CBSE
Class X Mathematics (Standard)
Sample Paper – 3 Reference Solutions (2024-25)

Section A

1. Correct option: C
Explanation:
'a' and 'b' are two prime numbers. Thus, the only factors of a are 1 and a and the only factors of b are 1 and b.
Hence, the only common factor of a and b is 1.

2. Correct option: C
Explanation:
Since x = 1 is a solution of $x^2 + kx + 3 = 0$, it must satisfy the equation.
$\therefore (1)^2 + k(1) + 3 = 0 \Rightarrow k = -4$
Hence, the required value of k = −4.

3. Correct option: B
Explanation:
The graph of P(x) intersects the x-axis at only 1 point.
So, the number of zeroes is 1.

4. Correct option: D
Explanation:
Let the digits be x and y.
x + y = 10 ….(i)
x − y = 2 ….(ii)
Adding (i) and (ii), we get 2x = 12 ⇒ x = 6
From (i), we get y = 10 − 6 = 4
Two-digit number = 10x + y = 10(6) + 4 = 64

5. Correct option: D
Explanation:
The point (3, a) lies on the line 2x − 3y = 5.
Substituting the values of x and y in the given equation:
2 × 3 − 3 × a = 5
∴ 6 − 3a = 5
$\therefore 3a = 1 \Rightarrow a = \frac{1}{3}$

6. Correct option: C
Explanation:
Using the graph, we get the coordinates of A and B as A(4,4) and B(3,1).
Thus, $d(AB) = \sqrt{(4-3)^2 + (4-1)^2} = \sqrt{(1)^2 + (3)^2} = \sqrt{10}$ km
Hence, the distance between their positions is $\sqrt{10}$ km.

7. Correct option: D
Explanation:
Using the graph, we get the coordinates of A and C as A(4,1) and C(7, 5).
Let B(x,y) be the co-ordinates of Raju's house, which is the mid-point of AC.
Hence, by using midpoint formula

$$B(x,y)=\left(\frac{4+7}{2},\frac{1+5}{2}\right)=(5.5,\ 3)$$

Hence, the co-ordinates of Raju's house is (5.5, 3).

8. Correct option: C
Explanation:
$\angle AOQ = 58°$ (given)

$$\angle ABQ=\frac{1}{2}\angle AOQ=\frac{1}{2}\times 58^\circ=29^\circ$$

In right-angled ΔBAT, $\angle ABT + \angle BAT + \angle ATB = 180°$
$29° + 90° + \angle ATB = 180°$
$\angle ATB = 61°$
That is, $\angle ATQ = 61°$

9. Correct option: A
Explanation:
$\Delta ABC \sim \Delta DEF$

$$\frac{AB}{DE}=\frac{AC}{DF}=\frac{BC}{EF}$$

$$\Rightarrow \frac{3}{DE}=\frac{2.5}{DF}=\frac{2}{4}$$

$$\Rightarrow DE = 6\,\text{cm},\ DF=5\ \text{cm}$$

$$\text{Perimeter}=4+5+6=15\ \text{cm}$$

10. Correct option: C
Explanation:
All equilateral triangles are similar to each other.

11. Correct option: A
Explanation:
The value of cot θ is not defined for θ = 0°.
Hence the angle in question here is 0°.

12. Correct Option: A
Explanation:

$$2\sin 2A=\sqrt{3}$$

$$\therefore \sin 2A=\frac{\sqrt{3}}{2}$$

$$\therefore \sin 2A=\sin 60^\circ$$

$$\therefore 2A=60^\circ$$

$$\therefore A=30^\circ$$

13. Correct Option: C
Explanation:
$\cos^4\theta - \sin^4\theta = (\cos^2\theta + \sin^2\theta)(\cos^2\theta - \sin^2\theta)$
$= \cos^2\theta - \sin^2\theta$
$= 1 - \sin^2\theta - \sin^2\theta$
$=1 - 2\sin^2\theta$
Also, $\cos^2\theta - \sin^2\theta = \cos^2\theta - (1 - \cos^2\theta) = 2\cos^2\theta - 1$

14. Correct Option: C
Explanation:
Area of sector of angle $\theta = \frac{\theta}{360^\circ} \times \pi r^2 = \frac{90^\circ}{360^\circ} \times \frac{22}{7} \times (7)^2 = 38.5 \text{ cm}^2$

