Class X Session 2026-27
Subject - Mathematics (Standard)
Sample Question Paper - 6

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

General Instructions:

Read the following instructions carefully and follow them:

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 Assertion- Reason 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 Questions 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 $\pi = 22/7$ wherever required if not stated.
11. Use of calculators is not allowed.

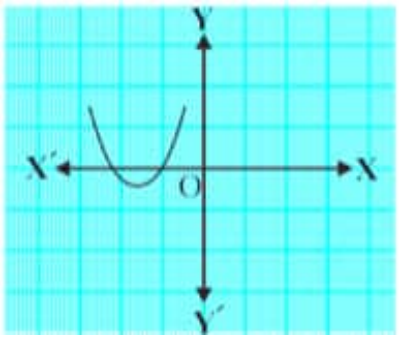
Section A

1. If a and b are two positive integers such that the least prime factor of a is 3 and the least prime factor of b is 5. Then, the least prime factor of (a + b) is **[1]**

   a) 3 b) 5

   c) 2 d) 8

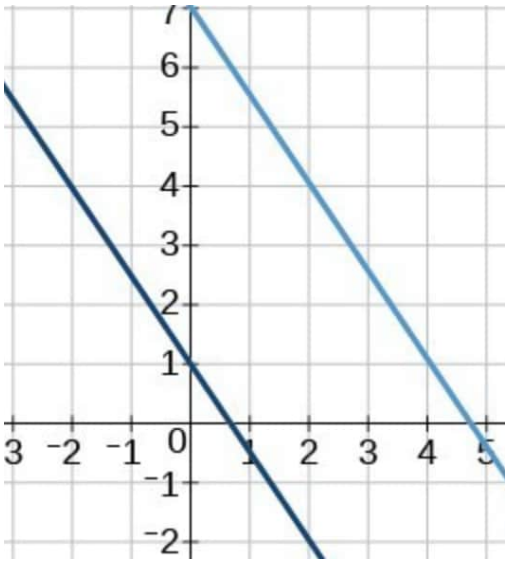
2. The graph of y = p(x) in a figure given below, for some polynomial p(x). Find the number of zeroes of p(x). **[1]**



a) 3 b) 2

c) 4 d) 1

3. The number of solutions for two linear equations representing parallel lines is/are **[1]**



a) 0 b) 1

c) ∞ d) 2

4. For what values of k, the equation kx^2 - 6x - 2 = 0 has real roots? **[1]**

a) $k \leq -2$ b) $k \leq \frac{-9}{2}$

c) $k \leq -5$ d) $k \geq \frac{-9}{2}$

5. The nth term of the A.P. 63, 65, 67, 69, ... and the A.P. 3, 10, 17, 24, ... are equal, then the value of n is **[1]**

a) 14 b) 15

c) 13 d) 12

6. The distance between the points (3, -2) and (-3, 2) is: **[1]**

a) $2\sqrt{10}$ b) $\sqrt{52}$

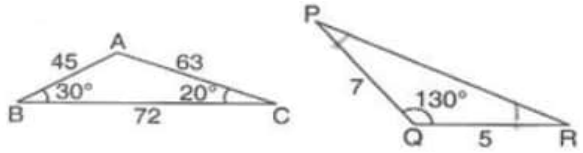
c) $4\sqrt{10}$ d) 40

7. If the line segment joining the points (3, -4) and (1, 2) is trisected at points P (a, -2) and $Q\left(\frac{5}{3}, b\right)$. Then, **[1]**

a) $a = \frac{2}{3}, b = \frac{1}{3}$ b) $a = \frac{7}{3}, b = 0$

c) $a = \frac{1}{3}, b = 1$ d) $a = \frac{8}{3}, b = \frac{2}{3}$

8. In the figures find the measures of $\angle P$ and $\angle R$ **[1]**



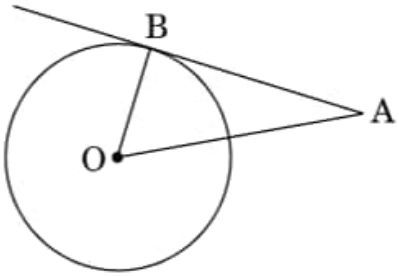
a) 20^o, 30^o.

b) 50^o, 40^o.

c) 40^o, 50^o.

d) 30^o, 20^o.

9. In Figure, AB is a tangent to the circle with centre at O from an external point A. If OA = 6 cm and OB = $3\sqrt{3}$ cm, then the length of the tangent is **[1]**



a) $\sqrt{33}$ cm

b) $3\sqrt{3}$ cm

c) 9 cm

d) 3 cm

10. If the distance of a tangent to a circle from its centre is 4 cm, then the length of diameter of the circle is: **[1]**

a) 8 cm

b) 16 cm

c) 2 cm

d) 4 cm

11. Which of the following is true for all values of $\theta\,(0^\circ \leq \theta \leq 90^\circ)$? **[1]**

a) $\sec^2\theta - \tan^2\theta = 1$

b) $\cos^2\theta - \sin^2\theta = 1$

c) $\cot^2\theta - \tan^2\theta = 1$

d) $\text{cosec}^2\theta - \sec^2\theta = 1$

12. If 8 tan x = 15, then sin x - cos x is equal to **[1]**

a) $\frac{7}{17}$

b) $\frac{17}{7}$

c) $\frac{1}{17}$

d) $\frac{8}{17}$

13. If the angle of depression of a car from a 100 m high tower is 45°, then the distance of the car from the tower is **[1]**

