CBSE
Class X Mathematics (Standard)
Sample Paper – 5 Reference Solutions (2024-25)

Section A

1. Correct option: B
Explanation:
HCF × LCM = product of two numbers
⇒ HCF × 3024 = 336 × 54
⇒ HCF = 18144 ÷ 3024 = 6

2. Correct Option: C
Explanation:
Let the required polynomial be $ax^2 + bx + c$.
Suppose its zeroes be α and β.

$$\alpha + \beta = \frac{1}{4} = \frac{-b}{a}$$

$$\alpha\beta = -1 = \frac{c}{a}$$

If a = 4k, then b = −k, c = −4k
Therefore, the quadratic polynomial is $k(4x^2 - x - 4)$, where k is a real number.

3. Correct Option: C
Explanation:

$$\frac{4}{5}, a, 2 \text{ are in AP}$$

$$\therefore \quad a - \frac{4}{5} = 2 - a \text{ or } 2a = 2 + \frac{4}{5} = \frac{14}{5}$$

$$\Rightarrow \quad a = \frac{7}{5}$$

4. Correct option: B
Explanation:
If two linear equations in x and y have more than two solutions, then the lines coincide.

5. Correct Option: B
Explanation:
$21x^2 + 11x - 2 = 0$
$21x^2 + 14x - 3x - 2 = 0$
$7x(3x + 2) - (3x + 2) = 0$
$(3x + 2)(7x - 1) = 0$
$x = -2/3$ or $x = 1/7$

6. Correct option: C

Explanation:

Let O(0, 0), A(1, 0) and C(0, 1).

d(OA) = $\sqrt{(1-0)^2+0} = 1$

d(AC) = $\sqrt{(1-0)^2+(0-1)^2} = \sqrt{2}$

d(OC) = $\sqrt{0+(1-0)^2} = 1$

Perimeter of triangle AOC = 1 + 1 + $\sqrt{2}$ = 2 + $\sqrt{2}$ units

7. Correct Option: A

Explanation:

Origin is O(0, 0) and A(6, −6)

Hence, OA = $\sqrt{(6-0)^2+(-6-0)^2} = \sqrt{72} = 6\sqrt{2}$ units

8. Correct Option: D

Explanation:

In ΔADE and ΔABC,

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

$\angle ADE = \angle B$ (Given)

$\therefore \Delta ADE \sim \Delta ABC$ (AA criterion)

$\Rightarrow \frac{AD}{AB} = \frac{DE}{BC}$

$\Rightarrow \frac{3.8}{(3.6+2.1)} = \frac{DE}{4.2}$

$\Rightarrow \frac{3.8}{5.7} = \frac{DE}{4.2}$

$\Rightarrow DE = \frac{3.8 \times 4.2}{5.7} = 2.8$ cm

9. Correct option: D

Explanation:

AR and AP are the tangents to the circle from a same point.

$\therefore$ AP = AR = 7 cm

Since, AB = 10 cm

$\therefore$ BP = AB – AP = (10 – 7) = 3 cm

Also, BP and BQ are tangents to the circle from the same point.

$\therefore$ BP = BQ = 3 cm

Further, CQ and CR are tangents to the circle from the same point.

$\therefore$ CQ = CR = 5 cm

Now, BC = BQ + QC = (3 + 5) cm = 8 cm

10. Correct option: C

Explanation:

$\sqrt{7}, \sqrt{28}, \sqrt{63}, \ldots$

$a_1 = \sqrt{7}$, $a_2 = \sqrt{28} = 2\sqrt{7}$, $a_3 = \sqrt{63} = 3\sqrt{7}$

$d = a_2 - a_1 = 2\sqrt{7} - 2\sqrt{7} = \sqrt{7}$

Therefore, next term, $a_4 = a_3 + d = 3\sqrt{7} + \sqrt{7} = 4\sqrt{7} = \sqrt{112}$

11. Correct option: A

Explanation:

The value of sin 0° is 0.

Thus, cosec 0° = 1/sin 0° is not defined.

