PACE IIT & MEDICAL

Sub. : Maths | Total Marks : 80
Std. X (CBSE)

Prelim Answer Paper - 05

SECTION A

Section A consists of 20 questions of 1 mark each.

1. Three farmers have 490 kg, 588 kg and 882 kg of wheat respectively. Find the maximum capacity of a bag so that the wheat can be packed in exact number of bags.

Ans : a) 98 kg

2. If one of the zeroes of the quadratic polynomial $(k-1)x^2 + kx + 1$ is -3, then the value of k is

Ans : a) $\frac{4}{3}$

3. Graphically, the pair of equations $7x - y = 5$; $21x - 3y = 10$ represents two lines which are

Ans : b) parallel

4. If the lines given by $2x + ky = 1$ and $3x - 5y = 7$ are parallel, then the value of k is

Ans : a) $\frac{-10}{3}$

5. The 10th term from the end of the A.P. $-5, -10, -15, \ldots, -1000$ is

a) -955 b) -945

c) -950 d) -965

Ans : a) -955

6. Find the distance of the point (-6, 8) from the origin.

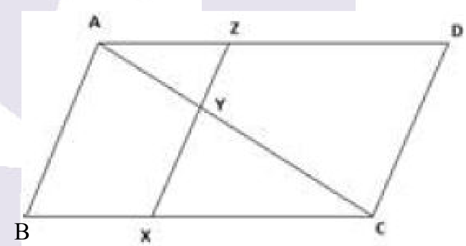
Ans : c) 10

7. Find the ratio in which the line joining the points (6, 4) and (1, –7) is divided by x-axis.

Ans : c) 4 : 7

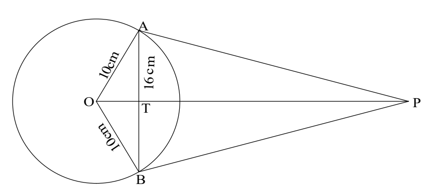
8. ABCD is a parallelogram with diagonal AC If a line XY is drawn such that

XY || AB. $\frac{BX}{XC} = ?$



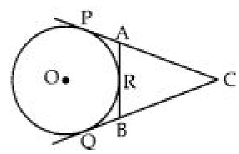
Ans : c) $\left(\frac{AZ}{ZD}\right)$

9. In the figure, AB is a chord of length 16 cm, of a circle of radius 10 cm. The tangents at A and B intersect at a point P. Find the length of PA.



Ans : d) $\frac{40}{3}$cm

10. **In given figure, CP and CQ are tangents to a circle with centre O. ARB is another tangent touching the circle at R. If CP = 11 cm and BC = 6 cm then the length of BR is**



Ans : b) 5 cm

11. **If $\sin A + \sin^2 A = 1$, then $\cos^2 A + \cos^4 A = ?$**

Ans : a) 1

12. **If a pole 6m high casts a shadow $2\sqrt{3}$ m long on the ground, then the sun's elevation is**

Ans : a) 60^0

13. **If $\sec\theta + \tan\theta = x$, then $\tan\theta$ is:**

Ans : a) $\frac{(x^2-1)}{2x}$

14. **If the sum of the circumferences of two circles with radii R_1 and R_2 is equal to the circumference of a circle of radius R, then :**

Ans : a) $R_1 + R_2 = R$

15. **The diameter of a sphere is 6 cm. then find its total surface area.**

Ans : c) $36\pi cm^2$

16. **One of the method for determining mode is**

Ans : b) Mode = 3 Median – 2 Mean

17. **Which of the following cannot be the probability of an event ?**

Ans : d) $\frac{17}{16}$

18. **The probability of getting a consonant from the word MAHIR is**

Ans : b) $\frac{3}{5}$

Direction : In the question number 19 and 20, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option.

19. **Assertion: If one root of the quadratic equation $6x^2 - x - k = 0$ is $\frac{2}{3}$, then the value of k is 2.**

Reason: The quadratic equation $ax^2 + bx + c = 0, a \neq 0$ has almost two roots.

Ans : b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

20. **Assertion: Perimeter of a semi circle is $(\pi r + d)$ units.**

Reason: Area of circle is (πr^2)

Ans : b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.

SECTION B

Section B consists of 5 questions of 2 marks each.

21. **Prove that $\sqrt{5}$ is irrational.**

Ans : Let us prove $\sqrt{5}$ irrational by contradiction.

