Next Toppers

Abhay 2025, Class 10th

Sample Question Paper-1

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

Read the following instructions carefully and follow them:

(i) *This question paper contains* ***38*** *questions. All questions are compulsory.*
(ii) *Question paper is divided into FIVE sections - Section* ***A, B, C, D*** *and* ***E.***
(iii) *In section A, question number* ***1*** *to* ***18*** *are multiple choice questions (MCQ's) and question number* ***19*** *and* ***20*** *are Assertion-Reason based questions of* ***1*** *mark each.*
(iv) *In section* ***B****, question number* ***21*** *to* ***25*** *are very short answer (VSA) type questions of* ***2*** *marks each.*
(v) *In section* ***C****, question number* ***26*** *to* ***31*** *are short answer (SA) type questions carrying* ***3*** *marks each.*
(vi) *In section* ***D****, question number* ***32*** *to* ***35*** *are long answer (LA) type questions carrying* ***5*** *marks each.*
(vii) *In section* ***E****, question number* ***36*** *to* ***38*** *are case based integrated units of assessment questions carrying* ***4*** *marks each. Internal choice is provided in* ***2*** *marks question in each case study.*
(viii) *There is no overall choice. However, an internal choice has been provided in* ***2*** *questions in Section* ***B****,* ***2*** *questions in Section* ***C****,* ***2*** *questions in Section* ***D*** *and* ***3*** *questions in Section E.*
(ix) *Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.*
(x) *Use of calculator is* ***not allowed****.*

Section-A

Section A Consists of Multiple Choice Type questions of 1 mark each

1. If a and b are two coprime numbers, then a^3 and b^3 are

(A) Coprime **(B)** Not coprime **(C)** Even **(D)** Odd

3. If $x - 1$ is a factor of the polynomial $p(x) = x^3 + ax^2 + 2b$ and $a + b = 4$, then

(A) $a = 5, b = -1$ **(B)** $a = 9, b = -5$ **(C)** $a = 7, b = -3$ **(D)** $a = 3, b = 1$

3. If a pair of linear equations is consistent, then the lines will be:

(A) parallel **(B)** always coincident
(C) intersecting or coincident **(D)** never intersecting

4. Which of the following equations has two distinct real roots?

(A) $2x^2 - 3\sqrt{2}x + \frac{9}{4} = 0$ **(B)** $x^2 + x - 5 = 0$

(C) $x^2 + 3x + 2\sqrt{2} = 0$ **(D)** $5x^2 - 3x + 1 = 0$

5. The n^{th} term of the A.P. $a, 3a, 5a, \ldots$ is

(A) na **(B)** $(2n - 1)a$ **(C)** $(2n + 1)a$ **(D)** $2na$

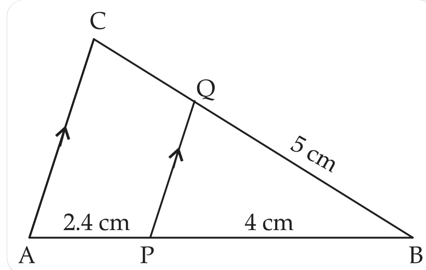
6. The distance of the point $(-6, 8)$ from x-axis is

(A) 6 units **(B)** – 6 units **(C)** 8 units **(D)** 10 units

7. The base BC of an equilateral ΔABC lies on the Y-axis. The co-ordinates of C are $(0, -3)$. If the origin is the mid-point of the base BC, what are the co-ordinates of A and B?

(A) $A\left(\sqrt{3}, 0\right), B(0, 3)$ **(B)** $A(\pm 3\sqrt{3}, 0), B(3, 0)$ **(C)** $A(\pm 3\sqrt{3}, 0), B(0, 3)$ **(D)** $A(-\sqrt{3}, 0), B(3, 0)$

8. In the given figure, PQ || AC. If BP = 4 cm, AP = 2.4 cm and BQ = 5 cm, then length of BC is:



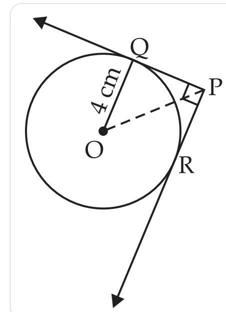
(A) 8 cm

(B) 3 cm

(C) 0.3 cm

(D) $\frac{25}{3}$ cm

9. In the given figure, from an external point P, two tangents PQ and PR are drawn to a circle of radius 4 cm with centre O. If $\angle QPR = 90°$, then length of PQ is:



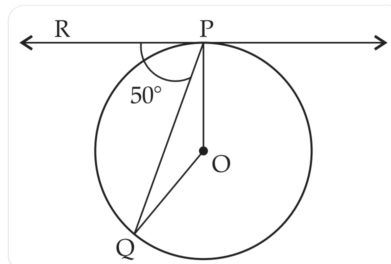
(A) 3 cm

(B) 4 cm

(C) 2 cm

(D) $2\sqrt{2}$ cm

10. In the given figure, O is the centre of the circle and PQ is the chord. If the tangent PR at P makes an angle of 50° with PQ, then the measure of ∠POQ is:



(A) 50°

(B) 40°

(C) 100°

(D) 130°

11. If sec θ + tan θ = p, then tan θ is

(A) $\frac{p^2+1}{2p}$ **(B)** $\frac{p^2-1}{2p}$

(C) $\frac{p^2-1}{p^2+1}$ **(D)** $\frac{p^2+1}{p^2-1}$

12. $\frac{\cos^2\theta}{\sin^2\theta} - \frac{1}{\sin^2\theta}$, in simplified form is:

(A) $\tan^2\theta$ **(B)** $\sec^2\theta$ **(C)** 1 **(D)** – 1

13. A kite is flying at a height of 80 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground in 30°, then the length of the string is:

(A) 160 m **(B)** 40 m **(C)** 100 m **(D)** 115 m

14. The area of sector of a circle with radius 12 cm, if angle of the sector is 120°, is:

(A) 145 cm^2 **(B)** 151 cm^2 **(C)** 160 cm^2 **(D)** 182 cm^2

15. In a circle of radius 35 cm, an arc subtends an angle of 60° at the centre, then the length of the arc is:

(A) 25 cm **(B)** 31 cm **(C)** 37 cm **(D)** 42 cm

16. A bag contains 5 pink, 8 blue and 7 yellow balls. One ball is drawn at random from the bag. What is the probability of getting neither a blue nor a pink ball ?

(A) $\frac{1}{4}$ **(B)** $\frac{2}{5}$ **(C)** $\frac{7}{20}$ **(D)** $\frac{13}{20}$

17. Cards bearing numbers 3 to 20 are placed in a bag and mixed thoroughly. A card is taken out of the bag at random. What is the probability that the number on the card taken out is an even number?

