Class X Session 2025-26
Subject - Mathematics (Basic)
Sample Question Paper - 10

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This question paper contains 38 questions.
2. This Question Paper is divided into 5 Sections A, B, C, D and E.
3. In Section A, Questions no. 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are AssertionReason based questions of 1 mark each.
4. In Section B, Questions no. 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
5. In Section C, Questions no. 26-31 are short answer (SA) type questions, carrying 03 marks each.
6. In Section D, Questions no. 32-35 are long answer (LA) type questions, carrying 05 marks each.
7. In Section E, Questions no. 36-38 are case study based questions carrying 4 marks each with sub parts of the values of 1, 1 and 2 marks each respectively.
8. All Questions are compulsory. However, an internal choice in 2 Question of Section B, 2 Questions of Section C and 2 Questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E .
9. Draw neat and clean figures wherever required.
10. Take wherever required if not stated.
11. Use of calculators is not allowed.

Section A

1. The LCM of $2^3 \times 3^2$ and $2^2 \times 3^3$ **[1]**

a) $2^2 \times 3^2$ b) $2^2 \times 3$

c) $2^3 \times 3^3$ d) 2×3^2

2. The HCF of two consecutive numbers is **[1]**

a) 1 b) 2

c) 3 d) 0

3. If α and β are zeroes of the polynomial $5x^2 + 3x - 7$, the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ is **[1]**

a) $-\frac{5}{7}$ b) $\frac{3}{7}$

c) $\frac{3}{5}$ d) $-\frac{3}{7}$

4. The number of polynomials having zeros 1 and -2 is **[1]**

a) more than 3

b) 2

c) 3

d) 1

5. X takes 3 hours more than Y to walk 30 km. But if X doubles his pace, he is ahead of Y by $1\frac{1}{2}$ hours. The speed of X is **[1]**

a) 5 km\hr

b) 9 km\hr

c) $\frac{9}{7}$ km\hr

d) $\frac{10}{3}$ km\hr

6. If the system of equations **[1]**

3x + y = 1 and

(2k - 1) x + (k - 1) y = 2k + 1

is inconsistent, then k =

a) 1

b) 0

c) -1

d) 2

7. The discriminant of the equation $(2a + b) x = x^2 + 2ab$ is ________ **[1]**

a) $(2a + b)^2$

b) $(2a - b)^2$

c) $(2a + b^2)$

d) $(2a - b^2)$

8. If $x^2 + 5kx + 16 = 0$, has equal roots, then the value of k is **[1]**

a) $\pm\frac{25}{64}$

b) $\pm\frac{64}{25}$

c) $\pm\frac{8}{5}$

d) $\pm\frac{5}{8}$

9. Which of the following is an A.P.? **[1]**

a) $\sqrt{3}, \sqrt{6}, \sqrt{9}, \sqrt{12}, \ldots$

b) 1, 3, 9, 27, ...

c) $1^2, 5^2, 7^2, 73, \ldots$

d) $1^2, 3^2, 5^2, 7^2, \ldots$

10. If the sum of first n even natural numbers is equal to k times the sum of first n odd natural numbers, then k = **[1]**

a) $\frac{n+1}{n}$

b) $\frac{n-1}{n}$

c) $\frac{1}{n}$

d) $\frac{n+1}{2n}$

11. **Assertion (A):** Two right-angled triangles are always similar. **[1]**

Reason (R): By Pythagoras Theorem, $H^2 = P^2 + B^2$

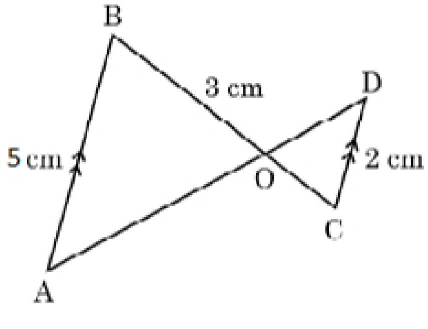
a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

12. In the given figure, AB || CD. If AB = 5 cm, CD = 2 cm and OB = 3 cm, then the length of OC is **[1]**



a) $\frac{15}{2}$ cm
b) $\frac{3}{5}$ cm
c) $\frac{10}{3}$ cm
d) $\frac{6}{5}$ cm

13. **Assertion (A):** Point P(0, 2) is the point of intersection of y-axis with the line 3x + 2y = 4. **[1]**
Reason (R): The distance of point P(0, 2) from x-axis is 2 units.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

14. The point which lies on the perpendicular bisector of the line segment joining the points A (-2, -5) and B (2, 5) is **[1]**

a) (–2, 0)
b) (0, 0)
c) (2, 0)
d) (0, 2)

15. $(3 \sin^2 30^o - 4 \cos^2 60^o)$ is equal to: **[1]**

a) $\frac{5}{4}$
b) $-\frac{9}{4}$
c) $-\frac{1}{4}$
d) $-\frac{3}{4}$

16. $\left(\frac{5}{\cot^2\theta} - \frac{5}{\cos^2\theta}\right)$ is equal to: **[1]**

a) 0
b) -5
c) 5
d) 1

17. QP is a tangent to a circle with centre O at the point P on the circle. If $\triangle$OPQ is an isosceles, then $\angle$OQP equals. **[1]**

a) 90^o
b) 30^o
c) 45^o
d) 60^o

18. A cylindrical vessel 32 cm high and 18 cm as the radius of the base, is filled with sand. This bucket is emptied on the ground and a conical heap of sand is formed. If the height of the conical heap is 24 cm, the radius of its base is **[1]**