12. Correct option: C

Explanation:

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

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

$\Rightarrow 2 - 2\cos^2\theta - \cos^2\theta = 2$

$\Rightarrow 2 - 3\cos^2\theta = 2$

$\Rightarrow 3\cos^2\theta = 0$

$\Rightarrow \cos^2\theta = 0$

$\Rightarrow \cos^2\theta = \cos^2 90°$

$\Rightarrow \theta = 90°$

13. Correct option: A

Explanation:

$\sqrt{3}\tan\theta - 1 = 0 \Rightarrow \sqrt{3}\tan\theta = 1$

$\Rightarrow \tan\theta = \frac{1}{\sqrt{3}}$

$\Rightarrow \tan\theta = \tan 30°$

$\Rightarrow \theta = 30°$

Now,

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

$= \sin^2 30 - \cos^2 30$

$= \left(\frac{1}{2}\right)^2 - \left(\frac{\sqrt{3}}{2}\right)^2 = \frac{1}{4} - \frac{3}{4} = \frac{-2}{4} = \frac{-1}{2}$

14. Correct option: D

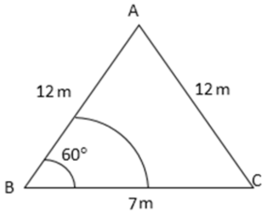
Explanation:

Curved surface area of cone = πrl

15. Correct option: C

Explanation:

Each angle of an equilateral triangle is 60°.



Area which can be grazed = area of the sector with r = 7 m, $\theta = 60^\circ$

$$= \left[\frac{22}{7} \times (7)^2 \times \frac{60}{360}\right] \text{ m}^2$$

$$= 25.67 \text{ m}^2$$

16. Correct Option: B

Explanation:

$$\text{Mean} = \left(\frac{\text{sum of observations}}{\text{no. of observations}}\right) = \left(\frac{3+11+5+2+6+8+7}{7}\right) = 6$$

Hence, 6 is the mean.

17. Correct option: B

Explanation:

The most repeated number will be the mode; hence mode is 3 (repeated 5 times).

18. Correct Option: A

Explanation:

Total number of parts of a machine = 1000

Sub-standard parts = 100

Standard parts = 1000 – 100 = 900

Probability of getting standard part = $\frac{900}{1000} = \frac{9}{10}$

19. Correct Option: A

Explanation:

Let the radius of the park be r metres.

Thus, $\pi r + 2r = 90^\circ \Rightarrow \frac{22r}{7} + 2r = 90^\circ$

Hence, the reason (R) is true.

$$\Rightarrow \frac{36r}{7} = 90 \Rightarrow r = \frac{90 \times 7}{36} = 17.5 \text{ m}$$

$$\text{Area of semicircle} = \frac{1}{2}\pi r^2 = \left(\frac{1}{2} \times \frac{22}{7} \times 17.5 \times 17.5\right)\text{m}^2 = 481.25 \text{ m}^2$$

Hence, both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

20. Correct Option: D

Explanation:

Given that PE = 3.9, EQ = 3, PF = 3.6, FR = 2.4

Now,

$$\frac{PE}{EQ} = \frac{3.9}{3} = 1.3$$

$$\frac{PF}{FR} = \frac{3.6}{2.4} = 1.5$$

Since $\frac{PE}{EQ} \neq \frac{PF}{FR}$

By the converse of BPT, we know that if a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.

Therefore, EF is not parallel to QR.

Thus, the assertion is false but reason is true.

Section B

21. Let us assume on the contrary that $3 + 2\sqrt{5}$ is rational.

Then there exists co-prime positive integers a and b such that

$$3 + 2\sqrt{5} = \frac{a}{b}$$

$$2\sqrt{5} = \frac{a}{b} - 3$$

$$\sqrt{5} = \frac{a-3b}{2b}$$

Since, and b are integers ⇒ a – 3b is an integer.

$\Rightarrow \frac{a-3b}{2b}$ is a rational number.

$\Rightarrow \sqrt{5}$ is rational.

This is a contradiction since $\sqrt{5}$ is irrational.

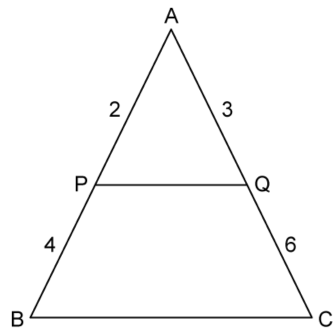
Hence, $3 + 2\sqrt{5}$ is irrational.

