as shown angle subtended by each side at centre

$$= \frac{\text{Angle of the centre}}{\text{Total number of the sides}}$$

$$= \frac{360°}{3} = 120°$$

In ΔOAB, as we know that perpendicular drawn from centre on chord bisect the chord.

In ΔOAD, $\quad \angle AOD = \frac{120°}{2} = 60°$

$$\Rightarrow \quad \sin 60° = \frac{AD}{OA} \Rightarrow \frac{\sqrt{3}}{2} = \frac{AD}{32}$$

$\Rightarrow \qquad \frac{32\sqrt{3}}{2} = AD \Rightarrow 16\sqrt{3} = AD$

$AB = 2AD = 2(16\sqrt{3}) = 32\sqrt{3}$ cm

Area of the equilateral triangle ABC = $\frac{\sqrt{3}}{4}(32\sqrt{3})^2 = \frac{\sqrt{3} \times 32 \times 32 \times 3}{4}$

$= 8 \times 32 \times 3\sqrt{3} = 768\sqrt{3}$ cm^2

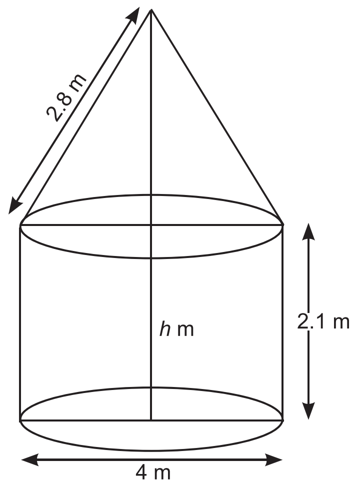
Area of design = Area of the circle – Area of the equilateral triangle

$= \frac{22528}{7} - 768\sqrt{3}$ cm^2 $= \frac{22528}{7} - 768 \times 1.732$

$= 3218.28 - 1330.17 = 1888.11$ cm^2

OR

Diameter of cylinder = 4 m $\Rightarrow$ Radius of cylinder = 2m



Height of cylinder = 2.1 m

Slant height of cone = 2.8 m

Area of canvas used = Curved surface area of cylinder + curved surface area of cone

$= 2\pi rh + \pi rl = \pi r[2h + l]$

$= \frac{22}{7} \times 2[2 \times 2.1 + 2.8]$

$= \frac{22}{7} \times 2[4.2 + 2.8]$

$= \frac{22}{7} \times 2 \times 7 = 44$ m^2

Cost of 1 m^2 of canvas = ₹ 500

$\therefore$ Total cost = ₹ 500 × 44

= ₹ 22000

Volume of air = Volume of cone + volume of cylinder

$= \frac{1}{3}\pi r^2 H + \pi r^2 h = \pi r^2\left[\frac{1}{3}H + h\right]$

Height of cone $= \sqrt{l^2 - r^2}$

$= \sqrt{(2.8)^2 - 2^2}$

$= \sqrt{7.84 - 4} = \sqrt{3.84} = 1.95$

Volume of air $= \frac{22}{7} \times 2^2\left(\frac{1}{3} \times 1.95 + 2.1\right)$m^3

$= \frac{22}{7} \times 2^2(0.65 + 2.1)$

$= \frac{22}{7} \times 4 \times 2.75 = 34.57$ m^3

34.

Concentration of SO_2	Class marks (x_i)	Frequency (f_i)	$u_i = \frac{x_i - 0.10}{0.04}$	$f_i u_i$
0.00 – 0.04	0.02	4	– 2	– 8
0.04 – 0.08	0.06	9	– 1	– 9
0.08 – 0.12	0.10 = a (let)	9	0	0
0.12 – 0.16	0.14	2	1	2
0.16 – 0.20	0.18	4	2	8
0.20 – 0.24	0.22	2	3	6
Total		$\Sigma f_i = 30$		$\Sigma f_i u_i = -1$

We have, $\quad \text{Mean} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$