a) $200\sqrt{3}$ m

b) $100\sqrt{3}$ m

c) 200 m

d) 100 m

14. The ratio of the area of a quadrant of a circle to the area of the same circle is: **[1]**

a) 1 : 2

b) 1 : 4

c) 4 : 1

d) 2 : 1

15. The area of the sector of a circle of radius 12 cm is 60π cm^2. The central angle of this sector is: **[1]**

a) 6^o

b) 150^o

c) 75^o

d) 120^o

16. Two coins are tossed together. The probability of getting at least one tail is: **[1]**

a) $\frac{1}{4}$ b) $\frac{1}{2}$

c) 1 d) $\frac{3}{4}$

17. A game of chance consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and these values are equally likely outcomes. The probability that it will point at a number greater than 5 is **[1]**

a) $\frac{1}{4}$ b) $\frac{1}{2}$

c) $\frac{1}{5}$ d) $\frac{1}{3}$

18. The cumulative frequency table is useful in determining **[1]**

a) All of these b) Mode

c) Median d) Mean

19. **Assertion (A):** In a solid hemisphere of radius 10 cm, a right cone of same radius is removed out. The surface area of the remaining solid is 570.74 cm^2 [Take π = 3.14 and $\sqrt{2}$ = 1.4] **[1]**

Reason (R): **Reason (R):** Expression used here to calculate Surface area of remaining solid = Curved surface area of hemisphere + Curved surface area of cone

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.

20. **Assertion (A):** Sum of first hundred even natural numbers divisible by 5 is 500 **[1]**

Reason (R): Sum of first n-terms of an A.P. is given by $S_n = \frac{n}{2}[a + l]$ where l = last term.

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.

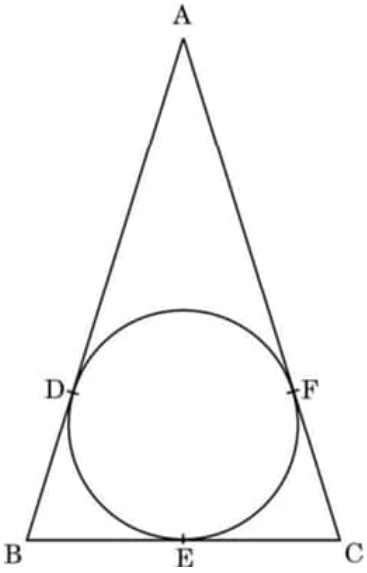
Section B

21. Find the LCM and HCF of the integers 17, 23 and 29 by applying the prime factorisation method. **[2]**

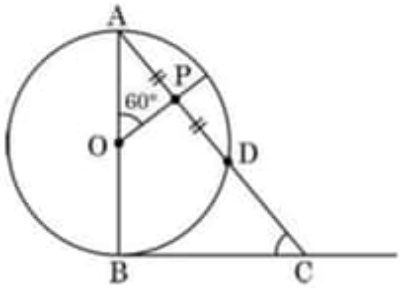
OR

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

22. ABC is an isosceles triangle with AB = AC, circumscribed about a circle. Prove that BC is bisected at E. **[2]**



23. In Fig., AB is diameter of a circle centered at O, BC is tangent to the circle at B. If OP bisects the chord AD and $\angle AOP = 60^o$, then find $m\angle C$. **[2]**



24. Prove the trigonometric identity : $\frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta} = 2\ \text{cosec}\ \theta$. **[2]**

OR

Given 15 cot A = 8 find sin A and sec A.

25. Write the formula for the area of a segment in a circle of radius r given that the sector angle is θ (in degrees). **[2]**

Section C

26. Lenin is preparing dinner plates. He has 12 pieces of chicken and 16 rolls. If he wants to make all the plates identical without any food left over, what is the greatest number of plates Lenin can prepare? **[3]**

27. Find the zeroes of the quadratic polynomial $3x^2 - 2$ and verify the relationship between the zeroes and the coefficients. **[3]**

28. The observations 29, 32, 48, 50, x, x + 2, 72, 78, 84, 95 are arranged in ascending order. What is the value of x if the median of the data is 63? **[3]**

29. A part of monthly expenses of a family is constant and the remaining varies with the price of wheat. When the rate of wheat is Rs.250 a quintal, the total monthly expenses of the family are Rs.1000 and when it is Rs.240 a quintal, the total monthly expenses are Rs.980. Find the total monthly expenses of the family when the cost of wheat is Rs.350 a quintal. **[3]**

OR

Solve the system of equations graphically:

3x - 4y =7

$5x + 2y = 3$

Shade the region between the lines and the y-axis

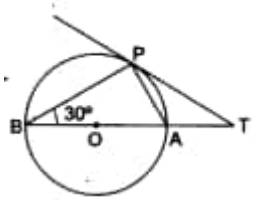
30. Prove the following trigonometric identity: **[3]**

$\frac{\tan\theta}{1+\cot\theta} + \frac{\cot\theta}{1+\tan\theta} = \tan\theta + \cot\theta - 1$

31. A point P is 26 cm from the centre of the circle. The length of the tangent drawn from P to the circle is 24 cm. Find the radius of the circle. **[3]**

OR

In the given figure, O is the centre of the circle and TP is the tangent to the circle from an external point T. If $\angle PBT$ = 30°, prove that BA: AT = 2:1.