Let us suppose that $\sqrt{5}$ is rational. It means that we have co-prime integers a and b $(b \neq 0)$ such that $\sqrt{5} = \frac{a}{b}$

$\Rightarrow b\sqrt{5} = a$

Squaring both sides, we get

$\Rightarrow \sqrt{5}b^2 = a^2 \quad \dots (1)$

It means that 5 is factor of a^2

Hence, 5 is also factor of a by Theorem. … (2)

If, 5 is factor of a, it means that we can write a = 5c for some integer c.

Substituting value of a in (1),

$5b^2 = 25c^2$

$\Rightarrow b^2 = 5c^2$

It means that 5 is factor of b^2.

Hence, 5 is also factor of b by Theorem. … (3)

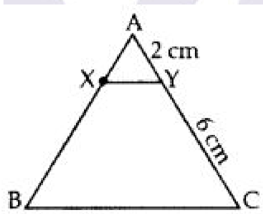
From (2) and (3), we can say that 5 is factor of both a and b.

But, a and b are co-prime.

Therefore, our assumption was wrong. $\sqrt{5}$ cannot be rational. Hence, it is irrational.

22. X and Y are points on the sides AB and AC respectively of a triangle ABC such that AX:AB = 1:4, AY = 2 cm and YC = 6 cm. Find whether XY || BC or not.

Ans : **Given :** AX:AB = 1:4



Let AX = 1K, AB = 4K

$\therefore$ BX = AB – AX

= 4K - 1K

= 3K

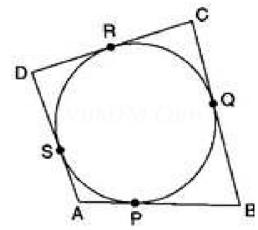
$$\frac{AX}{XB} = \frac{1K}{3K} = \frac{1}{3}$$

$$\frac{A\ X}{X\ B} = \frac{1}{3}$$

$$\therefore \frac{AX}{XB} = \frac{AY}{YC} = \frac{1}{3}$$

$\therefore$ XY || BC … [By converse of Thales' theorem]

23. A quadrilateral ABCD is drawn to circumscribe a circle (see figure). Prove that: AB + CD = AD + BC



Ans : We know that the tangents from an external point to a circle are equal.

$\therefore$ AP = AS ……….(i)

BP = BQ ……….(ii)

CR = CQ ……….(iii)

DR = DS ……….(iv)

On adding eq. (i), (ii), (iii) and (iv), we get

(AP + BP) + (CR + DR)

= (AS + BQ) + (CQ + DS)

$\Rightarrow$ AB + CD = (AS + DS) + (BQ + CQ)

$\Rightarrow$ AB + CD = AD + BC

24. $\sin(A+B) = 1$ **and** $\sin(A-B) = \frac{1}{2}$; $0^0 < (A+B) \le 90^0$); $(\angle A > \angle B)$. **Find** $\angle A$ **and** $\angle B$.

Ans : Given Data

$\sin(A+B) = 1$

$\sin(A-B) = \frac{1}{2}$

$0^0 < A + B \le 90^0$

$\angle A > \angle B$

Compute A and B using sin (A + B) and sin (A – B)

$\sin(A+B) = 1$

We know $\sin 90^0 = 1$

$\therefore \sin(A+B) = \sin 90^0$

$A + B = 90^0$ ......(1)

$\sin(A-B) = \frac{1}{2}$

We know $\sin 30^0 = \frac{1}{2}$

$\therefore \sin(A - B) = \sin 30^0$

$A - B = 30^0$...... (2)

Solve Equations (1) and (2) to Find A and B

Add equations (1) and (2):

$(A + B) + (A - B) = 90^0 + 30^0$

$2A = 120^0$ or $A = 60^0$

Substitute $A = 60^0$ in equation 1

$60^0 + B = 90^0$

Or $B = 90^0 - 60^0 \Rightarrow B = 30^0$

So, $\angle A = 60^0$ and $\angle B = 30^0$

OR

If $\sin\theta + \cos\theta = \sqrt{3}$, **then prove that tan** $\tan\theta + \cot\theta = 1$.