(A) $\frac{9}{17}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{5}{9}$ **(D)** $\frac{7}{18}$

18. The heights of plants in Dipti's garden are recorded in the table given below. The median plant height is 55 cm.

Heights of plants (in cm)	0-20	20-40	40-60	60-80	80-100
Number of plants	$2x$	4	$4x$	8	4

Which of the following is the value of x?

(A) 1
(B) 2
(C) 0.01
(D) the value of x cannot be found without knowing the total number of plants

DIRECTIONS: Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements (A) and (R).

(A) Both (A) and (R) are true and (R) is the correct explanation of the (A).
(B) Both (A) and (R) are true but (R) is not the correct explanation of the (A).
(C) (A) is true but (R) is false.
(D) (A) is false but (R) is true.

19. **Assertion (A):** The fourth term from the end of the A.P., –11, –8, –5, ..., 49 is 40.
Reason (R): If the n^{th} term of an A.P., – 1, 4, 9, 14, ... is 129, then the value of n is 100.

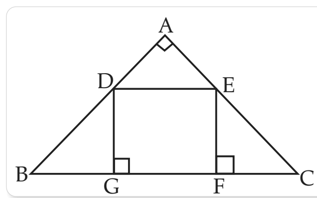
20. **Assertion (A):** If the circumference of a circle exceeds the diameter by 16.8 cm, then its radius is 3.92 cm.
Reason (R): Circumference of circle = Diameter of circle + 16.8

Section-B

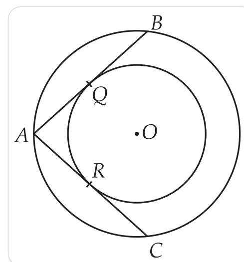
Section B consists of 5 questions of 2 marks each.

21. Show that 6^n cannot end with digit 0 for any natural number 'n'.

22. In the given figure, DEFG is a square and $\angle BAC = 90°$.
Show that $FG^2 = BG \times FC$.



23. In Fig. there are two concentric circles with centre O. If ARC and AQB are tangents to the smaller circle from the point A lying on the larger circle, find the length of AC, if $AQ = 5$ cm.



24. **(A)** Evaluate $2\sec^2\theta + 3\,\text{cosec}^2\theta - 2\sin\theta\cos\theta$ if $\theta = 45°$.

OR

(B) If $\sin\theta - \cos\theta = 0$, then find the value of $\sin^4\theta + \cos^4\theta$.

25. **(A)** Find the area (in cm^2) of the circle that can be inscribed in a square of side 8 cm.

OR

(B) The curved surface area of a cylinder is 264 m^2 and its volume is 924 m^3. Find the ratio of its height to its diameter.

Section-C

Section C Consists of 6 questions of 3 marks each

26. Given that $\sqrt{3}$ is irrational, prove that $5+2\sqrt{3}$ is irrational.

27. If one root of the quadratic equation $x^2 + 12x - k = 0$ is thrice the other root, then find the value of k.

28. **(A)** A fraction becomes $\frac{2}{3}$ when 3 is added from the numerator and it becomes $\frac{1}{2}$ when 1 is subtracted from the denominator. Find the fraction.

OR

(B) The present age of father is three years more than three times the age of his son. Three years later hence the father's age will be 10 years more than twice the age of the son. Determine their present ages.

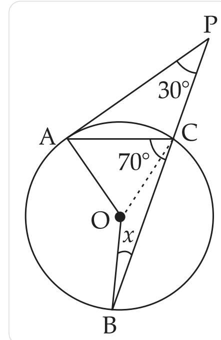
29. In the figure given below, PA is a tangent to the circle with centre O and PCB is a straight line.

(**Note:** The figure is not to scale.)

(A) Find the measure of $\angle OBC$. Show your steps and given valid reasons.

OR

(B) Prove that the parallelogram circumscribing a circle is a rhombus.



30. Prove that: $\dfrac{1+\sec A}{\sec A} = \dfrac{\sin^2 A}{1-\cos A}$

31. Find the mean of the following data using assumed mean method:

Class	0 – 5	5 – 10	10 – 15	15 – 20	20 – 25
Frequency	8	7	10	13	12

Section-D

Section D consists of 4 questions of 5 marks each.

32. **(A)** The sum of first seven terms of an A.P. is 182. If its 4^{th} term and the 17^{th} term are in the ratio 1 : 5, find the A.P.

OR

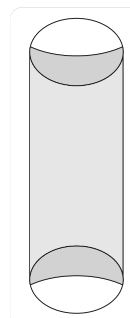
(B) The sum of first q terms of an A.P. is $63q - 3q^2$. If its p^{th} term is – 60, find the value of p. Also, find the 11^{th} term of this A.P.

33. $p(x) = ax^2 - 8x + 3$, where a is a non-zero real number. One zero of $p(x)$ is 3 times the other zero.

(i) Find the value of a. Show your work.

(ii) What is the shape of the graph of $p(x)$? Give a reason for your answer.

34. **(A)** Wooden article was made by scooping out a hemisphere from each end of solid cylinder, as shown in the figure. If the height of the cylinder is 10 cm and its base is of radius 3.5 cm, find the total surface area of the article.



OR

(B) From a solid cylinder of height 20 cm and diameter 12 cm, a conical cavity of height 8 cm and radius 6 cm is hallowed out. Find the total surface area of the remaining solid.

35. Two different dice are thrown together. Find the probability that the numbers obtained have

(i) even sum, and

(ii) even product.

Section-E

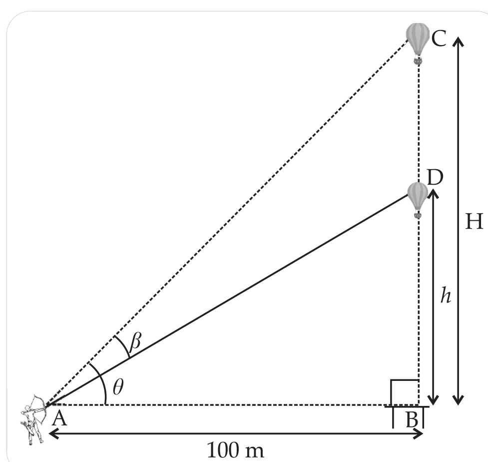
Case study based questions are compulsory.

36. At an archery academy, Guru Drona had floated a gift box with two balloons at a height of H metres from the table. As part of his practice, Arjuna was given the task to bring the gift box to the table placed below. Arjuna was standing on the ground at a horizontal distance of 100 metres from the table at point B. He aimed at the balloons with an elevation angle of θ and shot the arrow to burst one of the balloons.

When Arjuna burst the first balloon, the box came down to the height of h metres from the table. He now reduced his angle of elevation by β and shot his arrow at the second balloon. The seconds balloon burst and the gift box landed safely on the table. Assume that Arjuna's arrows traveller in straight lines and did not curve down.