a) 12 cm
b) 48 cm
c) 36 cm
d) 24 cm

19. Find the mean and mode of the following data. **[1]**

Classes	0-20	20-40	40-60	60-80	80-100	100-120	120-140
Frequency	6	8	10	12	6	5	3

a) 62.4, 65
b) 62.4, 65.32
c) 60.67, 64.5
d) 50.67, 64.5

20. A bag contains 100 cards numbered 1 to 100. A card is drawn at random from the bag. What is the probability that the number on the card is a perfect cube? **[1]**

a) $\frac{7}{100}$
b) $\frac{3}{50}$
c) $\frac{1}{25}$
d) $\frac{1}{20}$

Section B

21. Find the largest four-digit number which when divided by 4, 7 and 13 leaves a remainder 3 in each case. **[2]**

22. Solve graphically: 2x - 3y + 13 = 0; 3x - 2y + 12 = 0. **[2]**

23. Check whether the points P(5, -2), Q(6, 4) and R(7, -2) are the vertices of an isosceles triangle PQR. **[2]**

OR

In what ratio does the point P(2, -5) divide the line segment joining A(-3, 5) and B(4, -9)?

24. Prove (cosec A - sin A) (sec A - cos A) = $\frac{1}{\tan A+\cot A}$, where the angles involved are acute angles for which the expressions are defined. **[2]**

OR

Evaluate: $\frac{3\tan^2 30^\circ + \tan^2 60^\circ + cosec\ 30^\circ - \tan 45^\circ}{\cot^2 45^\circ}$.

25. Three coins are tossed together. Find the probability of getting at most two heads. **[2]**

Section C

26. Solve the system of equations by using the method of substitution: **[3]**

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

$\frac{x}{a} - \frac{y}{b} = 4$

OR

Solve 2x + 3y = 11 and 2x − 4y = −24 and hence find the value of 'm' for which y = mx + 3.

27. In what ratio is the line segment joining (-3, -1) and (-8, -9) divided at the point (-5,-21/5)? **[3]**

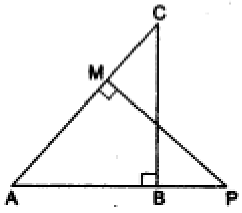
28. Prove the following identity : $\frac{1}{\cot^2\theta} + \frac{1}{1+\tan^2\theta} = \frac{1}{1-\sin^2\theta} - \frac{1}{cosec^2\theta}$ **[3]**

29. In the given figure $\triangle ABC$ and $\triangle AMP$ are right-angled at B and M respectively. **[3]**

Prove that

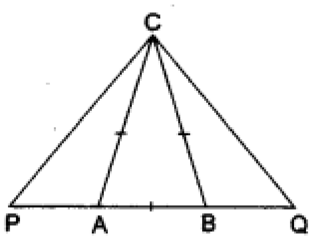
i. $\triangle ABC \sim \triangle AMP$.

ii. $\frac{CA}{PA} = \frac{BC}{MP}$.



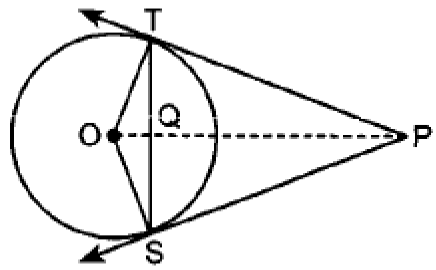
OR

In an isosceles, $\triangle ABC$ the base AB is produced both ways in P and Q such that $AP \times BQ = AC^2$ Prove that $\triangle ACP \sim \triangle BCQ$.



30. A chord of a circle of radius 30 cm makes an angle of 60° at the centre of the circle. Find the areas of the minor and major segments. [Take π =3.14 and $\sqrt{3}$ = 1.732.] **[3]**

31. In figure, from an external point P, two tangents PT and PS are drawn to a circle with centre O and radius r. If OP = 2r, show that ∠OTS= ∠OST = 30°. **[3]**



Section D

32. If (- 5) is a root of the quadratic equation $2x^2 + px + 15 = 0$ and the quadratic equation $p(x^2 + x) + k = 0$ has equal roots, then find the values of p and k. **[5]**

OR

The diagonal of a rectangular field is 60 m more than the shorter side. If the longer side is 80 m more than the shorter side, find the length of the sides of the field.

33. Which term of the A.P - 2, - 7, -1 2 ,... will be - 77? Find the sum of this A.P. upto the term -77. **[5]**

34. From the top of a hill, the angles of depression of two consecutive kilometre stones due east are found to be 45° and 30° respectively. Find the height of the hill. **[5]**

OR

From a window (h metres high above the ground) of a house in a street, the angles of elevation and depression of the top and the foot of another house on the opposite side of the street are θ and ϕ respectively. Show that the height of the opposite house is $h(1 + \tan\theta \cot\phi)$ metres.

