Class X Session 2025-26
Subject - Mathematics (Basic)
Sample Question Paper - 07

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. The prime factorisation of 1728 is **[1]**

a) $2^5 \times 3^4$ b) $2^6 \times 3^2$

c) $2^5 \times 3^3$ d) $2^6 \times 3^3$

2. $7 \times 11 \times 13 + 13$ is a/an: **[1]**

a) odd number but not composite b) composite number

c) prime number d) square number

3. If x = 1 is a common root of $ax^2 + ax + 2 = 0$ and $x^2 + x + b = 0$ then, ab **[1]**

a) 2 b) 4

c) 1 d) 3

[1]

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4. The graph of a pair of linear equations $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ in two variables x and y represents parallel lines, if

a) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

b) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

c) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$

d) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

5. A two digit number is such that the product of the digits is 12. When 36 is added to the number then the digits interchange their places. The number is **[1]**

a) 26

b) 43

c) 34

d) 62

6. Two vertices of $\triangle$ABC are A (-1, 4) and B(5, 2) and its centroid is G(0, -3). Then, the coordinates of C are **[1]**

a) (4, 15)

b) (-4, -15)

c) (-15, -4)

d) (4, 3)

7. In a triangle, ABC, the triangle bisector of the angle A meets BC at D. If AB = 4, AC = 3 and $\angle$ A = 60^o, then length of AD is: **[1]**

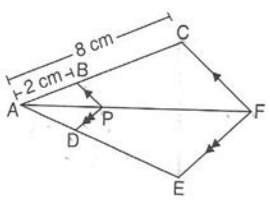
a) $(15\sqrt{3})/8$

b) $(12\sqrt{3})/7$

c) $(6\sqrt{3})/7$

d) $2\sqrt{3}$

8. In the given figure if $BP||CF$, $DP||EF$,then AD : DE is equal to **[1]**



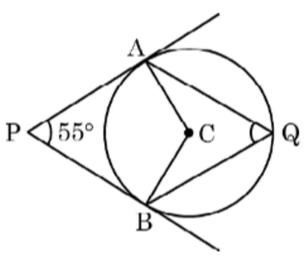
a) 1 : 4

b) 2 : 3

c) 1 : 3

d) 3 : 4

9. In the given figure, PA and PB are tangents from external point P to a circle with centre C and Q is any point on the circle. Then the measure of $\angle AQB$ is **[1]**



a) 125^o

b) $62\frac{1}{2}^o$

c) 55^o

d) 90^o

10. If $cosec\,\theta = \sqrt{10}$ then sec θ = ? **[1]**

a) $\frac{1}{\sqrt{10}}$

b) $\frac{\sqrt{10}}{3}$

c) $\frac{3}{\sqrt{10}}$

d) $\frac{2}{\sqrt{10}}$

11. A monkey is climbing a 10 m long rope which is tightly stretched and tied from the top of a vertical pole to the ground. If the angle made by the rope with the ground level is 45^o, then the height of pole is **[1]**

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a) 25 m

b) $5\sqrt{2}$ m

c) 15 m

d) 20 m

12. If $\tan \theta = 0$, then the value of $\sin \theta + \cos \theta$ is **[1]**

a) 1

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

c) 0

d) not defined

13. If the area of a sector of a circle is $\frac{1}{8}$ of the area of the circle, then the central angle of the sector is: **[1]**

a) 60^o

b) 90^o

c) 45^o

d) 30^o

14. On a square handkerchief, nine circular designs each of radius 7 cm are made. The area of the remaining portion of the handkerchief is **[1]**

a) 300 sq. cm

b) 375 sq. cm

c) 378 sq. cm

d) 200 sq. cm

15. From a well-shuffled deck of 52 playing cards, a card is drawn at random. What is the probability of getting a red queen? **[1]**

a) $\frac{1}{26}$

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

c) $\frac{1}{13}$

d) $\frac{3}{26}$

16. If the mean of a frequency distribution is 8.1 and $\sum f_i x_i = 132 + 5k$, $\sum f_i = 20$ then k = **[1]**

a) 5

b) 3

c) 6

d) 4

17. If a marble of radius 2.1 cm is put into a cylindrical cup full of water of radius 5cm and height 6 cm, then how much water flows out of the cylindrical cup? **[1]**

a) 471.4 cm^3

b) 19.4 cm^3

c) 55.4 cm^3

d) 38.8 cm^3

18. Consider the frequency distribution of the heights of 60 students of a class: **[1]**

Height (in cm)	No. of Students	Cumulative Frequency
150-155	16	16
155-160	12	28
160-165	9	37
165-170	7	44
170-175	10	54
175-180	6	60

The sum of the lower limit of the modal class and the upper limit of the median class is

a) 315

b) 320

c) 310

d) 330

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19. **Assertion (A):** The point (0,-3) lies on the y-axis. **[1]**

Reason (R): The x - coordinate of the point on y-axis is zero.

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):** If a number x is divided by y(x, y) (both x and y are positive) then remainder will be less than x. **[1]**

Reason (R): Dividend = Divisor $\times$ Quotient + Remainder.

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.

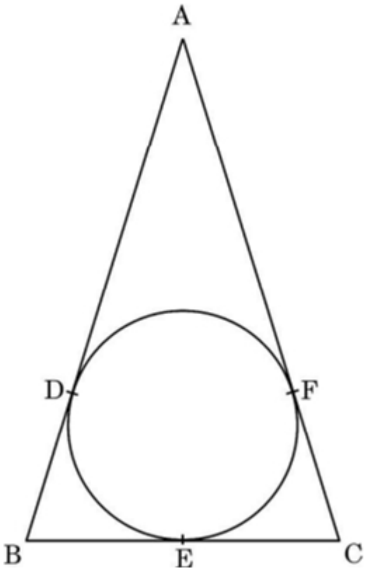
c) A is true but R is false.

d) A is false but R is true.