15. Correct option: B
Explanation:
For a cone, height, h = 70 cm and radius, r = 9 cm
Volume of the circular cone $= \frac{1}{3}\left(\pi \times 9^2 \times 70\right) = 5940 \text{ cm}^3$

16. Correct Option: C
Explanation:
The marks with the highest frequency will be the mode, hence mode is 25.

17. Correct Option: B
Explanation:
Total number of letters = 10
The vowels involved are E, I and O where O appears twice.
⇒ Number of vowels = 4
Therefore, probability of getting a vowel = $\frac{4}{10} = \frac{2}{5}$

18. Correct option: C
Explanation:
If a point lies in the 3rd quadrant, then its x-coordinate as well as its y-coordinate will be negative.

19. Correct Option: A
Explanation:
Let the radius of the park be r metres.
Thus, $\pi r + 2r = 90 \Rightarrow \frac{22r}{7} + 2r = 90$
Hence, the reason (R) is true.
$\Rightarrow \frac{36r}{7} = 90 \Rightarrow r = \frac{90 \times 7}{36}$
$\Rightarrow r = 17.5 \text{ m}$
Area of semicircular park $= \frac{1}{2}\pi r^2 = \left(\frac{1}{2} \times \frac{22}{7} \times 17.5 \times 17.5\right)\text{m}^2 = 481.25 \text{ m}^2$
Hence, both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

20. Correct Option: D
Explanation:
The equation given in reason is correct and hence, reason is true.
Given polynomial = $x^3 - 12x^2 + 19x - 28$

Sum of the zeros $= -\dfrac{\text{Coefficient of } x^2}{\text{Coefficient of } x^3}$

$(p - q) + p + (p + q) = -\dfrac{-12}{1}$

$3p = 12 \Rightarrow p = 4$
Hence, assertion is false.
Thus, assertion (A) is false but reason (R) is true.

Section B

21. According to the question,
HCF (185, 25) = 5
HCF × LCM = Product of numbers

$\Rightarrow \text{LCM} = \dfrac{185 \times 25}{5} \Rightarrow \text{LCM} = 925$

22. Given, AB = 5.7 cm, BD = 3.8 cm and CD = 5.4 cm.
In ΔCBA and ΔCDB,
$\angle CBA = \angle CDB = 90^\circ$
And $\angle C = \angle C$ (Common)
$\Delta CBA \sim \Delta CDB$ (by AA similarity)

$\Rightarrow \dfrac{BC}{5.4} = \dfrac{5.7}{3.8}$

$\Rightarrow \dfrac{CB}{CD} = \dfrac{BA}{DB}$

$\Rightarrow BC = \dfrac{5.7 \times 5.4}{3.8} = 8.1 \text{ cm}$

Hence, BC = 8.1 cm.

23. A circle is inscribed in a triangle ABC touching AB, BC and CA at P, Q and R, respectively.
Also, AB = 10 cm, AR = 7 cm, CR = 5 cm
AR and AP are the tangents to the circle.
$\therefore$ AP = AR = 7 cm
AB = 10 cm
$\therefore$ BP = AB – AP = (10 – 7) = 3 cm
Also, BP and BQ are tangents to the circle.
$\therefore$ BP = BQ = 3 cm
Further, CQ and CR are tangents to the circle.
$\therefore$ CQ = CR = 5 cm
BC = BQ + CQ = (3 + 5) cm = 8 cm
Hence, BC = 8 cm

24.

$$\text{L.H.S.} = \frac{\sin\theta}{\operatorname{cosec}\theta} + \frac{\cos\theta}{\sec\theta}$$
$$= \sin\theta\sin\theta + \cos\theta\ \cos\theta$$
$$= \sin^2\theta + \cos^2\theta$$
$$= 1$$
$$= \text{R.H.S.}$$

OR

$$\text{L.H.S.} = \cos 1^\circ \cos 2^\circ \cos 3^\circ \ldots \cos 180^\circ$$
$$= \cos 1^\circ \cos 2^\circ \cos 3^\circ \ldots \cos 90^\circ \ldots \cos 180^\circ$$
$$= \cos 1^\circ \cos 2^\circ \cos 3^\circ \ldots \times 0 \times \ldots \cos 180^\circ$$
$$(\text{Since } \cos 90^\circ = 0)$$
$$= 0$$
$$= \text{R.H.S.}$$

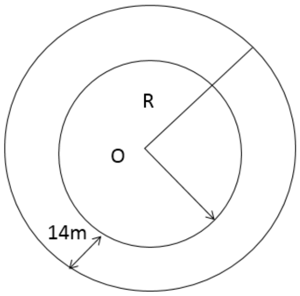
25. Let the inner and outer radii of the circular tracks be r metres and R metres, respectively.

