Solution
PRELIMINARY EXAM - 3
Class 10 - Mathematics
Section A

1.
(d) 2
Explanation:
Since 7 + 3 = 10
The least prime factor of a + b has to be 2; unless a + b is a prime number greater than 2.
Suppose a + b is a prime number greater than 2. Then a + b must be an odd number and one of 'a' or 'b' must be an even number.
Suppose that 'a' is even. Then the least prime factor of a is 2; which is not 3 or 7. So 'a' can not be an even number nor can b be an even number. Hence a + b can not be a prime number greater than 2 if the least prime factor of a is 3 and b is 7.
Thus the answer is 2.

2.
(d) 3
Explanation:
The graph of given polynomial cuts the x-axis at 3 distinct points.
therefore, No. of zeroes are 3.

3.
(b) consistent
Explanation:
Given: $a_1 = 3$, $a_2 = 2$, $b_1 = 2$, $b_2 = -3$, $c_1 = 5$ and $c_2 = 7$
Here, $\frac{a_1}{a_2} = \frac{3}{2}, \frac{b_1}{b_2} = \frac{2}{-3}$
$\because \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$
Therefore, the pair of given linear equations is consistent.

4.
(c) -2 < b < 2
Explanation:
In the equation
$x^2 - bx + 1 = 0$
$D = b^2 - 4ac = (-b)^2 - 4 \times 1 \times 1$
$= b^2 - 4$
$\because$ it is given that the roots are not real, D < 0
$\Rightarrow b^2 - 4 < 0$
$\Rightarrow b^2 < 4 \Rightarrow b^2 < (\pm 2)^2$
$\therefore$ b < 2 and b > -2 or -2 < b
$\therefore$ -2 < b < 2

5. **(a)** 28
Explanation:
Given: d = – 4, n = 7 and $a_n = 4$
$\therefore a_n = a + (n-1)d$
$\Rightarrow 4 = a + (7-1) \times (-4)$

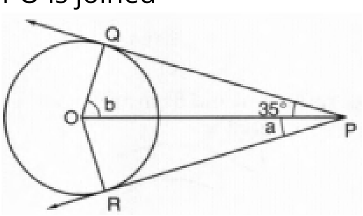
$\Rightarrow$ 4= a+6 $\times$-4
$\Rightarrow 4 = a - 24$
$\Rightarrow a = 28$

6. **(a)** $\sqrt{2}$ units
Explanation:
Distance between $(\sin\theta, \cos\theta)$ and $(\cos\theta, -\sin\theta)$
= $\sqrt{(\cos\theta - \sin\theta)^2 + (-\sin\theta - \cos\theta)^2}$
= $\sqrt{\cos^2\theta + \sin^2\theta - 2\cos\theta\sin\theta + \cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta}$
= $\sqrt{2\cos^2\theta + 2\sin^2\theta}$
= $\sqrt{2\left(\cos^2\theta + \sin^2\theta\right)}$
$\left[\because \cos^2\theta + \sin^2\theta = 1\right]$
= $\sqrt{2}$ units

7.
(c) (3, 0)
Explanation:
The given point P lies on x-axis
Let the co-ordinates of P be (x, 0)
The point P lies on the perpendicular bisector of the line segment joining the points A(7, 6), B(-3, 4)
$\therefore PA = PB \Rightarrow PA^2 = PB^2$
$\Rightarrow (x-7)^2 + (0-6)^2 = (x+3)^2 + (0-4)^2$
$\Rightarrow x^2 - 14x + 49 + 36 = x^2 + 6x + 9 + 16$
$\Rightarrow$ -14x + 85 = 6x + 25
$\Rightarrow$ 6x + 14x = 85 - 25 $\Rightarrow$ 20x = 60
$x = \frac{60}{20} = 3$
$\therefore$ co-ordinates of P will be (3, 0)

8. **(a)** 8 cm
Explanation:
As PQ || AC by using proportionality theorem
$\Rightarrow \frac{BP}{PA} = \frac{BQ}{QC}$
$\Rightarrow \frac{4}{2.4} = \frac{5}{QC}$
$\Rightarrow \mathrm{QC} = \frac{5\times2.4}{4}$ = 5 $\times$ 0.6
$\Rightarrow$ QC = 3 cm
$\therefore$ BC = BQ + QC
= 5 + 3
= 8 cm

