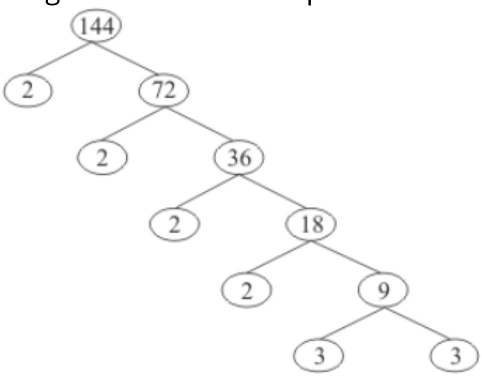
Solution
PRELIMINARY EXAM - I - SET B
Class 10 - Mathematics
Section A

1.
(d) 4
Explanation:
Using the factor tree for prime factorisation, we have:


Therefore, 144 = $2 \times 2 \times 2 \times 2 \times 3 \times 3$
$\Rightarrow 144 = 2^4 \times 3^2$
Thus, the exponent of 2 in 144 is 4.

2.
(b) 0
Explanation:
Here y = f(x) is not intersecting or touching the X-axis.
$\therefore$ Number of zeroes of f(x) = 0

3.
(c) 1
Explanation:
The number of solutions of two linear equations representing intersecting lines is 1 because two linear equations representing intersecting lines has a unique solution.

4.
(b) $\frac{b^2}{4a}$
Explanation:
If the quadratic equation $ax^2 + bx + c = 0$ has two real and equal roots, then
$b^2 - 4ac = 0$
$\Rightarrow b^2 = 4ac$
$\Rightarrow c = \frac{b^2}{4a}$

5. **(a)** 28
Explanation:
a + 6d = 4 $\Rightarrow$ a + 6 $\times$ (-4) = 4 $\Rightarrow$ a = 28

6. **(a)** 5 units
Explanation:
X(-3, 0), O(0, 0), Y(0, 4), Z(x, y).
XOYZ is a rectangle,
So, diagonal xy = diagonal OZ

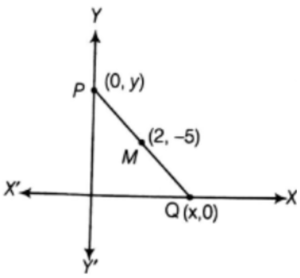
$xy = \sqrt{(-3-0)^2+(0-4)^2}$
$= \sqrt{9+16}$
$= \sqrt{25}$
xy = 5 units

7.

(b) (0, – 10) and (4, 0)

Explanation:

Let the coordinates of P (0, y) and Q (x, 0).
So, the mid - point of P (0, y) and Q (x, 0) = M
Coordinates of M = $\left(\frac{0+x}{2}, \frac{y+0}{2}\right)$
$\therefore$ Mid - point of a line segment having points (x_1, y_1) and (x_2, y_2)
= $\left(\frac{(x_1+x_2)}{2}, \frac{(y_1+y_2)}{2}\right)$
Given,
Mid - point of PQ is (2, - 5)



$\therefore 2 = \frac{x+0}{2}$ = 4 = x + 0
x = 4
$-5 = \frac{y+0}{2}$ = - 10 = y + 0
- 10 = y
So,
x = 4 and y = - 10
Thus, the coordinates of P and Q are (0, - 10) and (4, 0)

8.

(d) $DC^2 = CF \times AC$

Explanation:

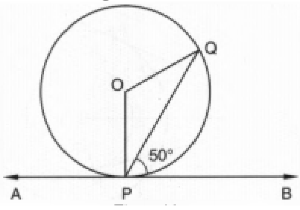
In $\triangle$ABC, using Thales theorem,
$\frac{DC}{AC} = \frac{CE}{BC}$ $[AB||DE]$ ....(i)
And in triangle BCD, using Thales theorem,
$\frac{CF}{DC} = \frac{CE}{BC}$ $[BD||EF]$ ....(ii)
From eq. (i) and (ii), we have
$\frac{DC}{AC} = \frac{CF}{DC}$
$\Rightarrow DC^2 = CF \times AC$

9.