Section B

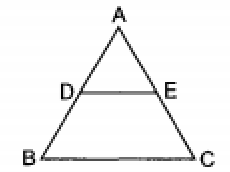
21. Two rails are represented by the equations: x + 2y – 4 = 0 and 2x + 4y – 12 = 0. Will the rails cross each other? **[2]**

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



OR

In figure, D and E are points on AB and AC respectively, such that DE || BC. If AD = $\frac{1}{3}$BD, AE = 4.5 cm, find AC.



23. If a circle touches the side BC of a triangle ABC at P and extended sides AB and AC at Q and R, respectively, prove that **[2]**

AQ = $\frac{1}{2}$(BC + CA + AB)

24. Prove that: $\frac{1}{\sec A+\tan A}-\frac{1}{\cos A}=\frac{1}{\cos A}-\frac{1}{\sec A-\tan A}$ **[2]**

25. To warm ships for underwater rocks, a lighthouse spreads a red coloured light over a sector of angle 80° to a distance of 16.5 km. Find the area of the sea over which the ships are warned. (use $\pi = 3.14$) **[2]**

OR

Find the area of the sector of a circle of radius 5 cm, if the corresponding arc length is 3.5 cm.

Section C

26. Prove that $\sqrt{5}$ is irrational. **[3]**

27. In equilateral $\triangle$ABC , coordinates of points A and B are (2,0) and (5,0) respectively. Find the co-ordinates of **[3]**

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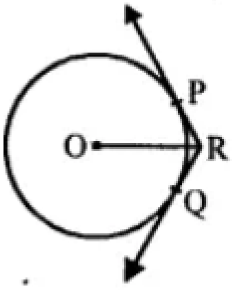
the other two vertices.

28. Solve 2x + 3y = 11 and 2x – 4y = –24 and hence find the value of **m** for which y = mx + 3. **[3]**

OR

Half of the difference between two numbers is 2. The sum of the greater number and twice the smaller number is 13. Find the numbers.

29. In the given figure, two tangents RQ and RP are drawn from an external point R to the circle with centre O. If $\angle PRQ = 120°$, then prove that OR = PR + RQ. **[3]**



30. In $\triangle ABC$, right angled at B, AB = 24 cm, BC = 7 cm. Determine: **[3]**

i. Sin A cos A
ii. Sin C cos C

OR

If $cosec\ \theta = \frac{13}{12}$ find the value of $\frac{2\sin\theta - 3\cos\theta}{4\sin\theta - 9\cos\theta}$

31. A piggy bank contains hundred 50 paise coins, fifty ₹1 coins, twenty ₹2 coins and ten ₹5 coins. If it is equally likely that one of the coins will fall out when the bank is turned upside down, find the probability that the coin which fell **[3]**

i. will be a 50 paise win
ii. will be of value more than ₹1
iii. will be of value less than ₹5
iv. will be a Rs.1 or ₹2 coin

Section D

32. A piece of cloth costs 200 Rupees . If the piece was 5 m longer and each metre of cloth costs 2 Rupees less, the cost of the piece would have remain unchanged. How long is the piece and what is the original rate per metre? **[5]**

OR

The product of Tanay's age (in years) five years ago and his age ten years later is 16. Determine Tanay's present age.

33. The angles of depression of the top and bottom of an 8 m tall building from top of a multistoreyed building are 30^{o} and 45^{o}, respectively. Find the height of multi-storeyed building and distance between two buildings. **[5]**

34. If the sum of the first p terms of an A.P. is q and the sum of the first q terms is p; then show that the sum of the first (p + q) terms is { -(p + q)}. **[5]**

OR

Find the sum of the integers between 100 and 200 that are divisible by 9?

35. If the median of the distribution given below is 28.5, then find the values of x and y. **[5]**

Class Interval	frequency
0-10	5
10-20	x

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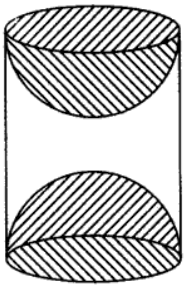
20-30	20
30-40	15
40-50	y
50-60	5
Total	60

Section E

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

A carpenter used to make different kinds and different shapes of a toy of wooden material. One day a man came to his shop to purchase an article that has values as per his requirement. He instructed the carpenter to make the toy by taking a wooden block of rectangular shape with height 12 cm and width 9 cm, then shaping this block as a solid cylinder and then scooping out a hemisphere from each end, as shown in the given figure. The difference between the length of rectangle and height of the cylinder is 2 cm (Rectangle length > Cylinder height), and the difference between the breadth of rectangle and the base of cylinder is also 2 cm (Rectangle breadth > Cylinder base(diameter)).



