

SAMPLE QUESTION PAPER (BASIC) - 03

Class 10 - Mathematics

Time Allowed: 3 hours

Maximum Marks: 80

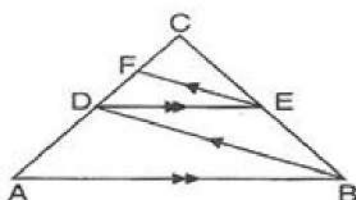
General Instructions:

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E.
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

Section A

1. We have, $AB \parallel DE$ and $BD \parallel EF$. Then,

[1]



a) $BC^2 = AB \cdot CE$

b) $AC^2 = BC \cdot DC$

c) $AB^2 = AC \cdot DE$

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

2. If the product of zeros of the polynomial $f(x) = ax^3 - 6x^2 + 11x - 6$ is 4, then $a = ?$

[1]

a) $\frac{2}{3}$

b) $-\frac{2}{3}$

c) $-\frac{3}{2}$

d) $\frac{3}{2}$

3. In $\triangle ABC$, if $\angle A = x^\circ$, $\angle B = 3x^\circ$ and $\angle C = y^\circ$. If $3y - 5x = 30$, then $\angle B =$

[1]

a) 60°

b) 45°

c) 30°

d) 90°

4. The graphs of the equations $6x - 2y + 9 = 0$ and $3x - y + 12 = 0$ are two lines which are

[1]

a) perpendicular to each other

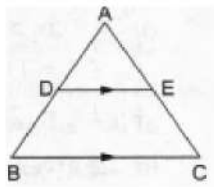
b) parallel



c) coincident

d) intersecting exactly at one point

5. In $\triangle ABC$, $DE \parallel BC$ so that $AD = 2.4$ cm, $AE = 3.2$ cm and $EC = 4.8$ cm. Then, $AB = ?$ [1]



a) 6.4 cm

b) 7.2 cm

c) 3.6 cm

d) 6 cm

6. In a lottery, there are 8 prizes and 16 blanks. What is the probability of getting a prize? [1]

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

b) None of these

c) $\frac{1}{3}$

d) $\frac{2}{3}$

7. If $2 \cos 3\theta = 1$ then $\theta = ?$ [1]

a) 30°

b) 10°

c) 15°

d) 20°

8. In a data, if $l = 40$, $h = 15$, $f_1 = 7$, $f_0 = 3$, $f_2 = 6$, then the mode is [1]

a) 82

b) 62

c) 52

d) 72

9. If in $\triangle ABC$ and $\triangle DEF$, $\frac{AB}{DE} = \frac{BC}{FD}$, then $\triangle ABC \sim \triangle DEF$ when [1]

a) $\angle B = \angle E$

b) $\angle B = \angle D$

c) $\angle A = \angle F$

d) $\angle A = \angle D$

10. The exponent of 2 in the prime factorisation of 144, is [1]

a) 4

b) 5

c) 6

d) 3

11. If $x^2 + 5kx + 16 = 0$, has equal roots, then the value of k is [1]

a) $\pm \frac{64}{25}$

b) $\pm \frac{8}{5}$

c) $\pm \frac{5}{8}$

d) $\pm \frac{25}{64}$

12. The point where the medians of a triangle meet is called the _____ of the triangle [1]

a) circumcentre

b) centroid

c) orthocentre

d) None of these

13. The mean of the first 10 prime numbers is [1]

a) 129

b) 1.29

c) 12.9

d) 11.9

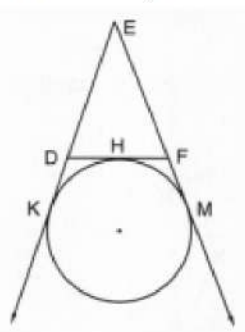
14. If $\sqrt{3} \tan \theta = 3 \sin \theta$, then the value of $\sin^2 \theta - \cos^2 \theta$ is [1]

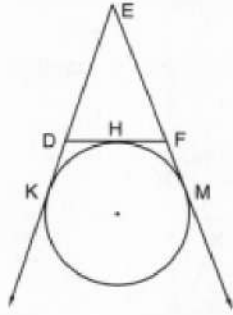
a) 1

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

c) 0

d) $\frac{1}{3}$

15. A pole casts a shadow of length $2\sqrt{3}$ m on the ground when the sun's elevation is 60° . The height of the pole is [1]
- a) 12 m
b) 6 m
c) $4\sqrt{3}$ m
d) 3 m
16. In Figure, a circle touches the side DF of $\triangle EDF$ at H and touches ED and EF produced at K and M respectively. If EK = 9 cm, then the perimeter of $\triangle EDF$ is
- 
- a) 18 cm
b) 13.5 cm
c) 9 cm
d) 12 cm
17. In $\triangle DEF$ and $\triangle PQR$, it is given that $\angle D = \angle Q$ and $\angle R = \angle E$, then which of the following is not true? [1]
- a) $\frac{DE}{QR} = \frac{DF}{PQ}$
b) $\frac{EF}{RP} = \frac{DE}{QR}$
c) $\frac{EF}{PR} = \frac{DF}{PQ}$
d) $\frac{DE}{PQ} = \frac{EF}{RP}$



- a) 18 cm
b) 13.5 cm
c) 9 cm
d) 12 cm
17. In $\triangle DEF$ and $\triangle PQR$, it is given that $\angle D = \angle Q$ and $\angle R = \angle E$, then which of the following is not true? [1]
- a) $\frac{DE}{QR} = \frac{DF}{PQ}$
b) $\frac{EF}{RP} = \frac{DE}{QR}$
c) $\frac{EF}{PR} = \frac{DF}{PQ}$
d) $\frac{DE}{PQ} = \frac{EF}{RP}$
18. In the equation $ax^2 + bx + c = 0$, it is given that $D = (b^2 - 4ac) > 0$. Then, the roots of the equation are [1]
- a) imaginary
b) real and equal
c) real and unequal
d) none of these

19. **Assertion:** $x^2 + 4x + 5$ has two zeroes. [1]

Reason: A quadratic polynomial can have at the most two zeroes.

20. **Assertion (A):** Two identical solid cubes of side 5 cm are joined end to end. The total surface area of the resulting cuboid is 350 cm^2 . **[1]**

Reason (R): Total surface area of a cuboid is $2(lb + bh + hl)$

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.

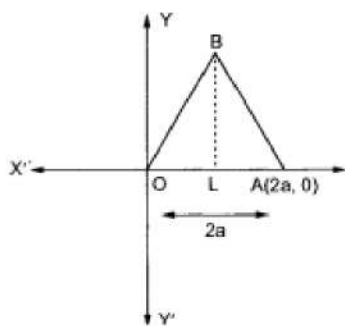
c) A is true but R is false. d) A is false but R is true.