35. Find the mean of the following frequency distribution: **[5]**

Class interval	0-8	8-16	16-24	24-32	32-40
Frequency	6	7	10	8	9

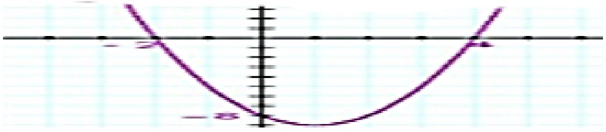
Section E

36. **Read the following text carefully and answer the questions that follow:** **[4]**

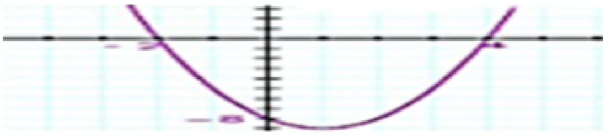
An asana is a body posture, originally and still a general term for a sitting meditation pose, and later extended in hatha yoga and modern yoga as exercise, to any type of pose or position, adding reclining, standing, inverted, twisting, and balancing poses. In the figure, one can observe that poses can be related to representation of quadratic polynomial.

i. Which type the shape of the poses shown in figure? (1)

ii. In the graph, how many zeroes are there for the polynomial? (1)



iii. Write two zeroes in the shown given graph? (2)



OR

How many zeroes are possible for a quadratic polynomial? (2)

37. **Read the following text carefully and answer the questions that follow:** **[4]**

Ashish is a Class IX student. His class teacher Mrs Verma arranged a historical trip to great Stupa of Sanchi. She explained that Stupa of Sanchi is great example of architecture in India. Its base part is cylindrical in shape. The dome of this stupa is hemispherical in shape, known as Anda. It also contains a cubical shape part called Hermika at the top. Path around Anda is known as Pradakshina Path.

i. Find the volume of the Hermika, if the side of cubical part is 10 m. (1)

ii. Find the volume of cylindrical base part whose diameter and height 48 m and 14 m. (1)

iii. If the volume of each brick used is 0.01 m^3, then find the number of bricks used to make the cylindrical base. (2)

OR

If the diameter of the Anda is 42 m, then find the volume of the Anda. (2)

38. **Read the following text carefully and answer the questions that follow:** **[4]**

A seminar is being conducted by an Educational Organisation, where the participants will be educators of different subjects. The number of participants in Hindi, English and Mathematics are 60, 84 and 108 respectively.

i. What is the maximum number of participants that can be accommodated in each room if there are multiple rooms, and in each room, the same number of participants are to be seated, and all of them are in the same subject? (1)

ii. What is the minimum number of rooms required during the event? (1)

iii. Show that the product of two numbers 60 and 84 is equal to the product of their HCF and LCM. (2)

OR

What is the LCM of two numbers if their product is 1080 and their HCF is 30? (2)

Solution

Section A

1.

(c) $2^3 \times 3^3$

Explanation:

L.C.M. of $2^3 \times 3^2$ and $2^2 \times 3^3$ is the product of all prime numbers with the greatest power of every given number, hence it will be $2^3 \times 3^3$

2. **(a)** 1

Explanation:

The HCF of two consecutive numbers is always 1. (e.g. HCF of 24, 25 is 1).

3.

(b) $\frac{3}{7}$

Explanation:

$p(x) = 5x^2 + 3x - 7$

$\alpha + \beta = \frac{-b}{a} = \frac{-3}{5}$

$\alpha\beta = \frac{c}{a} = \frac{-7}{5}$

Now $\frac{1}{\alpha} + \frac{1}{\beta}$

$= \frac{\beta+\alpha}{\alpha\beta}$

$= \frac{\frac{-3}{5}}{\frac{-1}{5}}$

$= \frac{-3}{-7} = \frac{3}{7}$

4. **(a)** more than 3

Explanation:

Since, 1 and -2

Sum of Roots = 1+(-2) = -1

Product of roots = (1) (-2) = -2

Therefore, the polynomial (p(x)) is: [p(x) =K[x^2 - (sum of roots)x + product of roots]

p(x) = K [x^2 - (-1)x+ (-2)]

Therefore, There are infinitely many polynomials that can have (1) and (-2) as their zeros. We can multiply or divide the polynomial by any nonzero constant(k), and the zeros will remain the same. So, the required number of polynomials is **infinite**!

5.

(d) $\frac{10}{3}$ km\hr

Explanation:

Let the speed of X and Y be x km/hr and y km/hr respectively. Then,

Time taken by X to cover 30 km = $\frac{30}{x}$ hr

and time taken by Y to cover 30 km = $\frac{30}{y}$ hr

By the given conditions, we have

$\frac{30}{x} - \frac{30}{y}$ = 3 $\Rightarrow \frac{10}{x} - \frac{10}{y}$ = 1 ...(i)

If X doubles his pace, then speed of X is 2x km/hr

$\therefore$Time taken by X to cover 30 km = $\frac{30}{2x}$ hr

We have $\frac{30}{y} - \frac{30}{2x} = 1\frac{1}{2} \Rightarrow \frac{30}{y} - \frac{30}{2x} = \frac{3}{2}$

$\Rightarrow \frac{10}{y} - \frac{5}{x} = \frac{1}{2} \Rightarrow \frac{-10}{x} + \frac{20}{y}$ = 1 ...(ii)

Putting $\frac{1}{x}$ = u and $\frac{1}{y}$ =v in equation (i) and (ii), we get

$10u - 10v = 1 \Rightarrow 10u - 10v - 1 = 0$ ...(iii)

and $-10u + 20v = 1 \Rightarrow -10u + 20v - 1 = 0$ ...(iv)

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

$10v - 2 = 0 \Rightarrow v = \frac{1}{5}$

Putting $v = \frac{1}{5}$ in equation (iii), we get

$10u - 3 = 0 \Rightarrow u = \frac{3}{10}$

Now, $u = \frac{3}{10} \Rightarrow \frac{1}{x} = \frac{3}{10} \Rightarrow x = \frac{10}{3}$

Hence, X's speed = $\frac{10}{3}$ km/hr

6.