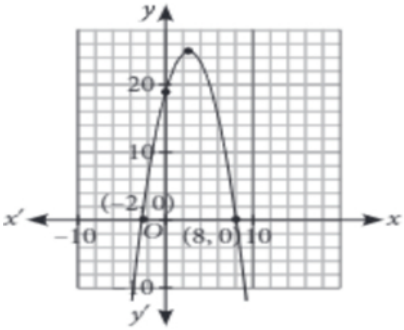
i. Find the volume of the cylindrical block before the carpenter started scooping the hemisphere from it. (1)
ii. Find the volume of wood scooped out? (1)
iii. Find the total surface area of the article? (2)

OR

Find the total surface area of cylinder before scooping out hemisphere? (2)

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

Rachna and her husband Amit who is an architect by profession, visited France. They went to see Mont Blanc Tunnel which is a highway tunnel between France and Italy, under the Mont Blanc Mountain in the Alps, and has a parabolic cross-section. The mathematical representation of the tunnel is shown in the graph.



i. What will be the expression of the polynomial given in diagram? (1)
ii. What is the value of the polynomial, represented by the graph, when x = 4? (1)
iii. If the tunnel is represented by $-x^2 + 3x - 2$. Then what is its zeroes? (2)

OR

What is sum of zeros and product of zeros for $-x^2 + 3x - 2$? (2)

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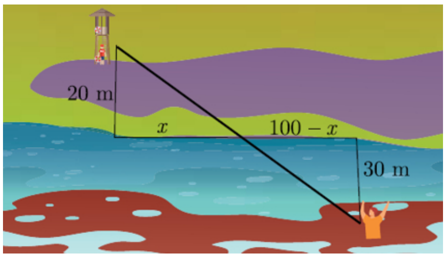
38. **Read the following text carefully and answer the questions that follow:** **[4]**

Swimmer in Distress: A lifeguard located 20 metre from the water spots a swimmer in distress. The swimmer is 30 metre from shore and 100 metre east of the lifeguard. Suppose the lifeguard runs and then swims to the swimmer in a direct line, as shown in the figure.



i. How far east from his original position will he enter the water? (Hint: Find the value of x in the sketch.) (1)

ii. Which similarity criterion of triangle is used? (1)

iii. What is the distance of swimmer from the shore? (2)

OR

What is the length of AD? (2)

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Solution

Section A

1.

(d) $2^6 \times 3^3$

Explanation:

$2^6 \times 3^3$

2.

(b) composite number

Explanation:

We have 7 × 11 × 13 + 13 = 13 (77 + 1) = 13 × 78. Since the given number has 2 more factors other than 1 and itself, therefore it is a composite number.

3. **(a)** 2

Explanation:

Here, $ax^2 + ax + 2 = 0$….. (1)

$x^2 + x + b = 0$….. (2)

Putting the value of x = 1 in equation (2) we get

$1^2 + 1 + b = 0$

2 + b = 0

b = −2

Now, putting the value of x = 1 in equation (1) we get

a + a + 2 = 0

2 a + 2 = 0

$a = \frac{-2}{2}$

= - 1

Then,

ab = (−1) × (−2) = 2

4.

(b) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Explanation:

Pair of linear equations

$a_1x + b_1y + c_1 = 0$

$a_2x + b_2y + c_2 = 0$

in two variables x and y represents. parallel lines, then there does not exist any solution, for Which,

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

5. **(a)** 26

Explanation:

Let the digit at the units place be x.

The digit at the tens place is $\frac{12}{x}$.

Original Number = $10\text{x}\frac{12}{x}+x$ = $\frac{120}{x}+x$

Reverse Number = 10 x x + $\frac{12}{x}$ = $10x$ + $\frac{12}{x}$.

Now, Reverse Number = Original Number + 36

=> $10x + \frac{12}{x}$ = $\frac{120}{x} + x + 36$

=> $9x + \frac{12}{x} - \frac{120}{x} - 36 = 0$

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=> $\frac{9x^2-108-36x}{x}=0$
=> $9x^2-36x-108=0$
=> $x^2-4x-12=0$
=> $x^2-6x+2x-12=0$
=> $x(x-6)+2(x-6)=0$
=> $(x-6)(x+2)=0$
=> $x-6=0$ or $x+2=0$
=> $x=6$ or $x=-2$ (But x cannot be -2)
Digit at the units place = 6
Digit at the tens place = $\frac{12}{6}$ =2
Thus, the original number = 26

6.

(b) (-4, -15)
Explanation:
Let the vertex C be C (x,y). Then
$\frac{-1+5+x}{1}=0$ and $\frac{4+2+y}{3}=-3 \Rightarrow x+4=0$ and $6+y=-9$
$\therefore \quad x=-4$ and $y=-15$
so, the coordinates of C are (-4, -15).

7.

(b) $(12\sqrt{3})/7$
Explanation:
$(12\sqrt{3})/7$

8.

(c) 1 : 3
Explanation:
Since BP$\|$CF,
Then, $\frac{AP}{PF}=\frac{AB}{BC}$ [Using Thales Theorem]
$\Rightarrow \frac{AP}{PF}=\frac{2}{6}=\frac{1}{3}$
Again, since DP$\|$ EF,
Then, $\frac{AP}{PF}=\frac{AD}{DE}$ [Using Thales Theorem]
$\Rightarrow \frac{AD}{DE}=\frac{1}{3}$
$\Rightarrow$ AD : DE = 1 : 3

9.

(b) $62\frac{1}{2}^{o}$
Explanation:
Given, $\angle$APB = 55^o
$\therefore$ $\angle$ACB = 180^o - 55^o = 125^o ...($\because$ $\angle$APB and $\angle$ACB are supplementary angles)
Now, as we know that
Angle subtended by an arc at the centre = 2 $\times$ angle subtended by arc at any point on the remaining part of the circle
$\therefore$ 125^o = 2 $\times$ $\angle$AQB
$\Rightarrow$ $\angle$AQB = $\frac{125}{2}$
= 62.5^o or $62\frac{1}{2}^{o}$

10.