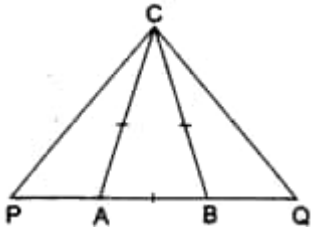


Section D

32. Find the mean marks of students for the following distribution: **[5]**

Marks	**Number of students**
0 and above	80
10 and above	77
20 and above	72
30 and above	65
40 and above	55
50 and above	43
60 and above	28
70 and above	16
80 and above	10
90 and above	8
100 and above	0

33. In an isosceles ΔABC, the base AB is produced both the ways to P and Q such that $AP \times BQ = AC^2$. Prove that $\Delta APC \sim \Delta BCQ$. **[5]**



34. A train travels at a certain average speed for a distance of 360 km. It would have taken 48 minutes less to travel the same distance if its speed was 5 km/hour more. Find the original speed of the train. **[5]**

OR

Solve for x:

$\frac{3}{x+1} - \frac{2}{3x-1} = \frac{1}{2}\left(x \neq -1, \frac{1}{3}\right)$

35. From one face of a solid cube of side 14 cm, the largest possible cone is carved out. Find the volume and surface area of the remaining solid. (Use $\pi = \frac{22}{7}, \sqrt{5} = 2.2$) **[5]**

OR

A solid is in the shape of a right-circular cone surmounted on a hemisphere, the radius of each of them being 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid.

Section E

36. Jaspal Singh is an auto driver. His autorickshaw was too old and he had to spend a lot of money on repair and maintenance every now and then. One day he got to know about the EV scheme of the Government of India where he can not only get a good exchange bonus but also avail heavy discounts on the purchase of an electric vehicle. So, he took a loan of Rs.1,18,000 from a reputed bank and purchased a new autorickshaw. **[4]**



Jaspal Singh repays his total loan of 118000 rupees by paying every month starting with the first instalment of 1000 rupees.

i. If he increases the installment by 100 rupees every month, then what amount will be paid by him in the 4th installment? (1)

ii. If he increases the installment by 100 rupees every month, then what amount will be paid by him in the 30th installment? (1)

iii. What is the total amount paid till 30th installment?

OR

What amount of loan does he still have to pay after 30th installment? (2)

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

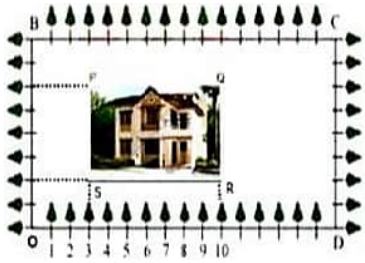
Using Cartesian Coordinates we mark a point on a graph by how far along and how far up it is.

The left-right (horizontal) direction is commonly called X-axis.

The up-down (vertical) direction is commonly called Y-axis.

In Green Park, New Delhi Suresh is having a rectangular plot ABCD as shown in the following figure. Sapling of Gulmohar is planted on the boundary at a distance of 1 m from each other. In the plot, Suresh builds his house in the rectangular area PQRS. In

the remaining part of plot, Suresh wants to plant grass.



i. Find the coordinates of the midpoints of the diagonal QS. (1)

ii. Find the length and breadth of rectangle PQRS? (1)

iii. Find Area of rectangle PQRS. (2)

OR

Find the diagonal of rectangle. (2)

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

Totem poles are made from large trees. These poles are carved with symbols or figures and mostly found in western Canada and northwestern United States.

In the given picture, two such poles of equal heights are standing 28 m apart. From a point somewhere between them in the same line, the angles of elevation of the top of the two poles are 60^o and 30^o respectively.



i. Draw a neat labelled diagram. (1)

ii. Find the height of the poles. (1)

iii. If the distances of the top of the poles from the point of observation are taken as p and q, then find a relation between p and q. (2)

OR

Find the location of the point of observation. (2)

Solution

Section A

1.

(c) 2

Explanation:

Since 5 + 3 = 8, the least prime factor of a + b has to be 2, unless a + b is a prime number greater than 2.

If a + b is a prime number greater than 2, then a + b must be an odd number. So, either a or b must be an even number. If a is even, then the least prime factor of a is 2, which is not 3 or 5. So, neither a nor b can be an even number. Hence, a + b cannot be a prime number greater than 2 if the least prime factor of a is 3 or 5.

2.

(b) 2

Explanation:

The number of zeroes is 2 as the graph intersects the x-axis at two points.

3. **(a)** 0

Explanation:

The number of solutions of two linear equations representing parallel lines is 0 because two linear equations representing parallel lines has no solution and they are inconsistent.

4.

(d) $k \geq \frac{-9}{2}$

Explanation:

For real roots, we must have, $b^2 - 4ac \geq 0$.

$(-6)^2 - 4 \times k \times (-2) \geq 0 \Rightarrow 36 + 8k \geq 0$

$\Rightarrow 8k \geq -36 \Rightarrow k \geq \frac{-9}{2}$.

5.

(c) 13

Explanation:

For 1st A.P.; a = 63 and d = 2 , hence T_n = 63 + (n - 1)2

$\Rightarrow T_n = 2n + 61$ ... (i)

for 2nd AP a = 3, d = 7, hence t_n = 3 + (n - 1)7

$t_n = 7n - 4$ ... (ii)

by condition, from (i) & (ii),

7n - 4 = 2n + 61

$\Rightarrow$ 5n = 65

$\therefore$ n = 13

6.