(**Note:** The figure is not to scale)

(Use $\sqrt{3} = 1.73$, $\sqrt{2} = 1.41$)



(i) If θ = 45° and β = 15°, what is the difference between the box's initial height and its height after the first shot? **[1]**

(ii) For Ashwatthama, Guru Drona raised the gift box further higher such that the angles θ and β were 60° and 30° respectively. What is the value of the ratio $\frac{H}{h}$ now? **[2]**

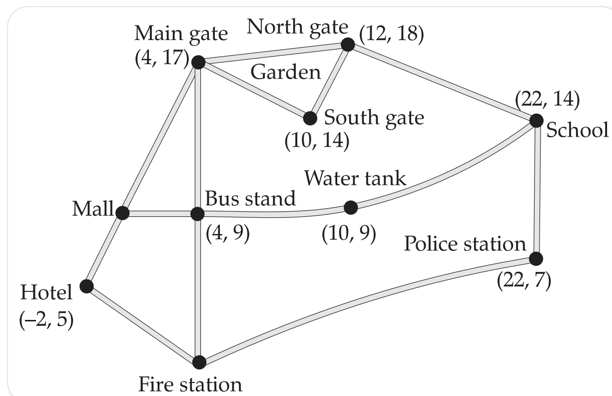
OR

When the initial angle of elevation, θ, was 45°, Arjuna felt uncomfortable as it straing his neck. From his original spot. From his original spot, approximately how much should he retreat away fro the balloons, so that the new angle of elevation, θ, becomes 30°?

(iii) If θ = 45° and β = 15°, what is the distance that the arrow has to travel to burst the second balloon? **[1]**

37. **Shown below is a map of Giri's neighbourhood.**

Giri did a survey of his neighbourhood and collected the following information.



- The hotel, mall and the main gate of the garden lie in a straight line.
- The distance between the hotel and the mall is half the distance between the mall and the main gate of the garden.
- The bus stand is exactiy midway between the main gate of the garden and the fire station.
- The mall, bus stand and the water tank lie in a straight line.

(i) What is the x-coordinate of the mall's location? **[1]**

(ii) What is the shortest distance between the water tank and the school? **[2]**

OR

How much more is the shortest distance of the school from the water tank than the distance of the school from the police station?

(iii) What are the coordinates of the fire station? **[1]**

38. **Read the following text and answer following questions from:**

SCALE FACTOR

A scale drawing of an object is the same shape at the object but a different size. The scale of a drawing is a comparison of the length used on a drawing to the length it represents. The scale is written as a ratio. The ratio of two corresponding sides in similar figures is called the scale factor.

Scale factor = length in image / corresponding length in object

If one shape can become another using revising, then the shapes are similar. Hence, two shapes are similar when one can become the other after are-size, flip, slide or turn. In the photograph below showing the side view of a train engine. Scale factor is 1:200

This means that a length of 1 cm on the photograph above corresponds to a length of 200 cm or 2 m, of the actual engine. The scale can also be written as the ratio of two lengths.

(i) If the length of the model is 11 cm, then find the overall length of the engine in the photograph above, including the couplings(mechanism used to connect)

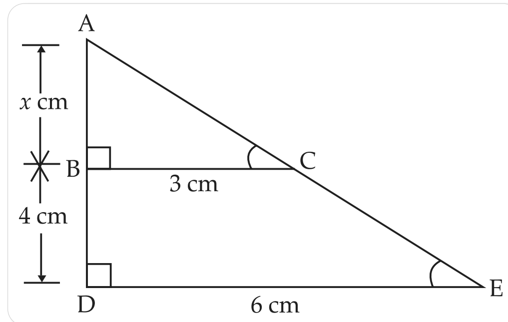
(ii) What will affect the similarity of any two polygons?

OR

What is the actual width of the door if the width of the door in photograph is 0.35 cm?

(iii) Find the length of AB in the given figure.

Also find the area of Δ ADE.



Abhay 2025, Class 10th

Sample Question Paper-1

SOLUTIONS

Section-A

1. **Option (A) is correct.**

Explanation: As a and b are co-prime then a^3 and b^3 are also co-prime.

We can understand above situation with the help of an example.

Let $a = 3$ and $b = 4$

$a^3 = 3^3 = 27$ and $b^3 = 4^3 = 64$

Clearly, HCF (a, b) = HCF $(3, 4) = 1$

Then, HCF (a^3, b^3) = HCF $(27, 64) = 1$

[CBSE Marking Scheme, 2021]

2. **Option (B) is correct.**

Explanation: Given,

$$p(x) = x^3 + ax^2 + 2b$$

$$a + b = 4 \quad \text{...(i)}$$

$x - 1$ is a factor of the polynomial $p(x)$,

it means $x = 1$ is a zero of the polynomial $p(x)$.

$\therefore$ $p(1) = 0$

or $(1)^3 + a(1)^2 + 2b = 0$

or $1 + a + 2b = 0$

or $a + 2b = -1$ ...(ii)

Subtracting (i) from (ii), we get

$b = -5$

Substituting the value of b in (i), we get $a = 9$

$\therefore$ $a = 9$ & $b = -5$

3. **Option (C) is correct.**

Explanation: Condition for consistency:

$\dfrac{a_1}{a_2} \neq \dfrac{b_1}{b_2}$ has unique solution (consistent), i.e., intersecting at one point

or $\dfrac{a_1}{a_2} = \dfrac{b_1}{b_2} = \dfrac{c_1}{c_2}$ (many solutions)

(Consistent lines, coincident or dependent)

4. **Option (B) is correct.**

Explanation: $x^2 + x - 5 = 0$

On comparing with $ax^2 + bx + c = 0$

$$a = 1, b = 1, c = -5$$

$$b^2 - 4ac = (1)^2 - 4(1)(-5)$$

$$= 1 + 20$$

$$= 21 > 0$$

Since, D (i.e., $b^2 - 4ac$) > 0

Hence, the equation has two distinct real roots.

5. **Option (B) is correct.**

Explanation: Given

A.P. $= a, 3a, 5a, \ldots$

Here, First term, $a = a$ and $d = 3a - a = 2a$

$\therefore$ n^{th} term $= a + (n-1)\,d$

$= a + (n-1)\,2a$

$= a + 2na - 2a$

$= 2na - a = (2n - 1)\,a$

[CBSE Marking Scheme, 2020]

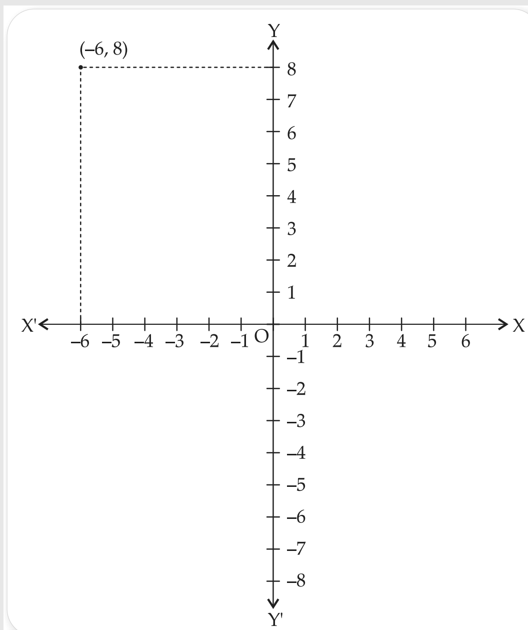
6. **Option (C) is correct.**

Explanation: Refer the following figure.