22. Given that P is a point on AB, then

AB = AP + PB = (2 + 4) cm = 6 cm

Also, Q is a point on AC, then

AC = AQ + QC = (3 + 6) cm = 9 cm



$\therefore \quad \frac{AP}{AB} = \frac{2}{6} = \frac{1}{3}$

and $\quad \frac{AQ}{AC} = \frac{3}{9} = \frac{1}{3}$

$\Rightarrow \quad \frac{AP}{AB} = \frac{AQ}{AC}$

Thus, in ΔAPQ and ΔABC

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

And $\frac{AP}{AB}=\frac{AQ}{AC}$

$\therefore \Delta APQ \sim \Delta ABC$ (by SAS similarity)

$\Rightarrow \frac{AP}{AB}=\frac{PQ}{BC}=\frac{AQ}{AC}$

$\therefore \frac{PQ}{BC}=\frac{AQ}{AC}$

$\Rightarrow \frac{PQ}{BC}=\frac{3}{9}=\frac{1}{3}$

$\Rightarrow BC = 3\ PQ$

Hence proved.

23. A circle touches the sides AB, BC, CD and DA at P, Q, R and S, respectively.

We know that the length of tangents drawn from an external point to a circle are equal.

AP = AS … (1) Tangents from A

BP = BQ … (2) Tangents from B

CR = CQ … (3) Tangents from C

DR = DS … (4) Tangents from D

Adding (1), (2), (3) and (4), we get

$\therefore AP + BP + CR + DR = AS + BQ + CQ + DS$

$\Rightarrow (AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)$

$\Rightarrow AB + CD = AD + BC$

$\Rightarrow AD = (AB + CD) - BC = \{(6 + 4) - 7\}$ cm = 3 cm

Hence, AD = 3 cm

24. L.H.S. = $(\sin\theta + \cos\theta)(\tan\theta + \cot\theta)$

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

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

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

$$=\frac{\sin\theta+\cos\theta}{\sin\theta\cos\theta}$$

$$=\frac{\sin\theta}{\sin\theta\cos\theta}+\frac{\cos\theta}{\sin\theta\cos\theta}$$

$$=\frac{1}{\cos\theta}+\frac{1}{\sin\theta}$$

$$=\sec\theta+\operatorname{cosec}\theta$$

$$=\text{R.H.S.}$$

OR

$$\text{L.H.S} = \frac{1+\sec\theta-\tan\theta}{1+\sec\theta+\tan\theta}$$
$$= \frac{1+(\sec\theta-\tan\theta)}{1+\sec\theta+\tan\theta}$$
$$= \frac{(\sec^2\theta-\tan^2\theta)+(\sec\theta-\tan\theta)}{1+\sec\theta+\tan\theta}$$
$$= \frac{(\sec\theta-\tan\theta)(\sec\theta+\tan\theta)+(\sec\theta-\tan\theta)}{1+\sec\theta+\tan\theta}$$
$$= \frac{(\sec\theta-\tan\theta)[\sec\theta+\tan\theta+1]}{1+\sec\theta+\tan\theta}$$
$$= \sec\theta-\tan\theta$$
$$= \frac{1}{\cos\theta}-\frac{\sin\theta}{\cos\theta}$$
$$= \frac{1-\sin\theta}{\cos\theta}$$
$$= \text{R.H.S.}$$

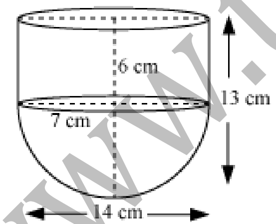
25. Radius of outer circle, r_1 = 23 cm
Radius of inner circle, r_2 = 12 cm
Then,

Area of outer circle $= \pi r_1^2 = \left(\frac{22}{7}\times 23\times 23\right)\text{cm}^2 = 1662.6\text{ cm}^2$

Area of inner circle $= \pi r_2^2 = \left(\frac{22}{7}\times 12\times 12\right)\text{cm}^2 = 452.6\text{ cm}^2$

Area of ring = Area of outer circle – Area of inner circle
$= (1662.6 - 452.6)\text{ cm}^2$
$= 1210\text{ cm}^2$

OR



Radius (r) of cylindrical part and hemispherical part = 7 cm
Height of hemispherical part = radius = 7 cm.
Height of cylindrical part (h) = 13 – 7 = 6 cm
Inner SA of the vessel = CSA of cylindrical part + CSA of hemispherical part
$= 2\pi rh + 2\pi r^2$
$= 2\times\frac{22}{7}\times 7\times 6 + 2\times\frac{22}{7}\times 7\times 7$
$= 44(6 + 7)$
$= 44 \times 13$
$= 572\text{ cm}^2$