Section B

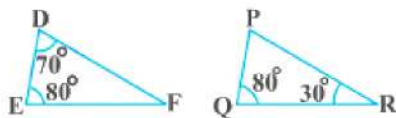
21. Find the non zero values of k for which the roots of the quadratic equation $9x^2 - 3kx + k = 0$ are real and equal. [2]
22. Prove that the points $(7, 10)$, $(-2, 5)$ and $(3, -4)$ are the vertices of an isosceles right triangle. [2]

OR

Find the coordinates of the vertices of an equilateral triangle of side $2a$ as shown in the figure.

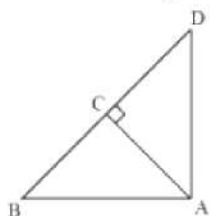


23. Find the largest number which divides 245 and 1037, leaving remainder 5 in each case. [2]
24. Verify: $\sin 60^\circ \cos 30^\circ - \cos 60^\circ \sin 30^\circ = \sin 30^\circ$ [2]
25. State the pair of triangles in Fig, are similar. Write the similarity criterion used by you for answering the question [2] and also write the pair of similar triangles in the symbolic form:



OR

$\triangle ABD$ is a right triangle right-angled at A and $AC \perp BD$. Show that $AB^2 = BC \times BD$



Section C

26. Solve: $\frac{2}{(x+1)} + \frac{3}{2(x-2)} = \frac{23}{5x}$, $x \neq 0, -1, 2$. [3]
27. In the given figure, E is a point on side CB produced of an isosceles $\triangle ABC$ with $AB = AC$. If $AD \perp BC$ and $EF \perp AC$, Prove that $\triangle ABD \sim \triangle ECF$. [3]
28. Find the point on the x-axis which are at a distance of $2\sqrt{5}$ from point $(7, -4)$. How many such points are there? [3]

OR

The line segment joining the points $A(3, -4)$ and $B(1, 2)$ is trisected at the points P and Q. Find the coordinates of P.

29. In a school there are two sections, namely A and B, of class X. There are 30 students in section A and 28 students in section B. Find the minimum number of books required for their class library so that they can be distributed equally among students of section A or section B. [3]
30. The angle of elevation of an aeroplane from a point on the ground is 45° . After flying for 15 s, the angle of elevation changes to 30° . If the aeroplane is flying at a constant height of 2500 m, then find the average speed of the aeroplane. [3]

OR

Two men standing on opposite sides of a tower measure the angles of elevation of the top of the tower as 30° and 60° respectively. If the height of the tower is 20 m, then find the distance between the two men.

31. If the median of the following frequency distribution is 32.5, find the values of f_1 and f_2 . [3]

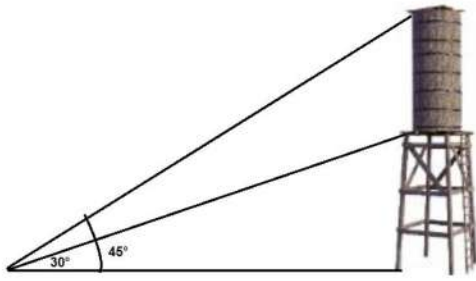
Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70	Total
Frequency	f_1	5	9	12	f_2	3	2	40

Section D

32. When 3 is added to the denominator and 2 is subtracted from the numerator a fraction becomes $\frac{1}{4}$. When 6 is [5]



300. the angle of elevation of the top of the water tank is 45° .



- (i) What is the height of the tower?
- (ii) What is the height of the water tank?
- (iii) At what distance from the bottom of the tower the angle of elevation of the top of the tower is 45° .

OR

What will be the angle of elevation of the top of the water tank from the place at $\frac{40}{\sqrt{3}}$ m from the bottom of the tower.

37. **Read the text carefully and answer the questions:**

[4]

Sehaj Batra gets pocket money from his father every day. Out of pocket money, he saves money for poor people in his locality. On 1st day he saves ₹27.5 On each succeeding day he increases his saving by ₹2.5.



- (i) Find the amount saved by Sehaj on 10th day.
- (ii) Find the amount saved by Sehaj on 25th day.
- (iii) Find the total amount saved by Sehaj in 30 days.

OR

Find in how many days Sehaj saves ₹1400.

38. **Read the text carefully and answer the questions:**

[4]

A juice seller is serving his customers using cylindrical container with radius 20cm and height 50cm. He serves juice into a glass as shown in Fig. The inner diameter of the cylindrical glass is 5 cm, but the bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass.



- (i) If the height of a glass was 10 cm, find the apparent capacity of the glass.
- (ii) Also, find its actual capacity. (Use $\pi = 3.14$)
- (iii) Find the capacity of the container in liter?

OR

How many glasses he serves if the container is full?

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

Explanation: In $\triangle ABC$, using Thales theorem,

$$\frac{DC}{AC} = \frac{CE}{BC} \quad [AB \parallel DE] \dots\dots(i)$$

And in triangle BCD, using Thales theorem,

$$\frac{CF}{DC} = \frac{CE}{BC} \quad [BD \parallel EF] \dots\dots(ii)$$

From eq. (i) and (ii), we have

$$\frac{DC}{AC} = \frac{CF}{DC}$$

$$\Rightarrow DC^2 = CF \times AC$$

2. (d) $\frac{3}{2}$

Explanation: Since α and β are the zeros of quadratic polynomial $f(x) = ax^3 - 6x^2 + 11x - 6$

$$\alpha\beta = \frac{-\text{Constant term}}{\text{Coefficient of } x^2}$$

So we have

$$4 = -\left(\frac{-6}{a}\right)$$

$$4 = \frac{6}{a}$$

$$a = \frac{3}{2}$$

Therefore value of a is $\frac{3}{2}$.

3. (d) 90°

Explanation: Here, $A = x$, $B = 3x$, $C = y$.

$$180 = 4x + y \dots (i) \quad (\text{Sum of angles of a triangle} = x + 3x + y)$$

$$180 - 4x = y \dots (ii)$$

$$\text{Also, } 3y - 5x = 30 \dots (iii)$$

Substituting the value of (ii) in (iii)

$$3(180 - 4x) - 5x = 30$$

$$540 - 12x - 5x = 30$$

$$-17x = 30 - 540$$

$$17x = 510$$

$$x = 30 \dots (iv)$$

But, angle $B = 3x \dots$ (Given)

$$\text{Therefore angle } B = 3 \times 30 = 90^\circ$$

4. (b) parallel

Explanation: We have,

$$6x - 2y + 9 = 0$$

$$\text{And, } 3x - y + 12 = 0$$

$$\text{Here, } a_1 = 6, b_1 = -2 \text{ and } c_1 = 9$$

$$a_2 = 3, b_2 = -1 \text{ and } c_2 = 12$$

$$\frac{a_1}{a_2} = \frac{6}{3} = \frac{2}{1}, \frac{b_1}{b_2} = \frac{-2}{-1} = \frac{2}{1} \quad \text{and} \quad \frac{c_1}{c_2} = \frac{9}{12} = \frac{3}{4}$$

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

Hence, the given system has no solution and the lines are parallel.