Ans : Given,

$\sin\theta + \cos\theta = \sqrt{3}$

Squaring on both sides,

$(\sin\theta + \cos\theta)^2 = (\sqrt{3})^2$

$\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$

Using the identity $\sin^2 A + \cos^2 A = 1$,

$1 + 2\sin\theta\cos\theta = 3$

$2\sin\theta\cos\theta = 3 - 1$

$2\sin\theta\cos\theta = 2$

$\sin\theta\cos\theta = 1$

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

$\Rightarrow \frac{(\sin^2\theta + \cos^2\theta)}{(\sin\theta\cos\theta)} = 1$

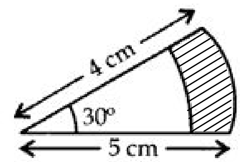
$\Rightarrow \left[\frac{\sin^2\theta}{(\sin\theta\cos\theta)}\right] + \left[\frac{\cos^2\theta}{(\sin\theta\cos\theta)}\right] = 1$

$\Rightarrow \left(\frac{\sin\theta}{\cos\theta}\right) + \left(\frac{\cos\theta}{\sin\theta}\right) = 1$

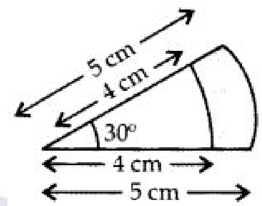
$\Rightarrow \tan\theta + \cot\theta = 1$

Hence proved

25. In Figure, find the area of the shaded region.



Ans : Area of shaded region



$= \frac{30}{360}(\pi \times 5^2 - \pi \times 4^2)$

$= \frac{1}{12}\pi(25 - 16)$

$= \frac{1}{12} \times \frac{22}{7} \times 9$

$= \frac{33}{14} = 2.36$ sq.cm.

SECTION C

Section C consists of 6 questions of 3 marks each.

26. The length, breadth, and height of a room are 8 m 50 cm, 6 m 25 cm and 4 m 75 cm respectively. Find the length of the longest rod that can measure the dimensions of the room exactly.

Ans : To find the length of the longest rod that can measure the dimensions of the room exactly, we have to find HCF.

Length(L) = 8 m 50 cm = 850 cm

$= 2^1 \times 5^2 \times 17$

Breadth(B) = 6 m 25 cm = 625 cm = 5^4

Height(H) = 4m75cm = 475 cm

$= 5^2 \times 19$

HCF of L, B and H is $5^2 = 25$ cm

Length of the longest rod = 25 cm

27. Three alarm clocks ring at intervals of 4, 12 and 20 minutes respectively. If they start ringing together, after how much time will they next ring together?

Ans : To find the time when the clocks will next ring together,

we have to find LCM of 4, 12 and 20 minutes.

$4 = 2^2$

$12 = 2^2 \times 3$

$20 = 2^2 \times 5$

$$\begin{array}{c|c} 2 & 12 \\ \hline 2 & 6 \\ \hline & 3 \end{array} \qquad \begin{array}{c|c} 2 & 20 \\ \hline 2 & 10 \\ \hline & 5 \end{array}$$

LCM of 4, 12 and 20 = $2^2 \times 3 \times 5 = 60$ minutes.

So, the clocks will ring together again after 60 minutes or one hour.

28. A and B each have a certain number of oranges. A says to B, "if you give me 10 of your oranges, I will have twice the number of oranges left with you." B replies," if you give me 10 of your oranges, I will have the same number of oranges as left with you. Find the number of oranges with A and B separately.

Ans : Suppose A has x number of oranges and B has y oranges. Then

$x + 10 = 2(y - 10)$

$\Rightarrow x - 2y + 30 = 0$

$y + 10 = x - 10$

$\Rightarrow \quad x - y - 20 = 0$

Equating both the equations we get y = 50 and x = 70

Hence A has 70 oranges and B has 50 oranges

OR

Yash scored 40 marks in a test, receiving 3 marks for each correct answer and losing 1 mark for each wrong answer. Had 4 marks been awarded for each correct answer and 2 marks been deducted for each wrong answer, then Yash would have scored 50 marks. How many questions were there in the test?

Ans : Let right answer questions attempt by Yash be x and wrong answer questions be y

Then, $3x - y = 40$.............(i)

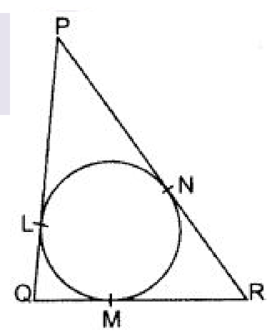
$4x - 2y = 50$ ....(ii)

Solving we get x = 15, y = 5

Total number of questions in the test

$= x + y = 15 + 5 = 20.$

29. In the figure, a circle is inscribed in a triangle PQR with PQ = 10 cm, QR = 8 cm and PR = 12 cm. Find the lengths of QM, RN and PL.