9.
(d) a = 35°, b = 55°
Explanation:
In the figure, PQ and PR are the tangents drawn from P to the circle with centre O
$\angle OPQ = 35^\circ$
PO is joined



PQ = PR (tangents from P to the circle)

$\angle OPQ = \angle OPR$
$\Rightarrow 35^{\circ} = \mathrm{a}$
$\Rightarrow a = 35^{\circ}$
OQ is radius and PQ is tangent $OQ \perp \mathrm{PQ}$
$\Rightarrow \angle OQP = 90^{\circ}$
In $\Delta \mathrm{OQP}$
$\angle \mathrm{POQ} + \angle \mathrm{QPO} = 90^{\circ}$
$\Rightarrow b + 35^{\circ} = 90^{\circ}$
$\Rightarrow \mathrm{b} = 90^{\circ} - 35^{\circ} = 55^{\circ}$
$a = 35^{\circ}, b = 55^{\circ}$

10.

(c) 50°
Explanation:
$\angle$ABC = 90° [Angle in semicircle]
In $\triangle$ABC, we have
$\angle ACB + \angle CAB + \angle ABC = 180^{\circ}$
$\Rightarrow 50^{\circ} + \angle CAB + 90^{\circ} = 180^{\circ}$
$\Rightarrow \angle CAB = 40^{\circ}$
Now, $\angle CAT = 90^{\circ} \Rightarrow \angle CAB + \angle BAT = 90^{\circ}$
$\Rightarrow 40^{\circ} + \angle BAT = 90^{\circ} \Rightarrow \angle BAT = 50^{\circ}$

11.

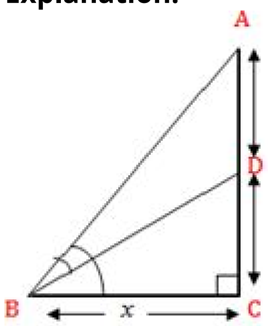
(b) 2
Explanation:
2

12.

(b) $\frac{1}{\sqrt{2}}$
Explanation:
$\frac{1}{\sqrt{2}}$

13.

(c) 60°
Explanation:



Here Height of the tower = CD = $\frac{h}{2}$ meters, height of the flagstaff = AD = h meters, angle of elevation of top of the tower = $\angle$DBC = 30° and angle of elevation of the top of the flagstaff from ground = $\angle$ABC = θ Now, in triangle DBC,

$\tan 30^{\circ} = \frac{\frac{h}{2}}{x} \Rightarrow x = \frac{h\sqrt{3}}{2}$ .....(i)

Again, In triangle ABC, $\tan\theta = \frac{h + \frac{h}{2}}{x} \Rightarrow \tan\theta = \frac{3h}{2x}$

$\Rightarrow \tan\theta = \frac{3h\times2}{2\times h\sqrt{3}}$ [From eq. (i)] $x \Rightarrow \tan\theta = \frac{3}{\sqrt{3}} \Rightarrow \tan\theta = \sqrt{3} \Rightarrow \tan\theta = \tan 60^\circ$
$\Rightarrow \theta = 60^\circ$

14.
(c) 52 cm^2
Explanation:
We know that perimeter of a sector of radius, $r = 2r + \frac{\theta}{360} \times 2\pi r$ ...(1)
Therefore, substituting the corresponding values of perimeter and radius in equation (1), we get,
$29 = 2 \times 6.5 + \frac{\theta}{360} \times 2\pi \times 6.5$ ...(2)
$29 = 2 \times 6.5\left(1 + \frac{\theta}{360} \times \pi\right)$
$\frac{29}{2\times6.5} = \left(1 + \frac{\theta}{360} \times \pi\right)$
$\frac{29}{2\times6.5} - 1 = \frac{\theta}{360} \times \pi$ ....(3)
We know that area of the sector $= \frac{\theta}{360} \times \pi r^2$
From equation (3), we get
Area of the sector $= \left(\frac{29}{2\times6.5} - 1\right) r^2$
Substituting r = 6.5 we get,
Area of the sector $= \left(\frac{29}{2\times6.5} - 1\right) 6.5^2$
$= \left(\frac{29\times6.5^2}{2\times6.5} - 6.5^2\right)$
$= \left(\frac{29\times6.5}{2} - 6.5^2\right)$
$= \left(\frac{29\times6.5}{2} - 6.5^2\right)$
$= (94.25 - 42.25)$
= 52
Therefore, area of the sector is 52 cm^2.