x-coordinate $= -6$

So, Distance of point along x-axis from origin

$= -6$ units



y co-ordinate $= 8$

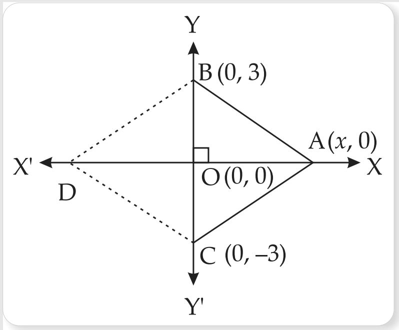
So, Distance of point along y-axis from origin

$= 8$ units

$\therefore$ The perpendicular distance of point $(-6, 8)$ from x-axis is 8 units.

7. Option (C) is correct.

Explanation:



O is the midpoint of the base BC

i.e., O is the midpoint of B and C(0, –3)

Therefore, co-ordinates of point B is (0, 3)

So, $BC = 6$ units.

Let the co-ordinates of point A be $(x, 0)$.

Using distance formula,

$$AB = \left|\sqrt{(0-x)^2+(3-0)^2}\right|$$

$$= |\sqrt{x^2+9}|$$

$$BC = \left|\sqrt{(0-0)^2+(-3-3)^2}\right|$$

$$= |\sqrt{36}|$$

Also, $BC = AB$

$$|\sqrt{x^2+9}| = |\sqrt{36}|$$

$$x^2 = 27$$

or $x = \pm 3\sqrt{3}$

Co-ordinates of A and B are $(\pm 3\sqrt{3}, 0)$ and (0, 3) respectively.

8. Option (A) is correct.

Explanation: As PQ || AC by using basic proportionality theorem,

$$\frac{BP}{PA} = \frac{BQ}{QC}$$

$$\frac{4}{2.4} = \frac{5}{QC}$$

$$QC = \frac{5\times 2.4}{4}$$

$$QC = 3 \text{ cm}$$

$$BC = BQ + QC$$

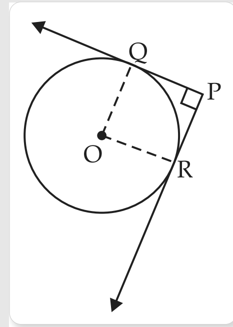
$$= 5 + 3 = 8 \text{ cm}$$

9. Option (B) is correct.

Explanation: $OQ = 4$ cm (given)

$OQ \perp PQ$ and $OR \perp RT$

($\because$ Radius $\perp$ tangent)



$\therefore$ $\angle OQP = \angle ORP = 90°$

and $\angle QPR = 90°$ (given)

Then $\angle QOR = 90°$

(By property of quadrilateral)

So, PQOR is a square in shape.

Hence, $OQ = PQ = 4$ cm

10. Option (C) is correct.

Explanation:

Here, $\angle OPQ = 90°$

(angle between radius and tangent)

$\therefore$ $\angle OPQ = 90° - 50°$

$= 40°$

Also, $\angle OPQ = \angle OQP = 40°$

(being of equal radius)

In ΔPOQ,

$\angle OPQ + \angle OQP + \angle POQ = 180°$

$40° + 40° + \angle POQ = 180°$

$\angle POQ = 180° - 80° = 100°$

11. Option (B) is correct.

Explanation: $\sec\theta + \tan\theta = p$ ...(i)

is the given equation.

Since, $1 + \tan^2\theta = \sec^2\theta$

or $\sec\theta = \sqrt{1+\tan^2\theta}$

Put this value in (i), we get

$$\sqrt{1+\tan^2\theta} + \tan\theta = p$$

or $\sqrt{1+\tan^2\theta} = p - \tan\theta$

Squaring both sides, we get

$$1 + \tan^2\theta = p^2 + \tan^2\theta - 2p\tan\theta$$

or $1 = p^2 - 2p(\tan\theta)$

or $1 - p^2 = -2p\tan\theta$

or $\tan\theta = \frac{p^2-1}{2p}$

12. Option (D) is correct.

Explanation: $\frac{\cos^2\theta}{\sin^2\theta} - \frac{1}{\sin^2\theta}$

$$= \frac{\cos^2\theta - 1}{\sin^2\theta} \quad \text{...(i)}$$

We know that,

$$\sin^2\theta + \cos^2\theta = 1$$

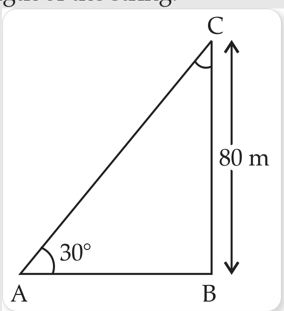
$$\therefore \quad \cos^2\theta - 1 = -\sin^2\theta$$

Substitute value of $\cos^2\theta - 1$ in equation (i)

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

13. Option (A) is correct.

Explanation: Let C be the position of the kite and AC be the length of the string.



In right ΔABC,

$$\sin 30° = \frac{BC}{AC}$$

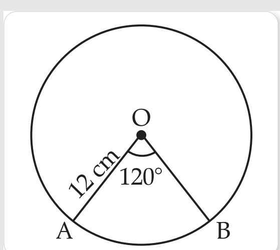
$$\Rightarrow \quad \frac{1}{2} = \frac{80}{AC}$$

$$\Rightarrow \quad AC = 160 \text{ m}$$

14. Option (B) is correct.

Explanation: Since, area of sector of circle $= \frac{\theta}{360°}\pi r^2$

Here, $\theta = 120°$ and $r = 12$ cm



$$\therefore \text{ Area of sector of circle} = \frac{120°}{360°} \times \frac{22}{7} \times (12)^2$$

$$= \frac{1}{3} \times \frac{22}{7} \times 144$$

$$= \frac{48 \times 22}{7}$$

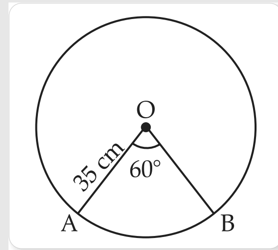
$$= \frac{1056}{7}$$

$$= 150.85 \text{ cm}^2$$

$$\approx 151 \text{ cm}^2$$

15. Option (C) is correct.

Explanation: Given, $r = 35$ cm and $\theta = 60°$



Since, Arc length $= \frac{\theta}{360°} \times 2\pi r$

$$= \frac{60°}{360°} \times 2 \times \frac{22}{7} \times 35$$

$$= \frac{1}{6} \times 2 \times 22 \times 5$$

$$= \frac{22 \times 5}{3}$$

$$= \frac{110}{3}$$

$$= 36.66 \text{ cm} \approx 37 \text{ cm}$$

16. Option (C) is correct.

Explanation: Number of balls which is neither a blue nor a Pink = 7

∴ P(Getting a ball which is neither blue or pink)

$$= \frac{7}{20}$$

17. Option (B) is correct.

Explanation: Total cards (3, 4 .... 20) = 18

Number of even cards = 9

Probability of getting even $= \frac{9}{18} = \frac{1}{2}$

18. Option (B) is correct.

Explanation:

Heights of plants (in cm)	0-20	20-40	40-60	60-80	80-100
Number of plants	$2x$	4	$4x$	8	4
Cumulative frequency	$2x$	$2x + 4$	$6x + 4$	$6x + 12$	$6x + 16$

$$\text{Median frequency} = \frac{N}{2}$$

$$= \frac{(6x + 16)}{2}$$

$$= 3x + 8$$

Therefore, Median Class = (40 – 60)

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$$

Here Median = 55

Lower limit of selected median class (l) = 40
cumulative frequency of preceding class (cf) = $(2x + 4)$
frequency of median class (f) = $4x$
median term (n) = $(3n + 8)$
class size (h) = 20

$$55 = 40 + \left[\frac{(3x+8)-(2x+4)}{4x}\right] \times 20$$

$$55 - 40 = (x+4) \times \frac{20}{4x}$$

$$15 = \frac{5 \times (x+4)}{x}$$

$$3x = x + 4$$
$$2x = 4$$
$$x = 2$$

19. **Option (C) is correct.**

Explanation: In case of assertion:
In the given $A.P.$, the last term $l = 49$ and common difference $d = -8 + 11 = 3$
4^{th} term from last is $t_4 = 49 - (4 - 1) \times 3 = 40$
$\therefore$ Assertion is true.
In case of reason:
Given, $a = -1$ and $d = 4 - (-1) = 5$

$$a_n = -1 + (n - 1) \times 5 = 129$$

or, $(n - 1)5 = 130$
$(n - 1) = 26$
$n = 27$

Hence, 27^{th} term = 129.
$\therefore$ Reason is false.
Hence, assertion is true but reason is false.

20. **Option (A) is correct.**

Explanation: According to Assertion,
Circumference of circle = Diameter of circle + 16.8

$\Rightarrow$ $2\pi r = 2r + 16.8$
$\Rightarrow$ $2\pi r - 2r = 16.8$
$\Rightarrow$ $2r(\pi - 1) = 16.8$
$\Rightarrow$ $r\left(\frac{22}{7} - 1\right) = 8.4$
$\Rightarrow$ $r = \frac{8.4 \times 7}{15}$
$\Rightarrow$ $r = 3.92$ cm

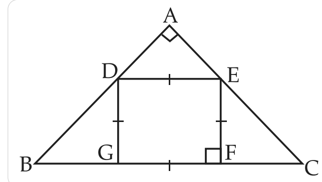
Section-B

21. If 6^n ends with 0 then it must have 5 as a factor.

But, $6^n = (2 \times 3)^n$
$= 2^n \times 3^n$

This shows that 2 and 3 are the only prime factors of 6^n.
According to Fundamental theorem of arithmetic prime factorization of each number is unique.
So, 5 is not a factor of 6^n
Hence, 6^n can never end with the digit 0. **2**

22. Given, DEFG is a square and $\angle BAC = 90°$



To prove: $FG^2 = BG \times FC$
Since, DEFG is a square, therefore we can write,

$$DE = EF = FG = GD$$

In ΔADE and ΔGDB,
$\therefore$ $\angle A = \angle DGB = 90°$
$\angle ADE = \angle GBD$
(Corresponding angles)
$\therefore$ By AA similarity, $\Delta EAD \sim \Delta GDB$ ...(i)
In ΔAED and ΔFCE,
$\angle A = \angle EFC = 90°$
$\angle AED = \angle FCE$
(Corresponding angles)
$\therefore$ By AA similarity, $\Delta AED \sim \Delta FCE$ ...(ii)
From (i) and (ii), we get

$$\Delta GDB \sim \Delta FCE$$

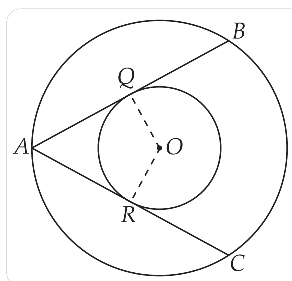
Since, corresponding sides of two similar triangles are proportional.

$\therefore$ $\frac{GD}{FC} = \frac{BG}{EF}$

$\Rightarrow$ $GD \times EF = BG \times FC$
$FG^2 = BG \times FC$

Hence Proved. 2

23.



½

Here, AC and AB are the tangents from external point A to smaller circle.
$\therefore$ $AC = AB$ ½
Now, AB is the chord of bigger circle and OQ is the perpendicular bisector of chord AB.
$\therefore$ $AQ = QB$
or, $AB = 2AQ$ ½
or, $AB = 2(5) = 10$ cm
[$\because$ Given $AQ = 5$ cm]
Similarly, $AC = 10$ cm ½

24. **(A)** We have,

$2\sec^2\theta + 3\operatorname{cosec}^2\theta - 2\sin\theta\cos\theta$

$= 2\sec^2 45° + 3\operatorname{cosec}^2 45° - 2\sin 45°\cos 45°$

(given $\theta = 45°$)

$$= 2(\sqrt{2})^2 + 3(\sqrt{2})^2 - 2\frac{1}{\sqrt{2}}\times\frac{1}{\sqrt{2}}$$ **1**

$$= 2\times 2 + 3\times 2 - \frac{2}{2}$$

$= 4 + 6 - 1$

$= 9$ **1**

OR

(B) Given $\quad \sin\theta - \cos\theta = 0$

$$\therefore \quad \frac{\sin\theta}{\cos\theta} = 1$$

or $\quad \tan\theta = 1$

or $$\theta = \frac{\pi}{4} \qquad \left[\because \tan\frac{\pi}{4} = 1\right]$$ **1**

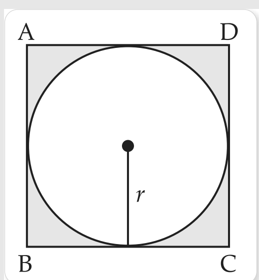
Now, $$\sin^4\theta + \cos^4\theta = \left(\sin\frac{\pi}{4}\right)^4 + \left(\cos\frac{\pi}{4}\right)^4$$