(b) $\sqrt{52}$

Explanation:

Let us take (3, – 2) and (– 3, 2) as (x_1, y_1) and (x_2, y_2)

Using distance formjula, d = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

d = $\sqrt{(-3-3)^2+(2-(-2)\ )^2}$

d = $\sqrt{(-6)^2+(2+2)^2}$

d = $\sqrt{36+(4)^2}$

d = $\sqrt{36+16}$

d = $\sqrt{52}$

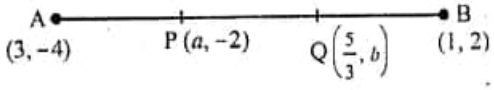
7.

(b) $a = \frac{7}{3}, b = 0$

Explanation:

The points P(a, -2) and Q $\left(\frac{5}{3}, b\right)$ trisect the line segment joining the points A(3, -4) and B(1, 2)

$\because$ P divides AB in the ratio 1 : 2



Then, $a = \frac{1\times1+2\times3}{1+2} = \frac{1+6}{3} = \frac{7}{3}$

and Q divides AB in the ratio 2 : 1, then

$b = \frac{2\times2+1\times(-4)}{2+1} = \frac{4-4}{3} = 0$

$\therefore a = \frac{7}{3}, b = 0$

8. **(a)** 20^o, 30^o.

Explanation:

In triangle ABC, $\angle A + \angle B + \angle C = 180^\circ$

$\Rightarrow \angle A + 30^\circ + 20^\circ = 180^\circ$

$\Rightarrow \angle A = 130^\circ$

In triangle ABC and QRP, $\frac{AB}{QR} = \frac{AC}{PQ}$

$\Rightarrow \frac{45}{5} = \frac{63}{7}$ => $\frac{9}{1} = \frac{9}{1}$

Since sides of triangles ABC and QRP are proportional, and included angles are equal, therefore by SAS similarity criteria ,$\Delta ABC \sim \Delta QRP$

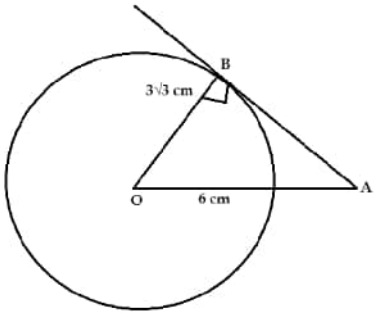
$\angle A = \angle Q, \angle B = \angle R, \angle C = \angle P$

$\Rightarrow \angle P = 20^\circ, \angle R = 30^\circ$

9.

(d) 3 cm

Explanation:



AB is tangent with center O $\therefore$ OB $\perp$ AB

OA = 6 cm

OB = $3\sqrt{3}$ cm.

$\because \triangle OBA$ is Right angled $\triangle$.

$\therefore OA^2 = OB^2 + AB^2$

$(6)^2 = (3\sqrt{3})^2 + AB^2$

$AB^2 = 36 - 27$

$AB^2 = 9$

$AB = \sqrt{9}$

$AB = \pm 3$ cm

$\therefore$ AB = 3 cm

Hence length of tangent = 3 cm.

10. **(a)** 8 cm

Explanation:

8 cm

11. **(a)** $\sec^2\theta - \tan^2\theta = 1$

Explanation:

$\because \sec^2\theta = 1 + \tan^2\theta$

$\therefore \sec^2\theta - \tan^2\theta = 1$

12. **(a)** $\frac{7}{17}$

Explanation:

$8 \tan x = 15 \Rightarrow \tan x = \frac{15}{8} = \frac{\text{Perpendicular}}{\text{Base}}$

By Pythagoras Theorem,

$(\text{Hyp.})^2 = (\text{Base})^2 + (\text{Perp.})^2$

$= (8)^2 + (15)^2$

$= 64 + 225 = 289 = (17)^2$

$\therefore$ Hyp. = 17 units

$\therefore \sin x = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{15}{17}$

$\cos x = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{8}{17}$

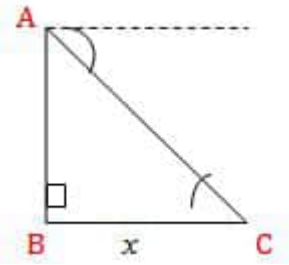
$\sin x - \cos x = \frac{15}{17} - \frac{8}{17} = \frac{15-8}{17}$

$= \frac{7}{17}$

13.

(d) 100 m

Explanation:



Let the distance of the car from the tower be $x$meters.

$\therefore \tan 45^\circ = \frac{AC}{BC}$

$\Rightarrow 1 = \frac{100}{x}$ m

$\Rightarrow x = 100$ m

Therefore, the distance of the car from the tower is 100 m.

14.

(b) 1 : 4

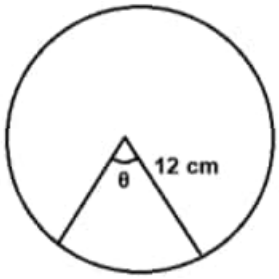
Explanation:

1 : 4

15.

(b) 150^o

Explanation:



area of sector = 60 π cm^2

Let centre angle = θ

area $= \frac{\theta}{360} \times \pi r^2$

$\frac{60 \times 360^\circ}{12 \times 12} = \theta$

= 150^o = θ

Central angle = 150^o

16.

(d) $\frac{3}{4}$

Explanation:

The possible outcomes when two coins are tossed together are {HH, TT, HT, TH}.

the number of possible outcomes when two coins are tossed is 4 .

Now, the possible outcomes of getting at least one tail are {TT,HT, TH}}, which means the number of favourable outcome is 3 .

P = $\frac{3}{4}$

Hence, the probability of getting at least one tail is $\frac{3}{4}$.

17.