(b) $\frac{\sqrt{10}}{3}$

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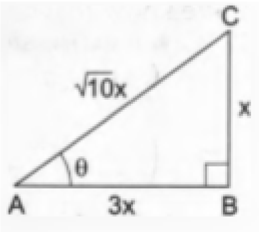
Explanation:



$cosec\theta = \frac{AC}{BC} = \frac{\sqrt{10}}{1} = \frac{\sqrt{10}x}{x} \Rightarrow AC = \sqrt{10x}$ and BC = x.

$\therefore$ $AB^2 = AC^2 - BC^2 = (\sqrt{10}x)^2 - (x^2) = 10x^2 - x^2 = 9x^2$

$\Rightarrow AB = \sqrt{9x^2} = 3x$

$\therefore \sec\theta = \frac{AC}{AB} = \frac{\sqrt{10}x}{3x} = \frac{\sqrt{10}}{3}$

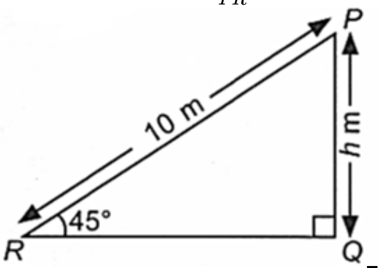
11.

(b) $5\sqrt{2}$ m

Explanation:

Let PR = 10 m be the length of rope and PQ = h m be the height of pole.

In $\triangle$POP, sin $45^o = \frac{PQ}{PR}$



$\Rightarrow \frac{1}{\sqrt{2}} = \frac{h}{10} \Rightarrow h = \frac{10}{\sqrt{2}} = \frac{10}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = 5\sqrt{2}$

Hence, the height of the pole is $5\sqrt{2}$ m

12. **(a)** 1

Explanation:

Tan θ = 0

Tan θ = Tan 0^o

$\theta = 0^o$

Now

sin 0^o + cos 0^o = 0 + 1

= 1

13.

(c) 45^o

Explanation:

Given

$\frac{\text{area of sector}}{\text{area of circle}} = \frac{1}{8}$

$\frac{\frac{\theta}{360^\circ} \times \pi r^2}{\pi r^2} = \frac{1}{8}$

$\frac{\theta}{360^\circ} = \frac{1}{8}$

$\theta = \frac{360^\circ}{8}$

$\theta = 45^\circ$

14.

(c) 378 sq. cm

Explanation:

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Here Side of square ABCD = AB = 3 $\times$ diameter of circular design

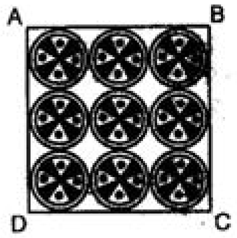
$\Rightarrow$ AB = $3 \times (2 \times 7) = 42\ cm$

$\therefore$ Area of square = 42 $\times$ 42 = 1764 cm^2

And Area of one circular design = πr^2 = $\frac{22}{7} \times 7 \times 7$ = 154 sq. cm

$\therefore$ Area of 9 circular designs = 154 $\times$ 9 = 1386 sq. cm

$\therefore$ Area of remaining portion of handkerchief= 1764 - 1386 = 378 sq. cm



15. **(a)** $\frac{1}{26}$

Explanation:

Red Queens = Diamond Queen + Heart Queen = 2

Number of possible outcomes = 2

Number of Total outcomes = 52

$\therefore$ Required Probability = $\frac{2}{52} = \frac{1}{26}$

16.

(c) 6

Explanation:

Mean = 8.1

$\Sigma f_i x_i$ = 132 + 5k

$\sum f_i$ = 20

$\therefore$ Mean = $\frac{\Sigma f_i x_i}{\Sigma f_i}$ $\Rightarrow$ 8.1 = $\frac{132+5k}{20}$

$\Rightarrow$ 132 + 5k = 8.1 $\times$ 20 = 162

$\Rightarrow$ 5k = 162 - 132 = 30

$\Rightarrow$ k = $\frac{30}{5}$ = 6

17.

(d) 38.8 cm^3

Explanation:

We have,

radius of spherical marble = r = 2.1 cm

Now, volume of spherical marble $= \frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times \frac{21}{10} \times \frac{21}{10} \times \frac{21}{10} = 38.808 cm^3$

When a marble is dropped into the cylindrical cup full of water, then

volume of water that flows out of the cup = volume of marble = 38.808 cm^3

18. **(a)** 315

Explanation:

Class having maximum frequency is the modal class.

hence, modal class : 150-155

$\therefore$ Lower limit of the modal class = 150

Also, $N = 60 \Rightarrow \frac{N}{2} = 30$

The cumulative frequency just greater than 30 is 37.

Hence, the median class is 160-165.

$\therefore$ Upper limit of the median class = 165

Required sum = 150 + 165 = 315

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

Explanation:

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

20.

(d) A is false but R is true.

Explanation:

Remainder is less than by divisor not by divident.