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

$$= \frac{1}{4} + \frac{1}{4}$$

$$= \frac{2}{4} = \frac{1}{2}$$ **1**

25. **(A)**



1

Side of square = diameter of circle = 8 cm

$$\therefore \text{ Radius of circle, } \quad r = \frac{8}{2} = 4 \text{ cm}$$

Area of circle $= \pi r^2$

$= \pi \times 4 \times 4 = 16\pi \text{ cm}^2$ **1**

[CBSE Marking Scheme, 2012]

OR

(B) Curved surface area of cylinder $= 2\pi rh$

Volume of cylinder $= \pi r^2 h$

$$\frac{\pi r^2 h}{2\pi rh} = \frac{924}{264} \Rightarrow \frac{r}{2} = \frac{7}{2}$$ **1**

$\therefore \quad r = 7$ m

$2\pi rh = 264$

or, $$2\times\frac{22}{7}\times 7\times h = 264$$

or, $\quad h = 6$ m

$$\therefore \quad \frac{h}{2r} = \frac{6}{14} = \frac{3}{7}$$ **1**

Hence, the ratio of its height to its diameter is

$h : d = 3 : 7$

Section-C

26. Let us assume $5+2\sqrt{3}$ is rational, then it must be in the form of $\frac{p}{q}$ where p and q are co-prime integers and $\quad q \neq 0$ **1**

i.e., $$5+2\sqrt{3} = \frac{p}{q}$$ ½

So $$\sqrt{3} = \frac{p-5q}{2q}$$ ...(i) ½

Since p, q, 5 and 2 are integers and $q \neq 0$, RHS of equation (i) is rational. But LHS of (i) is $\sqrt{3}$ which is irrational. This is not possible. ½

This contradiction has arisen due to our wrong assumption that $5+2\sqrt{3}$ is rational. So, $5+2\sqrt{3}$ is irrational. ½

27. Let one root of equation $= \alpha$

other root $= 3\alpha$

Given, $\quad x^2 + 12x - k = 0$

Here, $a = 1$, $b = 12$ and $c = -k$

[On comparing with $ax^2 + bx + c = 0$]

$$\text{sum of roots} = \alpha + \beta = \frac{-b}{a} = -12$$ **1**

$\alpha + 3\alpha = -12$

$4\alpha = -12$

$\alpha = -3$ **1**

Product of Roots $= \alpha\beta = \alpha \times 3\alpha = -k$

$3\alpha^2 = -k$

$3(-3)^2 = -k$

$27 = -k$ **1**

Thus, value of $k = 27$

28. **(A)** Let the fraction be $\frac{x}{y}$.

$$\therefore \quad \frac{x+3}{y} = \frac{2}{3}$$ ...(1) **1**

and $$\frac{x}{y-1} = \frac{1}{2}$$ ...(2) **1**

Solving (1) and (2) to get $x = 7$, $y = 15$

$\therefore$ Required fraction is $\frac{7}{15}$. **1**

[CBSE Marking Scheme, 2019]

OR

Topper Answer, 2020

Sol. (B) Let the Present age of

Father = x years

Son = y years

$x = 3y + 3$

$\cancel{x+}\ x - 3y - 3 = 0 \rightarrow (1)$

$\cancel{x+3 = 2y+10}$

$x + 3 = 2(y+3) + 10$

$x + 3 = 2y + 6 + 10$

$x - 2y = 16 - 3$

$x - 2y - 13 = 0 \rightarrow (2)$

Solving (1) and (2), $x - 3y - 3 = 0$

$-x + 2y + 13 = 0$

$-y + 10 = 0$

$y = 10$

$x = 33$

Ans: Present age of father = 33 years

son = 10 years **3**

29. (A) $\angle ACP + \angle ACB = 180°$

(Straight line angle)

$\therefore \quad \angle ACP = 110°$ ½

In ΔAPC

$\angle CAP + \angle APC + \angle ACP = 180°$

(Angle sum property)

$\angle CAP = 180° - (110° + 30°)$

$= 40°$ ½

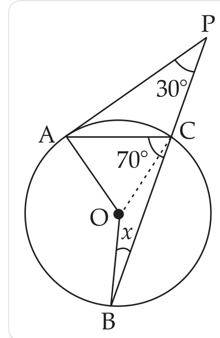
$\angle OAP = 90°$

(Tangent is perpendicular to the radius through the point of contact)

$\angle OAP = \angle PAC + \angle OAC$

$90° = 40° + \angle OAC$

So, $\angle OAC = 50°$ ½



Join OC

In ΔOAC,

$OA = OC$ (equal radii)

$\therefore \quad \angle OAC = \angle OCA = 50°$

(Angle opposite to equal side)

So, $\angle OCB = 70° - 50°$

$= 20°$ ½

In ΔOCB

$OB = OC$ (equal radii)

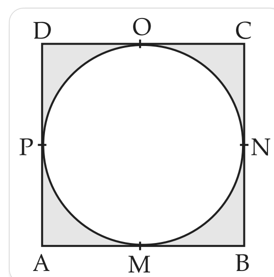
$\therefore \quad \angle OBC = \angle OCB = 20°$

(Angle opposite to equal sides)

Thus, $\angle OBC = 20°$ ½

OR

(B)



Let ABCD be a parallelogram circumscribing a circle

To prove: ABCD is a rhombus.

i.e., To prove AB = BC = CD = DA

Proof: We know that, the tangents to a circle from an external point are equal in lengths.

$\therefore$ AM = AP, BM = BN, CO = CN and DO = DP

On adding all the above equations, we get

AM + BM + CO + DO = AP + BN + CN + DP

$\Rightarrow$ (AM + BM) + (CO + DO) = (AP + PD) + (BN + NC)

$\Rightarrow \quad AB + CD = AD + BC$ ...(i)

Given, ABCD is a parallelogram

$\therefore \quad AB = CD$ and $BC = AD$ ...(ii)

[$\because$ Opposite sides of a parallelogram are equal]

Then, from eqs. (i) and (ii), we get

$2AB = 2BC$

$\Rightarrow \quad AB = BC$ ...(iii)

from eqs. (ii) and (iii), we get

$AB = BC = CD = DA$

Hence, ABCD is a rhombus. **Hence Proved 2**

30. $$\frac{1+\sec A}{\sec A} = \frac{\sin^2 A}{1-\cos A}$$

$$\text{LHS} = \frac{1+\sec A}{\sec A}$$

$$= \frac{1+\frac{1}{\cos A}}{\frac{1}{\cos A}}$$

$$\Rightarrow \frac{\cos A+1}{\cos A}\times\frac{\cos A}{1} = \cos A + 1 \quad ...(i) \ \mathbf{1}$$

$$\text{RHS} = \frac{\sin^2 A}{1-\cos A}$$

$$= \frac{1-\cos^2 A}{1-\cos A}$$

$$\frac{(1+\cos A)(1-\cos A)}{1-\cos A} = 1 + \cos A \quad ...(ii)$$

From (i) and (ii),

LHS = RHS **Hence Proved. 2**

31.