Section C

26. It can be observed that Ravi and Sonia do not take the same amount of time. Ravi takes less time than Sonia to complete 1 round of the circular path.
As they are going in the same direction, they will meet again at the same time when Ravi has completed one round of that circular path with respect to Sonia.
i.e., when Sonia completes one round, then Ravi completes 1.5 rounds.
So they will meet first at a time that is a common multiple of the time it takes them to complete one round, i.e., LCM of 18 minutes and 12 minutes.
Now,
$18 = 2 \times 3 \times 3 = 2 \times 3^2$
And, $12 = 2 \times 2 \times 3 = 2^2 \times 3$
LCM of 12 and 18 = product of factors raised to highest exponent = $2^2 \times 3^2 =$ 36
Therefore, Ravi and Sonia will meet at the starting point after 36 minutes.

27. Let the first number be x.
Then, the second number is $27 - x$.
Now,
$$x(27-x)=182$$
$$\Rightarrow x^2-27x+182=0$$
$$\Rightarrow x^2-13x-14x+182=0$$
$$\Rightarrow x(x-13)-14(x-13)=0$$
$$\Rightarrow (x-13)(x-14)=0$$
Either x = 13 = 0 or x – 14 = 0
i.e., x = 13 or x = 14
If first number = 13, then other number = 27 – 13 = 14
If first number = 14, then other number = 27 – 14 = 13
Therefore, the numbers are 13 and 14.

28. Given: $p(x) = 2x^2 + 5x + k$
Sum of the zeroes = $\alpha + \beta = -5/2$
Product of zeroes = $\alpha\beta = k/2$
Given $\alpha^2 + \beta^2 + \alpha\beta = 21/4$
$(\alpha + \beta)^2 - \alpha\beta = 21/4$
$$\left(\frac{-5}{2}\right)^2-\frac{k}{2}=\frac{21}{4}$$
$$\frac{25}{4}-\frac{k}{2}=\frac{21}{4}$$
$$\frac{k}{2}=1$$
k = 2

OR

Let the monthly income of A and B be Rs. 5x and Rs. 4x, respectively, and let their expenditures be Rs. 7y and Rs. 5y, respectively.

Then

$5x - 7y = 3000$ … (1)

$4x - 5y = 3000$ … (2)

Multiplying (1) by 5 and (2) by 7, we get

$25x - 35y = 15000$ … (3)

$28x - 35y = 21000$ … (4)

Subtracting (3) from (4), we get

$3x = 6000 \Rightarrow x = 2000$

Hence,

Income of A = $5x = 5 \times 2000$ = Rs. 10000

Income of B = $4x = 4 \times 2000$ = Rs. 8000

29. In a cyclic quadrilateral ABCD,

$\angle A = (x + y + 10)°$, $\angle B = (y + 20)°$, $\angle C = (x + y - 30)°$, $\angle D = (x + y)°$

We have, $\angle A + \angle C = 180°$ and $\angle B + \angle D = 180°$ $[\because \text{ABCD is a cyclic quadrilateral}]$

Now, $\angle A + \angle C = (x + y + 10)° + (x + y - 30)° = 180°$

$\Rightarrow 2x + 2y - 20° = 180°$

$\Rightarrow x + y - 10° = 90°$

$x + y = 100°$ … (1)

$\angle B + \angle D = (y + 20)° + (x + y)° = 180°$

$\Rightarrow x + 2y + 20° = 180°$

$\Rightarrow x + 2y = 160°$ … (2)

Subtracting (1) from (2), we get

$y = 160 - 100 = 60$

and $x = 100 - y = 100 - 60 = 40$

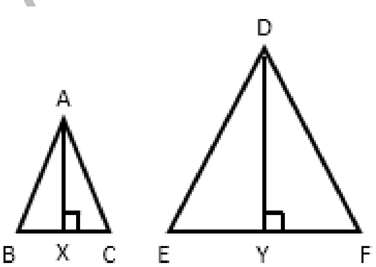
$\angle A = (x + y + 10)° = (100 + 10)° = 110°$