5. (d) 6 cm

Explanation: In $\triangle ABC$, $DE \parallel BC$

$$AD = 2.4 \text{ cm, } AE = 3.2 \text{ cm, } EC = 4.8 \text{ cm}$$

$$\text{Let } AD = x \text{ cm}$$

$$DE \parallel BC$$

$$\begin{aligned}\therefore \frac{AD}{DB} &= \frac{AE}{EC} \\ \Rightarrow \frac{2.4}{x} &= \frac{3.2}{4.8} \Rightarrow x = \frac{2.4 \times 4.8}{3.2} \\ \Rightarrow x &= \frac{24 \times 48 \times 10}{32 \times 10 \times 10} = \frac{36}{10} = 3.6 \\ \therefore AB &= AD + DB = 2.4 + 3.6 = 6.0\text{cm}\end{aligned}$$

6. (c) $\frac{1}{3}$

Explanation: Total number of lottery tickets = 8 + 16 = 24.

Number of prizes = 8.

$$\therefore P(\text{getting a prize}) = \frac{8}{24} = \frac{1}{3}$$

7. (d) 20°

$$\text{Explanation: } 2 \cos 3\theta = 1 \Rightarrow \cos 3\theta = \frac{1}{2} = \cos 60^\circ \Rightarrow 3\theta = 60^\circ \Rightarrow \theta = 20^\circ$$

8. (c) 52

$$\text{Explanation: Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$= 40 + \frac{7-3}{7 \times 2 - 3 - 6} \times 15$$

$$= 40 + \frac{4}{5} \times 15$$

$$= 40 + 12$$

$$= 52$$

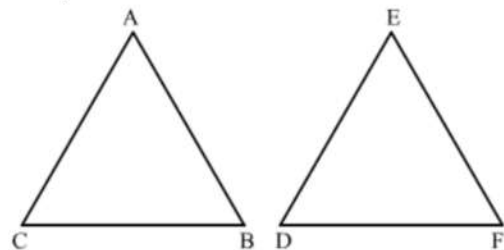
9. (b) $\angle B = \angle D$

Explanation:

Given: In $\triangle ABC$ and $\triangle DEF$, $\frac{AB}{DE} = \frac{BC}{FD}$.

We know that if in two triangles, one pair of corresponding sides are proportional and the included angles are equal, then the two triangles are similar.

Then, $\angle B = \angle D$

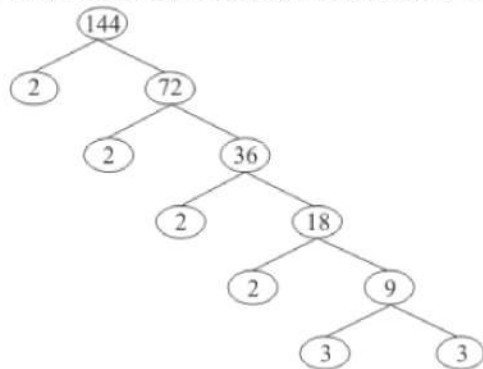


Hence, $\triangle ABC$ is similar to $\triangle DEF$, we should have $\angle B = \angle D$.

10. (a) 4

Explanation:

Using the factor tree for prime factorisation, we have:



$$\text{Therefore, } 144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$$

$$\Rightarrow 144 = 2^4 \times 3^2$$

Thus, the exponent of 2 in 144 is 4.

11. (b) $\pm \frac{8}{5}$

Explanation: Here, $a = 1$, $b = 5k$, $c = 16$

If $x^2 + 5kx + 16 = 0$ has equal roots,

$$\text{then, } b^2 - 4ac = 0$$

$$\Rightarrow (5k)^2 - 4 \times 1 \times 16 = 0$$

$$\Rightarrow 25k^2 - 64 = 0$$

$$\Rightarrow 25k^2 = 64$$

$$\Rightarrow k^2 = \frac{64}{25}$$

$$\Rightarrow k = \pm \frac{8}{5}$$

12. (b) centroid

Explanation: The point where three medians of a triangle meet is called the centroid of the triangle. It is the centre of gravity of the triangle. It divides the median in the ratio 2 : 1

13. (c) 12.9

Explanation: The first 10 prime numbers are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

$$\begin{aligned} \therefore \text{Mean} &= \frac{\text{Sum of first 10 prime numbers}}{10} \\ &= \frac{2+3+5+7+11+13+17+19+23+29}{10} \\ &= \frac{129}{10} \\ &= 12.9 \end{aligned}$$

14. (d) $\frac{1}{3}$

Explanation: Given: $\sqrt{3} \tan \theta = 3 \sin \theta$

$$\Rightarrow \sqrt{3} \frac{\sin \theta}{\cos \theta} = 3 \sin \theta$$

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

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

$$\text{And } \sin \theta = \sqrt{1 - \cos^2 \theta} = \sqrt{1 - \frac{1}{3}} = \sqrt{\frac{2}{3}}$$

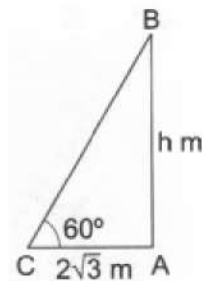
$$\therefore \sin^2 \theta - \cos^2 \theta = \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$$

15. (b) 6 m

Explanation: Let the height of the pole be h metres.