(b) $\frac{1}{2}$

Explanation:

Number of possible outcomes = {6, 7, 8, 9, 10} = 5

Number of total outcomes = 10

$\therefore$ Required Probability = $\frac{5}{10} = \frac{1}{2}$

18.

(c) Median

Explanation:

Median

19.

(d) A is false but R is true.

Explanation:

A is false but R is true.

20.

(d) A is false but R is true.

Explanation:

Assertion: Even natural numbers divisible by 5 are 10, 20, 30, 40, ...

They form an A.P. with,

a = 10, d = 10

$S_{100} = \frac{100}{2}[2(10) + 99(10)] = 50500$

So, reason is correct.

Section B

21. Given numbers are: 17, 23 and 29

Since the three numbers are prime, we have

17 = 1 × 17

23 = 1 × 23

29 = 1 × 29

$\Rightarrow$ HCF = 1

and LCM = 17 × 23 × 29 = 11339

OR

LCM of (4,7,13) = 364

Largest 4 digit number = 9999

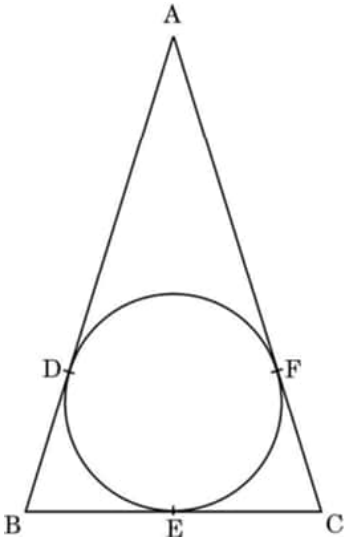
On dividing 9999 by 364 we get remainder as 171

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. ABC is an isosceles triangle.



According to the question, AB = AC ...(i)

AD = AF (Tangents from A) ...(ii)

AB - AD = AC - AF

$\Rightarrow$ BD = CF ...(iii)

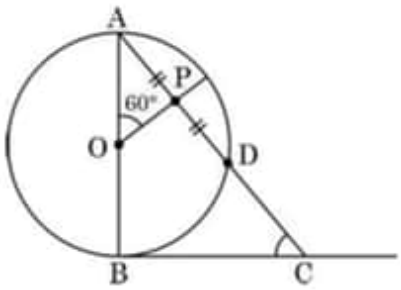
Now, BD = BE (Tangents from B)

Also, CF = CE (Tangents from C)

$\Rightarrow$ BE = CE

So, BC is bisected at the point of contact E.

23. Since, OP bisects the chord AD, therefore $\angle OPA = 90^o$... [$\because$ The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord]



Now, In $\triangle$AOP

$\angle$A = 180^o - 60^o - 90^o

= 120^o - 90^o

= 30^o

Also, we know that the tangent at any point of a circle is perpendicular to the radius through the point of contact

$\therefore \angle ABC = 90^o$

Now, In $\triangle$ABC,

$\angle C = 180^o - \angle A - \angle B$

= 180^o - 30^o - 90^o

= 150^o - 90^o

= 60^o

24. LHS = $\frac{\sin\theta}{1+\cos\theta} + \frac{1+\cos\theta}{\sin\theta}$

= $\frac{\sin\theta \times \sin\theta}{(1+\cos\theta)\times\sin\theta} + \frac{(1+\cos\theta)\times(1+\cos\theta)}{\sin\theta\times(1+\cos\theta)}$

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

Using the Pythagorean identity $\cos^2\theta + \sin^2\theta = 1$

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

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

$= \frac{2}{sin\theta}$

Now $\frac{1}{sin\theta}$ = cosec θ

= 2 cosec θ.

OR

Let us draw a right triangle ABC.

15 cot A = 8 ..... Given

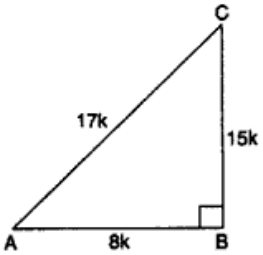
$\Rightarrow \cot A = \frac{8}{15} \Rightarrow \frac{AB}{BC} = \frac{8}{15}$

$\Rightarrow \frac{AB}{8} = \frac{BC}{15} = k(5ay)$

where k is a positive number

$\Rightarrow AB = 8k$

BC = 15k



By using the Pythagoras theorem, we have

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

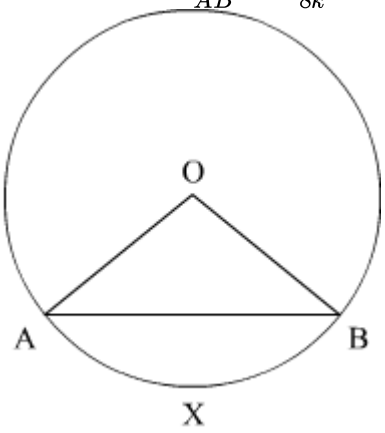
$\Rightarrow AC^2 = (8k)^2 + (15k)^2 \Rightarrow AC^2 = 64k^2 + 225k^2$

$\Rightarrow AC = \sqrt{289k^2} \Rightarrow AC = 17k$

Now, $\sin A = \frac{BC}{AC} = \frac{15k}{17k} = \frac{15}{17}$

and, $\sec A = \frac{AC}{AB} = \frac{17k}{8k} = \frac{17}{8}$

25.



In this figure, centre of the circle is O, radius $OA = r$ and $\angle AOB = \theta$

We are going to find the area of the segment AXB.