$$= 0.10 + \frac{(-1) \times (0.04)}{30} = 0.10 - 0.001 = 0.099 \text{ ppm}$$

35. Width of rectangle ABCD = x m

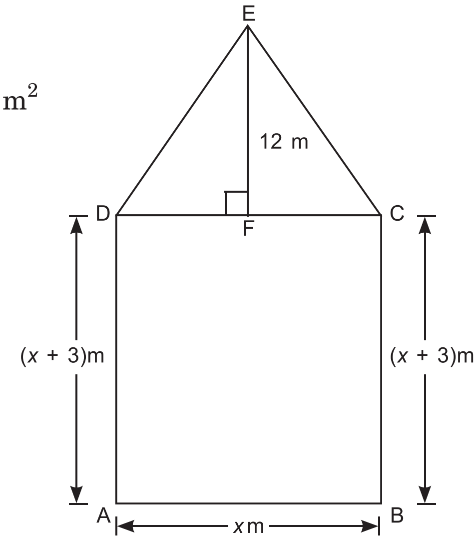
Length of the rectangle = $(x + 3)$ m

Area of rectangle = $l \cdot b = x(x + 3) = (x^2 + 3x)$ m^2

Now AB = CD = x

$$\text{Area of } \Delta EDC = \frac{1}{2} CD \times EF$$

$$= \frac{1}{2} x \times 12 = 6x \text{ m}^2$$



A.T.Q $\quad (x^2 + 3x) = 6x + 4$

$$x^2 - 3x - 4 = 0$$

$$(x - 4)(x + 1) = 0$$

$$x = 4 \text{ or } x = -1$$

$\therefore$ $\quad$ Width = x m = 4 m

Length = 4 + 3 = 7 m

OR

We have

$$\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}$$

$$\frac{x - 7 - x - 4}{(x+4)(x-7)} = \frac{11}{30}$$

$$\frac{-11}{x^2 + 4x - 7x - 28} = \frac{11}{30}$$

$$-30 = x^2 - 3x - 28$$

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

$$(x - 2)(x - 1) = 0$$

$\Rightarrow$ $\quad x = 2$

or $\quad x = 1$

36. Here production of TV sets is in A.P.

Let production of TV sets in Ist year = a units

Common difference = d

$\therefore$ Production of TV sets in IIIrd year = 600

$\Rightarrow \quad a + 2d = 600 \quad ...(i)$

Production of TV sets in VIIth year = 700

$\Rightarrow \quad a + 6d = 700 \quad ...(ii)$

$(ii) - (i)$ we get

$$4d = 100 \Rightarrow d = 25$$

When $d = 25$, (i) becomes

$$a + 2 \times 25 = 600 \Rightarrow a = 550$$

Production in 10th year = $a + 9d$

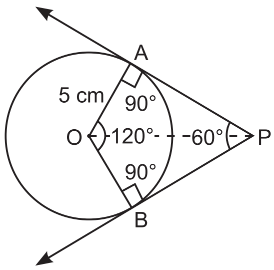
$$= 550 + 9 \times 25 = 775$$

Total production in 7 years

$$s_n = \frac{n}{2}(a + l)$$

$$s_7 = \frac{7}{2}(550 + 700) = 4375 \text{ sets.}$$

37. Steps of Construction:

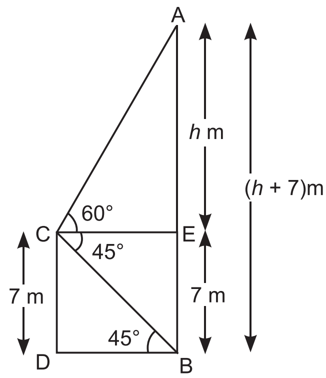


1. Draw a circle of radius 5 cm.
2. As tangents are inclined to each other at an angle of 60°.

   $\therefore$ Angle between the radii of circle is 120°. (Use quadrilateral property)
3. Draw radii OA and OB inclined to each other at an angle 120°.
4. At points A and B, draw 90° angles. The arms of these angles intersect at point P.

PA and PB are the required tangents.

38. Let height of the tower AB = $(h + 7)$ m



Given: CD = 7 m (height of the building),

$$\angle ACE = 60°, \text{ and } \angle ECB = 45°$$

$\Rightarrow \quad \angle CBD = 45°$

In ΔCDB, $\quad \frac{CD}{DB} = \tan 45° \Rightarrow \frac{7}{DB} = 1$

$\Rightarrow \quad DB = 7$ m

In ΔAEC, $\quad \frac{AE}{CE} = \tan 60°$

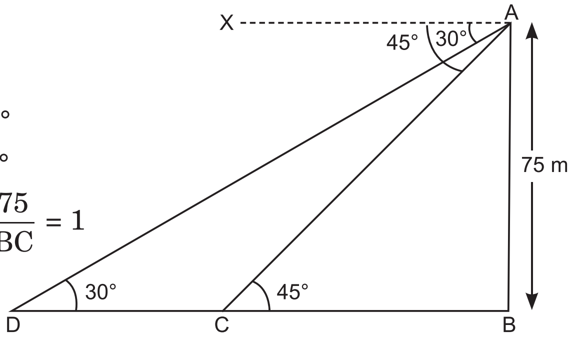
$$\Rightarrow \quad \frac{h}{7} = \sqrt{3} \quad [\because \text{DB} = \text{CE} = 7\text{m}]$$

$$\Rightarrow \quad h = 7\sqrt{3}\,\text{m}$$

Now, $\quad \text{AB} = h + 7 = 7\sqrt{3} + 7 = 7(\sqrt{3} + 1)\text{m}$

Hence, height of the tower = $7(\sqrt{3} + 1)$m

OR



Given: Height of the lighthouse = 75 m

Let C and D are the position of two ships.