$\angle B = (y + 20)° = (60 + 20)° = 80°$

$\angle C = (x + y - 30)° = (100 - 30)° = 70°$

$\angle D = (x + y)° = 100°$

OR



Given: $\Delta ABC \sim \Delta DEF$

To prove that $AX : DY = AB : DE$

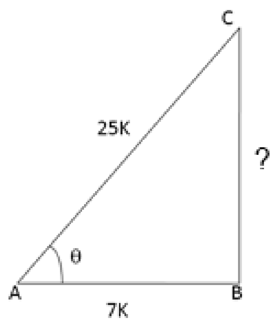
Proof:
In ΔABX and ΔDEY,
$\angle B = \angle E$ (corresponding angles)
$\angle AXB = \angle DYE$ (Each 90°)
$\Rightarrow \Delta ABX \sim \Delta DEY$ (AA similarity)

$$\frac{AB}{DE} = \frac{BX}{EY} = \frac{AX}{DY}$$

$$\frac{AX}{DY} = \frac{AB}{DE}$$

30. Given : $\cos\theta = \frac{7}{25}$

Let Ab = 7k and AC = 25k, where k is positive
Let us draw a ΔABC in which $\angle B = 90^\circ$ and $\angle BAC = \theta$.
By Pythagoras' theorem, we have



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

$$\Rightarrow BC^2 = AC^2 - AB^2$$

$$BC^2 = \left[(25k)^2 - (7k)^2\right]$$

$$= \left(625k^2 - 49k^2\right)$$

$$= 576k^2$$

$$\Rightarrow BC = \sqrt{576k^2} = 24k$$

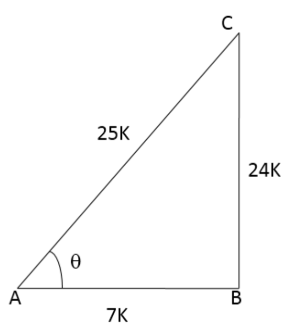
$$\therefore \sin\theta = \frac{BC}{AC} = \frac{24k}{25k} = \frac{24}{25}; \cos\theta = \frac{7}{25}\text{(given)}$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta} = \left(\frac{24}{25} \times \frac{25}{7}\right) = \frac{24}{7}$$

$$\text{cosec}\,\theta = \frac{1}{\sin\theta} = \frac{25}{24}$$

$$\sec\theta = \frac{1}{\cos\theta} = \frac{25}{7}$$

$$\cot\theta = \frac{1}{\tan\theta} = \frac{7}{24}$$



31. Two dice are thrown simultaneously.

Total number of outcomes = 6 × 6 = 36

i. 5 will not come up on either of them.
Favorable cases are

(1, 1), (1, 2), (1, 3), (1, 4), (1, 6), (2, 1), (2, 2),
(2, 3), (2, 4), (2, 6), (3, 1), (3, 2), (3, 3), (3, 4),
(3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 6), (6, 1),
(6, 2), (6, 3), (6, 4), (6, 6) = 25

$\therefore$ Probability that 5 will not come up on either die $= \frac{25}{36}$

ii. 5 will not come up on at least one.
Favorable cases are
(1, 5), (2, 5), (3, 5), (4, 5), (5, 5), (6, 5), (5, 1), (5, 2), (5, 3), (5, 4), (5, 6) = 11

Probability that 5 will come at least once $= \frac{11}{36}$

iii. 5 will come up on both dice.
Favourable case: (5, 5)

$\therefore$ Probability that 5 will come on both dice $= \frac{1}{36}$

Section D

32. Let the speed of the boat in still water be x km/hr
Then, the speed of the boat downstream = (x + 2) km/hr
And the speed of the boat upstream = (x − 2) km/hr

Time taken to cover 8 km downstream $= \frac{8}{(x+2)}$hrs

Time taken to cover 8 km upstream $= \frac{8}{(x-2)}$hrs

Total time taken $= 1\frac{40}{60} = \frac{5}{3}$ hrs

$$\frac{8}{(x+2)} + \frac{8}{(x-2)} = \frac{5}{3}$$

$$\Rightarrow \frac{1}{x+2} + \frac{1}{x-2} = \frac{5}{24}$$

$$\Rightarrow \frac{x-2+x+2}{(x+2)(x-2)} = \frac{5}{24}$$

$$\Rightarrow \frac{2x}{x^2-4} = \frac{5}{24}$$

$$\Rightarrow 5x^2 - 48x - 20 = 0$$

$$\Rightarrow 5x^2 - 50x + 2x - 20 = 0$$

$$\Rightarrow 5x(x-10) + 2(x-10) = 0$$

$$\Rightarrow (x-10)(5x+2) = 0$$

$$\Rightarrow x = 10 \text{ or } x = \frac{-2}{5}$$

$$\Rightarrow x = 10 \ (\text{speed cannot be negative})$$

Then the speed of the boat in still water is 10 km/hr.