Area of the segment AXB = Area of the sector OAXB - Area of ΔAOB ....(i)

We know that area of sector $OAXB = \frac{\theta}{360} \times \pi r^2$

We also know that area of $\Delta AOB = r^2 \sin\frac{\theta}{2}\cos\frac{\theta}{2}$

Substituting these values in equation (1) we get,

Area of the segment $AXB = \frac{\theta}{360} \times \pi r^2 - r^2 \sin\frac{\theta}{2}\cos\frac{\theta}{2}$

Area of the segment $AXB = \left(\frac{\theta}{360} \times \pi - \sin\frac{\theta}{2}\cos\frac{\theta}{2}\right) r^2$

So, Area of the segment $AXB = \left(\frac{\pi\theta}{360} - \sin\frac{\theta}{2}\cos\frac{\theta}{2}\right) r^2$

Therefore, area of the segment is $\left(\frac{\pi\theta}{360} - \sin\frac{\theta}{2}\cos\frac{\theta}{2}\right) r^2$

Section C

26. To make all the plates identical and find the greatest number of plates, we have to find the greatest number which can divide 12 and 16 exactly.
That is nothing but H.C.F of 12 and 16.
H.C.F of (12, 16) = 4
That is, 12 pieces of chicken would be served in 4 plates at the rate of 3 pieces per plate.
And 16 rolls would be served in 4 plates at the rate of 4 rolls per plate.
In this way, each of the 4 plates would have 3 pieces of chicken and 4 rolls. And all the 4 plates would be identical.
Hence, the greatest number of plates Lenin can prepare is 4.

27. Here, p(x) = $3x^2$ - 2.
Now p(x) = 0

$\Rightarrow \quad 3x^2 - 2 = 0$

$\Rightarrow 3x^2 = 2$

$\Rightarrow \quad x^2 = \frac{2}{3}$

$\Rightarrow x = \pm\sqrt{\frac{2}{3}}$

Therefore, zeroes are $\sqrt{\frac{2}{3}}$ and $-\sqrt{\frac{2}{3}}$.

If p(x) = $3x^2$ - 2 , then a = 3, b = 0 and c = -2

Now, sum of zeroes = $\sqrt{\frac{2}{3}} + \left(-\sqrt{\frac{2}{3}}\right) = 0$ .... (i)

Also, $\frac{-b}{a} = \frac{-0}{3} = 0$ ..... (ii)

From (i) and (ii)

Sum of zeroes$= \frac{-b}{a}$

and product of zeroes = $\sqrt{\frac{2}{3}} \times -\sqrt{\frac{2}{3}} = \frac{-2}{3}$ ..... (iii)

Also, $\frac{c}{a} = \frac{-2}{3}$..... (iv)

From (iii) and (iv)

Product of zeroes = $\frac{c}{a}$

28. Observations in ascending order are:

29, 32, 48, 50, x, x + 2, 72, 78, 84, 95

Number of observations = n = 10 (even)

$$\Rightarrow \text{ Median } = \frac{\text{Value of } \left(\frac{n}{2}\right)^{th} \text{ observation} + \text{Value of } \left(\frac{n}{2}+1\right)^{th} \text{ observation}}{2}$$

$$\Rightarrow 63 = \frac{\text{Value of } \left(\frac{10}{2}\right)^{th} \text{ observation} + \text{Value of } \left(\frac{10}{2}+1\right)^{th} \text{ observation}}{?}$$

$\Rightarrow$ 126 = Value of 5^{th} observation + Value of 6^{th} observation

$\Rightarrow$ 126 = x + (x + 2)

$\Rightarrow$ 126 = 2x + 2

$\Rightarrow$ 2x = 124

$\Rightarrow$ x = 62

29. Let the constant expenditure be Rs.x

And consumption of wheat be y quintals

Then total expenditure =x + y $\times$Rate per quintal

According to the question,

$1000 = x + 250y$ ...(i)

$980 = x + 240y$ ...(ii)

Subtracting (ii) from (i), we get $y = 2$.

Putting $y = 2$ in (i), we get

$1000 = x + 2 \times 250$

$\Rightarrow 1000 = x + 500$

$\Rightarrow x = 1000 - 500 = 500$

Total expenses when the price of wheat is Rs.350 per quintal $= 500 + 350 \times 2 = 500 + 700 = Rs.1,200$

OR

$3x - 4y = 7 \; and \; 5x + 2y = 3$

The given system of linear equation is $3x - 4y = 7 \; and \; 5x + 2y = 3$

Now, $3x - 4y = 7$

$y = \frac{3x-7}{4}$

When x = 1 then, y = -1

When x = -3 then y = -4

x	1	-3
y	-1	-4

Now, 5x + 2y = 3

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

When x = 1 then, y = -1

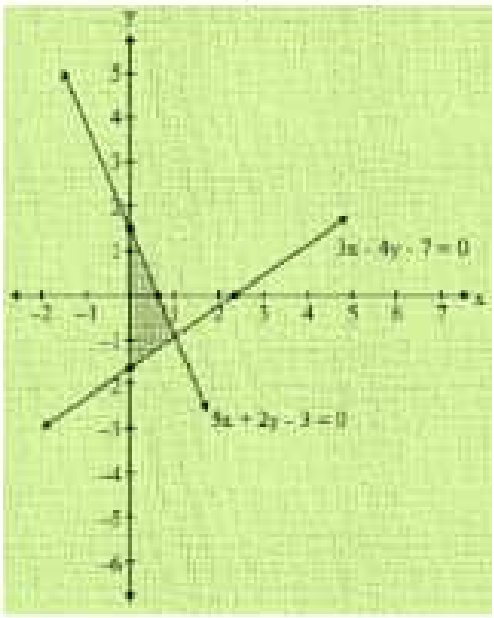
When x = 3 then y = -6

Thus, we have the following table

x	1	3

y	-1	-6

Graph of the given system of equations are



Clearly the two lines intersect at A(1, -1)

Hence, x = 1 and y = -1 is the solution of the given system of equations.