Now, inner circumference = 440 metres

$\Rightarrow 2\pi r = 440$

$\Rightarrow 2 \times \frac{22}{7} \times r = 440$

$\Rightarrow r = 70$ m



Since the track is 14 m wide everywhere,

Therefore,

Outer radius R = r + 14 m = (70 + 14) m = 84 m

$\therefore$ Outer circumference = $2\pi R$

$= \left(2 \times \frac{22}{7} \times 84\right) m = 528$ m

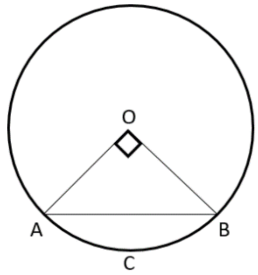
$\therefore$ Total length of the outer boundary of the track = 528 m.

OR

Let AB be the cord of circle subtending 90° angle at centre O of circle.

Area of minor sector OACB $= \frac{90^\circ}{360^\circ} \times \pi r^2$

$$= \frac{1}{4} \times \frac{22}{7} \times 10 \times 10$$
$$= \frac{1100}{14}$$
$$= 78.57 \text{ cm}^2$$



Section C

26. To find the minimum number of rooms required, first find the maximum number of participants which can be accommodated in each room such that the number of participants in each room is the same.
This can be determined by finding the HCF of 60, 84 and 108.

$60 = 2^2 \times 3 \times 5$

$84 = 2^2 \times 3 \times 7$

$108 = 2^2 \times 3^3$

$\text{H.C.F.} = 2^2 \times 3 = 12$

So, the minimum number of rooms required

$= \dfrac{\text{Total number of participants}}{12}$

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

$= 21$

27. $4s^2 - 4s + 1 = 0$

$\Rightarrow 2s - 1 = 0$

$\Rightarrow s = \dfrac{1}{2}$

So, the zeroes of $4s^2 - 4s + 1$ are $\dfrac{1}{2}$ and $\dfrac{1}{2}$.

Sum of zeroes $= \dfrac{1}{2} + \dfrac{1}{2} = 1 = \dfrac{-(-4)}{4} = \dfrac{-(\text{Coefficient of } s)}{(\text{Coefficient of } s^2)}$

Product of zeroes $= \dfrac{1}{2} \times \dfrac{1}{2} = \dfrac{1}{4} = \dfrac{\text{Constant term}}{\text{Coefficient of } s^2}$

28. Let the speed of train be x km/h.

Time taken to travel 480 km = $\dfrac{480}{x}$ hrs

In second condition, let the speed of train = $(x-8)$ km/h

It is also given that the train will take 3 more hours to cover the same distance.

Therefore, time taken to travel 480 km = $\left(\dfrac{480}{x} + 3\right)$ hrs

Speed × Time = Distance

$(x-8)\left(\dfrac{480}{x} + 3\right) = 480$

$\Rightarrow 480 + 3x - \dfrac{3840}{x} - 24 = 480$

$\Rightarrow 3x - \dfrac{3840}{x} = 24$

$\Rightarrow 3x^2 - 24x - 3840 = 0$

$\Rightarrow x^2 - 8x - 1280 = 0$

$\Rightarrow x^2 - 40x + 32x - 1280 = 0$

$\Rightarrow x(x - 40) + 32(x - 40) = 0$

$\Rightarrow (x - 40)(x + 32) = 0$

Hence, x = 40 or -32

Since speed can't be negative, we have x = 40.

Thus speed of the train is 40 km/hr.