Section B

21. The pair of linear equations are given as:

x + 2y – 4 = 0 ...(i)

2x + 4y – 12 = 0 ...(ii)

We express x in terms of y from equation (i), to get

x = 4 – 2y

Now, we substitute this value of x in equation (ii), to get

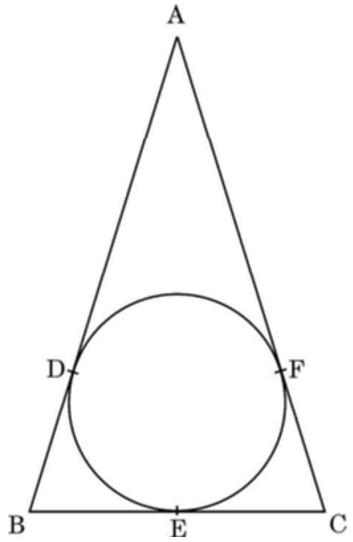
2(4 – 2y) + 4y – 12 = 0

i.e., 8 – 12 = 0

i.e., – 4 = 0

Which is a false statement. Therefore, the equations do not have a common solution. So, the two rails will not cross each other.

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.

OR

According to question it is given that D and E are the points on sides AB and AC respectively

Also AD= $\frac{1}{3}$BD,

AE = 4.5 cm, DE $\parallel$ BC

$\therefore \quad \frac{\mathrm{AD}}{\mathrm{BD}} = \frac{\mathrm{AE}}{\mathrm{EC}}$

$\Rightarrow \quad \frac{\frac{1}{3}\mathrm{BD}}{\mathrm{BD}} = \frac{4.5}{\mathrm{EC}}$

$\Rightarrow \quad \frac{1}{3} = \frac{4.5}{\mathrm{EC}}$

$\Rightarrow \quad \mathrm{EC} = 4.5 \times 3$ cm

$\Rightarrow$ EC = 13.5 cm

Now, AC = AE + EC = 4.5 + 13.5 = 18 cm

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23. AQ = $\frac{1}{2}$(2AQ)

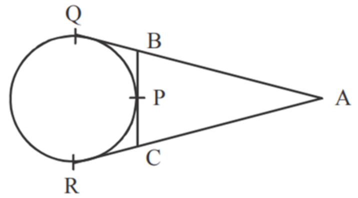
= $\frac{1}{2}$(AQ + AQ)

= $\frac{1}{2}$(AQ + AR)

= $\frac{1}{2}$(AB + BQ + AC + CR)

= $\frac{1}{2}$(AB + BC + CA)

$\because$ [BQ = BP, CR = CP]



24. We have, $\frac{1}{\sec A+\tan A}-\frac{1}{\cos A}=\frac{1}{\cos A}-\frac{1}{\sec A-\tan A}$

$\Rightarrow \frac{1}{\sec A+\tan A}+\frac{1}{\sec A-\tan A}=\frac{1}{\cos A}+\frac{1}{\cos A}$

LHS $=\frac{1}{\sec A+\tan A}+\frac{1}{\sec A-\tan A}$

$=\frac{\sec A-\tan A+\sec A+\tan A}{(\sec A+\tan A)(\sec A-\tan A)}$

$=\frac{2\sec A}{\sec^2 A-\tan^2 A}$ $[\because (a+b)(a-b)=(a^2-b^2]$

$=\frac{2\sec A}{1}$ $[\because \sec^2 A-\tan^2 A=1]$

= 2secA

RHS $=\frac{1}{\cos A}+\frac{1}{\cos A}$

$=\frac{1+1}{\cos A}$

$=\frac{2}{\cos A}$

= 2 secA

LHS = RHS

25. We have, r = 16.5 km and θ = 80°.

Let A be the area of the sea over which the ships are warmed. Then,

$A=\frac{\theta}{360}\times\pi r^2$ = $\frac{80}{360}\times 3.14\times 16.5\times 16.5\ km^2$ = 189.97 km^2

OR

According to the question,

The radius of a circle $=r=5cm$

Arc length $=l=3.5cm$

$\therefore$ Area of sector $=\frac{1}{2}\times l\times r$

$=\frac{1}{2}\times 3.5\times 5$

= 8.75 cm^2

Section C

26. 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 ≠ 0)

Such that $\sqrt{5}=\frac{a}{b}$

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

Squaring both sides, we get

$\Rightarrow$ 5b^2 =a^2 ... (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* = 5*c* for some integer *c* .

Substituting value of *a* in (1) ,

5b^2 = 25c^2

⇒ 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* .

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But, a and b are co-prime .

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

27. In equilateral $\triangle$ABC , coordinates of points A and B are (2,0) and (5,0) respectively.we have to find the co-ordinates of the other two vertices.

Let co-ordinates of C be (x, y)

Since $AC^2 = BC^2$ (sides of equilateral triangle)

$(x - 2)^2 + (y - 0)^2 = (x - 5)^2 + (y - 0)^2$

or, $x^2 + 4 - 4x + y^2 = x^2 + 25 - 10x + y^2$

or, 6x = 21

$x = \frac{7}{2}$

And $(x - 2)^2 + (y - 0)^2 = 9$

or, $\left(\frac{7}{2}-2\right)^2+y^2=9$

or, $\frac{9}{4}+y^2=9$

or, $y^2=\frac{27}{4}=\frac{3\sqrt{3}}{2}$

Hence, C = $\left(\frac{7}{2},\frac{3\sqrt{3}}{2}\right)$

28. The given pair of linear equations

2x + 3y = 11 ...... (1)

2x - 4y = -24 .... (2)

From equation (1), 3y = 11 - 2x

$\Rightarrow \quad y=\frac{11-2x}{3}$

Substituting this value of y in equation (2), we get

$2x-4\left(\frac{11-2x}{3}\right)=-24$

$\Rightarrow 6x-44+8x=-72$

$\Rightarrow 14x-44=-72$

$\Rightarrow 14x=44-72$

$\Rightarrow 14x=-28$

$\Rightarrow x=-\frac{28}{14}=-2$

Substituting this value of x in equation (3), we get

$y=\frac{11-2(-2)}{3}=\frac{11+4}{3}=\frac{15}{3}=5$

Verification, Substituting x = -2 and y = 5, we find that both the equations (1) and (2) are satisfied as shown below:

$2x+3y=2(-2)+3(5)=-4+15=11$

$2x-4y=2(-2)-4(5)=-4-20=-24$

This verifies the solution,

Now, y = axe + 3

$\Rightarrow 5=m(-2)+3$

$\Rightarrow -2m=5-3$

$\Rightarrow -2m=2$

$\Rightarrow$ m $=\frac{2}{-2}=-1$

OR

Let the greater numbers be 'x' and the smaller number 'y'.