(d) 2

Explanation:

The given system of equations is inconsistent,

$3x + y = 1$

$(2k - 1)x + (k - 1)y = 2k + 1$

If the system of equations is inconsistent, we have

$\frac{3}{2k-1} = \frac{1}{k-1} = \frac{1}{2k+1}$

Take,

$\frac{3}{2k-1} = \frac{1}{k-1}$

$\Rightarrow 3k - 3 = 2k - 1$

$\Rightarrow k = 2$

7.

(b) $(2a - b)^2$

Explanation:

$(2a + b)x = x^2 + 2ab$

$x^2 - (2a + b)x + 2ab = 0$

$D = b^2 - 4ac$

$D = [-(2a + b)]^2 - 4 \times 1 \times 2ab$

$D = 4a^2 + b^2 + 4ab - 8ab$

$D = 4a^2 + b^2 - 4ab$

$D = (2a - b)^2$

8.

(c) $\pm\frac{8}{5}$

Explanation:

Here, a = 1, b = 5k, c = 16

If $x^2 + 5kx + 16 = 0$ has equal roots,

then, $b^2 - 4ac = 0$

$\Rightarrow (5k)^2 - 4 \times 1 \times 16 = 0$

$\Rightarrow 25k^2 - 64 = 0$

$\Rightarrow 25k^2 = 64$

$\Rightarrow k^2 = \frac{64}{25}$

$\Rightarrow k = \pm\frac{8}{5}$

9.

(c) $1^2, 5^2, 7^2, 73, ...$

Explanation:

In $1^2, 5^2, 7^2, 73, ... = 1, 25, 49, 73, ...$

$d = a_2 - a_1 = 25 - 1 = 24$

And $d = a_3 - a_2 = 49 - 25 = 24$

Also $d = a_4 - a_3 = 73 - 49 = 24$

Here, the common difference is the same for all terms, therefore, it is an AP.

10. **(a)** $\frac{n+1}{n}$

Explanation:

Sum of n even natural number = n(n+1)

and sum of n odd natural numbers = n^2

$\therefore n(n+1) = kn^2$

$\Rightarrow k = \frac{n(n+1)}{n^2} = \frac{n+1}{n}$

11.

(d) A is false but R is true.

Explanation:

Two right-angled triangle are similar only if at least one more angle is also equal.

12. **(a)** $\frac{15}{2}$ cm

Explanation:

In $\triangle$ABO and $\triangle$DCO

$\angle$AOB = $\angle$DCO (vert. oppo. angle)

$\angle$ BAO = $\angle$CDO (alt. angle)

$\therefore \triangle ABO \sim \triangle DCO$ by (AA Similarity).

$\frac{AB}{DC} = \frac{OC}{OB}$

$\frac{5}{2} = \frac{OC}{3}$

OC = $\frac{15}{2}$ cm

13.

(c) A is true but R is false.

Explanation:

Put (0, 2) in 3x + 2y = 4

We get LHS = RHS

Assertion is true.

Reason is also true. But it is not the correct explanation of Assertion (A).

Hence option B is the answer.

14.

(b) (0, 0)

Explanation:

As we know that, the perpendicular bisector of the any line segment divides the line segment into two equal parts i.e., the perpendicular bisector of the line segment always passes through the mid - point of the line segment.

As mid - point of any line segment which passes through the points

(x_1, y_1) and (x_2, y_2) is;

$= \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

So mid - point of the line segment joining the points A (- 2, - 5) and B (2, 5) will be;

$= \left(\frac{-2+2}{2}, \frac{-5+5}{2}\right) = (0, 0)$

Hence, (0, 0) is the required point lies on the perpendicular bisector of the lines segment.

15.

(c) $-\frac{1}{4}$

Explanation:

(3 $\sin^2 30^o$ - 4 $\cos^2 60^o$)

$\Rightarrow 3 \times \left(\frac{1}{2}\right)^2 - 4 \times \left(\frac{1}{2}\right)^2$

$\Rightarrow -\frac{1}{4}$

16.

(b) -5

Explanation:

$\frac{5}{\cot^2\theta} - \frac{5}{\cos^2\theta}$

$= 5\tan^2\theta - 5\sec^2\theta$

$5\left(\tan^2\theta - \sec^2\theta\right)$

= 5(-1)

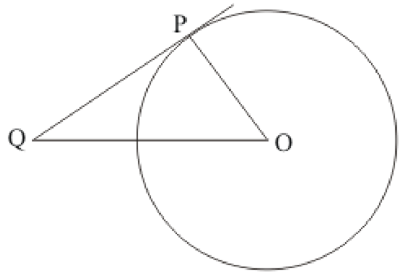
= -5

17.

(c) 45^o

Explanation:

Let us first put the given data in the form of a diagram.



We know that the radius of a circle will always be perpendicular to the tangent at the point of contact. Therefore, OP is perpendicular to QP. Therefore,

$\angle OQP = 90^o$

The side opposite to perpendicular is OQ.OQ will be the longest side of the triangle. So, in the isosceles right triangle ΔOPQ, OP = PQ

And the angles opposite to these two sides will also be equal. Therefore,

$\angle OQP = \angle POQ$

We know that sum of all angles of a triangle will always be equal to 180°. Therefore,

$\angle OQP + \angle POQ + \angle OPQ = 180^\circ$

$\angle OQP + \angle POQ + \angle OPQ = 180^\circ$

$90^\circ + 2\angle OQP = 180^\circ$

$2\angle OQP = 90^\circ$

$\angle OQP = 45^\circ$

18.