Ans : Let PL = PN = x cm

QL = QM = y cm

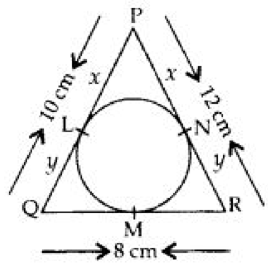
RN = MR = z cm

PQ = 10 cm = $x + y = 10$ …(i)

QR = 8 cm = $y + z = 8$ …(ii)

PR = 12 cm = $x + z = 12$ …(iii)

By adding (i), (ii) and (iii),



We get,

$\Rightarrow 2x + 2y + 2z = 10 + 8 + 12$

$\Rightarrow 2(x + y + z) = 30$

$\Rightarrow x + y + z = 15$

$\Rightarrow 10 + z = 15$ … [From (i)

$\therefore\ z = 15 - 10 = 5$ cm

From (ii)

$y + 5 = 8$

$y = 8 - 5$

$y = 3$ cm

From (iii)

$x + 5 = 12$

$x = 12 - 5$

$x = 7$ cm

$\therefore$ QM = 3 cm, RN = 5 cm, PL = 7 cm.

OR

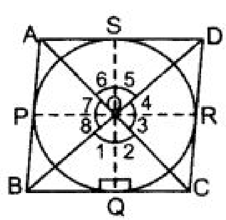
Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

Ans : **To prove :** i) $\angle AOD + \angle BOC = 180^0$

ii) $\angle AOB + \angle COD = 180^0$

Proof : In ΔBPO and ΔBQO

…[Tangents drawn from an external point are equal



PO = QO … [radii of same circle]

BO = BO … [Common]

$\Delta BPO \cong \Delta BQO$ … [SSS Congruency rule]

$\angle 8 = \angle 1$ …(1) (c.p.c.t.)

Similarly,

$\angle 2 = \angle 3, \angle 4 = \angle 5$ and $\angle 6 = \angle 7$ ...(2)

$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8$

$= 360^0$ …(Complete angles)

$\angle 1 + \angle 2 + \angle 2 + \angle 5 + \angle 5 + \angle 6 + \angle 6 + \angle 1$

$= 360^0$ ....[from (1) and (2)]

$\Rightarrow 2(\angle 1 + \angle 2 + \angle 5 + \angle 6) = 360^0$

$\Rightarrow \angle BOC + \angle AOD = 180^0$

…(3) [Proved part I

$\angle AOB + \angle BOC + \angle COD + \angle DOA$

$= 360^0$ …(Complete angles)

$\angle AOB + \angle COD + 180^0 = 360^0$

… [From (3)

$\angle AOB + \angle COD = 360^0 - 180^0 = 180^0$

…(proved)

30. Prove that:

$$\frac{\sin\theta - \cos\theta}{\sin\theta + \cos\theta} + \frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = \frac{2}{2\sin^2\theta - 1}$$

Ans : L.H.S. $= \dfrac{\sin\theta - \cos\theta}{\sin\theta + \cos\theta} + \dfrac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta}$

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

$$\frac{\sin^2\theta + \cos^2\theta - 2\cos\theta\sin\theta + \sin^2\theta + \cos^2\theta + 2\cos\theta\sin\theta}{\sin^2\theta - \cos^2\theta}$$

$$= \frac{1+1}{\sin^2\theta - (1 - \sin^2\theta)} = \frac{2}{\sin^2\theta - 1 + \sin^2\theta}$$

$$= \frac{2}{2\sin^2\theta - 1} = \text{R.H.S.}$$ ...(Hence proved)

31. If the mean of the following distribution

is 50, find the value of p:

Class	Frequency
0 – 20	17
20 – 40	p
40 – 60	32
60 – 80	24
80 – 100	19

Ans :