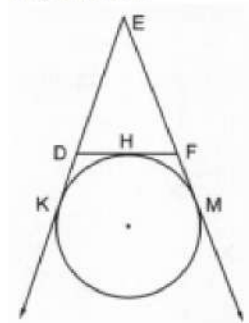
$$\text{Then, } \frac{h}{2\sqrt{3}} = \tan 60^\circ = \sqrt{3}$$

$$\Rightarrow h = (2\sqrt{3} \times \sqrt{3}) = 6.$$



16. (a) 18 cm

Explanation:



In $\triangle DEF$

DF touches the circle at H

and circle touches ED and EF Produced at K and M respectively

$$EK = 9 \text{ cm}$$

EK and EM are the tangents to the circle

$$EM = EK = 9 \text{ cm}$$

Similarly DH and DK are the tangent

DH = DK and FH and FM are tangents

FH = FM

Now, perimeter of $\triangle DEF$

$$= ED + DF + EF$$

$$= ED + DH + FH + EF$$

$$= ED + DK + FM + EF$$

$$= EK + EM$$

$$= 9 + 9$$

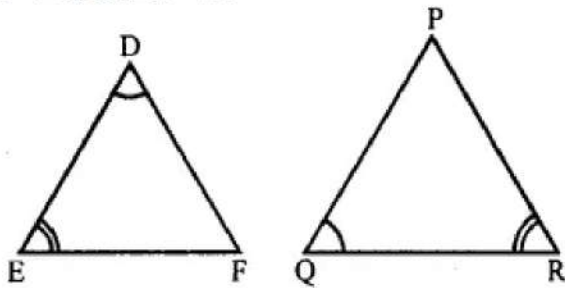
$$= 18 \text{ cm}$$

17. (d) $\frac{DE}{PQ} = \frac{EF}{RP}$

Explanation:

In $\triangle DEF$ and $\triangle PQR$,

$\angle D = \angle Q$ and $\angle R = \angle E$



Then $\frac{DE}{PQ} = \frac{EF}{RP}$ is not true.

($\because$ There are not corresponding sides)

18. (c) real and unequal

Explanation: When $D > 0$, the roots of the given quadratic equation are real and unequal.

19. (d) Assertion is wrong statement but reason is correct statement.

Explanation: Assertion is wrong statement but reason is correct statement.

20. (d) A is false but R is true.

Explanation: A is false but R is true.

Section B

21. Here, $a = 9$, $b = -3k$, $c = k$

Since roots of the equation are equal

So, $b^2 - 4ac = 0$

$$(-3k)^2 - (4 \times 9 \times k) = 0$$

$$9k^2 - 36k = 0$$

$$k^2 - 4k = 0$$

$$k(k - 4) = 0$$

$$k = 0 \text{ or } k = 4$$

But given k is non zero hence $k = 4$ for which roots of the quadratic equation are real and equal.

22. Let $A(7, 10)$, $B(-2, 5)$ and $C(3, -4)$ be the vertices of given isosceles triangle.

$$\text{Then, } AB = \sqrt{(7+2)^2 + (10-5)^2} = \sqrt{106}$$

$$AC = \sqrt{(7-3)^2 + (10+4)^2} = \sqrt{212}$$

$$BC = \sqrt{(3+2)^2 + (-4-5)^2} = \sqrt{106}$$

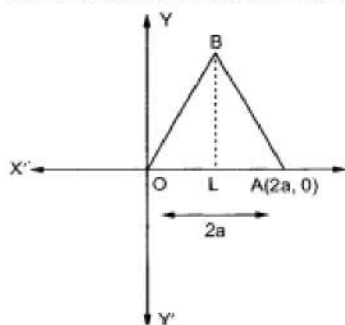
Thus, $AB = AC$

$$\text{Also } AB^2 + BC^2 = 106 + 106 = 212 = AC^2 \text{ (pythagoras theorem)}$$

Hence, given vertices are coordinates of an isosceles right triangle.

OR

We have to find the coordinates of the vertices of an equilateral triangle of side $2a$ as shown in the figure.



Since, OAB is an equilateral triangle of side $2a$. Therefore,

$$OA = AB = OB = 2a$$

Let BL perpendicular from B on OA. Then

$$OL = LA = a$$

In $\triangle OLB$, we have

$$OB^2 = OL^2 + LB^2$$

$$\Rightarrow (2a)^2 = a^2 + LB^2$$

$$\Rightarrow LB^2 = 3a^2$$

$$\Rightarrow LB = \sqrt{3}a$$

Clearly, coordinates of O are $(0,0)$ and that of A are $(2a, 0)$. Since, $OL = a$ and $LB = \sqrt{3}a$. So, the coordinates of B are $(a, \sqrt{3}a)$

23. Clearly, the required number divides $(245 - 5) = 240$ and $(1037 - 5) = 1032$ exactly.

So, the required number is HCF of $(240, 1032)$.

2	240	2	1032
2	120	2	516
2	60	2	258
2	30	3	129
3	15		43
	5		

$$\text{Now } 240 = 2 \times 2 \times 2 \times 2 \times 3 \times 5 = (2^4 \times 3 \times 5)$$

$$\text{and } 1032 = 2 \times 2 \times 2 \times 2 \times 3 \times 43 = (2^3 \times 3 \times 43)$$

$$\therefore \text{HCF}(240, 1032) = (2^3 \times 3)$$

$$\text{HCF}(240, 1032) = 24$$

Hence, the largest number which divides 245 and 1037, leaving remainder 5 is 24.

24. Consider L.H.S. = $\sin 60^\circ \cos 30^\circ - \cos 60^\circ \sin 30^\circ$

$$= (\sqrt{3}/2) \times (\sqrt{3}/2) - (1/2)(1/2)$$

$$= (3/4) - (1/4)$$

$$= 2/4$$

$$= 1/2$$

$$\text{Consider R.H.S.} = \sin 30^\circ = 1/2$$

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

Hence, verified.

25. In triangle DEF, we have

$$\angle D + \angle E + \angle F = 180^\circ \text{ (Sum of angles of triangle)}$$

$$70^\circ + 80^\circ + \angle F = 180^\circ$$

$$\angle F = 30^\circ$$

In PQR, we have

$$\angle P + \angle Q + \angle R = 180^\circ$$

$$\angle P + 80^\circ + 30^\circ = 180^\circ$$

$$\angle P = 70^\circ$$

In triangle DEF and PQR, we have

$$\angle D = \angle P = 70^\circ$$

$$\angle F = \angle Q = 80^\circ$$

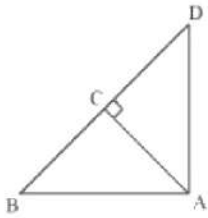
$$\angle F = \angle R = 30^\circ$$

Hence, $\triangle DEF \sim \triangle PQR$ (AAA similarity)

OR

Given: $\triangle ABD$ is a right triangle right-angled at A and $AC \perp BD$.