It is said that half the difference between the two numbers is 2. So, we can write it as;

$\frac{1}{2}\times$(x - y) = 2

$\Rightarrow$ (x - y) = 4 ...(1)

It is also said that the sum of the greater number and twice the smaller number is 13. So, we can write it as;

x + 2y = 13 ...(2)

Subtracting (2) from (1), we get;

(x - y) - (x + 2y) = 4 - 13

$\Rightarrow$ x - y - x - 2y = - 9

$\Rightarrow$ -3y = -9

$\Rightarrow$ y = $\frac{9}{3}$

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$\Rightarrow$ y = 3

Putting y = 3 in (1), we get;

x - y = 4

$\Rightarrow$ x - 3 = 4

$\Rightarrow$ x = 4 + 3

$\Rightarrow$ x = 7

Hence, the greater number is 7. The smaller number is 3.

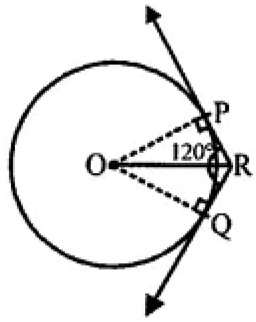
29. In the given figure, two tangents RQ and RP are drawn from the external point R to the circle with centre O.

$\angle$PRQ = 120°

To prove: OR = PR + RQ

Construction: Join OP and OQ.

Also join OR.



Proof: OR bisects the $\angle$PRQ

$\therefore \angle \mathrm{PRO} = \angle \mathrm{QRO} = \frac{120^\circ}{2} = 60^\circ$

$\because$ OP and OQ are radii and RP and RQ are tangents.

$\therefore$ OP $\perp$ PR and $\mathrm{OQ} \perp \mathrm{QR}$

In right $\triangle$ OPR

$\angle \mathrm{POR} = 180^\circ - (90^\circ + 60^\circ)$

$= 180^\circ - 150^\circ = 30^\circ$

Similarly,

$\angle \mathrm{QOR} = 30^\circ$

and $\cos\theta = \frac{\mathrm{PR}}{\mathrm{OR}}$

$\Rightarrow \cos 60^\circ = \frac{\mathrm{PR}}{\mathrm{OR}} \Rightarrow \frac{1}{2} = \frac{\mathrm{PR}}{\mathrm{OR}}$

$\Rightarrow$ 2PR=OR ......(i)

Similarly, in right $\triangle$OQR

$\Rightarrow$ 2QR=OR ....(ii)

Adding (i) and (ii)

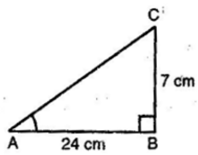
$\Rightarrow$ 2PR + 2QR = 2OR

$\Rightarrow$ OR = PR + RQ

Hence Proved.

30. Let us draw a right angled triangle ABC, right angled at B.

Using Pythagoras theorem,



Given, AB = 24cm and BC = 7cm

Using Pythagoras theorem,

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

$AC^2 = 24^2 + 7^2 = 576 + 49 = 625$

$\therefore$ AC = 25 cm

i. $\sin \mathrm{A} = \frac{\mathrm{P}}{\mathrm{H}} = \frac{\mathrm{BC}}{\mathrm{AC}} = \frac{7}{25}$, $\cos A = \frac{B}{H} = \frac{AB}{AC} = \frac{24}{25}$

$\Rightarrow sinA.cosA = \frac{7}{25} \times \frac{24}{25} = \frac{168}{625}$

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ii. $\sin C = \frac{P}{H} = \frac{AB}{AC} = \frac{24}{25}$, $\cos C = \frac{B}{H} = \frac{BC}{AC} = \frac{7}{25}$

$\Rightarrow sinC.cosC = \frac{24}{25} \times \frac{7}{25} = \frac{168}{625}$

OR

We have

$cosec\ \theta = \frac{13}{12}$

$\sin\theta = \frac{1}{cosec\ \theta} = \frac{12}{13}$

$\sin^2\theta = \left(\frac{12}{13}\right)^2 = \frac{144}{169}$

We know that,

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

$\cos^2\theta = 1 - \frac{144}{169}$

$\cos^2\theta = \frac{25}{169}$

$\cos\theta = \frac{5}{13}$

Now, $\frac{2\sin\theta - 3\cos\theta}{4\sin\theta - 9\cos\theta}$

$= \frac{2\times\frac{12}{13} - 3\times\frac{5}{13}}{4\times\frac{12}{13} - 9\times\frac{5}{13}}$

$= \frac{\frac{24}{13} - \frac{15}{13}}{\frac{48}{13} - \frac{45}{13}}$

$= \frac{\frac{9}{13}}{\frac{3}{13}} = \frac{9}{3} = 3$

Hence $\frac{2\sin\theta - 3\cos\theta}{4\sin\theta - 9\cos\theta} = 3$

31. Number of 50 paisa coins, i.e n(50 paisa) = 100

n(₹1 coins) = 50

n(₹2 coins) = 20

n(₹5 coins) = 10

n(Total no. of coins)=180

i. P(will be a 50 paisa win) = $\frac{100}{180} = \frac{5}{9}$

ii. P(will be of value more than ₹1)=$\frac{30}{180} = \frac{1}{6}$

iii. P(will be of value less than ₹5)=$\frac{170}{180} = \frac{17}{18}$

iv. P(will be a ₹1 or ₹2 coins)=$\frac{70}{180} = \frac{7}{18}$.