(d) 100^o

Explanation:

In the figure, APB is a tangent to the circle with centre O



$\angle \mathrm{OPB} = 50^\circ$

OP is radius and APB is a tangent

$OP \perp AB$

$\Rightarrow \angle OPB = 90^\circ$

$\Rightarrow \angle OPQ + \angle QPB = 90^\circ$

$\angle OPQ + 50^\circ = 90^\circ$

$\Rightarrow \angle OPQ = 90^\circ - 50^\circ = 40^\circ$

But OP = OQ $\angle \mathrm{OPQ} = \mathrm{OQP} = 40^\circ$

$\angle \mathrm{POQ} = 180^\circ - (40^\circ + 40^\circ) = 180^\circ - 80^\circ = 100^\circ$

10.

(c) 30 cm

Explanation:

AQ = AR = 4

Similarly,

PC = CQ = 5

Similarly,

BP = BR = 6

Perimeter =AB + BC + CA

Perimeter = AR + RB + BP + PC + CQ + QA

= 4 + 6 + 6 + 5 + 5 + 4

= 30 cm

11. **(a)** $\frac{1-\cos\theta}{\sin\theta}$

Explanation:

We have, $\frac{\sin\theta}{1+\cos\theta} = \frac{\sin\theta(1-\cos\theta)}{(1+\cos\theta)(1-\cos\theta)}$

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

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

12. **(a)** cosecα

Explanation:

1 + $\frac{\cot^2\alpha}{1+\cos ec\alpha}$

= 1 + $\frac{cosec^2\alpha-1}{1+\cos ec\alpha}$

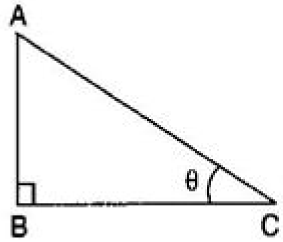
= 1 + $\frac{\left(cosec\ \alpha-1\right)\left(cosec\ \alpha+1\right)}{1+cosec\alpha}$

= 1 + cosecα - 1 = cosec α

13.

(c) remains unchanged

Explanation:



Let height of the tower be $h$meters and distance of the point of observation from its foot be x meters and angle of elevation be $\theta \therefore \tan\theta = \frac{h}{x}$ ....(i)
Now, new height = h + 10% of h = $h + \frac{10}{100}h$ = $\frac{11h}{10}$ And new distance = x + 10% of x = $x + \frac{10}{100}x$ = $\frac{11x}{10}$
$\therefore \tan\theta = \frac{\frac{11h}{10}}{\frac{11x}{10}} = \frac{h}{x}$ ....(ii)
From eq. (i) and (ii), it is clear that the angle of elevation is same i.e., angle of elevation remains unchanged.

14.

(b) 308 cm^2
Explanation:
We know that the area A of a sector of a circle of radius r and central angle θ(in degrees) is given by $A = \frac{\theta}{360} \times \pi r^2$
Here, r = 28 cm and θ = 45.
$\therefore A = \frac{45}{360} \times \pi \times (28)^2 = \frac{1}{8} \times \frac{22}{7} \times 28 \times 28\text{cm}^2$ = 308 cm^2

15.

(c) 77 cm^2
Explanation:
For a minute hand, 60 minutes is equivalent to 360^o and so 30 minutes will be 180^o.
Area swept in 60 minutes is area of full circle.
So area swept in 30 minutes will be area of half circle.
Thus, area swept $= \frac{1}{2} \times \left(\frac{22}{7}\right) \times 7^2$ = 77 cm^2

16.

(d) $\frac{4}{9}$
Explanation:
Total numbers of digits from 1 to 9 (n) = 9
Numbers which are even (m) = 2, 4, 6, 8 = 4
$\therefore$ Probability $= \frac{m}{n} = \frac{4}{9}$

17.