Class	Frequency (f_i)	x_i	$f_i x_i$
0 – 2	17	10	170
20 – 40	p	30	30p
40 – 60	32	50	1600
60 – 80	24	70	1680
80 – 100	19	90	1710
	$\sum f_i = 92 + p$		$\sum f_i X_i = 5160 + 30p$

$$\therefore \text{ Mean} = \frac{\sum f_i x_i}{\sum f_i}$$

$$50 = \frac{5160 + 30p}{92 + p}$$

$\Rightarrow$ 4600 + 50P = 5160 + 30P

$\Rightarrow$ 50P – 30P = 5160 – 4600

$\Rightarrow$ 20P = 560

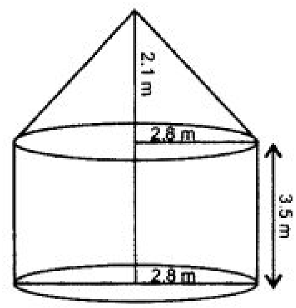
$$\Rightarrow \quad p = \frac{560}{20} = 28 \qquad \therefore \ P = 28.$$

SECTION D

Section D consists of 4 questions of 5 marks each.

32. Due to heavy floods in a State, thousands were rendered homeless. 50 schools collectively offered to the State Government to provide place and the canvas for 1,500 tents to be fixed by the Government and decided to share the whole expenditure equally. The lower part of each tent is cylindrical of base radius 2.8 m and height 3.5 m, with conical upper part of same base radius but of height 2.1 m. If the canvas used to make the tents costs ₹ 120 per sq. m, find the amount shared by 'each school to set up the tents.

Ans :



Let r and h be the radius and height of cylindrical part respectively and l be the slant height of conical part.

Slant height of conical part (l),

$= \sqrt{(2.1)^2 + (2.8)^2}$ ...[By Pythagoras' theorem

$\therefore \ l = \sqrt{4.41 + 7.84} = \sqrt{12.25} = 3.5$ m

Area of Canvas / tent

= C.S. area of cylindrical part + C.S. area of conical part

$= 2\pi rh + \pi rl$

$[\because r = 2.8\text{m}, h = 3.5\text{m}, l = 3.5\text{m}$

$= \pi r(2h + l)$

$= \frac{22}{7} \times 2.8[2(3.5) + 3.5]$

$= 22 \times 0.4(7.0 + 3.5)$

$= 8.8(10.5) = 92.4 \text{ m}^2$

area of canvas for 1,500 tents

$= (92.4 \times 1{,}500)\text{m}^2$

$= 1{,}38{,}600 \text{ m}^2$

Cost of 1,500 tents at ₹ 120 per m^2

$= 1,38,600 \times ₹120$ per m^2

$= ₹1,66,32,000$

$$\text{Share of each school} = \frac{\text{Total Cost}}{\text{No. of Schools}}$$

$$= \frac{₹1,66,32,000}{50} = ₹3,32,640$$

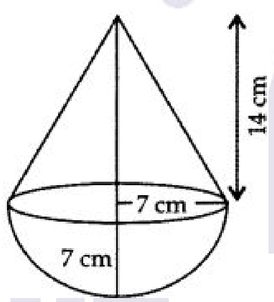
OR

A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid. [Use $\pi = 227$)

Ans : Radius, r = 7 cm

Height of cone, h = 2(7) = 14 cm

Volume of solid = Vol. of hemisphere + Volume of cone



$$= \frac{2}{3}\pi r^3 + \frac{1}{3}\pi r^2 h$$

$$= \frac{1}{3}\pi r^2 (2r + h)$$

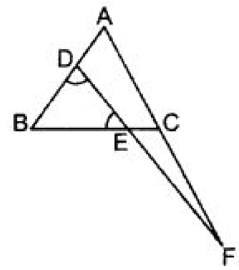
$$= \frac{1}{3} \times \frac{22}{7} \times 7 \times 7(2(7) + 14)$$

$$= \frac{22 \times 7}{3} \times 28 = \frac{4312}{3}$$

$$= 1437.\overline{3}\text{cm}^3.$$

33. **In the figure, $\angle BED = \angle BDE$ & E divides BC in the ratio 2 : 1.**

Prove that AF × BE = 2 AD × CF.

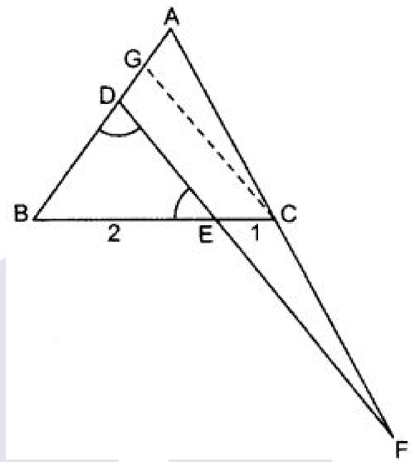


Ans : Construction : Draw CG || DF

Proof: E divides

BC in 2 : 1.