To Prove: $AB^2 = BC \times BD$



Proof: In $\triangle ADB$ and $\triangle CAB$

$$\angle DAB = \angle ACB = 90^\circ$$

$$\angle ABD = \angle CBA \text{ [common angle]}$$

$$\angle ADB = \angle CAB \text{ [remaining angle]}$$

So, $\triangle ADB \sim \triangle CAB$ (by AAA similarity)

$$\text{Therefore } \frac{AB}{CB} = \frac{BD}{AB}$$

$$\Rightarrow AB^2 = CB \times BD$$

Section C

26. Given,

$$\frac{2}{(x+1)} + \frac{3}{2(x-2)} = \frac{23}{5x}$$

Taking LCM, we get

$$\Rightarrow \frac{4(x-2)+3(x+1)}{2(x+1)(x-2)} = \frac{23}{5x} \Rightarrow \frac{7x-5}{2(x^2-x-2)} = \frac{23}{5x}$$

By cross multiplication

$$\Rightarrow 5x(7x-5) = 46(x^2-x-2)$$

$$\Rightarrow 35x^2 - 25x = 46x^2 - 46x - 92$$

$$\Rightarrow 46x^2 - 35x^2 - 46x + 25x - 92 = 0$$

$$\Rightarrow 11x^2 - 21x - 92 = 0$$

$$\Rightarrow 11x^2 - 44x + 23x - 92 = 0$$

$$\Rightarrow 11x(x-4) + 23(x-4) = 0$$

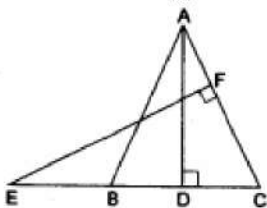
$$\Rightarrow (x-4)(11x+23) = 0$$

$$\Rightarrow x-4 = 0 \text{ or } 11x+23 = 0$$

$$\Rightarrow x = 4 \text{ or } x = \frac{-23}{11}$$

Therefore, 4 or $\frac{-23}{11}$ are the roots of the given equation.

27.



Given $\triangle ABC$ in which $AB = AC$ and $AD \perp BC$. Side CB is produced to E and $EF \perp AC$.

To Prove $\triangle ABD \sim \triangle ECF$.

Proof: We know that the angles opposite to equal sides of a triangle are equal.

$$\therefore \angle B = \angle C \text{ [}\because AB = AC\text{]}.$$

Now, in $\triangle ABD$ and $\triangle ECF$, we have

$$\angle B = \angle C \text{ [proved above]}$$

$$\angle ADB = \angle EFC = 90^\circ$$

$\therefore \triangle ABD \sim \triangle ECF$ [by AA-similarity],

28. Let point $P(x, 0)$ be a point on x-axis, and A be the point $(7, -4)$.

$$\text{So, } AP = 2\sqrt{5} \text{ [Given]}$$

$$\Rightarrow AP^2 = 4 \times 5 = 20$$

$$\Rightarrow (x-7)^2 + [0-(-4)]^2 = 20$$

$$\Rightarrow x^2 + 49 - 14x + 16 = 20$$

$$\Rightarrow x^2 - 14x - 20 + 65 = 0$$

$$\Rightarrow x^2 - 14x + 45 = 0$$

$$\Rightarrow x^2 - 9x - 5x + 45 = 0$$

$$\Rightarrow x(x - 9) - 5(x - 9) = 0$$

$$\Rightarrow (x - 9)(x - 5) = 0$$

$$\Rightarrow x - 9 = 0 \text{ or } x - 5 = 0$$

$$\Rightarrow x = 9 \text{ or } x = 5$$

Hence, there are two such points on x-axis whose distance from $(7, -4)$ is $2\sqrt{5}$. Hence, required points are $(9, 0)$, $(5, 0)$.

OR

Given: points $A(3, -4)$ and $B(1, 2)$ trisected at the points P and Q

Let the co-ordinates of P be (x, y)

Since $AP = PQ = QB$

$\therefore AP : PB = 1 : 2$

Using intersection formula

$$x = \frac{x_2(m_1) + x_1(m_2)}{m_1 + m_2}, y = \frac{y_2(m_1) + y_1(m_2)}{m_1 + m_2}$$

$$x = \frac{1 \times 1 + 2 \times 3}{1 + 2} = \frac{7}{3}$$

$$y = \frac{1 \times 2 + 2 \times -4}{1 + 2} = -2$$

Hence point P is $\left(\frac{7}{3}, -2\right)$.

29. As per question, the required number of books are to be distributed equally among the students of section A or B.

There are 30 students in section A and 28 students in section B.

So, the number of these books must be a multiple of 30 as well as that of 28.

Consequently, the required number is $\text{LCM}(30, 28)$.

Now, $30 = 2 \times 3 \times 5$

and $28 = 2^2 \times 7$.

$\therefore \text{LCM}(30, 28) = \text{product of prime factors with highest power}$

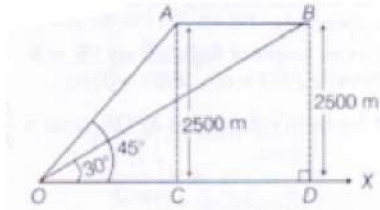
$$= 2^2 \times 3 \times 5 \times 7$$

$$= 4 \times 3 \times 5 \times 7$$

$$= 420$$

Hence, the required number of books = 420.

30. Let OX be the horizontal ground; A and B be the two positions of the plane and O be the point of observation.



Here, $AC = BD = 2500 \text{ m}$,

$\angle AOC = 45^\circ$ and $\angle BOD = 30^\circ$

In right angled $\triangle OCA$, $\cot 45^\circ = \frac{B}{P} = \frac{OC}{AC}$

$$\Rightarrow 1 = \frac{OC}{AC}$$

$$\Rightarrow OC = AC = 2500 \text{ m}$$

In right angled $\triangle ODB$, $\cot 30^\circ = \frac{B}{P} = \frac{OD}{BD}$

$$\Rightarrow \sqrt{3} = \frac{OD}{2500}$$

$$\Rightarrow OD = 2500\sqrt{3} \text{ m}$$

$$\text{Now, } CD = OD - OC = 2500\sqrt{3} - 2500$$

$$\Rightarrow CD = 2500(1.732 - 1)$$

$$\Rightarrow CD = 2500(0.732)$$

$$\Rightarrow CD = 1830 \text{ m}$$

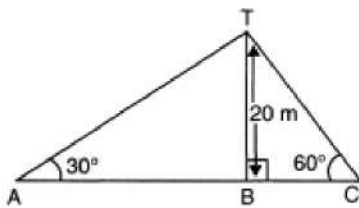
Thus, distance covered by plane in 15 s is 1830 m.

$$\therefore \text{Speed of the plane} = \frac{\text{Distance}}{\text{Time}} = \frac{1830}{15} \times \frac{60 \times 60}{1000} = 439.2 \text{ km/h}$$

OR

Let two men are standing at A and C.