(b) 0.24
Explanation:
Given: P (It will rain on a particular day) = 0.76
$\therefore$ P (It will not rain on a particular day) = 1 - P (It will rain particular day)
= 1 - 0.76 = 0.24

18.

(b) 67.5
Explanation:

Mode = $l+\left(\frac{f_1-f_0}{2f_1-f_0-f_2}\right)\times h$
= 60 + $\frac{16-6}{2\times16-6-6}\times 15$
= 60 + $\frac{10}{32-12}\times 15$
= 60 + $\frac{10}{20}\times 15$
= 60 + 7.5
= 67.5

19.
(d) A is false but R is true.
Explanation:
A is false but R is true.

20. **(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.

Section B

21. To Prove: 5+3$\sqrt{2}$ is irrational number
Proof: If possible let us assume 5 + 3$\sqrt{2}$ is a rational number.
$\implies$ 5 + 3$\sqrt{2}$ = $\frac{p}{q}$ where q $\neq$ 0 and p and q are coprime integers.
$\implies 3\sqrt{2}=\frac{p}{q}-5$
$\implies 3\sqrt{2}=\frac{p-5q}{q}$
$\implies \sqrt{2}=\frac{p-5q}{3q}$
$\implies \sqrt{2}=\frac{integer}{integer}$
$\Rightarrow$ $\sqrt{2}$ is a rational number.
This contradicts the given fact that $\sqrt{2}$ is irrational.
Hence 5 + 3$\sqrt{2}$ is an irrational number.

OR

Let us assume that 7 - 2$\sqrt{3}$ is a rational number
$\Rightarrow$ 7 - 2$\sqrt{3}$ = $\frac{\mathrm{a}}{\mathrm{b}}$, where a and b are integers, b $\neq$ 0
$\Rightarrow$ $\sqrt{3}$ = $\frac{7\,\mathrm{b}-\mathrm{a}}{2\,\mathrm{b}}$
RHS is a rational number but LHS is irrational.
$\therefore$ Our assumption was wrong. Hence, 7 - 2$\sqrt{3}$ is irrational.

22. It is given that, AB = 5 cm, AC = 10 cm, BD = 1.5 cm and CD = 3.5 cm
We have to check whether AD is bisector of $\angle A$
First we will check proportional ratio between sides
So,
$\frac{AB}{AC}=\frac{5}{10}=\frac{1}{2}$
$\frac{BD}{CD}=\frac{1.5}{3.5}=\frac{3}{7}$
Since $\frac{AB}{AC}\neq\frac{BD}{CD}$
Hence, AD is not the bisector of $\angle A$

23. Let O be the centre of the given circle.
AB is the tangent drawn touching the circle at A.
Draw AC ⊥ AB at point A, such that point C lies on the given circle.
∠OAB = 90° (Radius of the circle is perpendicular to the tangent)
Given ∠CAB = 90°
∴ ∠OAB = ∠CAB
This is possible only when centre O lies on the line AC.

Hence, perpendicular at the point of contact to the tangent to a circle passes through the centre of the circle.

24. LHS $= \frac{\tan^2 A}{1+\tan^2 A} + \frac{\cot^2 A}{1+\cot^2 A}$

$= \frac{\tan^2 A}{\sec^2 A} + \frac{\cot^2 A}{1+\cot^2 A}$

$= \frac{\frac{\sin^2 A}{\cos^2 A}}{\frac{1}{\cos^2 A}} + \frac{\frac{\cos^2 A}{\sin^2 A}}{\frac{1}{\sin^2 A}}$

$= \frac{\sin^2 A}{\cos^2 A} \times \frac{\cos^2 A}{1} + \frac{\cos^2 A}{\sin^2 A} \times \frac{\sin^2 A}{1}$

= $\sin^2$A + $\cos^2$A

= 1 $\left[\because \sin^2 A + \cos^2 A = 1\right]$

= RHS

Hence proved.