BE:EC = 2:1 …(i)



Proof : $\angle BED = \angle BDE$ ...[Given

BD = BE ...(ii)

...[Sides opposite to equal angles

In ΔCBG, DE || CG ...[By construction

$$\Rightarrow \frac{BD}{DG} = \frac{BE}{EC} \quad \text{...[Thales' theorem}$$

$$\Rightarrow \frac{BD}{DG} = \frac{BE}{EC} = \frac{2}{1} \quad \text{...[From (i)}$$

$$\Rightarrow \frac{BD}{DG} = \frac{2}{1}$$

2DG = BD

2DG = BE ...[From (ii)

$$\Rightarrow DG = \frac{1}{2}BE \quad \text{...(iii)}$$

In $\Delta ADF, CG \parallel DF$ ...[By construction

$$\Rightarrow \frac{AG}{GD} = \frac{AC}{CF} \quad \text{...[Thales' theorem}$$

$$\Rightarrow \frac{AG}{GD} + 1 = \frac{AC}{CF} + 1$$

...[Adding one on both sides

$$\Rightarrow \frac{AG + GD}{GD} = \frac{AC + CF}{CF}$$

$$\Rightarrow \frac{AD}{GD} = \frac{AF}{CF}$$

$$\Rightarrow AF \times GD = AD \times CF$$

$$\Rightarrow AF \times \frac{BE}{2} = AD \times CF$$

$\therefore$ $AF \times BE = 2AD \times CF$ (Hence proved).

34. A train travels at a certain average speed for a distance of 54 km and then travels a distance of 63 km at an average speed of

6 km/h more than the first speed. If it takes 3 hours to complete the total journey, what is its first speed?

Ans : Let the original average speed of (first) train be x km/hr.

Now, new speed will be = (x + 6) km/hr.

We know,

$$\frac{54}{x} + \frac{63}{x+6} = 3$$

$$\Rightarrow \frac{54(x+6) + 63(x)}{x(x+6)} = 3$$

$$\Rightarrow \frac{54x + 324 + +63x}{x(x+6)} = 3$$

$$\Rightarrow 54x + 324 + 63x = 3x(x + 6)$$

$$\Rightarrow 117x + 324 = 3x^2 + 18x$$

$$\Rightarrow 3x^2 + 18x - 117x - 324 = 0$$

$$\Rightarrow 3x^2 - 99x - 324 = 0$$

$$\Rightarrow x^2 - 33x - 108 = 0$$

$$\Rightarrow x^2 - 36x + 3x - 108 = 0$$

$$\Rightarrow x(x - 36) + 3(x - 36) = 0$$

$$\Rightarrow (x - 36)(x + 3) = 0$$

$$\Rightarrow x - 36 = 0 \text{ or } x + 3 = 0$$

$x = 36$ or $x = -3$ (Reject)

$\Rightarrow$ First speed of train = 36 km/h.

OR

Solve the following for x:

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

Ans :

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

$$\Rightarrow \frac{1}{2a + b + 2x} - \frac{1}{2x} = \frac{1}{2a} + \frac{1}{b}$$

$$\Rightarrow \frac{2x - (2a + b + 2x)}{(2a + b + 2x)2x} = \frac{b + 2a}{2ab}$$

$$\Rightarrow \frac{-(2a + b)}{(2a + b + 2x)2x} = \frac{(2a + b)}{2ab}$$

$$\Rightarrow 2x^2 + 2ax + bx + ab = 0$$

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

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

$$\Rightarrow x + a = 0 \text{ or } 2x + b = 0$$

$$\Rightarrow x = -a \text{ or } x = -b2$$

35. Find the values of x and y if the median for the following data is 31.

Class	Frequency
0 – 10	5
10 – 20	x
20 – 30	6
30 – 40	y
40 – 50	6
50 – 60	5
Total	**40**

Ans :

Class	f	c.f.
0 – 10	5	5
10 – 20	x	5 + x
20 – 30	6	11 + x
30 – 40	y	11 + x + y
40 – 50	6	17 + x + y
50 – 60	5	22 + x + y
Total	**40**	