(c) 36 cm

Explanation:

Radius of a cylindrical vessel (r_1) = 18 cm

and height (h_1) = 32 cm

$\therefore$ Volume of sand filled in it = $\pi r_1^2 h_1$

= π $(18)^2$ $\times$ 32 = π $\times$ 324 $\times$ 32 cm^3

= 10368π cm^3

Now height of the conical heap (h_2) = 24 cm

Let r_2 be the its radius, then

$\frac{1}{3}\pi r_2^2 h_2$ = 10368π

$\Rightarrow \frac{1}{3}\pi r_2^2 \times 24 = 10368\pi$

$\Rightarrow 8\pi r_2^2 = 10368\pi$

$r_2^2 = \frac{10368\pi}{8\pi}$ = 1296

$\therefore r_2 = \sqrt{1296}$ = 36

Hence radius of the base of the heap = 36 cm

19. **(a)** 62.4, 65

Explanation:

62.4, 65

20.

(c) $\frac{1}{25}$

Explanation:

n(S) = 100

E = {1, 8, 27, 64}

n(E) = 4

the probability of drawing a number on the card that is a cube is

P(E) = $\frac{4}{100}$ = $\frac{1}{25}$

Section B

21. LCM of (4,7,13) = 364

Largest 4 digit number = 9999

On dividing 9999 by 364 we get remainder as 171

Greatest number of 4 digits divisible by 4, 7 and 13 = (9999 – 171) = 9828

Hence, required number = (9828 + 3) = 9831

Therefore 9831 is the number.

22. 2x - 3y + 13 = 0

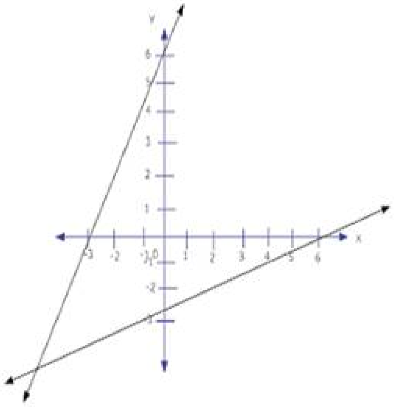
3x - 2y + 12 = 0

when $x = \frac{-13+3y}{2}$

x	**6.5**	**5**
y	0	-1

when $y = \frac{3x+12}{2}$

x	0	-3
y	6	3



23. Let ABC be the triangle P(5, -2),Q(6, 4),R(7, -2)

By distance formula,

$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$PQ = \sqrt{(6-5)^2 + (4+2)^2} = \sqrt{1+36}$

PQ = $\sqrt{37}$

$QR = \sqrt{(7-6)^2 + (-2-4)^2} = \sqrt{1+36}$

QR = $\sqrt{37}$

$PR = \sqrt{(7-5)^2 + (-2+2)^2} = \sqrt{4} = 2$

$\because$ PQ = QR = $\sqrt{37}$

$\therefore$ $\triangle$PQR is an isosceles triangle.

OR

Let the required ratio be k:1.

Then, by the section formula, the coordinates of P are

$P\left(\frac{4k-3}{k+1}, \frac{-9k+5}{k+1}\right)$

$\therefore$ $\frac{4k-3}{k+1} = 2$ and $\frac{-9k+5}{k+1} = -5$ [$\because$ P(2, 5) is given]

$\Rightarrow$ 4k - 3 = 2k + 2 and -9k + 5 = -5k - 5

$\Rightarrow$ 2k = 5 and 4k = 10

$\Rightarrow k = \frac{5}{2}$ in each case.

So, the required ratio is $\frac{5}{2} : 1$, which is 5:2

Hence, P divides AB in the ratio 5:2.

24. LHS

$= (cos A - \sin A)(\sec A - \cos A)$

$= \left(\frac{1}{\sin A} - \sin A\right)\left(\frac{1}{\cos A} - \cos A\right) = \frac{1-\sin^2 A}{\sin A}\frac{1-\cos^2 A}{\cos A}$

$= \frac{\cos^2 A}{\sin A}\frac{\sin^2 A}{\cos A}, \ldots\ldots \because \sin^2 A + \cos^2 A = 1 = \frac{\frac{\sin A \cos A}{\sin A \cos A}}{\frac{\sin^2 A}{\sin A \cos A} + \frac{\cos^2 A}{\sin A \cos A}}$

.... Dividing the numerator and denominator by sin A cos A

$= \frac{1}{\tan A + \cot A}$

= RHS

OR

$= \frac{3\tan^2 30^\circ + \tan^2 60^\circ + cosec 30^\circ - \tan 45^\circ}{\cot^2 45^\circ}$

$= \frac{3\times\left(\frac{1}{\sqrt{3}}\right)^2 + (\sqrt{3})^2 + 2 - 1}{(1)^2}$

$= \frac{3\times\frac{1}{3} + 3 + 2 - 1}{1}$

= 1 + 3 + 2 - 1

= 6 - 1

= 5

25. When three coins are tossed then the outcome will be

{TTT, THT, TTH, THH, HTT, HHT, HTH, HHH}

Hence total number of outcome is 8.