OR

$\frac{1}{1-\sin\theta} + \frac{1}{1+\sin\theta} = 2\sec^2\theta$

L.H.S. $= \frac{1}{1-\sin\theta} + \frac{1}{1+\sin\theta}$

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

$= \frac{2}{\cos^2\theta}\left[\because 1-\sin^2\theta = \cos^2\theta\right]$

$= 2\sec^2\theta$ [$\because \sec(x) = \frac{1}{\cos(x)}$]

= R.H.S. Proved

25. i. Area of sector OAPB = $\frac{90^\circ}{360^\circ}$ $\times$ 3.14 $\times$ 100 = 78.5 cm^2

ii. Area minor segment APB = Area sector OAPB - Area $\triangle$OAB

= $78.5 - \frac{1}{2} \times 100$

= 28.5 cm^2.

Section C

26. The required greatest capacity is the HCF of 120, 180 and 240.

$240 = 180 \times 1 + 60$

$180 = 60 \times 3 + 0$

HCF is 60.

Now HCF of 60, 120

$120 = 60 \times 2 + 0$

$\therefore$ HCF of 120, 180 and 240 is 60.

$\therefore$ The required capacity is 60 litres.

27. Let $P(x) = 2x^2 + 3x + \lambda$

Its one zero is $\frac{1}{2}$ so $P(\frac{1}{2}) = 0$

$P(\frac{1}{2}) = 2 \times (\frac{1}{2})^2 + 3(\frac{1}{2}) + \lambda = 0$

$\Rightarrow 2 \times \frac{1}{4} + 3/2 + \lambda = 0$

$\Rightarrow \frac{1}{2} + \frac{3}{2} + \lambda = 0$

$\Rightarrow \frac{4}{2} + \lambda = 0$

$\Rightarrow 2 + \lambda = 0$

$\Rightarrow \lambda$= -2

Let the other zero be α

Then $\alpha + \frac{1}{2} = -\frac{3}{2}$

$\Rightarrow \alpha = -\frac{3}{2} - \frac{1}{2} = -\frac{4}{2} = -2$

28. First, we will convert the graph given into tabular form as shown below:

Class interval	**Frequency (f_i)**	**Mid value (x_i)**	**$f_i x_i$**	**Cumulative Frequency**
1 – 4	6	2.5	15	6

4 – 7	30	5.5	165	36
7 – 10	40	8.5	340	76
10 – 13	16	11.5	184	92
13 – 16	4	14.5	58	96
16 – 19	4	17.5	70	100
	N = $\sum f_i$ = 100		$\Sigma f_i x_i$ = 832	

i. N = 100

Mean = $\frac{\Sigma f_i x_i}{N} = \frac{832}{100}$ = 8.32

ii. $\frac{N}{2} = \frac{100}{2}$ = 50

The cumulative frequency just greater than $\frac{N}{2}$ is 76, then the median class is 7 - 10 such that

l = 7, h = 10 - 7 = 3, f = 40, F = 36

Median = l + $\frac{\frac{N}{2}-F}{f} \times$ h

= 7 + $\frac{50-36}{40} \times$ 3

$= 7 + \frac{42}{40}$ = 7 + 1.05 = 8.05

iii. Mode = 3 Median - 2 Mean

= 3 $\times$ 8.05 - 2 $\times$ 8.32 = 7.51

29. Let the amount invested at 12% be ₹x and that invested at 10% be ₹y.

Then, total annual interest

$= \left(\frac{x\times12\times1}{100} + \frac{y\times10\times1}{100}\right) = \left(\frac{6x+5y}{50}\right)$

$\therefore \quad \frac{6x+5y}{50} = 2600 \Rightarrow 6x + 5y = 130000$ ....(i)

Again, the amount invested at 12% is ₹y and that invested at 10% is ₹x.