$\therefore \quad x + y + 22 = 40$

$x + y = 40 - 22 = 18$

$y = 18 - x \qquad ...(i)$

$\frac{n}{2} = \frac{40}{2} = 20$

Median is 31 ...[Given

$$\text{Median} = l + \left(\frac{\left(\frac{n}{2} - \text{c.f.}\right)}{f} h\right)$$

$$31 = 30 + \left(\frac{20 - (11 + x)}{y} \times 10\right)$$

$$\Rightarrow 31 - 30 = \frac{(20 - 11 - x)}{18 - x} \times 10$$

...[From (i)

$\Rightarrow 18 - x = (9 - x)10$

$\Rightarrow 18 - x = 90 - 10x$

$\Rightarrow -x + 10x = 90 - 18$

$\Rightarrow 9x = 72$

$\Rightarrow x = 8$

Putting the value of x in (i), we have

$y = 18 - 8 = 10$

$\therefore \quad x = 8, y = 10.$

SECTION E

Case study based questions are compulsory.

36. Balloon Elevation from Windows

Suppose, there are two windows in a house. A window of the house is at a height of

1.5 m above the ground and the other window is 3 m vertically above the lower window.

Amit and Manjeet are sitting in the two windows. At an instant, the angles of elevation of a balloon from these windows are observed as 45° and 30°, respectively.

On the basis of above information, answer the following questions.

i) Find the height of the balloon from the ground. 2

OR

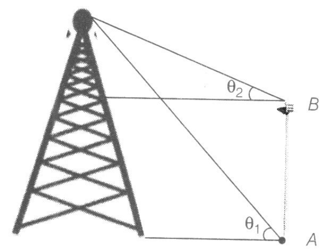
Find the distance between Manjeet and balloon.

ii) If the height of any tower is double and the distance between the observer and foot of the tower is also doubled, then what is the angle of elevation.

1

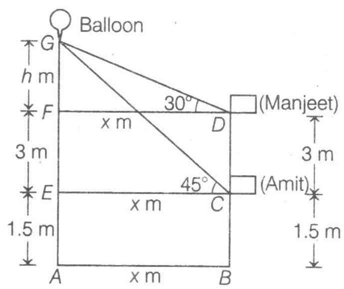
iii) Suppose a tower and a pole is standing on the gound and angle of elevation from bottom of pole is θ_1 and elevation from top of pole to the top of tower is θ_2, then show that $\theta_1 > \theta_2$.

1



Ans : i) Let AG be the height of the balloon from the ground and C, D be the position of the windows, such that BC = 1.5m and

CD = 3m



At points C and D, angles of elevation of balloon are 45° and 30°.

Draw perpendicular lines EC and FD on AG. Then. $\angle ECG = 45^0$ and

$\angle FDG = 30^0$,

BC = AE = 1.5 m and CD = EF = 3 m

Let AB =CE= DF = x m and FG = h m

In right angled ΔECG,

$$\tan 45^0 = \frac{EG}{EC} = \frac{3+h}{x}$$

$$\Rightarrow 1 = \frac{3+h}{x}$$

$$\Rightarrow x = 3 + h \ [\because \tan 45^0 = 1] \quad ...(i)$$

In right angled ΔFDG,

$$\tan 30^0 = \frac{GF}{DF} = \frac{h}{x} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{x}$$

$$\Rightarrow x = \sqrt{3}h \qquad [\because \tan 30^0 = \frac{1}{\sqrt{3}}]$$

On putting $x = \sqrt{3}h$ in Eq. (i), we get

$$3 + h = \sqrt{3}h$$

$$\Rightarrow h(\sqrt{3}-1) = 3$$

$$\Rightarrow h = \frac{3}{(\sqrt{3}-1)}$$

$$\Rightarrow h = \frac{3}{1.732-1}$$

$$= \frac{3}{1.732}$$

$$\therefore \ h = 4.098 \text{ m}$$

Hence, height of balloon from the ground

= 4.098 + 3 + 1.5 = 8.598 m = 8.6 m

Now, distance between Manjeet and balloon is given by

$$GD = \sqrt{(GF)^2 + (FD)^2}$$

$$= \sqrt{h^2 + x^2} = \sqrt{h^2 + 3h^2}$$

$[\because x = \sqrt{3}h]$

$$= \sqrt{4h^2} = 2h = 2 \times 4.098 = 8.196\text{m}$$

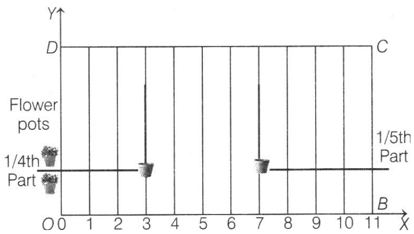
ii) If the height of any tower is double and the distance between the observer and foot of the tower is also double, then the angle of elevation remain same.

iii) It is clear from the figure that $\theta_1 > \theta_2$.