Class Interval	Mid-point (x)	Frequency (f)	$d = x - A$	fd
0 – 5	2.5	8	– 10	– 80
5 – 10	7.5	7	– 5	– 35
10 – 15	12.5 = A	10	0	0
15 – 20	17.5	13	5	65
20 – 25	22.5	12	10	120
		$\Sigma f = 50$		$\Sigma fd = 70$

1

Here, assumed mean, $A = 12.5$

Now, $$\text{Mean} = A + \frac{\Sigma fd}{\Sigma f} \quad \mathbf{1}$$

$$= 12.5 + \frac{70}{50}$$

$$= 12.5 + 1.4$$

$$= 13.9 \quad \mathbf{1}$$

Section-D

32. **(A)** Given:

$$S_7 = 182$$

$$\frac{a_4}{a_{17}} = \frac{1}{5}$$

We know that,

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

$$182 = \frac{7}{2}[2a+6d]$$

$$\frac{182\times 2}{7} = 2a + 6d$$

$$26 \times 2 = 2(a+3d)$$

$$26 = a + 3d \quad ...(i)$$

Also, $$a_n = a + (n-1)d$$

$$a_4 = a + 3d$$

$$a_{17} = a + 16d \quad \mathbf{1}$$

$$\frac{a_4}{a_{17}} = \frac{a+3d}{a+16d}$$

$$\frac{1}{5} = \frac{a+3d}{a+16d}$$

$$a + 16d = 5a + 15d \quad \mathbf{1}$$

$$d = 4a \quad ...(ii)$$

Substitute value of equation (ii) in (i)

$$a + 3d = 26$$

$$a + 3 \times 4a = 26$$

$$13a = 26$$

$$a = 2 \quad \mathbf{1}$$

So, $d = 4a = 4 \times 2 = 8$ **1**

Therefore, AP will be

2, 10, 18, 26 ....

OR

(B) Given

$$S_q = 63q - 3q^2$$

$$\therefore \quad S_1 = 63 \times 1 - 3 \times 1^2$$

$$= 63 - 3 = 60$$

$$S_2 = 63 \times 2 - 3 \times 2^2$$

$$= 126 - 12 = 114 \quad \mathbf{1}$$

Now, a_1 = Sum of first term

$$a_1 = 60$$

a_2 = Difference of S_2 and S_1

$$a_2 = 114 - 60 = 54 \quad \mathbf{1}$$

Common difference

$$(d) = a_2 - a_1$$

$$= 54 - 60$$

$$= -6$$

Now $$a_p = -60$$

$$a + (p-1)d = -60$$

$$60 + (p-1)(-6) = -60$$

$$(p-1)(-6) = -120$$

$$p - 1 = 20$$

$$p = 21 \quad \mathbf{1}$$

Thus, value of $p = 21$

Now, $a_{11} = a + (11 - 1)d$

$= 60 + 10 \times -6$

$= 60 - 60$

$= 0$ **2**

33. $p(x) = ax^2 - 8x + 3$

(i) Let zeroes of $p(x) = \alpha$ and β

$\therefore \quad \alpha = 3\beta$ (given) **1**

Sum of roots $(\alpha + \beta) = \frac{-b}{a}$

$(3\beta + \beta) = \frac{-(-8)}{a}$

$4\beta = \frac{8}{a}$

$\beta = \frac{2}{a}$ ...(i) **1**

Product of roots $(\alpha\beta) = \frac{c}{a}$

$(3\beta \times \beta) = \frac{3}{a}$

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

$\beta^2 = \frac{1}{a}$ ...(ii) **1**

On equating (i) and (ii), we get

$\left(\frac{2}{a}\right)^2 = \frac{1}{a}$

$\frac{4}{a^2} = \frac{1}{a}$

$a = 4$ **1**

(ii) Since, 'a' is positive, therefore the graph of $p(x)$ is an open upward parabola. **1**

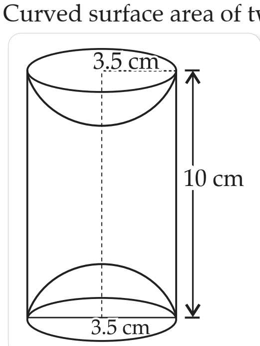
34. **(A)** Given, Radius of cylinder = 3.5 cm

Height of cylinder = 10 cm

Total surface area of article

= Curved surface area of cylinder

+ Curved surface area of two hemisphere **1**



Now, curved surface area of cylinder

$= 2\pi rh$

$= 2 \times \pi \times 3.5 \times 10$

$= 70\pi$ **1**

Surface area of a hemisphere

$= 2\pi r^2$

$= 24.5\pi$ **1**

Hence, Total surface area of article

$= 70\pi + 2(24.5\pi)$

$= 70\pi + 49\pi$

$= 119\pi$

$= 119 \times \frac{22}{7}$

$= 374 \text{ cm}^2$ **2**

OR

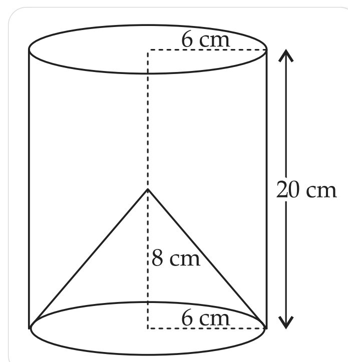
(B) The remaining solid, after removing the conical cavity can be drawn as,

Height of the cylinder, $h_1 = 20$ cm

Radius of the cylinder, $r = \frac{12}{2} = 6$ cm

Height of the cone, $h_2 = 8$ cm

Radius of the cone, $r = 6$ cm



Total surface area of remaining solid

= Areas of the top face of the cylinder

+ curved surface area of the cylinder

+ curved surface area of cone

Now, slant height of cone,

$l = \sqrt{r^2 + h_2^2}$

$= \sqrt{6^2 + 8^2}$

$= \sqrt{36 + 64}$

$= \sqrt{100}$

$= 10$ cm **1**

Curved surface area of the cone $= \pi rl$

$= \frac{22}{7} \times 6 \times 10$

$= \frac{1320}{7} \text{ cm}^2$ **1**

Curved surface area of the cylinder $= 2\pi rh_1$,

$$= 2\times\frac{22}{7}\times 6\times 20$$

$$= \frac{5280}{7}\ \text{cm}^2 \qquad \mathbf{1}$$

Area of the top face of the cylinder

$$= \pi r^2$$

$$= \frac{22}{7}\times 6\times 6$$

$$= \frac{792}{7}\ \text{cm}^2 \qquad \mathbf{1}$$

Thus, total surface area of remaining solid

$$= \left(\frac{1320}{7}+\frac{5280}{7}+\frac{792}{7}\right)\text{cm}^2$$

$$= \frac{7392}{7}\ \text{cm}^2$$

$$= 1056\ \text{cm}^2 \qquad \mathbf{1}$$

35.

Topper Answer, 2017

i) A = sum of digits is even.