Total annual interest at the new rates

$= \left(\frac{y\times12\times1}{100} + \frac{x\times10\times1}{100}\right) = \left(\frac{6y+5x}{50}\right)$

But, interest received at the new rates = ₹$(2600 - 140) =$ ₹$2460.$

$\therefore \quad \frac{6y+5x}{50} = 2460 \Rightarrow 5x + 6y = 123000$ ....(ii)

Adding (i) and (ii), we get

$11x + 11y = 253000$

$\Rightarrow 11(x+y) = 253000 \Rightarrow x + y = 23000$ . ... (iii)

Subtracting (ii) from (i), we get

$x - y = 7000$ . ...(iv)

Adding (iii) and (iv), we get $2x = 30000 \Rightarrow x = 15000.$

Putting $x = 15000$ in (i), we get

$15000 + y = 23000 \Rightarrow y = 23000 - 15000 = 8000$

$\therefore x = 15000\ and\ y = 8000.$

Hence, the amount at 12% is ₹15000 and that at 10% is ₹8000.

OR

Let fixed charge be Rs x and charge taken per day for food be Rs y

x + 20y = 3000 ....(i)

x + 25y = 3500 ......(ii)

Subtracting (i) from (ii)

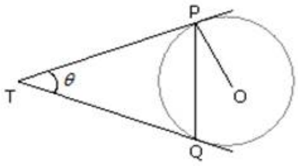
$$\begin{array}{r} x + 25y = 3500 \\ x + 20y = 3000 \\ - \quad - \qquad - \\ \hline 5y = 500 \\ \hline y = 100 \end{array}$$

Substituting this value of y in (i)

x + 20(100) = 3000

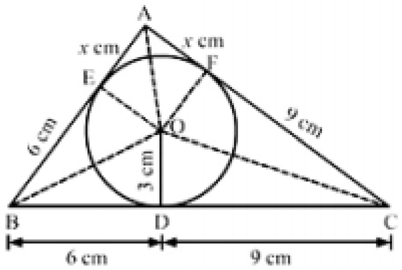
x = 1000
x = 1000 and y = 100
Fixed charge and cost of food per day are Rs 1000 and Rs100

30. = $(m + n)^{2/3} + (m - n)^{2/3}$
= $(a\cos^3\theta + 3a\cos\theta\sin^2\theta + a\sin^2\theta + 3a\cos^2\sin\theta)^{2/3} + (a\cos^3\theta + 3a\cos\theta\sin^2\theta - a\sin^3\theta - 3a\cos^2\theta\sin\theta)^{2/3}$
= $a^{2/3}(\cos^3\theta + 3\cos\theta\sin^2\theta + \sin^3\theta + 3\cos^2\theta\sin\theta)^{2/3} + a^{2/3}(\cos^3\theta + 3\cos\theta\sin^2\theta - \sin^3\theta - 3\cos^2\theta\sin\theta)^{2/3}$
= $a^{2/3}\{(\cos\theta + \sin\theta)^3\}^{2/3} + a^{2/3}\{(\cos\theta - \sin\theta)^3\}^{2/3}$
= $a^{2/3}(\cos\theta + \sin\theta)^2 + a^{2/3}(\cos\theta - \sin\theta)^2$
= $a^{2/3}(\cos^2\theta + \sin^2\theta + 2\cos\theta\sin\theta) + a^{2/3}(\cos^2\theta + \sin^2\theta - 2\cos\theta\sin\theta)$
= $a^{2/3}(1 + 2\cos\theta\sin\theta) + a^{2/3}(1 - 2\cos\theta\sin\theta)$ [$\because \cos^2\theta + \sin^2\theta = 1$]
= $a^{2/3}(1 + 2\cos\theta\sin\theta + 1 - 2\cos\theta\sin\theta)$
= $a^{2/3}(1 + 1)$
= $2a^{2/3}$
= RHS
Hence proved.

31. 