15.
(b) 32 m^2
Explanation:
The area of the segment $= \left(\frac{x^\circ}{360^\circ} \times \pi r^2\right) - \frac{bh}{2}$
= Area of the sector - Area of the triangle
= 44 - 12
= 32 m^2

16.
(d) 1 – p
Explanation:
If the probability of an event is p, the probability of its complementary event will be 1 - p. because we know that the sum of probability of an event and its complementary event is always 1.
Hence, p + 1 - p = 1

17. **(a)** $\frac{1}{3}$
Explanation:
Number of composite numbers on a dice = {4, 6} = 2
Number of possible outcomes = 2
Number of Total outcomes = 6
$\therefore$ Required Probability = $\frac{2}{6} = \frac{1}{3}$

18.

(d) $A + \bar{d}$

Explanation:

$A + \bar{d}$

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:

We have, common difference of an AP

d = a_n - a_{n-1} is independent of n or constant.

So, A is false but R is true.

Section B

21. 26 and 91

26= 2 × 13

91 = 7 × 13

HCF = 13

LCM = 2 × 7 × 13 = 182

Product of two numbers 26 and 91 = 26 × 91 = 2366

HCF × LCM = 13 × 182 = 2366

Hence, product of two numbers = HCF × LCM

OR

$462 = 2 \times 3 \times 7 \times 11$

$644 = 2^2 \times 7 \times 23$

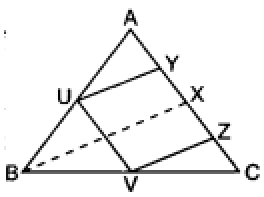
$\text{LCM}(462, 644) = 2^2 \times\ 3 \times 7 \times 11 \times 23 = 21252$

$\therefore$ Smallest number which is divisible by both 462 and 644 is 21252

22. Join BX

In ABX, U is midpoint of AB and Y is mid-point AX (given)

$\therefore$ UY $\parallel$ BX (using mid-point theorem) .....(i)



In BCX, v is mid-point of BC and z is mid-point of XC

VZ $\parallel$ BX ..(ii)

from (i) and (ii)

UY $\parallel$ VZ

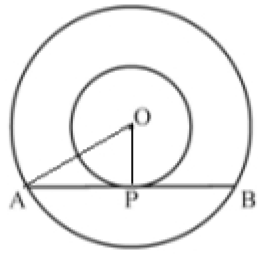
In ABC, U is mid-point of AB and V is mid-point of BE.

$\therefore$ UV $\parallel$ AC

$\Rightarrow$ UV $\parallel$ YZ Hence proved.

23. Join OA and OP

OP $\perp$ AB (radius $\perp$ tangent at the point of contact)



OP is the radius of smaller circle and AB is tangent at P.
AB is chord of larger circle and OP $\perp$ AB
$\therefore$ AP = PB($\perp$ from centre bisects the chord)

In right $\triangle$AOP, AP^2 = OA^2 - OP^2

= (5)^2 - (3)^2 = 16
AP = 4 cm = PB
$\therefore$ AB = 8 cm

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 θ + sin^2 θ = 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

LHS = $\left(\frac{1}{\cos\theta}-\cos\theta\right)\left(\frac{1}{\sin\theta}-\sin\theta\right)$
= $\left(\frac{1-\cos^2\theta}{\cos\theta}\right)\left(\frac{1-\sin^2\theta}{\sin\theta}\right)$
= $\frac{\sin^2\theta}{\cos\theta}\times\frac{\cos^2\theta}{\sin\theta}$
= sin θ cos θ
RHS = $\frac{1}{\tan\theta+\cot\theta}$ = $\frac{1}{\frac{\sin\theta}{\cos\theta}+\frac{\cos\theta}{\sin\theta}}$
= $\frac{\cos\theta\sin\theta}{\sin^2\theta+\cos^2\theta}$
= sin θ cos θ
$\therefore$ LHS = RHS

25. 