In case, at most two head we have favourable outcomes as- { TTT, THT, TTH, THH, HTT, HHT, HTH}

Hence total number of favourable outcome i.e. at most two head is 7

We know that PROBABILITY $= \frac{\text{Number of favourable event}}{\text{Total number of event}}$

Hence probability of getting at most two head when three coins are tossed simultaneously is equal to $\frac{7}{8}$

Section C

26. We have to solve the following systems of equations by using the method of substitution

$\frac{2x}{a} + \frac{y}{b} = 2$ ......(i)

$\frac{x}{a} - \frac{y}{b} = 4$ ....(ii)

From equation (i), we get

$\frac{y}{b} = 2 - \frac{2x}{a}$

$\Rightarrow y = b\left(2 - \frac{2x}{a}\right)$

Substituting $y = b\left(2 - \frac{2x}{a}\right)$ in equation (ii), we get

$\frac{x}{a}-\frac{b}{b}\left(2-\frac{2x}{a}\right)=4$

$\Rightarrow \frac{x}{a}-2+\frac{2x}{a}=4$

$\Rightarrow \frac{3x}{a}=6$

$\Rightarrow$ 3x = 6a

$\Rightarrow$ x = 2a

Putting x = 2a in equation (i), we get

$4+\frac{y}{b}=2$

$\Rightarrow \frac{y}{b}=-2$

$\Rightarrow y=-2b$

Hence, the solution of the given system of equations is x = 2a and y = -2b.

OR

We have to solve 2x + 3y = 11 and 2x − 4y = −24 and also we have to find the value of 'm' for which y = mx + 3.

2x + 3y = 11 …. (1)

2x - 4y = −24 …. (2)

Using equation (2), we can say that

2x = −24 + 4y

⇒ x = −12 + 2y

Putting this in equation (1), we get

2 (−12 + 2y) + 3y = 11

⇒ −24 + 4y + 3y = 11

⇒ 7y = 11+ 24

⇒ 7y = 35

or, y = 5

Putting value of y in equation (1), we get

2x + 3 (5) = 11

⇒ 2x + 15 = 11

⇒ 2x = 11 – 15 = −4⇒ x = −2

Therefore, x = −2 and y = 5

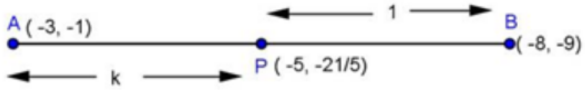
Putting values of x and y in y = mx + 3, we get

5 = m (−2) + 3

⇒ 5 = −2m + 3

or, 5 - 3 = -2m

⇒ −2m = 2 ⇒ m = −1

27. 

Let the point P divide AB in the ratio K:1

Then, the coordinates of P are $\left[\frac{-8k-3}{k+1},\frac{-9k-1}{k+1}\right]$

But the coordinates of P are given as $\left(-5,\frac{-21}{5}\right)$

$\therefore \frac{-8k-3}{k+1}=-5$

$\Rightarrow$ -8k - 3 = -5k - 5

$\Rightarrow$ -8k + 5k = -5 + 3

$\Rightarrow$ -3k = -2

$\Rightarrow k=\frac{2}{3}$

Hence, the point P divides AB in the

ratio $\frac{2}{3}:1\Rightarrow 2:3$

28. LHS

$=\frac{1}{\cot^2\theta}+\frac{1}{1+\tan^2\theta}$

$=\tan^2\theta+\frac{1}{\sec^2\theta}$

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

$=(\sec^2\theta-1)+\cos^2\theta$

$= \sec^2\theta$ - (1 - $\cos^2\theta$)

$= \sec^2\theta$ - $\sin^2\theta$

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

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

= R.H.S

Hence proved.

29. Given $\triangle ABC$ and $\triangle AMP$ such that $\angle B = 90^\circ$ and $\angle M = 90^\circ$.

Proof

i. In $\triangle ABC$ and $\triangle AMP$, we have

$\angle ABC = \angle AMP = 90^\circ$

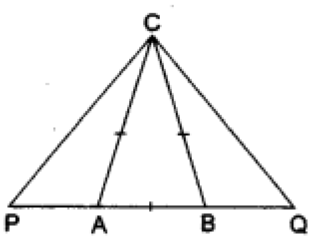
$\angle A = \angle A$ (common)

$\therefore \quad \triangle ABC \sim \triangle AMP$ [by AA-similarity]

ii. Since $\triangle ABC \sim \triangle AMP$, their corresponding sides are proportional.

$\therefore \quad \frac{CA}{PA} = \frac{BC}{MP}$

OR



It is given that $\triangle ABC$ is an isosceles triangle, therefore we have

CA = CB

$\Rightarrow \angle CAB = \angle CBA$

$\Rightarrow 180^0 - \angle CAB = 180^0 - \angle CBA$

$\Rightarrow \angle CAP = \angle CBQ$ (Angles opposite to equal sides of a triangle are equal)

Also, we have

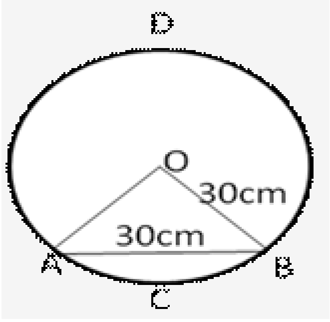
$\text{AP} \times \text{BQ} = AC^2$

$\implies \frac{AP}{AC} = \frac{AC}{BQ}$

$\implies \frac{AP}{AC} = \frac{BC}{BQ}$ [$\because$ AC = BC]

Thus, by SAS similarity theorem, we obtain

$\triangle\text{APC} \sim \triangle\text{BCQ}$

30. 