OR

Let the faster pipe take x minutes to fill the cistern.
Then the other pipe takes (x + 3) minutes.

$$\frac{1}{x}+\frac{1}{(x+3)}=\frac{13}{40}$$

$$\Rightarrow \frac{(x+3)+x}{x(x+3)}=\frac{13}{40}$$

$$\Rightarrow 40(2x+3)=13\left(x^2+3x\right)$$

$$\Rightarrow 80x+120=13x^2+39x$$

$$\Rightarrow 13x^2-41x-120=0$$

$$\Rightarrow 13x^2-65x+24x-120=0$$

$$\Rightarrow 13x(x-5)+24(x-5)=0$$

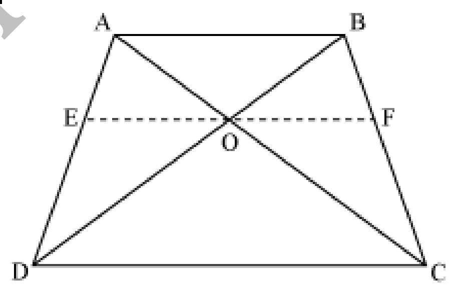
$$\Rightarrow (x-5)(13x+24)=0$$

$$\Rightarrow x=5 \quad \text{or} \quad x=\frac{-24}{13}$$

$$\Rightarrow x=5 \quad (\text{Time cannot be negative})$$

If the faster pipe takes 5 minutes to fill the cistern, then the other pipe takes (5 + 3) minutes = 8 minutes

33. Draw a line EF through point O such that EF||CD.



In ΔADC, EO || CD

So, by basic proportionality theorem

$$\frac{AE}{ED}=\frac{AO}{OC} \ldots(1)$$

Similarly, in ΔBDC, FO || CD

So, by basic proportionality theorem

$$\frac{BF}{FC}=\frac{BO}{OD} \ldots(2)$$

Now consider trapezium ABCD

As FE||CD

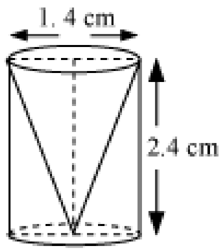
$$\text{So, } \frac{AE}{ED}=\frac{BF}{FC} \ldots (3)$$

Now from equations (1), (2), (3)

$$\frac{AO}{OC}=\frac{BO}{OD}$$

$$\text{Or, } \frac{AO}{BO}=\frac{OC}{OD}$$

34.



Given that

Height (h) of the conical part = Height (h) of the cylindrical part = 2.4 cm

Diameter of the cylindrical part = 1.4 cm

So, radius (r) of the cylindrical part = 0.7 cm

Slant height (l) of conical part = $\sqrt{r^2 + h^2}$

$$= \sqrt{(0.7)^2 + (2.4)^2} = \sqrt{0.49 + 5.76}$$

$$= \sqrt{6.25} = 2.5$$

Total surface area of remaining solid

= CSA of cylindrical part + CSA of conical part + Area of cylindrical base

$= 2\pi rh + \pi rl + \pi r^2$

$= 2 \times \frac{22}{7} \times 0.7 \times 2.4 + \frac{22}{7} \times 0.7 \times 2.5 + \frac{22}{7} \times 0.7 \times 0.7$

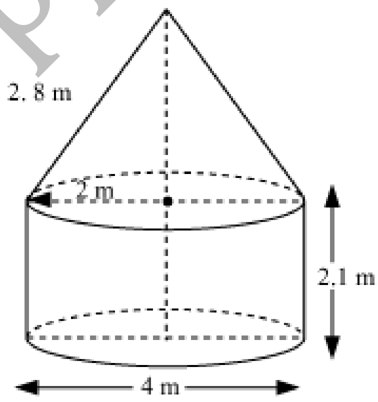
= 4.4 × 2.4 + 2.2 × 2.5 + 2.2 × 0.7

= 10.56 + 5.50 + 1.54

= 17.60 cm^2

Clearly total surface area of the remaining solid to the nearest cm^2 is 18 cm^2.