Given Radius = r = $5\sqrt{2}\mathrm{cm}$
= OA = OB
Length of chord AB = 10 cm
In $\triangle OAB$, OA = OB = $=5\sqrt{2}$
AB = 10cm
OA^2 + OB^2 = $=(5\sqrt{2})^2+(5\sqrt{2})^2$
= 50 + 50 = 100 = (AB)^2
Pythagoras theorem is satisfied OAB is right triangle
= angle subtended by chord = $\angle AOB=90^\circ$

Area of segment (minor) = shaded region
= area of sector - area of $\triangle OAB$
$= \frac{\theta}{360} \times \pi r^2 - \frac{1}{2} \times OA \times OB$
$= \frac{90}{360} \times \frac{22}{7}(5\sqrt{2})^2 - \frac{1}{2} \times 5\sqrt{2} \times 5\sqrt{2}$
$= \frac{275}{7} - 25 = \frac{100}{7}\text{cm}^2$
Area of major segment = (area of circle) - (area of minor segment)
$= \pi r^2 - \frac{100}{7}$
$= \frac{22}{7} \times (5\sqrt{2})^2 - \frac{100}{7}$
$= \frac{1100}{7} - \frac{100}{7}$
$= \frac{1000}{7}\text{cm}^2$

Section C

26. To distribute the fruits equally Renu has to take the H.C.F. of 45 and 20.
H.C.F. of 20 and 45 = 5
i.e. 5 fruits can be placed in 1 pack
$\therefore$ Total no. of packs = $\frac{Total\ available\ fruits}{no.\ of\ fruits\ in\ 1\ packs}$
$= \frac{45+20}{5}$
$= \frac{65}{5}$
= 13
Hence, maximum no. of packets required = 13

27. p(y) = $7y^2 - \frac{11}{3}y - \frac{2}{3} = \frac{1}{3}(21y^2 - 11y - 2)$
= $\frac{1}{3}(21y^2 - 14y + 3y - 2)$
= $\frac{1}{3}[7y(3y - 2) + 1(3y - 2)]$
= $\frac{1}{3}[(7y + 1)(3y - 2)]$
$\therefore$ Zeroes are $\frac{2}{3}, -\frac{1}{7}$
Sum of Zeroes = $\frac{2}{3} - \frac{1}{7} = \frac{11}{21}$
$\frac{-b}{a} = \frac{11}{21}$
$\therefore$ sum of zeroes = $\frac{-b}{a}$
Product of Zeroes = $(\frac{2}{3})(-\frac{-1}{7}) = -\frac{2}{21}$
$\frac{c}{a} = -\frac{2}{3}(\frac{1}{7}) = -\frac{2}{21}$
$\therefore$ Product = $\frac{c}{a}$

28. Calculation of mean:

Class interval	**Mid – value (x_i)**	**f_i**	**$f_i x_i$**
0 – 6	3	6	18
6 – 12	9	8	72
12 – 18	15	10	150
18 – 24	21	9	189
24 – 30	27	7	189
		Σf_i = 40	$\Sigma f_i x_i$ = 618

We know that, Mean = $\frac{\Sigma f_i x_i}{\Sigma f_i}$
$= \frac{618}{40}$
= 15.45

29. Let us suppose that the numerator be x and denominator be y

Therefore, the fraction is $\frac{x}{y}$.

Then, according to the given conditions, we have

$\frac{3x}{y-3}=\frac{18}{11}$ and $\frac{x+8}{2y}=\frac{2}{5}$

⇔ 11x = 6y -18 and 5x + 40 =4y

⇔11x - 6y + 18 =0 and 5x - 4y + 40 =0

By cross multiplication, we have

$\frac{x}{(-6)\times40-(-4)\times18}=\frac{-y}{11\times40-5\times18}=\frac{1}{11\times(-4)-5\times(-6)}$

$\Rightarrow \quad \frac{x}{-240+72}=\frac{-y}{440-90}=\frac{1}{-44+30}$

$\Rightarrow \quad \frac{x}{-168}=\frac{y}{-350}=\frac{1}{-14}$

$\Rightarrow \quad x=\frac{-168}{-14}$ and $y=\frac{-350}{-14}$

⇒x =12 and y =25

Therefore, the fraction is $\frac{12}{25}$.