30. $\text{LHS} = \frac{\tan\theta}{1+\frac{1}{\tan\theta}} + \frac{\frac{1}{\tan\theta}}{1+\tan\theta}$

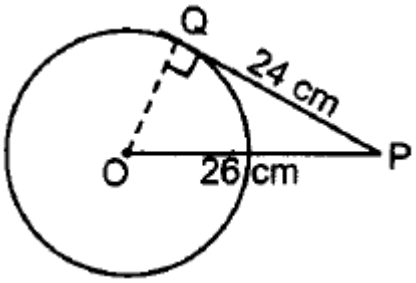
$= \frac{\tan^2\theta}{1+\tan\theta} + \frac{1}{\tan\theta(1+\tan\theta)}$

$= \frac{1+\tan^3\theta}{\tan\theta(1+\tan\theta)}$

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

$= \cot\theta + \tan\theta - 1 = \text{RHS}$

31.



According to the question, $OP = 26\ cm\ and\ PQ = 24\ cm$

In $\triangle$OQP, we have $\angle$Q = 90°

$\text{OP}^2 = \text{OQ}^2 + \text{PQ}^2$

$\Rightarrow (26)^2 = \text{OQ}^2 + (24)^2$

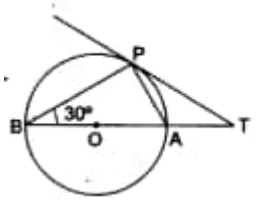
$\Rightarrow \text{OQ}^2 = 676 - 576 = 100$

$\Rightarrow \quad OQ = 10\text{cm}$

$\therefore$ Radius of the circle$= 10cm$

OR

O is the centre of the circle and TP is the tangent to the circle from an external point T.



From figure,

AB is the diameter

Since, angle in a semicircle is a right angle

$\angle APB = 90^\circ$

By using alternate segment theorem

We have $\angle APB = \angle PAT = 30^\circ$

Now, in $\triangle$APB

$\angle$BAP + $\angle$APB + $\angle$ABP $= 180^\circ$ (Angle sum property of triangle)

$\angle$BAP = 180° - 90° - 30° = 60°

Now, $\angle$BAP = $\angle$APT + $\angle$PTA (Exterior angle property)

60° = 30° + $\angle$PTA

$\angle PTA = 60^\circ - 30^\circ = 30^\circ$

We know that sides opposite to equal angles are equal

AP = AT

In right triangle ABP,

$\sin 30^\circ = \frac{\text{AT}}{\text{BA}}$

$\Rightarrow \frac{1}{2} = \frac{\text{AT}}{\text{BA}}$

$\therefore BA : AT = 2 : 1$

Section D

32. Calculation of mean:

Class	$\mathbf{f_i}$	$\mathbf{x_i}$	$u_i = \frac{x_i - a}{h}$	$\mathbf{f_i u_i}$
0 - 10	3	5	-5	-15
10- 20	5	15	-4	-20
20 - 30	7	25	-3	-21
30 - 40	10	35	-2	-20
40 - 50	12	45	-1	-12
50 - 60	15	55	0	0
60 - 70	12	65	1	12
70 - 80	6	75	2	12
80 - 90	2	85	3	6
90 -100	8	95	4	32
	$\Sigma f_i = 80$			$\Sigma f_i u_i = -26$

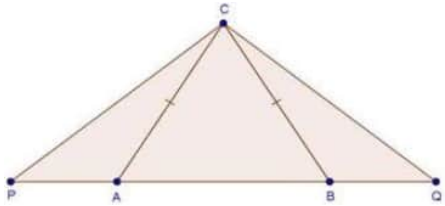
$a = 55 \; and \; h = 10$

We know that, Mean = $a + \left(\frac{\Sigma f_i u_i}{\Sigma f_i}\right) \times h$

=$55 + \left(\frac{-26}{80}\right) \times 10$

$= 55 - 3.25 = 51.75$

33. Given:- In ΔABC, CA = CB and AP $\times$ BQ = AC^2



To prove:- ΔAPC ~ ΔBCQ

Proof:- AP $\times$ BQ = AC^2 [Given]

$\Rightarrow AP \times BQ = AC \times AC$

$\Rightarrow AP \times BQ = AC \times BC$ [AC = BC given]

$\Rightarrow \frac{AP}{BC} = \frac{AC}{BQ}$ ....(i)

Since, CA = CB [Given]

Therefore, $\angle CAB = \angle CBA$ ...(ii) [Opposite angles to equal sides]

Now, $\angle CAB + \angle CAP = 180^\circ$ ...(iii) [Linear pair of angles]

And, $\angle CBA + \angle CBQ = 180^\circ$ ...(iv) [Linear pair of angles]

Therefore, Comparing equation (ii)(iii) and (iv),we get,

$\angle CAP = \angle CBQ$ ...(v)

In ΔAPC and ΔBCQ

$\angle CAP = \angle CBQ$ [From (v)]

$\frac{AP}{BC} = \frac{AC}{BQ}$ [From (i)]

Therefore,by SAS criteria of similar triangles,we have,

Then, ΔAPC ~ ΔBCQ

34. Given that a train travelling at a uniform speed for 360 km

Let the original speed of the train be x km/hr

Time taken $= \frac{\text{Distance}}{\text{Speed}} = \frac{360}{x}$

Time taken at increased speed $= \frac{360}{x+5}$ hours.