Let AB be the chord of circle of centre O and radius = 30

such that $\angle AOB = 60^\circ$

Area of the sector OACBO

$= \frac{\pi r^2\theta}{360}\text{cm}^2$

$= \left(3.14 \times 30 \times 30 \times \frac{60}{360}\right) \text{cm}^2$

= 471 cm^2

Area of $\triangle OAB = \frac{1}{2}r^2 \sin\theta$

$= \left(\frac{1}{2} \times 30 \times 30 \times \sin 60^\circ\right) \text{cm}^2$

$= \left(\frac{1}{2} \times 30 \times 30 \times \frac{\sqrt{3}}{2}\right) \text{cm}^2$

$= (225\sqrt{3})\text{cm}^2$

$= (225 \times 1.73)\text{cm}^2$

= 389.25 cm^2

Area of the minor segment ACBA

= (area of the sector OACBO) - (area of the $\triangle OAB$)

= (471 - 389.25) cm^2

= 81.75 cm^2

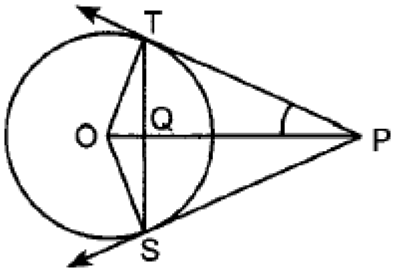
Area of the major segment BADB

= (area of circle) - (area of the minor segment)

$= [(3.14 \times 30 \times 30) - 81.75)]\text{cm}^2$

= 2744.25 cm^2

31. Given,



In $\triangle$OTS,

$OT = OS$

$\Rightarrow \quad \angle OTS = \angle OST$ ...(i)

In right $\triangle OTP$,

$\frac{\text{OT}}{\text{OP}} = \sin \angle\text{TPO}$

$\Rightarrow \frac{r}{2r} = \sin \angle\text{TPO}$

$\sin \angle\text{TPO} = \frac{1}{2} \Rightarrow \angle\text{TPO} = 30^\circ$

Similarly $\angle\text{OPS} = 30^\circ$

$\Rightarrow \angle TPS = 30^\circ + 30^\circ = 60^\circ$

Also $\angle\text{TPS} + \angle\text{SOT} = 180^\circ$

$\Rightarrow \quad \angle\text{SOT} = 120^\circ$

In $\triangle$SOT,

$\angle\text{SOT} + \angle\text{OTS} + \angle\text{OST} = 180^\circ$

$\Rightarrow 120^\circ + 2\angle\text{OTS} = 180^\circ$

$\Rightarrow \angle\text{OTS} = 30^\circ$ ...(ii)

From (i) and (ii)

$\angle\text{OTS} = \angle\text{OST} = 30^\circ$

Section D

32. Since (-5) is a root of given quadratic equation $2x^2 + px + 15 = 0$,then,

$2(-5)^2 + p(-5) - 15 = 0$

$50 - 5p - 15 = 0$

$5p = 35 \Rightarrow p = 7$

Now $p\left(x^2 + x\right) + k = 0$ has equal roots

$px^2 + px + k = 0$

So $(b)^2 - 4ac = 0$

$(p)^2 - 4p \times k = 0$

$(7)^2 - 4 \times 7 \times k = 0$

28k = 49

$k = \frac{49}{28} = \frac{7}{4}$

hence p = 7 and $k = \frac{7}{4}$

OR

There is an error in the question, so full marks to be awarded to the Candidates, who attempted.

33. Given A.P. is -2, -7, -12, … -77. Here, first term a = -2, and (last term) a_n = - 77.

And common difference , d =(-7)- (-2) = (-7 + 2)= -5.

Now a_n = -77

$\Rightarrow$ a + (n - 1)d = -77$[\because a_n = a + (n-1)d]$

$\Rightarrow$ -2 + (n - 1)(-5) = -77

$\Rightarrow$ -[2+ (n - 1)5] = -77

$\Rightarrow$ (2 + 5n - 5) = 77

$\Rightarrow$ 5n - 3 = 77

$\Rightarrow$ 5n = 77 + 3

$\Rightarrow n = \frac{80}{5}$

$\Rightarrow$ n = 16

So, the 16th term will be -77.

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

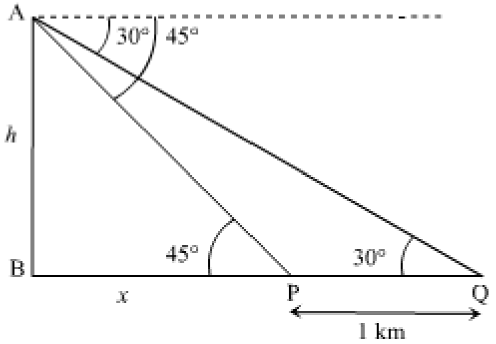
$\Rightarrow S_{16} = \frac{16}{2}$ [2 (-2) + (16 - 1)(-5)]

= 8 [-4 + (15)(- 5)]

= 8 [-4 - 75]

= 8 [- 79] = - 632

Hence, the sum of the given A.P. upto the term -77 is - 632.

34. 

Given, AB is the hill and P and Q are two consecutive km stones.

Let the height of the hill AB be h m and

$BP = x\ m.$

$PQ = 1km = 1000m$

In ΔABP,

$\tan 45^\circ = \frac{AB}{BP}$

$\therefore 1 = \frac{h}{x}$

$\Rightarrow x = h$ ...(i)

In $\triangle$ABQ,

$\tan 30^\circ = \frac{\mathrm{AB}}{\mathrm{BQ}}$

$\therefore \frac{1}{\sqrt{3}} = \frac{hm}{(x+1000)\mathrm{m}}\ [\because \mathrm{BQ} = \mathrm{BP} + \mathrm{PQ} = x + 1000]$

$\Rightarrow x + 1000 = \sqrt{3}h$

$\Rightarrow \sqrt{3}h = h + 1000$ [Using (i)]