BT is the tower



In rt. $\triangle ABT$,

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

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{20}{AB}$$

$$\Rightarrow AB = 20\sqrt{3}$$

In rt. $\triangle BTC$,

$$\tan 60^\circ = \frac{BT}{BC}$$

$$\Rightarrow \sqrt{3} = \frac{20}{BC}$$

$$\Rightarrow BC = \frac{20}{\sqrt{3}}$$

$\therefore$ Distance between two men

$$= AB + BC$$

$$= 20\sqrt{3} + \frac{20}{\sqrt{3}}$$

$$= \frac{60+20}{\sqrt{3}} = \frac{80\sqrt{3}}{3} \text{ m}$$

Hence, distance between the two men is $\frac{80\sqrt{3}}{3}$ m

31. Let f_1 and f_2 be the frequencies of class intervals 0 - 10 and 40 - 50.

$$f_1 + 5 + 9 + 12 + f_2 + 3 + 2 = 40$$

$$\Rightarrow f_1 + f_2 = 9$$

Median is 32.5 which lies in 30 - 40, so the median class is 30 - 40.

$$l = 30, h = 10, f = 12, N = 40 \text{ and } c = f_1 + 5 + 9 = (f_1 + 14)$$

$$\text{Now, median} = l + \left[h \times \frac{\left(\frac{N}{2} - c \right)}{f} \right]$$

$$\Rightarrow 32.5 = \left[30 + \left(10 \times \frac{20 - f_1 - 14}{12} \right) \right]$$

$$= \left[30 + \left(10 \times \frac{6 - f_1}{12} \right) \right]$$

$$= \left[30 + \left(\frac{30 - 5f_1}{6} \right) \right]$$

$$\frac{30 - 5f_1}{6} = 2.5$$

$$30 - 5f_1 = 15$$

$$5f_1 = 15 \Rightarrow f_1 = 3$$

$$f_1 = 3 \text{ and } f_2 = (9 - 3) = 6$$

Section D

32. Let the numerator and the denominator be x & y respectively. Hence, the fraction is $\frac{x}{y}$.

Now, according to the question, we have

$$\frac{x-2}{y+3} = \frac{1}{4}$$

$$\Rightarrow 4(x-2) = y+3$$

$$\Rightarrow 4x - 8 = y + 3$$

$$\Rightarrow 4x - y = 3 + 8$$

$$\Rightarrow 4x - y = 11 \dots (i)$$

Also according to the question, $\frac{x+6}{3y} = \frac{2}{3}$

$$\Rightarrow \frac{3(x+6)}{3y} = 2$$

$$\Rightarrow x + 6 = 2y$$

$$\Rightarrow x - 2y = -6 \dots(ii)$$

Multiplying equation (i) by 2 & then subtracting equation (ii) from it, we get

$$\Rightarrow 8x - x = 22 + 6$$

$$\Rightarrow 7x = 28$$

$$\Rightarrow x = \frac{28}{7} = 4$$

Putting $x = 4$ in equation (ii), we get

$$\Rightarrow 4 - 2y = -6$$

$$\Rightarrow -2y = -6 - 4$$

$$\Rightarrow -2y = -10$$

$$\Rightarrow y = \frac{-10}{-2} = 5$$

Hence, the fraction is $\frac{4}{5}$.

OR

The given system of equations is

$$11x + 15y + 23 = 0 \dots(1)$$

$$7x - 2y - 20 = 0 \dots(2)$$

To solve the equations (1) and (2) by cross multiplication method, we draw the diagram below:

$$\begin{array}{ccccccc} 15 & \times & 23 & y & 11 & 1 & 15 \\ & \swarrow & \searrow & \swarrow & \searrow & \swarrow & \searrow \\ -2 & & -20 & & 7 & & -2 \end{array}$$

Then,

$$\Rightarrow \frac{x}{(15)(-20) - (-2)(23)} = \frac{y}{(23)(7) - (-20)(11)} = \frac{1}{(11)(-2) - (7)(15)}$$

$$\Rightarrow \frac{x}{-300 + 46} = \frac{y}{161 + 220} = \frac{1}{-22 - 105}$$

$$\Rightarrow \frac{x}{-254} = \frac{y}{381} = \frac{1}{-127}$$

$$\Rightarrow x = \frac{-254}{-127} = 2 \text{ and } y = \frac{381}{-127} = -3$$

Hence, the required solution of the given pair of equations is

$$x = 2, y = -3$$

Verification: Substituting $x = 2, y = -3$,

We find that both the equations (1) and (2) are satisfied as shown below:

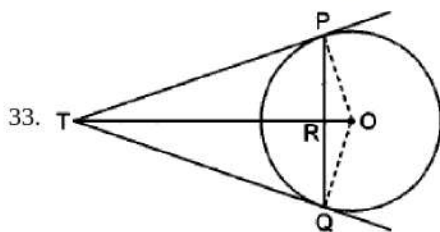
$$11x + 15y + 23 = 11(2) + 15(-3) + 23$$

$$= 22 - 45 + 23 = 0$$

$$7x - 2y - 20 = 7(2) - 2(-3) - 20$$

$$= 14 + 6 - 20 = 0$$

Hence, the solution we have got is correct.



Given, PQ is a chord of length 16 cm, of a circle of radius 10 cm. The tangents at P and Q intersect at a point T.

Construction: Join OP and OQ.

In triangles OTP and OTQ , OT is common

$$OP = OQ \text{ (radii)}$$

$$TP = TQ$$

$$\therefore \triangle OPT \cong \triangle OQT$$

$$\therefore \angle POT = \angle QOT$$

Consider, triangles OPR and OQR;

$$OP = OQ \text{ (radii); } OP \text{ is common}$$

$$\angle POR = \angle QOR \text{ [from (i)]}$$

$$\therefore \triangle OPR \cong \triangle OQR \text{ (SAS cong. rule)}$$

$$\therefore PR = RQ = \frac{1}{2} \times 16 = 8 \text{ cm} \dots(\text{ii})$$

$$\angle ORP = \angle ORQ = 90^\circ \dots(\text{iii})$$

In right angled triangle TRP,

$$TR^2 = TP^2 - (8)^2 = TP^2 - 64 \text{ [from (iii)]} \dots(\text{iv})$$

$$\text{Also } OT^2 = TP^2 + (10)^2$$

$$(TR + 6)^2 = TP^2 + 100 [\because OR = \sqrt{100 - 64} = 6]$$

$$TR^2 + 12TR + 36 = TP^2 + 100$$

$$TP^2 - 64 + 12TR + 36 = TP^2 + 100$$

$$12TR = 128 \Rightarrow TR = \frac{32}{3} \text{ cm}$$

From (iv)

$$\left(\frac{32}{3}\right)^2 = TP^2 - 64$$

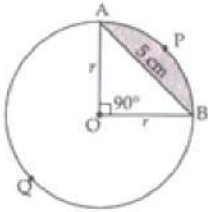
$$\Rightarrow TP^2 = \frac{1024}{9} + 64 = \frac{1024+576}{9} = \frac{1600}{9}$$

$$\Rightarrow TP = \frac{40}{3} \text{ cm}$$

34. Chord AB = 5 cm divides the circle into two segments minor segment APB and major segment AQB. We have to find out the difference in area of major and minor segment.