According to the question

$\frac{360}{x} - \frac{360}{x+5} = \frac{48}{60}$

$360\left[\frac{1}{x} - \frac{1}{x+5}\right] = \frac{4}{5}$

$or, \frac{360(x+5-x)}{x^2+5x} = \frac{4}{5}$

$or, \frac{1800}{x^2+5x} = \frac{4}{5}$

$\Rightarrow \quad x^2 + 5x - 2250 = 0$

$\Rightarrow \quad x^2 + (50 - 45)x - 2250 = 0$

$\Rightarrow \quad x^2 + 50x - 45x - 2250 = 0$

$\Rightarrow \quad (x + 50)(x - 45) = 0$

Either x = - 50 or x = 45

As speed cannot be negative

$\therefore$ Original speed of train = 45 km/hr.

OR

$\frac{3(3x-1)-2(x+1)}{(x+1)(3x-1)} = \frac{1}{2}$

$\Rightarrow 14x - 10 = 3x^2 + 2x - 1$

$\Rightarrow x^2 - 4x + 3 = 0$

$\Rightarrow (x - 1)(x - 3) = 0$

$\Rightarrow x = 1, x = 3$

35. Diameter of cone $= 14\ cm$

Radius $= 7\ cm$

Height of cone $= 14\ cm$

Slant height $l = \sqrt{14^2 + 7^2} = 7\sqrt{5} = 15.4\ cm$

Volume of remaining solid = Volume of cube - Volume of cone

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

$= \frac{6076}{3} cm^3$

Surface area of remaining solid = Surface area of cube - Area of circle + Curved surface area of cone

$= 6 \times 14 \times 14 - \frac{22}{7} \times 7 \ \times 7 + \frac{22}{7} \times 7 \times 15.4$

$= 1360.8 cm^2$

OR

Given, radius of cone = radius of hemisphere

= r

= 7 cm

Height of cone (h) = 2 × radius

= 2 × 7

= 14 cm

Volume of solid = Volume of cone + Volume of hemisphere

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

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

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

$= \frac{4}{3}\pi r^3$

$= \frac{4}{3} \times \frac{22}{7} \times 7 \times 7 \times 7$

$= \frac{4312}{3}$

= 1437.33 cm^3

Section E

36. Clearly, the amount of installment in the first month is 1000, which increases by Rs100 every month

therefore, installment amount in second month=Rs 1100, third month=Rs1200, fourth month=1300 ..... which forms an AP, with first term, a = 1000 and common difference, d=1100-1000= 100

(i) Amount Paid in 4th installment will be 1400.

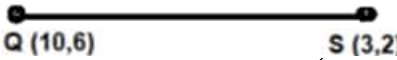
(ii) Now, amount paid in the 30th installment,

$a_{30} = 1000 + (30-1)100 = 3900 \ \{a_n = a + (n-1)d\}$

(iii) Amount paid in 30 installments,

$S_{30} = \frac{30}{2}[2 \times 1000 + (30-1)100] = 73500$

(iv) Hence, the remaining amount of the loan that he has to pay = 118000 - 73500 = 44500 Rupees

37. i. 

Middle point of QS = $\left(\frac{10+3}{2}, \frac{6+2}{2}\right)$

= (6.5, 4)

ii. Length = RS = $\sqrt{(10-3)^2 + (2-2)^2}$

RS = $\sqrt{7^2 + 0}$

RS = 7 m

Breadth = RQ = $\sqrt{(10-10)^2 + (2-6)^2}$

$= \sqrt{0 + 16}$

= 4 m

iii. Area of rectangle = l × b

= 7 × 4

= 28 m^2

OR

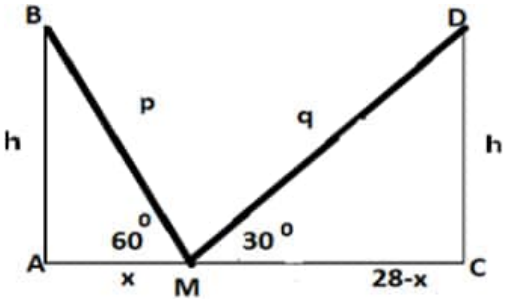
Diagonal = $\sqrt{l^2 + b^2}$

$= \sqrt{7^2 + 4^2}$

$= \sqrt{49 + 16}$

$= \sqrt{65}$

38. i. Let AB and CD be the 2 poles and M be a point somewhere between their bases in the same line.



ii. $\tan 60^o = \frac{h}{x} \Rightarrow h = x\sqrt{3}$

$\tan 30^o = \frac{h}{28-x} \Rightarrow h = \frac{(28-x)}{\sqrt{3}}$

$\therefore h = 7\sqrt{3}$ m

iii. BM = p and DM = q

$\sin 60^o = \frac{h}{p} \Rightarrow h = \frac{p\sqrt{3}}{2}$

$\sin 30^o = \frac{h}{q} \Rightarrow h = \frac{q}{2}$

$\therefore \frac{p\sqrt{3}}{2} = \frac{q}{2} \Rightarrow q = \sqrt{3}p$

OR

$\tan 60^o = \frac{7\sqrt{3}}{x} \Rightarrow x = 7m = AM$

MC = 28 - x = 21m