OR

In a cyclic quadrilateral ABCD,

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

Then, $\angle A + \angle C = 180°$ and $\angle B + \angle D = 180°$

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

$\Rightarrow 2x + 2y - 20° = 180°$

$\Rightarrow x + y = 100$ ....(1)

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

$\Rightarrow x + 2y + 20° = 180°$

$\Rightarrow x + 2y = 160°$ ....(2)

Subtracting (1) from (2), we get

$y = 160 - 100 = 60$

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

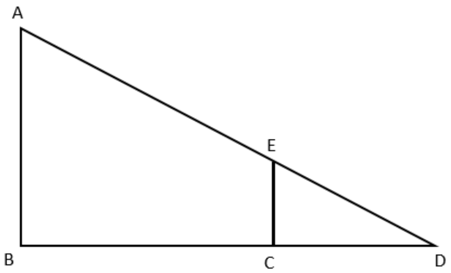
$\angle A = (x + y + 10)° = (100 + 10)° = 110°$

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

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

$\angle D = (x + y)° = 100°$

29.



Let AB be the lamp post and CE be Raja's height.

Then, CE = 90 cm = 0.9 m

BC is the distance covered in 4 sec.

Hence, BC = 4×2 = 8 m

Now, CD is the length of the shadow.

In $\triangle ABD$ and $\triangle ECD$

$\angle ABD = \angle ECD$ (each 90 degree)

$\angle ADB = \angle EDC$ (common angle)

Hence, $\triangle ABD \sim \triangle ECD$ … (AA test)

$\therefore \frac{AB}{EC} = \frac{3}{0.9}$

$\therefore \frac{BD}{CD} = \frac{10}{3}$

$\therefore \frac{8+CD}{CD} = \frac{10}{3}$

$\therefore \frac{24+3CD}{10} = CD$

$\therefore$ 2.4 + 0.3(CD) = CD

$\therefore$ 2.4 = 0.7(CD)

$\therefore$ x = 3.43m

Hence, the length of Raja's shadow after 4 seconds will be 3.43 m.

OR

Given, AO = 6 m, OB = 4 m, AB = 8 m, OD = 2 m and OC = 3 m.

In $\triangle$AOB and $\triangle$COD,

$\frac{AO}{CO} = \frac{6}{3} = 2$ and $\frac{OB}{OD} = \frac{4}{2} = 2$

$\angle AOB = \angle COD$ (vertically opposite angles)

$\therefore \triangle AOB \sim \triangle COD$… (SAS test)

$\therefore \frac{AB}{CD} = 2$ (Corresponding angles of similar triangles)

$\therefore$ CD = ½ AB = 4 m

Hence, the length of CD is 4 m.

30. In ΔPQR, by applying Pythagoras theorem

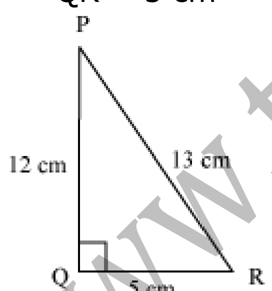
$PR^2 = PQ^2 + QR^2$

$(13)^2 = (12)^2 + QR^2$

$169 = 144 + QR^2$

$25 = QR^2$

QR = 5 cm



$$\tan P = \frac{\text{Side opposite to } \angle P}{\text{Side adjacent to } \angle P} = \frac{QR}{PQ} = \frac{5}{12}$$

$$\cot R = \frac{\text{Side adjacent to } \angle R}{\text{Side opposite to } \angle R} = \frac{QR}{PQ} = \frac{5}{12}$$

$$\tan P - \cot R = \frac{5}{12} - \frac{5}{12} = 0$$

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 $= \dfrac{25}{36}$

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 $= \dfrac{11}{36}$

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

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

Section D

32. Let the marks obtained by Kamal in Mathematics and English be x and y.

$\therefore x + y = 40 \quad ....(1)$

and $(x+3)(y-4) = 360 \quad ....(2)$

From (1), $y = 40 - x$

Putting value of y in (2)

$(x+3)(40-x-4) = 360$

$\Rightarrow (x+3)(36-x) = 360$

$\Rightarrow 36x - x^2 + 108 - 3x = 360$

$\Rightarrow -x^2 + 33x - 252 = 0$

$\Rightarrow x^2 - 33x + 252 = 0$

$\Rightarrow x^2 - 21x - 12x + 252 = 0$

$\Rightarrow x(x-21) - 12(x-21) = 0$

$\Rightarrow (x-21)(x-12) = 0$

When $x - 21 = 0$, $x = 21$

when $x - 12 = 0$, $x = 12$

For $x = 21$,

$y = 40 - 21 = 19$

For $x = 12$,

$y = 40 - 12 = 28$

The marks obtained by Kamal in Mathematics and English, respectively, are 21 and 19 or 12 and 28.