OR

The given system of linear equations is:

4 x + 7 y = 20....................(1)

21 x - 13 y = 21...................(2)

From equation (2), 13 y = 21x - 21

$\Rightarrow \quad y=\frac{21x-21}{13}$ ....(3)

Substitute this value of y in equation (1), we get

$4x+7\left(\frac{21x-21}{13}\right)=20$

⇒52 x + 147 x - 147 = 260

⇒199 x = 147 + 260

⇒ 199 x = 407

$\Rightarrow x=\frac{407}{199}$

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

$y=\frac{21\left(\frac{407}{199}\right)-21}{13}=\frac{8547-4179}{2587}=\frac{4368}{2587}=\frac{336}{199}$

Therefore, the solution is

$\mathrm{x}=\frac{407}{199}, \quad \mathrm{y}=\frac{336}{199}$

Verification: Substituting, $\mathrm{x}=\frac{407}{199}, \quad \mathrm{y}=\frac{336}{199}$ we find that both the equations (1) and (2) are satisfied as shown below:

$4x+7y=4\left(\frac{407}{199}\right)+7\left(\frac{336}{199}\right)=\frac{1628+2352}{199}=\frac{3980}{199}=20$

21x - 13y $=21\left(\frac{407}{199}\right)-13\left(\frac{336}{199}\right)=21$

This verifies the solution.

30. We have,

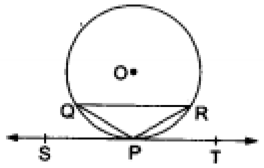
$5\tan\theta=4\Rightarrow\tan\theta=\frac{4}{5}$

Now, L.H.S = $\frac{5\sin\theta-3\cos\theta}{5\sin\theta+2\cos\theta}=\frac{\frac{5\sin\theta-3\cos\theta}{\cos\theta}}{\frac{5\sin\theta+2\cos\theta}{\cos\theta}}$ [Dividing Numbers and Denominator by $\cos\theta$]

$=\frac{\frac{5\sin\theta}{\cos\theta}-\frac{3\cos\theta}{\cos\theta}}{\frac{5\sin\theta}{\cos\theta}+\frac{2\cos\theta}{\cos\theta}}=\frac{5\tan\theta-3}{5\tan\theta+2}=\frac{5\times\frac{4}{5}-3}{5\times\frac{4}{5}+2}\quad\left[\because\tan\theta=\frac{4}{5}\right]$

$=\frac{4-3}{4+2}=\frac{1}{6}$ = R.H.S

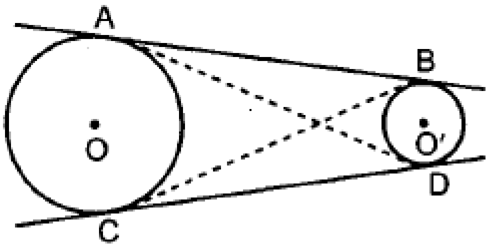
Hence proved.

31. 

Point P is the midpoint of arc $\widehat{QR}$ of a circle with centre O.

ST is the tangent to the circle at point P.
TO prove :Chord $\mathrm{QR}\|\mathrm{ST}$
Proof: P is the midpoint of $\widehat{QR}$
$\Rightarrow \widehat{QP}=\widehat{PR}$
$\Rightarrow$ chord QP = chord PR [$\because$ in a circle, if two arcs are equal, then their corresponding chords are equal]
$\therefore \quad \angle PQR=\angle PRQ$
$\Rightarrow \angle TPR=\angle PRQ$ [as , $\angle PQR=\angle TPR,$ angles in alternate segments]
$\Rightarrow \quad QR\|ST$, [$\because \angle TPR$ and $\angle PRQ$ are alternate interior $angles$]

OR



Construction: Join $AD\ and\ BC$
Proof:

Here, A & C are external points for circle having centre O.
AB = AD ...(i) [$\because$ The lengths of the two tangents drawn from an external point to a circle are equal]
CB = CD ...(ii) [$\because$ The lengths of the two tangents drawn from an external point to a circle are equal]
Now, B & D are external points for circle having centre O'.
BA = BC ...(iii) [$\because$ The lengths of the two tangents drawn from an external point to a circle are equal]
DA = DC ...(iv) [$\because$ The lengths of the two tangents drawn from an external point to a circle are equal]
So, from (i),(ii) and (iii), (iv), we get
$AB=BC=CD$
So, AB = CD Hence proved.

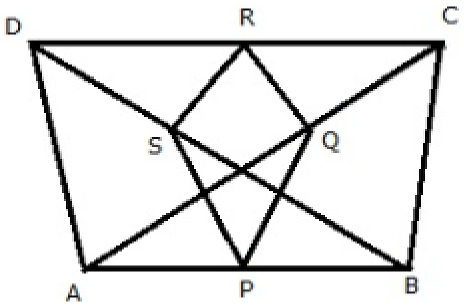
Section D

32. $4+2x+1+12+x+2=25 \Rightarrow x=2$

C. I.	x_i	**fi**	u_i	f_iu_i
$500-750$	625	4	-2	-8
$750-1000$	875	5	-1	-5
$1000-1250$	**1125 = a**	12	0	0
$1250-1500$	1375	2	1	2
$1500-1750$	1625	2	2	4
		25		-7

$\overline{x}=1125+\frac{-7}{25}\times 250$
$\overline{x}=1055$
$\therefore$ mean daily expenditure $=₹1055$

33. Given: ABCD is a quadrilateral in which AD = BC. P, Q, R, S are the midpoints of AB, AC, CD and BD.
To prove: PQRS is a rhombus



Proof: In$\triangle ABC$,

Since P and Q are mid points of AB and AC
Therefore, $\mathrm{PQ} \| \mathrm{BC}$,PQ=$\frac{1}{2}$ BC ....(1) (Mid-point theorem)
Similarly,
In $\triangle CDA$,
Since R and Q are mid points of CD and AC
Therefore, $RQ \| DA$,RQ=$\frac{1}{2}$ DA=$\frac{1}{2}$ BC ....(2)
In $\triangle BDA$,
Since S and P mid points of BD and AB
Therefore, $\mathrm{SP} \| \mathrm{DA}$,,SP=$\frac{1}{2}$ DA=$\frac{1}{2}$ BC ....(3)
In $\triangle CDB$,
Since S and R are mid points of BD and CD
Therefore, $\mathrm{SR}|| \mathrm{BC}$,SR=$\frac{1}{2}$ BC .....(4)
From (1) (2),(3)and (4) PQ || SR and (3) RQ || SP
PQ=RQ=SP=SR
So the opposite sided of PQRS are parallel and all sides are equal
Hence, PQRS is a rhombus.

34. Shorter side = x meters
Longer side = x + 20 meters
Diagonal = x + 40 meters
Using Pythagoras Theorem:
$(\text{ Diagonal })^2=(\text{ Shorter side })^2+(\text{ Longer side })^2$
= $(x+40)^2=x^2+(x+20)^2$
$x^2-40x-1200=0$
Solve the quadratic:
$x=\frac{40 \pm \sqrt{(-40)^2+4 \cdot 1200}}{2}=\frac{40 \pm \sqrt{1600+4800}}{2}=\frac{40 \pm \sqrt{6400}}{2}=\frac{40 \pm 80}{2}$
$x=\frac{40+80}{2}=\frac{120}{2}=60$
Shorter side $=60\ m$
Longer side $=60+20=80\ m$
Diagonal $=60+40=100\ m$

OR

$\frac{x-2-x}{x(x-2)}=3$
$\Rightarrow 3x^2-6x+2=0$
Discriminant $=36-24=12$
Roots are $\frac{6+\sqrt{12}}{6}$ and $\frac{6-\sqrt{12}}{6}$
or $1+\frac{\sqrt{3}}{3}$ and $1-\frac{\sqrt{3}}{3}$