Given A circle with centre O and an external point T and two tangents TP and TQ to the circle, where P, Q are the points of contact.
To Prove: $\angle PTQ = 2\angle OPQ$
Proof: Let $\angle PTQ = \theta$
Since TP, TQ are tangents drawn from point T to the circle.
TP = TQ
$\therefore$ TPQ is an isoscles triangle
$\therefore \angle TPQ = \angle TQP = \frac{1}{2}(180^o - \theta) = 90^o - \frac{\theta}{2}$
Since, TP is a tangent to the circle at point of contact P
$\therefore \angle OPT = 90^o$
$\therefore \angle OPQ = \angle OPT - \angle TPQ = 90^o - (90^o - \frac{1}{2}\theta) = \frac{\theta}{2} = \frac{1}{2}\angle PTQ$
Thus, $\angle PTQ = 2\angle OPQ$

OR



We know that tangent segments to a circle from the same external point are congruent
Now, we have
AE = AF,
BD = BE =6 cm and
CD = CF = 9 cm
Now,
$\text{Area}(\triangle ABC)$
$= \text{Area}(\triangle BOC) + \text{Area}(\triangle AOB) + \text{Area}(\triangle AOC)$
$\Rightarrow 54 = \frac{1}{2} \times BC \times OD + \frac{1}{2} \times AB \times OE + \frac{1}{2} \times AC \times OF$
$\Rightarrow 108 = 15 \times 3 + (6 + x) \times 3 + (9 + x) \times 3$

$\Rightarrow$ 36 = 15 + 6 + x + 9 + x
$\Rightarrow$ 36 = 30 + 2x
$\Rightarrow$ 2x = 6
$\Rightarrow$ x = 3cm
$\therefore$ AB = 6 + 3 = 9cm and
AC = 9 + 3 = 12cm.

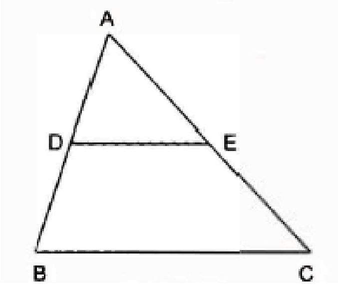
Section D

32. From the given table

Monthly Consumption	Number of Families (f)	Cumulative frequency (C.f.)
130 - 140	5	5
140 - 150	9	14
150 - 160	17	31
160 - 170	28	59
170 - 180	24	83
180 - 190	10	93
190 - 200	7	100

We have, N = 100
$\frac{N}{2}$ = 50
Median class = 160 - 170
$\Rightarrow$ l = 160, f = 28, Cf = 31, h = 10
Median = $l+\left[\frac{\left(\frac{N}{2}-Cf\right)}{f}\right] \times h$
= $160+\left[\frac{(50-31)}{28}\right] \times 10$
= $160+\left[\frac{19}{28}\right] \times 10$
= 160 + 6.78
= 166.78

33. We have,
Area (ΔADE) = Area (trapezium BCED)
$\Rightarrow$ Area (ΔADE)+ Area (ΔADE) = Area (trapezium BCED) + Area (ΔADE)
$\Rightarrow$ 2 Area (ΔADE)= Area (Δ ABC) ...(i)
In ΔADE and ΔABC, we have



$DE \| BC, therefore, \angle ADE = \angle B$ [Corresponding angles]
and, $\angle$A = $\angle$A [Common]
$\therefore$ ΔADE~ ΔABC
Since for similar triangles ,the ratio of the areas is the square of the ratio of their corresponding sides.Therefore,

$$\frac{\text{Area }(\Delta ADE)}{\text{Area }(\Delta ABC)} = \frac{AD^2}{AB^2}$$

$\Rightarrow \quad \frac{\text{Area }(\Delta ADE)}{2\text{ Area }(\Delta ADE)} = \frac{AD^2}{AB^2}$