OR

Let x km/hr be the usual speed of the passenger train.

Then, time taken to travel 300 km $= \frac{300}{x}$ hours

When speed is (x + 5) km/hr, the time taken to travel 300 km $= \frac{300}{x+5}$ hours

$$\therefore \frac{300}{x} - \frac{300}{x+5} = 2$$

$$\Rightarrow \frac{1}{x} - \frac{1}{x+5} = \frac{2}{300} = \frac{1}{150}$$

$$\Rightarrow \frac{x+5-x}{x(x+5)} = \frac{1}{150}$$

$$\Rightarrow \frac{5}{x(x+5)} = \frac{1}{150}$$

$$\therefore x(x+5) = 750 \quad \text{or} \quad x^2 + 5x - 750 = 0$$

$$\Rightarrow x^2 + 30x - 25x - 750 = 0$$

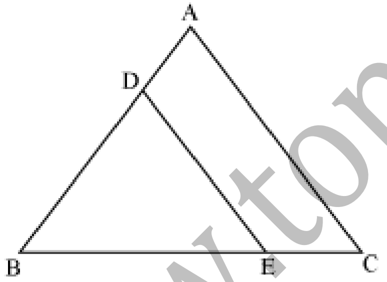
$$\Rightarrow x(x+30) - 25(x+30) = 0 \quad \text{or} \quad (x+30)(x-25) = 0$$

$\therefore x + 30 = 0, x = -30,$ but x cannot be negative

$\therefore x - 25 = 0,\ x = 25$

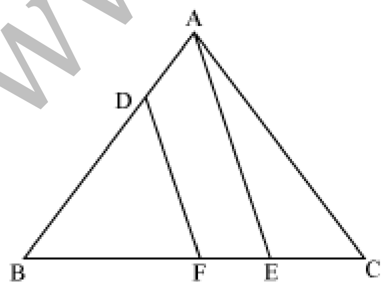
Therefore, the usual speed of the passenger train is 25 km/hr.

33.



In ΔABC, DE || AC.

$$\therefore \frac{BD}{DA} = \frac{BE}{EC} \qquad ....(i)$$



In ΔBAE, $DF \parallel AE$.

$\therefore \frac{BD}{DA} = \frac{BF}{FE} \quad ....(ii)$

From (i) and (ii),

$\frac{BE}{EC} = \frac{BF}{FE}$

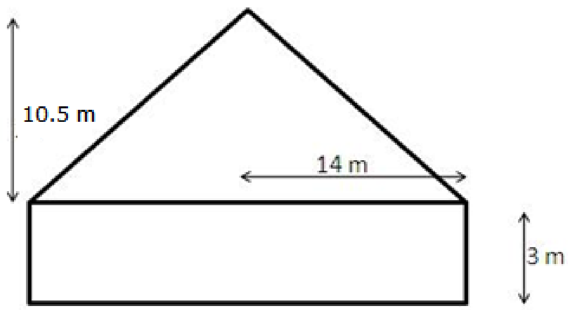
34. For a cylinder,
Radius = 14 m and Height = 3 m
For a cone,
Radius = 14 m and Height = 10.5 m
Let l be the slant height of the cone. Then,

$l = \sqrt{(14)^2 + (10.5)^2}$

$= \sqrt{(196 + 110.25)}$

$= \sqrt{306.25}$

$= 17.5$ m



Now, Curved surface area of the tent
= (curved area of the cylinder + curved surface area of the cone)

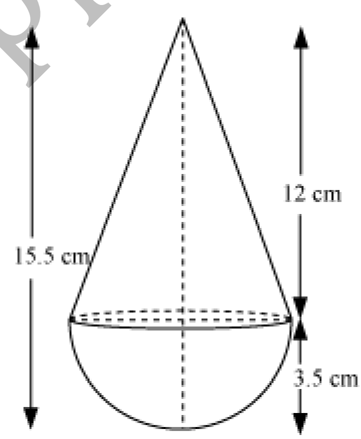
$= \left[\left(2 \times \frac{22}{7} \times 14 \times 3\right) + \left(\frac{22}{7} \times 14 \times 17.5\right)\right] m^2$

$= (264 + 770) m^2$

$= 1034\ m^2$

Hence, the cost of canvas = Rs. (1034 × 80) = Rs. 82720.