35. CSA of cylinder = $2 \times \frac{22}{7} \times 2.1 \times 5.8$
= 76.56 cm^2
CSA of two hemisphere $=4 \times \frac{22}{7} \times 2.1 \times 2.1$
= 55.44 cm^2
Total Surface Area of article = 76.56 + 55.44 = 132 cm^2

OR

Height of cylinder = 15 cm
Radius of cylinder = Radius of hemisphere = 4.2 cm
Total surface area = CSA of cylinder + CSA of 2 hemispheres
$=2\pi \mathrm{rh}+4\pi \mathrm{r}^2$
$=2 \times \frac{22}{7} \times 4.2 \times (15+2 \times 4.2)$
$=2 \times \frac{22}{7} \times 4.2 \times 23 \cdot 4=617.76\ \mathrm{cm}^2$

Section E

36. i. The number of rose plants in the 1st, 2nd, ... are 23, 21, 19, ... 5

a = 23, d = 21 - 23 = - 2, a_n = 5

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

or, 5 = 23 + (n - 1)(-2)

or, 5 = 23 - 2n + 2

or, 5 = 25 - 2n

or, 2n = 20

or, n = 10

ii. Total number of rose plants in the flower bed,

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

$S_{10} = \frac{10}{2}[2(23) + (10-1)(-2)]$

S_{10} = 5[46 - 20 + 2]

S_{10} = 5(46 - 18)

S_{10} = 5(28)

S_{10} = 140

iii. a_n = a + (n - 1)d

$\Rightarrow$ a_6 = 23 + 5 $\times$ (-2)

$\Rightarrow$ a_6 = 13

OR

S_n = 80

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

$\Rightarrow$ 80 = $\frac{n}{2}[2 \times 23 + (n-1) \times -2]$

$\Rightarrow$ 80 = 23n - n^2 + n

$\Rightarrow$ n^2 - 24n + 80 = 0

$\Rightarrow$ (n - 4)(n - 20) = 0

$\Rightarrow$ n = 4 or n = 20

n = 20 not possible

a_{20} = 23 + 19 $\times$ (-2) = -15

Number of plants cannot be negative.

n = 4

37. i. P(4, 6), Q(3, 2), R(6, 5)

ii. a. PQ = $\sqrt{(4-3)^2 + (6-2)^2} = \sqrt{17}$

QR = $\sqrt{(3-6)^2 + (2-5)^2} = \sqrt{18}$

OR

b. The coordinate of required point are $\left(\frac{6\times2+1\times4}{3}, \frac{5\times2+1\times6}{3}\right)$ i.e. $\left(\frac{16}{3}, \frac{16}{3}\right)$

iii. $\mathrm{PQ} = \sqrt{(4-3)^2 + (6-2)^2} = \sqrt{17}$

$\mathrm{QR} = \sqrt{(3-6)^2 + (2-5)^2} = \sqrt{18}$

$\mathrm{PR} = \sqrt{(4-6)^2 + (6-5)^2} = \sqrt{5}$

$\mathrm{PQ} \neq \mathrm{QR} \neq \mathrm{PR}$

$\triangle\mathrm{PQR}$ is not isosceles

38. i. Length BD = AD - AB

= 10 - 2.5 = 8.5

ii. The length of ladder BC

In $\triangle$BDC

$\cos\theta = \frac{\sqrt{3}}{2}$

$\Rightarrow \theta$ = 30°

sin 30° = $\frac{BD}{BC}$
$\Rightarrow \frac{1}{2} = \frac{8.5}{BC}$
$\Rightarrow BC = 2 \times 8.5$ = 17 m

iii. Distance between foot of ladder and foot of wall CD
In $\triangle$BDC
cos 30° = $\frac{CD}{BC}$
$\Rightarrow \frac{\sqrt{3}}{2} = \frac{CD}{17}$
$\Rightarrow CD = 8.5\sqrt{3}$ m
OR
If the height of pole and distance BD is doubled, then the length of the ladder is
sin 30° = $\frac{BD}{BC}$
$\Rightarrow \frac{1}{2} = \frac{17}{BC}$
$\Rightarrow BC = 2 \times 17$ = 34 m