$\Rightarrow \quad \frac{1}{2} = \left(\frac{AD}{AB}\right)^2$

$\Rightarrow \quad \frac{AD}{AB} = \frac{1}{\sqrt{2}}$

$\Rightarrow \quad AB = \sqrt{2}AD$

$\Rightarrow \quad AB = \sqrt{2}(AB - BD)$

$\Rightarrow \quad (\sqrt{2}-1)AB = \sqrt{2}BD \Rightarrow \frac{BD}{AB} = \frac{\sqrt{2}-1}{\sqrt{2}} = \frac{2-\sqrt{2}}{2}$

34. Since (-5) is a root of given quadratic equation $2x^2 + px + 15 = 0$,then,

$2(-5)^2 + p(-5) - 15 = 0$

$50 - 5p - 15 = 0$

$5p = 35 \Rightarrow p = 7$

Now $p\left(x^2 + x\right) + k = 0$ has equal roots

$px^2 + px + k = 0$

So $(b)^2 - 4ac = 0$

$(p)^2 - 4p \times k = 0$

$(7)^2 - 4 \times 7 \times k = 0$

28k = 49

$k = \frac{49}{28} = \frac{7}{4}$

hence p = 7 and $k = \frac{7}{4}$

OR

Distance travelled by the train = 480 km

Let the speed of the train be x kmph

Time taken for the journey = $\frac{480}{x}$

Given speed is decreased by 8 kmph

Hence the new speed of train = (x – 8) kmph

Time taken for the journey = $\frac{480}{x-8}$

$\frac{480}{x-8} = \frac{480}{x} + 3$

$\Rightarrow \frac{480}{x-8} - \frac{480}{x} = 3$

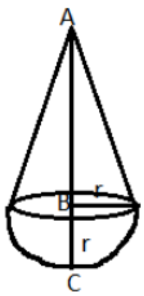
$\Rightarrow \frac{480(x-x+8)}{x(x-8)} = 3$

$\Rightarrow \frac{480 \times 8}{x(x-8)} = 3$

$\Rightarrow 3x(x-8) = 480 \times 8$

$\Rightarrow x(x-8) = 160 \times 8$

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

35. 

From the given figure,

Height (AB) of the cone = AC - BC (Radius of the hemisphere)

Thus, height of the cone = Total height - Radius of the hemisphere

= 9.5 - 3.5

= 6 cm

Volume of the solid = Volume of the cone + Volume of the hemisphere

$= \left(\frac{1}{3}\pi r^2 h\right) + \left(\frac{2}{3}\pi r^3\right)$
$= \frac{1}{3}\pi r^2(h + 2r)$
$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5(6 + 2 \times 3.5)$
$= \frac{1}{3} \times \frac{22}{7} \times 3.5 \times 3.5 \times 13$
= 166.83 cm^3

Thus, total volume of the solid is 166.83 cm^3.

OR

Given side of a cube = 21 cm
Diameter of the hemisphere is equal to the side of the cubical piece (d) = 21 cm
$\Rightarrow$ Radius of the hemisphere = 10.5 cm
Volume of cube = $Side^3$
= $(21)^3$
= 9261 cm^3
Surface area of cubical piece of wood = $6a^2$
= 6 × 21 × 21 cm^2
= 2646 cm^2
Volume of the hemisphere $= \frac{2}{3}\pi r^3$
$= \frac{2}{3} \times \frac{22}{7} \times 10.5 \times 10.5 \times 10.5$
= 44 $\times$0.5 $\times$10.5 $\times$10.5
= 2425.5 cm^3
Surface area of hemisphere = $2\pi r^2$
= 2 × π × 10.5 × 10.5 cm
= 693 cm
Volume of remaining solid = Volume of cubical piece of wood – Volume of hemisphere
$\Rightarrow$ Volume of the remaining solid = 9261 - 2425.5
= 6835.5 cm^3
Surface area remaining piece of solid = surface area of cubical piece of wood – Area of circular base of hemisphere + Curved Surface area of hemisphere
= $6a^2 - \pi r^2 + 2\pi r^2$
= $(2646 - \pi \times 10.5^2 + 693)$ cm^2
= 2992.5 cm^2.