We have $\quad \angle XAD = \angle ADB = 30°$

and $\quad \angle XAC = \angle ACB = 45°$

In ΔABC, $\quad \frac{\text{AB}}{\text{BC}} = \tan 45° \Rightarrow \frac{75}{\text{BC}} = 1$

$\Rightarrow \quad \text{BC} = 75$ m

In ΔABD, $\quad \frac{\text{AB}}{\text{BD}} = \tan 30°$

$$\Rightarrow \quad \frac{75}{\text{DC}+75} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \quad \text{DC} + 75 = 75\sqrt{3}$$

$$\Rightarrow \quad \text{DC} = 75\sqrt{3} - 75 = 75(\sqrt{3} - 1)$$

$$= 75(1.73 - 1 = 75 \times 0.73 = 54.75 \text{ m}$$

Hence, the distance between two ships is 54.75 m.

39.

Length (in mm)	Number of leaves (f)	cf
117.5 – 126.5	3	3
126.5 – 135.5	5	8
135.5 – 144.5	9	17
144.5 – 153.5	12	29
153.5 – 162.5	5	34
162.5 – 171.5	4	38
171.5 – 180.5	2	40
Total	40	

Here, $\quad \frac{n}{2} = \frac{40}{2} = 20$

So, Median class = 144.5 – 153.5

Here, $\quad l = 144.5, f = 12, cf = 17$

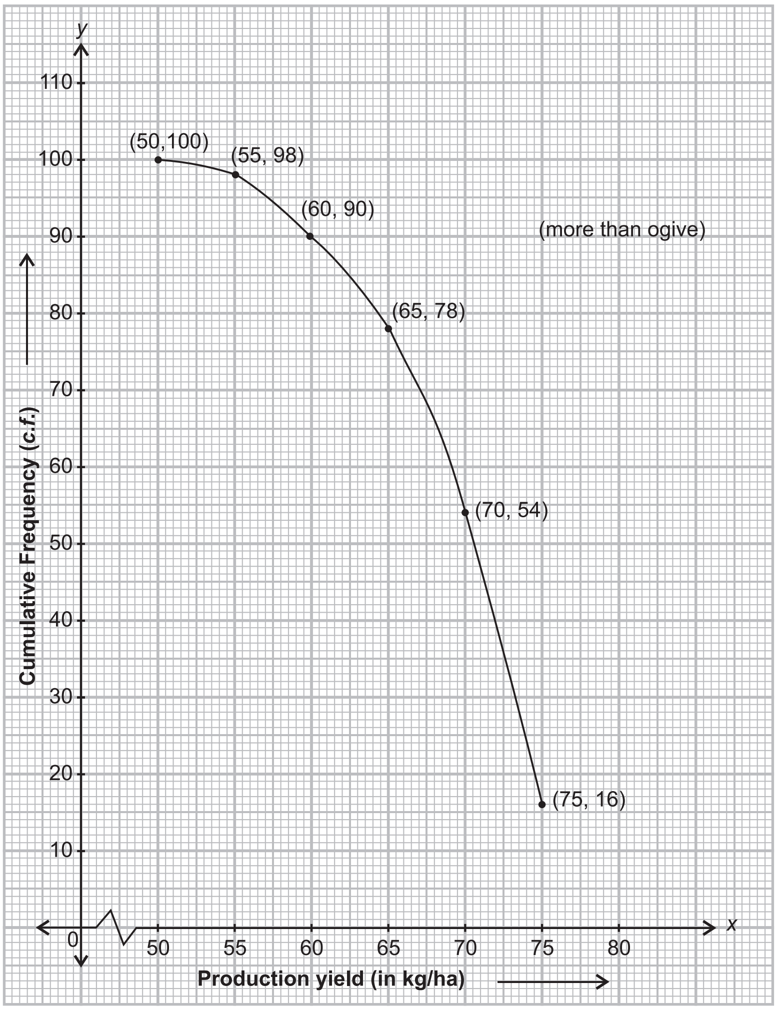
$\quad h = 9$

We have, $\quad \text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$

$$= 144.5 + \left(\frac{20-17}{12}\right) \times 9 = 144.5 + \frac{9}{4} = 146.75 \text{ mm}$$

OR

Production yield (in kg/ha)	Number of farms	More than production yield in kg/ha	*cf*
50 – 55	2	More than 50	100
55 – 60	8	More than 55	98
60 – 65	12	More than 60	90
65 – 70	24	More than 65	78
70 – 75	38	More than 70	54
75 – 80	16	More than 75	16



40. Radius of open side (r_1) = 10 cm

Radius of upper base (r_2) = 4 cm

Slant height (l) = 15 cm

Curved surface area of frustum = $\pi(r_1 + r_2)l$

$= \pi(10 + 4)\ 15\ \text{cm}^2$

$= \frac{22}{7} \times 14 \times 15\ \text{cm}^2$

$= 22 \times 2 \times 15\ \text{cm}^2$

$= 660\ \text{cm}^2$

Surface area of upper base = πr_2^2

$= \frac{22}{7} \times 4 \times 4 = 50.28\ \text{cm}^2$

Total surface area of cap = curved surface area of frustum + area of upper base

$= 660\ \text{cm}^2 + 50.28\ \text{cm}^2 = 710.28\ \text{cm}^2$