Here, we are given that $\theta = 90^\circ$

$$\text{Area of } \triangle OAB = \frac{1}{2} \text{Base} \times \text{Altitude} = \frac{1}{2} r \times r = \frac{1}{2} r^2$$



Area of minor segment APB

$$= \frac{\pi r^2 \theta}{360^\circ} - \text{Area of } \triangle AOB$$

$$= \frac{\pi r^2 90^\circ}{360^\circ} - \frac{1}{2} r^2$$

$$\Rightarrow \text{Area of minor segment} = \left(\frac{\pi r^2}{4} - \frac{r^2}{2} \right) \dots(\text{i})$$

Area of major segment AQB = Area of circle - Area of minor segment

$$= \pi r^2 - \left[\frac{\pi r^2}{4} - \frac{r^2}{2} \right]$$

$$\Rightarrow \text{Area of major segment AQB} = \left[\frac{3}{4} \pi r^2 + \frac{r^2}{2} \right] \dots(\text{ii})$$

Difference between areas of major and minor segment

$$= \left(\frac{3}{4} \pi r^2 + \frac{r^2}{2} \right) - \left(\frac{\pi r^2}{4} - \frac{r^2}{2} \right)$$

$$= \frac{3}{4} \pi r^2 + \frac{r^2}{2} - \frac{\pi r^2}{4} + \frac{r^2}{2}$$

$$\Rightarrow \text{Required area} = \frac{2}{4} \pi r^2 + r^2 = \frac{1}{2} \pi r^2 + r^2$$

In right $\triangle OAB$,

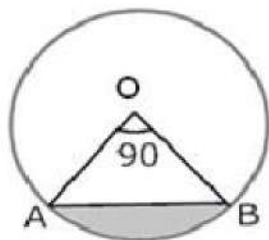
$$r^2 + r^2 = AB^2$$

$$\Rightarrow 2r^2 = 5^2$$

$$\Rightarrow r^2 = \frac{25}{2}$$

$$\text{Therefore, required area} = \left[\frac{1}{2} \pi \times \frac{25}{2} + \frac{25}{2} \right] = \left[\frac{25}{4} \pi + \frac{25}{2} \right] \text{ cm}^2$$

OR



$$\begin{aligned} \text{i. Area of minor sector} &= \frac{\theta}{360} \pi r^2 \\ &= \frac{90}{360} (3.14) (10)^2 \\ &= \frac{1}{4} \times 3.14 \times 100 \\ &= \frac{314}{4} \\ &= 78.50 = 78.5 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{ii. Area of major sector} &= \text{Area of circle} - \text{Area of minor sector} \\ &= \pi(10)^2 - \frac{90}{360} \pi(10)^2 = 3.14 (100) - \frac{1}{4} (3.14) (100) \\ &= 314 - 78.50 = 235.5 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{iii. We know that area of minor segment} &= \text{Area of minor sector OAB} - \text{Area of } \triangle OAB \\ \therefore \text{ area of } \triangle OAB &= \frac{1}{2} (OA)(OB) \sin \angle AOB \\ &= \frac{1}{2} (OA)(OB) (\because \angle AOB = 90^\circ) \\ \text{Area of sector} &= \frac{\theta}{360} \pi r^2 \\ &= \frac{1}{4} (3.14) (100) - 50 = 25(3.14) - 50 = 78.50 - 50 = 28.5 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{iv. Area of major segment} &= \text{Area of the circle} - \text{Area of minor segment} \\ &= \pi(10)^2 - 28.5 \\ &= 100(3.14) - 28.5 \\ &= 314 - 28.5 = 285.5 \text{ cm}^2 \end{aligned}$$

35. No. of cards removed = 2 jacks + 2 queens + 2 kings + 2 aces = 8

No. of all possible outcomes $n = 52 - 8 = 44$ — — — — — (1)

i. No. of black Queens in the deck = 0
 $\therefore P(\text{getting a black Queen}) = \frac{0}{44} = 0$
Hence it is an impossible event

ii. No. of red cards = 26 - 4 = 22
 $P(\text{getting a red card}) = \frac{m}{n} = \frac{22}{44} = \frac{1}{2}$

iii. No. of Jacks (black) = 2 so $m=2$
 $\therefore P(\text{getting a black colored Jack}) = \frac{m}{n} = \frac{2}{44} = \frac{1}{22}$

iv. No. of face cards in the deck = 12 - 6 = 6 so $m=6$
 $\therefore P(\text{getting a face card}) = \frac{m}{n} = \frac{6}{44} = \frac{3}{22}$

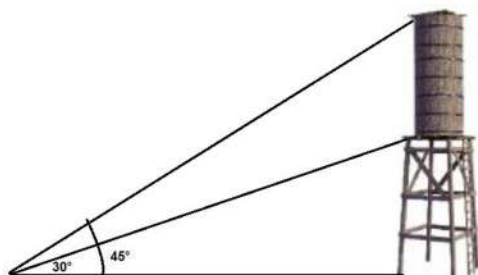
Section E

36. Read the text carefully and answer the questions:

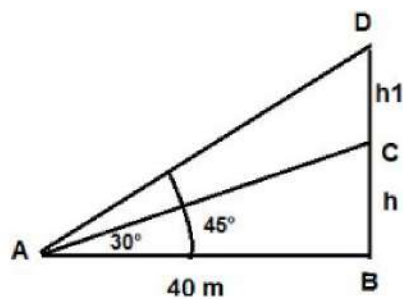
In a society, there are many multistory buildings. The RWA of the society wants to install a tower and a water tank so that all the households can get water without using water pumps.

For this they have measured the height of the tallest building in the society and now they want to install a tower that will be taller than that so that the level of water must be higher than the tallest building in their society. Here is one solution they have found and now they want to check if it will work or not.

From a point on the ground 40 m away from the foot of a tower, the angle of elevation of the top of the tower is 30° . the angle of elevation of the top of the water tank is 45° .



(i)



Let BC be the tower of height h and CD be the water tank of height h_1

In $\triangle ABD$, we have

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

$$\Rightarrow 1 = \frac{h+h_1}{40}$$

$$\Rightarrow h + h_1 = 40 \dots (1)$$

In $\triangle ABC$, we have

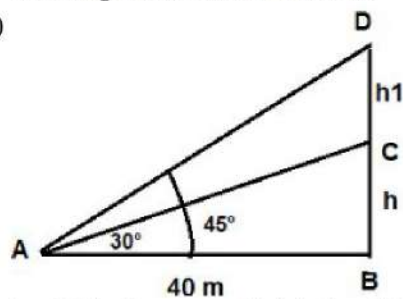
$$\tan 30^\circ = \frac{BC}{AB}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{40}$$

$$\Rightarrow h = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3} = 23.1 \text{ m}$$

Thus height of the tower is 23.1 m.