$\Rightarrow (\sqrt{3} - 1)h = 1000$

$\Rightarrow h = \frac{1000}{\sqrt{3}-1}$

$\Rightarrow h = \frac{1000(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$

$= \frac{1000(\sqrt{3}+1)}{(3-1)}$

$= \frac{1000(\sqrt{3}+1)}{2}$

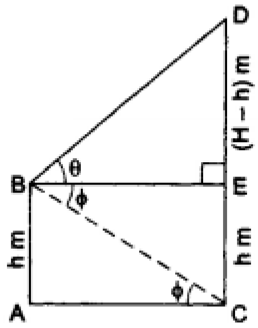
$= 500(\sqrt{3} + 1)$

OR

Let B be the position of the window of house AB which is h metres above the ground.i.e AB = h m

CD be the house on the opposite side of the street

Draw $BE \| AC$, meeting CD at E. Then,



$\angle EBD = \theta$ and $\angle ACB = \angle EBC = \phi$.

Let CD = H metres. Then,

CE = AB = h metres and

ED = (H - h)m.

From right ΔACB, we have

$\frac{AC}{AB} = \cot\phi \Rightarrow \frac{AC}{h} = \cot\phi \Rightarrow AC = h\cot\phi\, metres.$

From right ΔBED, we have

$\frac{DE}{BE} = \tan\theta \Rightarrow \frac{(H-h)}{h\cot\phi} = \tan\theta$ $[\because BE = AC = h\cot\phi \mathrm{m}]$

$\Rightarrow \quad (H-h) = h\tan\theta\cot\phi$

$\Rightarrow \quad H = h(1+\tan\theta\cot\phi).$

Hence, the height of the opposite house is $h(1+\tan\theta\cot\phi)$metres.

35.

Class interval	**Mid- value**	**$d_i = x_i - 20$**	$u_i = \left(\frac{x_i - 20}{8}\right)$	**f_i**	**f_iu_i**
0-8	4	-16	-2	6	-12
8-16	12	-8	-1	7	-7
16-24	20	0	0	10	0
24-32	28	8	1	8	8
32-40	36	16	2	9	18
				N = 40	$\sum f_iu_i$ = 7

Let the assumed mean (A) is = 20

h = 8

Mean= A + h$\left(\frac{\sum f_iu_i}{N}\right)$

= 20 + 8$\left(\frac{7}{40}\right)$

= 20 + 1.4

= 21.4

Section E

36. i. Parabola

ii. As the curve cuts x-axis two times

$\therefore$ No of zero's = 2

iii. $\because$ The parabola cuts x-axis at x = -2 and x = 4

$\therefore$ The zero's are = -2, 4

OR

2

37. i. Volume of Hermika = side^3 = 10 $\times$ 10 $\times$ 10 = 1000 m^3

ii. r = radius of cylinder = 24, h = height = 16

Volume of cylinder = $\pi r^2 h$

$\Rightarrow$ V = $\frac{22}{7}$ $\times$ 24 $\times$ 24 $\times$ 14 = 25344 m^3

iii. Volume of brick = 0.01 m^3

$\Rightarrow$ n = Number of bricks used for making cylindrical base = $\frac{\text{Volume of cylinder}}{\text{Volume of one brick}}$

$\Rightarrow n = \frac{25344}{0.01}$ = 2534400

OR

Since Anda is hespherical in shape r = radius = 21

V = Volume of Anda = $\frac{2}{3} \times \pi \times r^3$

$\Rightarrow$ V = $\frac{2}{3} \times \frac{22}{7} \times 21 \times 21 \times 21$

$\Rightarrow$ V = 44 $\times$ 21 $\times$ 21 = 19404 m^3

38. i. The Number of room will be minimum if each room accomodates maximum number of participants. Therefore, the number of participants in each room must be the HCF of 60, 84 and 108. The prime factorisations of 60, 84 and 108 are as under.

60 = $2^2 \times 3 \times 5$, 84 = $2^2 \times 3 \times 7$ and 108 = $2^2 \times 3^3$

$\therefore$ HCF of 60, 84 and 108 is $2^2 \times 3 = 12$

Therefore, in each room 12 participants can be seated.

ii. The Number of room will be minimum if each room accomodates maximum number of participants. Therefore, the number of participants in each room must be the HCF of 60, 84 and 108. The prime factorisations of 60, 84 and 108 are as under.

60 = $2^2 \times 3 \times 5$, 84 = $2^2 \times 3 \times 7$ and 108 = $2^2 \times 3^3$

$\therefore$ HCF of 60, 84 and 108 is $2^2 \times 3 = 12$

Therefore, in each room 12 participants can be seated.

$\therefore$ Number of rooms required = $\frac{\text{Total number of participants}}{12}$

= $\frac{60+84+108}{12}$

= $\frac{252}{12}$

= 21

iii. Prime factorisation of 60 = 2 $\times$ 2 $\times$ 3 $\times$ 5

Prime factorisation of 84 = 2 $\times$ 2 $\times$ 3 $\times$ 7

Hence, LCM of 60, 84 = 2 $\times$ 2 $\times$ 3 $\times$ 5 $\times$ 7 = 420

And HCF of 60, 84 = 2 $\times$ 2 $\times$ 3 = 12

Now, LCM $\times$ HCF = 420 $\times$ 12 = 5040

Also, 60 $\times$ 84 = 5040

i.e., HCF $\times$ LCM = Product of the two numbers

OR

Product of numbers = HCF $\times$ LCM

$\Rightarrow$ 1080 = 30 $\times$ LCM

$\therefore$ LCM = $\frac{1080}{30}$ = 36