OR



Given that

Height (h) of the cylindrical part = 2.1 m

Diameter of the cylindrical part = 4 m

So, radius of the cylindrical part = 2 m

Slant height (l) of conical part = 2.8 m

Area of canvas used = CSA of conical part + CSA of cylindrical part

$$= \pi rl + 2\pi rh$$
$$= \pi \times 2 \times 2.8 + 2\pi \times 2 \times 2.1$$
$$= 2\pi[2.8 + 4.2]$$
$$= 2 \times \frac{22}{7} \times 7$$
$$= 44\ m^2$$

Cost of 1 m^2 canvas = Rs.500

Cost of 44 m^2 canvas = 44 × 500 = Rs. 22000

So, it will cost Rs.22000 for making such a tent.

35. Given that mean pocket allowance $\bar{x} = \text{Rs.}18$

Now taking 18 as assured mean (a) we may calculate d_i and f_id_i as following.

Daily pocket allowance (in Rs.)	Number of children (f_i)	Class-mark (x_i)	$d_i = x_i - 18$	f_id_i
11–13	7	12	−6	−42
13–15	6	14	−4	−24
15–17	9	16	−2	−18
17–19	13	18	0	0
19–21	f	20	2	2f
21–23	5	22	4	20
23–25	4	24	6	24
Total	$\sum f_i = 44 + f$			2f − 40

Here,

$\sum f_i = 44 + f$ and $\sum f_id_i = 2f - 40$

$$\bar{x} = a + \frac{\sum f_id_i}{\sum f_i}$$
$$18 = 18 + \left(\frac{2f - 40}{44 + f}\right)$$
$$0 = \left(\frac{2f - 40}{44 + f}\right)$$
$$2f - 40 = 0$$
$$2f = 40$$
$$f = 20$$

Hence the messing frequency is 20.

Section E

36.

i. Here,
$a_3 = a + 2d = 4$ …… (i) and
$a_9 = a + 8d = -8$ ….. (ii)
Subtracting (i) from (ii), we get
$6d = -12 \Rightarrow d = -2$

ii. $d = -2$ and $a_3 = a + 2d = 4$
$\Rightarrow a = 4 - 2(-2) = 4 + 4 = 8$

iii. Here, $a = 8$ and $d = -2$ and $a_n = -160$
$\Rightarrow -160 = 8 + (n - 1)(-2)$
$\Rightarrow -168 = -2n + 2$
$\Rightarrow n = 85$

OR

Here, $a = 8$ and $d = -2$
$\Rightarrow a_{75} = a + 74d = 8 + 74(-2) = 8 - 148 = -140$

37.

i. A (1, 1) and C(4, 5)
$$d(AC) = \sqrt{(4-1)^2 + (5-1)^2} = 5 \text{ km}$$

OR

B(4,1) and D(7,5)
$$d(BD) = \sqrt{(7-4)^2 + (5-1)^2} = 5 \text{ km}$$

ii. B (4, 1) and A(1, 1)
$$d(BA) = \sqrt{(1-4)^2 + (1-1)^2} = 3 \text{ km}$$

iii. C (4, 5) and B(4, 1)
$$d(BC) = \sqrt{(4-4)^2 + (5-1)^2} = 4 \text{ km}$$

38.

i. The one who makes small angle of elevation is closer to airplane.
As Rishabh makes an angle of elevation 30° from the airplane, he is closer and Reema is far from the airplane.

ii. In ΔBDE, we have

$$\tan 30^\circ = \frac{DE}{BD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{BD}$$

$$\Rightarrow BD = h\sqrt{3}\ m$$

OR

In ΔACE, we have

$$\tan 60^\circ = \frac{CE}{AC}$$

$$\Rightarrow \sqrt{3} = \frac{h+4}{BD}$$

$$\Rightarrow BD = \frac{h+4}{\sqrt{3}}$$

$$\Rightarrow \sqrt{3} \times h = \frac{h+4}{\sqrt{3}}$$

$$\Rightarrow h = 2$$

iii. Distance between the airplane and the ground = EF
EF = ED + DC + CF = 2 + 4 + 2 = 8 m