Section D

32. Let the length of piece be x m

Then , rate = $\frac{200}{x}$ per m

Now , new length = (x + 5)m

Since, the cost remains same .

$\therefore$ New rate = $\frac{200}{x+5}$ per m .

Then, $\frac{200}{x+5} = \frac{200}{x} - 2$

$\frac{200}{x+5} = \frac{200-2x}{x}$

$\Rightarrow$ 200x = (x + 5) (200 - 2x)

$\Rightarrow$ 200x = 200x - $2x^2$ + 1000 - 10x

$\Rightarrow$ $2x^2$ + 10x - 1000 = 0

$\Rightarrow$ x^2 + 5x - 500 = 0

$\Rightarrow$ x^2 + 25x – 20x – 500 =0

$\Rightarrow$ x(x + 25) – 20(x +2 5) = 0

$\Rightarrow$ (x – 20) (x + 25) = 0

Therefore, x = 20 or x = -25

But length cannot be negative, therefore x = 20 m

Therefore , length of the piece = 20m

OR

Let the present age of Tanay be x years

By the question,

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(x - 5)(x + 10) = 16

or, $x^2+5x-50=16$

or, $x^2+5x-66=0$

or, $x^2+11x-6x-66=-66$

x(x + 1)-16(x - l11) = 0

(x + 11) (x -6) = 0

=-11, 6

Rejecting x = - 11, as age cannot be negative.

∴ Present age of Tanay is 6 years.

33. Let h is height of big building,here as per the diagram.

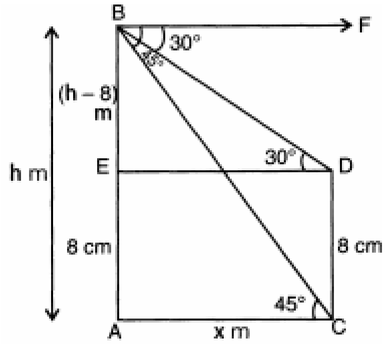
AE = CD = 8 m (Given)

BE = AB-AE = (h - 8) m

Let AC = DE = x

Also, $\angle FBD=\angle BDE=30^{\circ}$

$\angle FBC=\angle BCA=45^{\circ}$



In △ACB, $\angle A=90^{\circ}$

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

⇒ x = h, ...(i)

In △BDE, $\angle E=90^{\circ}$

$\tan 30^{\circ}=\frac{BE}{ED}$

$\Rightarrow \quad x=\sqrt{3}(h-8)$.(ii)

From (i) and (ii), we get

$h=\sqrt{3}h-8\sqrt{3}$

h(√3 - 1) = 8√3

h = $\frac{8\sqrt{3}}{\sqrt{3}-1}=\frac{8\sqrt{3}}{\sqrt{3}-1}\times\frac{\sqrt{3}+1}{\sqrt{3}+1}$

= $\frac{1}{2}\times(24+8\sqrt{3})=\frac{1}{2}\times(24+13.84)=18.92m$

Hence height of the multistory building is 18.92 m and the distance between two buildings is 18.92 m.

34. It is given that, Sum of first p terms of an AP = q

and Sum of the first q terms the same AP = p

Let us take the first term as a and the common difference d

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

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

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

Subtracting the sum of the q terms from the sum of p terms

we get

q - p = $\left[\frac{p}{2}(2a+(p-1)d]-\frac{q}{2}[2a+(q-1)d\right]$

q - p = $a(p-q)+\frac{d}{2}\left(p^2-p-q^2+q\right)$

After solving the equation we get

$d=-\frac{2(p+q)}{pq}$

Now with d $=-\frac{2(p+q)}{pq}$, the first term of the series is a and the number of terms is (p + q)

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

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Sp + q = $\frac{p+q}{2}[2a+(p+q-1)d] = \frac{p+q}{pq}(-pq)$
Therefore, the sum is -(p + q).

OR

Numbers between 100 – 200 divisible by 9 are 108, 117, 126, … 198.
Here, a= 108, d = 117 – 108 = 9 and a_n = 198.
⇒ a + (n – 1)d = 198 [∵a_n = a + (n – 1)d]
⇒ 108 + (n – 1)9 =198.
⇒108 + 9n-9=198
⇒ 9n + 99=198}
⇒ 9(n + 11)=198}
⇒ 11 + n = $\frac{198}{9}$
⇒ n = 22 – 11.
⇒ n = 11
Now, S_n = $\frac{n}{2}$ [2a+ (n – 1)d]
⇒ S_{11} = $\frac{11}{2}$ [2(108) + (11 – 1) (9)]
= $\frac{11}{2}$ [216 + 99 – 9]
= $\frac{11}{2}$ [216 + 90]
= $\frac{11}{2}$ × 306
= 11 × 153
⇒ S_{11} = 1683.