OR



Radius of the conical part and the hemispherical part (r) = 3.5 cm

Height of hemispherical part = radius = 3.5 = $\frac{7}{2}$ cm.

Height of conical part (h) = (15.5 – 3.5) = 12 cm

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

$$= \sqrt{\left(\frac{7}{2}\right)^2 + (12)^2} = \sqrt{\frac{49}{4} + 144} = \sqrt{\frac{49+576}{4}}$$

$$= \sqrt{\frac{625}{4}} = \frac{25}{2}$$

Total surface area of toy = CSA of conical part + CSA of hemispherical part

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

$= \frac{22}{7} \times \frac{7}{2} \times \frac{25}{2} + 2 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$

$= 137.5 + 77$

$= 214.5 \text{ cm}^2$

35. Let us find class mark for each interval by using the relation.

$x_i = \dfrac{\text{upper class limit} + \text{lower class limit}}{2}$

Class size (h) of this data = 20

Now taking 150 as assured mean (a) we may calculate d_i, u_i and f_iu_i as following:

Daily wages (in Rs)	Number of workers (f_i)	x_i	$d_i = x_i - 150$	$u_i = \frac{x_i - 150}{h}$	f_iu_i
100 –120	12	110	–40	–2	–24
120 – 140	14	130	–20	–1	–14
140 – 160	8	150	0	0	0
160 –180	6	170	20	1	6
180 – 200	10	190	40	2	20
Total	50				–12

Here, $\sum f_i = 50$ and $\sum f_iu_i = -12$

Mean $\bar{x} = a + \left(\frac{\sum f_iu_i}{\sum f_i}\right)h$

$= 150 + \left(\frac{-12}{50}\right)20$

$= 150 - \frac{24}{5}$

$= 150 - 4.8$

$= 145.2$

Therefore, the mean daily wages of the workers in a factory is Rs.145.20

Section E

36.

i. The production of TV sets in a factory increases uniformly by a fixed number every year.
This is an example of an A.P.
Production of TV sets in 6^{th} year = 16000 and
Production of TV sets in 9^{th} year = 22600
n^{th} term of an AP = a + (n − 1)d
⇒ 6^{th} term of an AP = a + (6 − 1)d
⇒ 16000 = a + 5d ….. (i)
Similarly we get, 22600 = a + 8d ….. (ii)
Solving (i) and (ii), we get
d = 2200 and a = 5000
Therefore, the production during first year is 5000.

OR

The production of TV sets in a factory increases uniformly by a fixed number every year.
This is an example of an A.P.
Production of TV sets in 6^{th} year = 16000 and
Production of TV sets in 9^{th} year = 22600
n^{th} term of an AP = a + (n − 1)d
⇒ 6^{th} term of an AP = a + (6 − 1)d
⇒ 16000 = a + 5d ….. (i)
Similarly we get, 22600 = a + 8d ….. (ii)
Solving (i) and (ii), we get
d = 2200 and a = 5000
Therefore, the difference in production between two consecutive years is 2200.

ii. Production during 8^{th} year = a + 7d = 5000 + 7(2200) = 20400

iii. Production during first three years,

$$S_3 = \frac{3}{2}(2\times 5000 + 2\times 2200)$$
$$= \frac{3}{2}\times 14400$$
$$= 21600$$

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. Distance between Boat 1 and the base of the lighthouse = BC

$\angle ACB=\angle EAC=45^\circ$

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

$\therefore 1=\frac{100}{BC}$

$\therefore BC=100\text{ m}$

OR

Distance between Boat 2 and the base of the lighthouse = BD

$\angle ADB=\angle EAD=30^\circ$

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

$\therefore \frac{1}{\sqrt{3}}=\frac{100}{BD}$

$\therefore BD=100\sqrt{3}\text{ m}$

ii.

$\angle ACB=\angle EAC=45^\circ$

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

$\therefore \frac{1}{\sqrt{2}}=\frac{100}{AC}$

$\therefore AC=100\sqrt{2}\text{ m}$

iii.

$\angle ADB=\angle EAD=30^\circ$

$\sin 30^\circ=\frac{AB}{AD}$

$\therefore \frac{1}{2}=\frac{100}{AD}$

$\therefore AD=200\text{ m}$