Section E

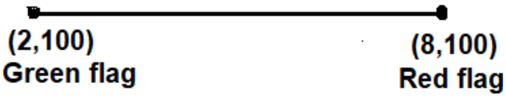
36. i. Let production in a 1st year be 'a' unit and increase in production (every year) be 'd' units.
Increase in production is constant, therefore unit produced every year forms an AP.
Now, a_3 = 6000
a + 2d = 6000 $\Rightarrow$ a = 6000 - 2d ...(i)
and a_7 = 7000 $\Rightarrow$ a + 6d = 7000
$\Rightarrow$ (6000 - 2d) + 6d = 7000 $\Rightarrow$ 4d = 1000 [using eq. (i)]
$\Rightarrow$ d = 250
When d = 250, eq. (i) becomes
a = 6000 - 2(250) = 5500
$\therefore$ Production in 1st year = 5500

ii. Production in fifth year
a_5 = a + 4d = 5500 + 4(250) = 6500

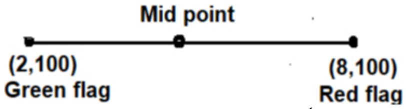
iii. Total production in 7 years = $\frac{7}{2}$(5500 + 7000) = 43750
OR
a_n = 1000 units
a_n = 1000

$\Rightarrow$ 10000 = a + (n - 1)d
$\Rightarrow$ 1000 = 5500 + 250n - 250
$\Rightarrow$ 10000 - 5500 + 250 = 250n
$\Rightarrow$ 4750 = 250n
$\Rightarrow$ n = $\frac{4750}{250}$ = 19

37. i. Co-ordinate of green flag = (2,100)

ii. 

distance between Red flag and Green flag
d $= \sqrt{(8-2)^2 + (100-100)^2}$
= $\sqrt{6^2 + 0^2}$
d = 6
$\therefore$ distance between Green and Red flag is 6 m.

iii. 

Position of blue flag = $\left(\frac{2+8}{2}, \frac{100+100}{2}\right)$
= (5,100)
OR
Distance = $\sqrt{(5-2)^2 + (100-100)^2}$
$= \sqrt{9+0}$
= 3 m

38. i. In $\triangle$ ABC
tan 60^o = $\frac{AB}{BC}$
$\sqrt{3} = \frac{AB}{200}$
AB = $200\sqrt{3}$
Now, In $\triangle$ ABD
tan 45^o = $\frac{AB}{BD}$
1 = $\frac{200\sqrt{3}}{BD}$
BD = $200\sqrt{3}$
$\therefore$ CD = BD - BC
= $200\sqrt{3}$ - 200
= 200 ($\sqrt{3}$ - 1)
= 200 $\times$ (1.732 - 1)
= 200 $\times$ 0.732
= 146.4 m
speed = $\frac{distance}{time}$
= $\frac{146.4}{10}$
= 14.64 m/s
Now,
speed = 14.64 $\times$ $\frac{18}{5}$ km/hr
= 52.7
$\approx$ 53 km/hr

ii. In $\triangle$ ABD
tan 45^o = $\frac{AB}{BD}$
1 = $\frac{200\sqrt{3}}{BD}$
BD = $200\sqrt{3}$ m
$\therefore$ CD = $200\sqrt{3}$ - 200

= 200 ($\sqrt{3}$ - 1)
= 200 (1.732 - 1)
= 200 $\times$ 0.732
= 146.4
$\approx$ 147 m
$\therefore$ boat is at a distance of 147 m from its actual position.

iii. In $\triangle$ ABC
tan 60^{o} = $\frac{AB}{BC}$
$\sqrt{3}$ = $\frac{AB}{200}$
AB = $200\sqrt{3}$ m
Hence, height of tower = $200\sqrt{3}$ m

OR

As boat moves away from the tower angle of depression decreases.