(ii)



Let BC be the tower of height h and CD be the water tank of height h_1

In $\triangle ABD$, we have

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

$$\Rightarrow 1 = \frac{h+h_1}{40}$$

$$\Rightarrow h + h_1 = 40 \dots (1)$$

In $\triangle ABC$, we have

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

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{40}$$

$$\Rightarrow h = \frac{40}{\sqrt{3}} = \frac{40\sqrt{3}}{3} = 23.1 \text{ m}$$

Thus height of the tower is 23.1 m.

Substituting the value of h in (1), we have

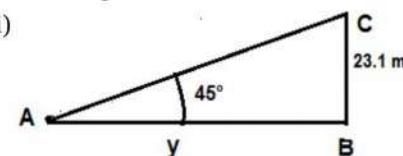
$$23.1 + h_1 = 40$$

$$\Rightarrow h_1 = 40 - 23.1$$

$$= 6.9 \text{ m}$$

Thus height of the tank is 6.9 m.

(iii)



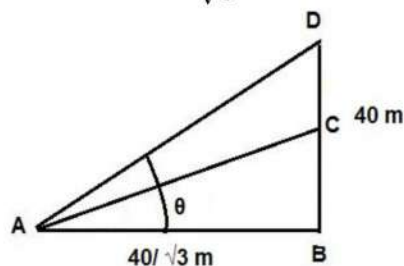
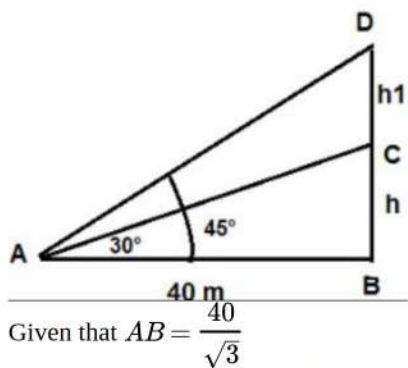
In the $\triangle ABC$ if $\angle CAB = 45^\circ$ then

$$\cot 45^\circ = \frac{y}{23.1} = 1$$

$$y = 23.1 \text{ m}$$

Thus the angle of elevation will be 45° at 23.1 m.

OR



In the $\triangle ABD$

$$\cot \theta = \frac{AB}{BD} = \frac{\frac{40}{\sqrt{3}}}{40}$$

$$\cot \theta = \frac{1}{\sqrt{3}}$$

$$\Rightarrow \theta = 60^\circ$$

Hence the angle of elevation would be 60° .

37. Read the text carefully and answer the questions:

Sehaj Batra gets pocket money from his father every day. Out of pocket money, he saves money for poor people in his locality. On

1st day he saves ₹27.5 On each succeeding day he increases his saving by ₹2.5.



(i) Money saved on 1st day = ₹27.5

$\therefore$ Sehaj increases his saving by a fixed amount of ₹2.5

$\therefore$ His saving form an AP with $a = 27.5$ and $d = 2.5$

$\therefore$ Money saved on 10th day,

$$a_{10} = a + 9d = 27.5 + 9(2.5)$$

$$= 27.5 + 22.5 = ₹50$$

(ii) $a_{25} = a + 24d$

$$= 27.5 + 24(2.5)$$

$$= 27.5 + 60 = ₹87.5$$

(iii) Total amount saved by Sehaj in 30 days.

$$= \frac{30}{2} [2 \times 27.5 + (30 - 1) \times 2.5]$$

$$= 15(55 + 29(2.5))$$

$$= ₹1912.5$$

OR

Let $S_n = 387.5$, $a = 27.5$ and $d = 2.5$

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

$$\Rightarrow 387.5 = \frac{n}{2} [2 \times 27.5 + (n - 1)2.5]$$

$$\Rightarrow 387.5 = \frac{n}{2} [55 + (n - 1) \times 2.5]$$

$$\Rightarrow 775 = 55n + 2.5n^2 - 2.5n$$

$$\Rightarrow 25n^2 + 525n = 7750 = 0$$

$$\Rightarrow n^2 + 21n - 310 = 0$$

$$\Rightarrow (n + 31)(n - 10) = 0$$

$$\Rightarrow n = -31 \text{ reject } n = 10 \text{ accept}$$

So in 10 years Sehaj saves ₹ 387.5.

38. Read the text carefully and answer the questions:

A juice seller is serving his customers using cylindrical container with radius 20cm and height 50cm. He serves juice into a glass as shown in Fig. The inner diameter of the cylindrical glass is 5 cm, but the bottom of the glass had a hemispherical raised portion which reduced the capacity of the glass.



(i) We have, Inner diameter of the glass, $d = 5$ cm, Height of the glass = 10 cm

The apparent capacity of the glass = Volume of cylinder

$$= \pi r^2 h$$

$$= 3.14 \times \left(\frac{5}{2}\right)^2 \times 10$$

$$= 3.14 \times \frac{25}{4} \times 10 = 196.25 \text{ cm}^3$$

(ii) We have, Inner diameter of the glass, $d = 5$ cm, Height of the glass = 10 cm

The actual capacity of glass = Apparent capacity of glass - Volume of hemispherical part of the glass

$$\text{The volume of hemispherical part} = \frac{2}{3} \pi r^2 h = \frac{2}{3} \times 3.14 \times \left(\frac{5}{2}\right)^3 = 32.71 \text{ cm}^3$$

$$\text{Actual capacity of glass} = 196.25 - 32.71 = 163.54 \text{ cm}^3$$

(iii) We have, inner diameter of the glass, $d = 5$ cm, height of the glass = 10 cm

$$\text{Volume of container} = V = \pi r^2 h$$

$$\Rightarrow V = 3.14 \times 20 \times 20 \times 50 = 62800 \text{ cm}^3$$

$$\Rightarrow V = 62.8 \text{ litre}$$

OR

We have, Inner diameter of the glass, $d = 5$ cm, Height of the glass = 10 cm

$$\text{Number of glasses} = \frac{\text{Volume of container}}{\text{Actual volume of one glass}}$$

$$\Rightarrow \text{Number of glasses} = \frac{20 \times 3.14 \times 20 \times 50}{3.14 \times \frac{2\pi}{4} \times 10 - \frac{2}{3} \times 3.14 \times \frac{125}{8}}$$

$$\Rightarrow \text{Number of glasses} = \frac{20000}{\frac{250}{4} - \frac{125}{12}} = \frac{20000 \times 12}{750 - 125} = \frac{240000}{625} = 384$$

$$\Rightarrow \text{Number of glasses} = 384$$