37. Sports Day Activity in School

In sports day activities of Delhi Public School, the lines have been drawn with chalk powder in rectangular shaped field OBCD. Each line is 1/2 m apart from each other. 60 flower pots have been placed at a distance of 1/2 m from each other along OD. Yamini runs 1/4th of the distance OD on the 3rd line and plants a red flower. Kamla runs -1/5 th

of the distance OD on the 7th line and plants a yellow flower.



Based on the above information, answer the following questions

i) Find the distance between red and yellow flowers. 1

ii) Find the area of rectangular field. 2

Ans : i) Distance between red flower (1.5, 7.5) and yellow flower $(3.5, 6)$

$= \sqrt{(3.5-1.5)^2 + (6-7.5)^2}$

$= \sqrt{4+2.25} = \sqrt{6.25} = 2.5\text{m}$

ii) The width of the rectangular field $= \frac{1}{2} \times 60$

$= 30$ m

$\therefore$ Area of rectangular field = Length × Breadth

= 5.5 × 30

=165 m^2

OR

Find the length of the diagonal of the rectangular field.

iii) What is the length of the rectangle field? 1

Coordinates of point O are (0, 0)

and coordinates of point C are $\left(\frac{1}{2}\times 11, \frac{1}{2}\times 60\right)$

i.e. C (5.5, 30)

Length of diagonal of rectangle

$= \sqrt{(0-5.5)^2 + (0-30)^2}$

$= \sqrt{(5.5)^2 + (30)^2}$

$= \sqrt{30.25 + 900}$

$= \sqrt{930.25}$

$= 30.5$ m

iii) Length of the rectangle field $= \frac{1}{2} \times 11 = 5.5\text{m}$

38. India is competitive manufacturing location due to the low cost of manpower and strong technical and engineering capabilities contributing to higher quality production runs. The production of TV sets in a factory increases uniformly by a fixed number every year. It produced 16000 sets in 6th year and 22600 in 9th year.

i) In which year, the production is Rs 29,200. (1)

ii) Find the production during 8th year. (2)

Ans : $a_6 = 16000$, $a_9 = 22600$

a + 5d = 16000-----(1)

a + 8d = 22600 -------(2)

substitute a = 1600 -5d from (1)

16000-5d + 8d = 22600

3d = 22600-16000

3d = 6600

d = 6600/3 = 2200

a = 16000 - 5(2200)

$a = 16000 - 11000$

$a = 5000$

(i) $a_n = 29200$, $a = 5000$, $d = 2200$

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

$29200 = 5000 + (n - 1)2200$

$29200 - 5000 = 2200n - 2200$

$24200 + 2200 = 2200n$

$26400 = 2200n$

$n = 264/22 \quad n = 12$

in 12^{th} year the production was

Rs 29200

(ii) $n = 8$, $a = 5000$, $d = 2200$

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

$= 5000 + (8-1)2200$

$= 5000 + 7 \times 2200$

$= 5000 + 15400$

$= 20400$

The production during 8th year is = 20400

OR

Find the production during first 3 years.

iii) Find the difference of the production during 7th year and 4th year. (1)

Ans $n = 3, a = 5000, d = 2200$

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$= \frac{3}{2}[2(5000) + (3-1)2200]$$

$$S_3 = \frac{3}{2}(10000 + 2 \times 2200)$$

$$= \frac{3}{2}(10000 + 4400)$$

$$= 3 \times 7200$$

$$= 21600$$

The production during first 3 year is 21600

(iii) $a_4 = a+3d$

$= 5000 + 3\ (2200)$

$= 5000 + 6600 = 11600$

$a_7 = a+6d$

$= 5000 + 6 \times 2200$

$= 5000 + 13200$

$= 18200$

$a_7 - a_4 = 18200 - 11600 = 6600$

* * *