$n(S) = 6^2 = 36.$ – total possible outcomes.

$n(A) = \{(1,3), (1,5), (1,1), (2,2), (2,4), (2,6), (3,1), (3,3), (3,5), (4,2), (4,4), (4,6), (5,1), (5,3), (5,5), (6,2), (6,4), (6,6)\}$

$= 18.$

$P(A) = \frac{n(A)}{n(S)} = \frac{18}{36}$

$\frac{1}{2}$ or 0.5

∴ probability of getting an even sum is $\frac{1}{2}$ or 0.5.

ii) A = product of digits is even

$n(S) = 36.$

$n(A) = \{(1,2), (1,4), (1,6), (2,1), (2,2), (2,3), (2,4), (2,5), (2,6), (3,2), (3,4), (3,6), (4,1), (4,2), (4,3), (4,4), (4,5), (4,6), (5,2), (5,4), (5,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}.$

$= 27$

$P(A) = \frac{n(A)}{n(S)} = \frac{27}{36}$

$= \frac{3}{4} = 0.75$

probability of getting even product is $\frac{3}{4}$ or 0.75.

5

36. (i) If $\theta = 45°$ and $\beta = 15°$

Then, In right ΔACB,

$$\tan\theta = \frac{BC}{AB}$$

$$1 = \frac{BC}{100} \qquad [\because \tan 45° = 1]$$

$$\Rightarrow \quad BC = 100 \text{ m} \qquad ...(i)$$

In right ΔDAB

$$\tan(\theta-\beta) = \frac{DB}{AB}$$

$$\tan 30° = \frac{DB}{100}$$

$$\frac{1}{\sqrt{3}} = \frac{DB}{100}$$

$$BD = \frac{100}{\sqrt{3}} \qquad ...(ii)$$

$$BC = BD + DC$$

$$\therefore \quad DC = BC - BD$$

$$= \left(100 - \frac{100}{\sqrt{3}}\right)\text{m}$$

(From (i) and (ii)) **1**

(ii) In ΔABC

If $\theta = 60°$

then, $\tan 60° = \frac{BC}{AB}$

$$\sqrt{3} = \frac{H}{100}$$

$$H = 100\sqrt{3}\ \text{m} \qquad ...(i)$$

If $\beta = 30°$, then $\theta - \beta = 60° - 30° = 30°$

So, in ΔADB

$$\tan 30° = \frac{BD}{AB}$$

$$\frac{1}{\sqrt{3}} = \frac{h}{100}$$

$$\Rightarrow \quad h = \frac{100}{\sqrt{3}} \text{ m} \quad \text{...(ii)}$$

$$\frac{H}{h} = \frac{100\sqrt{3}}{100} \times \sqrt{3} = 3 \text{ m} \quad \textbf{2}$$

OR

When $\theta = 45°$

Height $\Rightarrow$ $\tan 45° = \frac{H}{100}$

$$1 = \frac{H}{100}$$

$$H = 100 \text{ m}$$

When $\theta = 30°$

Height = 100 m

Base = ?

$$\tan 30° = \frac{H}{AB}$$

$$\frac{1}{\sqrt{3}} = \frac{100}{AB}$$

$$AB = 100\sqrt{3}$$

$$= 100 \times 1.732$$

$$AB = 173.2 \text{ m} \quad \textbf{1}$$

Thus, difference between original spot and new spot = 173,2 – 100 = 73 m (approx) **1**

(iii) Distance covered by arrow to burst second ballon = AD.

$\therefore$ In right ΔABD,

$$\sin 30° = \frac{BD}{AD} \quad (\because \theta - \beta = 30°)$$

$$\frac{1}{2} = \frac{100}{\sqrt{3}} \times \frac{1}{AD}$$

$$\frac{200}{\sqrt{3}} \text{ m} = AD$$

37. **(i)** The ratio between main-gate & mall : mall & hotel $\Rightarrow$ 2 : 1

$\Rightarrow$ $m : n = 2 : 1$

Co-ordinates of main gate $(x_1, y_1) = (4, 17)$

Co-ordinates of hotel $(x_2, y_2) = (–2, 5)$

x Co-ordinate of mall's location $= \frac{mx_2 + nx_1}{m+n}$

[By using section formula]

$$x = \frac{2 \times -2 + 1 \times 4}{2+1} = \frac{-4+4}{3} = 0 \quad \textbf{1}$$

(ii) Coordinates of water tank $(x_1, y_1) = (10, 9)$

Coordinates of school $(x_2, y_2) = (22, 14)$

According to distant formula

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad \textbf{1}$$

$$= \sqrt{(22-10)^2 + (14-9)^2}$$

$$= \sqrt{12^2 + 5^2}$$

$$= \sqrt{144 + 25}$$

$$= \sqrt{169}$$

$$= 13 \text{ units}$$

Thus, shortest distance between the water tank and school = 13 units. **1**

OR

According to distant formula shortest distance between school and police station

$$= \sqrt{(22-22)^2 + (14-7)^2}$$

$$= \sqrt{0^2 + 7^2}$$

$$= \sqrt{49}$$

$$= 7 \text{ units}$$

And, distance between school and water tank = 13 units **(Calculated above)**

Thus difference between then = 6 units. **2**

(iii) Let co-ordinates of Fire station be (x, y) Bus stand is the mid point of main gate and Fire station.

$\therefore$ By using mid-point formula we can get

$$4 = \frac{4+x}{2} \quad \text{and} \quad 9 = \frac{17+y}{2}$$

$$8 - 4 = x \qquad 18 - 17 = y$$

$$x = 4 \qquad y = 1$$

Thus coordinates of Fire station (4, 1). **1**

38. **(i)** Length of model = 11 cm

$\therefore$ Total length of the engine = 2 × 11 = 22 m. **1**

(ii) They are not the mirror image of one another. **1**

OR

Actual width of the door

$$= \frac{\text{Length of door in photograph}}{\text{Corresponding length in object}} \quad ½$$

$$= \frac{0.35}{1/200}$$

$$= 0.35 \times 200$$

$$= 70 \text{ cm}$$

$$= 0.7 \text{ m.} \quad ½$$

(iii) Since, ΔABC and ΔADE are similar, then their ratio of corresponding sides are equal.

$$\frac{AB}{BC} = \frac{AB+BD}{DE}$$

$$\frac{x}{3 \text{ cm}} = \frac{(x+4) \text{ cm}}{6 \text{ cm}}$$

$$6x = 3(x + 4)$$

$$6x = 3x + 12$$

$$6x - 3x = 12$$

$$3x = 12$$
$$x = 4$$

Hence, $AB = 4$ cm. **1**

Here, $AD = AB + BD$

$= 4 + 4 = 8$ cm

and $DE = 6$ cm

$$\text{Area} = \frac{1}{2} \times AD \times DE$$
$$= \frac{1}{2} \times 8 \times 6$$
$$= 24 \text{ cm}^2.$$ **1**