35.

Monthly Consumption	**Number of consumers (f_i)**	**Cumulative Frequency**
0-10	5	5
10-20	x	5 + x
20-30	20	25 + x
30-40	15	40 + x
40-50	y	40 + x + y
50-60	5	45 + x + y
Total	$\sum f_i = n = 60$	

Here, $\sum f_i = n = 60$, then $\frac{n}{2} = \frac{60}{2} = 30$, also, median of the distribution is 28.5, which lies in interval 20 – 30.
∴ Median class = 20 – 30
So, l = 20, n = 60, f = 20, cf = 5 + x and h = 10
$\because 45 + x + y = 60$
$\Rightarrow x + y = 15$ …….............(i)
Now, Median = $l + \left[\frac{\frac{n}{2}-cf}{f}\right] \times h$
$\Rightarrow 28.5 = 20 + \left[\frac{30-(5+x)}{20}\right] \times 10$
$\Rightarrow 28.5 = 20 + \frac{30-5-x}{2}$
$\Rightarrow 28.5 = \frac{40+25-x}{2}$
$\Rightarrow 57.0 = 65 - x$
$\Rightarrow x = 65 - 57 = 8$
⇒ x = 8
Putting the value of x in eq. (i), we get,
8 + y = 15
⇒ y = 7
Hence the value of x and y are 8 and 7 respectively.

Section E

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36. i. Given:

Length of rectangle = 12 cm

Width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

Height of cylinder = 10 cm

Diameter of base = 7 cm

$\Rightarrow$ Radius of base = 3.5 cm

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

= $\frac{22}{7} \times 3.5^2 \times 10$ = 385 cm^3

ii. Given:

length of rectangle = 12 cm

width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

height of cylinder = 10 cm

diameter of base = 7 cm

$\Rightarrow$ radius of base = 3.5 cm

Volume of wood scooped out = 2 $\times$ volume of hemisphere

$\Rightarrow$ Volume of wood scooped-out = $2 \times \frac{2}{3} \times \pi \times r^3$

$\Rightarrow$ Volume of wood scooped out = $\frac{4}{3} \times \frac{22}{7} \times (3.5)^3 = 179.66 \text{ cm}^3$

iii. length of rectangle = 12 cm

width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

height of cylinder = 10 cm

diameter of base = 7 cm

$\Rightarrow$ radius of base = 3.5 cm

Total surface area of the article

$= 2\pi(3.5)(10) + 2\left[2\pi(3.5)^2\right]$

$= 70\pi + 49\pi = 119\pi$

$= 119 \times \frac{22}{7} = 17 \times 22$

= 374 cm^2

OR

Given:

length of rectangle = 12 cm

width of rectangle = 9 cm

After scratching the rectangle into a cylinder,

height of cylinder = 10 cm

diameter of base = 7 cm

$\Rightarrow$ radius of base = 3.5 cm

T.S.A of cylinder = $2\pi r(r + h)$

$\Rightarrow$ T.S.A of cylinder = $2 \times \frac{22}{7} \times 3.5(3.5 + 10)$ = 99 cm^2

37. i. Zeroes are -2 and 8

$\alpha + \beta$ = -2 + 8 = 6

$\alpha\beta$ =-2 $\times$ 8 = -16

expression of polynomial

$x^2 - (\alpha + \beta)x + \alpha\beta$

$x^2 - 6x - 16$

ii. $P(x) = x^2 - 6x - 16$

$P(4) = 4^2 - 6(4) - 16$

= 16 - 24 - 16

= -24

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iii. P(x) = -x^2 + 3x - 2

$\alpha + \beta = \frac{-3}{-1}$

$\alpha + \beta$ = 3 ...(i)

$\alpha\beta$ = $\frac{-2}{-1}$

$\alpha\beta$ = 2 ...(ii)

$(\alpha - \beta)^2 = (\alpha + \beta)^2$ - 4$\alpha\beta$

$(\alpha - \beta)^2$ = $(3)^2$ - 4(2)

$(\alpha - \beta)^2$ = 9 - 8

$\alpha - \beta = \pm\sqrt{1}$

$\alpha - \beta = \pm 1$

Taking

$\alpha - \beta = 1$

$\alpha + \beta = 3$

2α = 4

α = 2

Put α = 2 in, $\alpha - \beta = 1$

2 - β = 1

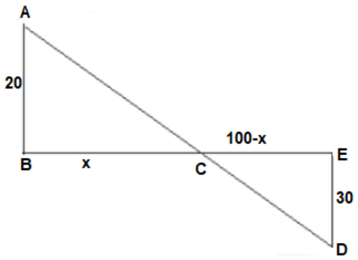
β = 1

OR

$\alpha + \beta$ = $\frac{-3}{-1}$ = 3

$\alpha\beta = \frac{-2}{-1} = 2$

38. i.



$\triangle$ABC $\sim$ $\triangle$DEC

$\frac{20}{30} = \frac{x}{100-x}$

2000 - 20x = 30x

2000 = 50x

x = 40 m

ii. AA

iii. 60 metres

OR

AD = AC + CD

$= \sqrt{20^2 + 40^2} + \sqrt{60^2 + 30}^2$

$= \sqrt{400 + 1600} + \sqrt{3600 + 900}$

$= \sqrt{2000} + \sqrt{4500}$

$\Rightarrow$ 20$\sqrt{5}$ + 30$\sqrt{5}$

$\Rightarrow$ 50$\sqrt{5}$ m

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