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- Multiple Choice Questions
- Case Study Questions
- Assertion-Reason Questions
- Subjective Type Questions

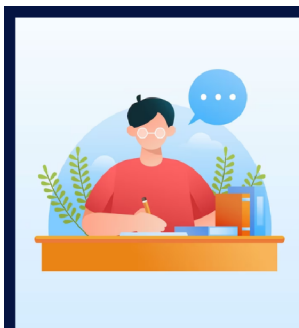


SURE SHOT QUESTIONS
FOR 2027 BOARD EXAMS

O.P. GUPTA

SACHIN PANDEY

VISHAL MINOCHA

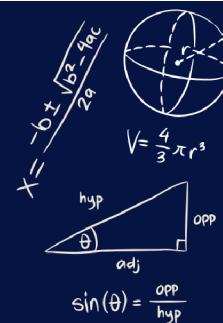


For CBSE 2027 Board Exams - Class 10 (Standard)

SAMPLE PAPER

issued by CBSE on 21 September, 2026

MATHEMATICS (041)



Time Allowed : 180 Minutes

Max. Marks : 80

General Instructions :

1. This Question paper contains **five sections** - A, B, C, D and E.
2. Section A has **20 MCQs** of **1 mark** each.
Section B has **05 questions** (Very Short Answer type) carrying **2 marks** each.
Section C has **06 questions** (Short Answer type) carrying **3 marks** each.
Section D has **04 questions** (Long Answer type) carrying **5 marks** each.
Section E has **03 Case study-based questions** carrying **4 marks** each.
3. Each section is compulsory. However, there are internal choices in some questions.
The **internal choice** has been provided in
 - **02 Questions of Section B**
 - **02 Questions of Section C**
 - **02 Questions of Section D**
 - **03 Questions of Section E** in all the sub-parts having 2 marks questions.You have to attempt only one of the alternatives in all such questions.
4. Draw neat figures wherever required. Take $\pi = \frac{22}{7}$ wherever required if not stated.

SECTION A

(Question numbers 01 to 20 carry **1 mark** each.)

Followings are **multiple choice questions**. Select the correct option in each one of them.

01. The greatest number which divides both 134 and 188, leaving remainders 4 and 6 respectively, is
(a) 13 (b) 26 (c) 39 (d) 65
02. If $f(x) = px^2 + qx + r$, $p \neq 0$ and $p + r = q$, then one of the zeroes of $f(x)$ is
(a) $\frac{q}{p}$ (b) $\frac{r}{p}$ (c) $-\frac{r}{p}$ (d) $-\frac{q}{p}$
03. Tarun correctly solved a pair of linear equations in two variables and found their only point of intersection as (5, -1). One of the lines was $x - y = 6$. Which of the following could have been the other line?
I : $3x - 3y = 18$
II : $2x - 3y = 13$
III : $2x - 3y = 16$
(a) I only (b) II only (c) I and II (d) II and III
04. If $(1 - p)$ is a root of the quadratic equation $x^2 + px + 1 - p = 0$, then its roots are
(a) 0, 1 (b) -1, 1 (c) 0, -1 (d) -1, 2
05. The middle term of the A.P. : 10, 7, 4, ..., -62 is
(a) -26 (b) -29 (c) -32 (d) -35
06. The perimeters of two similar triangles are 56 cm and 70 cm respectively. If one side of the first triangle is 14 cm, then the corresponding side of the second triangle (in cm) is
(a) 5 (b) 7.5 (c) 10 (d) 17.5

07. The point which lies on the perpendicular bisector of the line segment joining the points $A(-3, -4)$ and $B(3, 4)$ is
(a) $(0, 0)$ (b) $(0, 3)$ (c) $(3, 0)$ (d) $(0, 4)$
08. If $\tan(A + B) = \sqrt{3}$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, $0^\circ < A + B < 90^\circ$, $A > B$, then the value of A and B respectively are
(a) $60^\circ, 30^\circ$ (b) $60^\circ, 45^\circ$ (c) $45^\circ, 15^\circ$ (d) $60^\circ, 15^\circ$
09. T-shirts marked with numbers 4 to 99 are placed in a box. Gunika is fond of numbers. She randomly takes out a T-shirt from this box. The probability that she gets a T-shirt marked with a number that is either a perfect square or a perfect cube is
(a) $\frac{1}{12}$ (b) $\frac{1}{32}$ (c) $\frac{11}{96}$ (d) $\frac{5}{48}$
10. The diameter of a car wheel is 21 cm. The number of complete revolutions it will make in moving 66 km is
(a) 10^4 (b) 10^5 (c) 10^6 (d) 10^7
11. Two cubes each of volume 64 cm^3 are joined end to end to form a solid. The surface area of the resultant cuboid is
(a) 192 cm^2 (b) 160 cm^2 (c) 96 cm^2 (d) 80 cm^2
12. The mean age of a combined group of men and women is 35 years. If the mean ages of the men and women are 38 years and 30 years respectively, then the percentage of women in the group is
(a) 15 (b) 25.5 (c) 35 (d) 37.5
13. Two dice are rolled simultaneously. The probability of getting number less than 4 on each die is
(a) $\frac{1}{4}$ (b) $\frac{1}{9}$ (c) $\frac{1}{36}$ (d) $\frac{1}{6}$
14. PM is a median of $\triangle PQR$ with vertices $P(5, -6)$, $Q(6, 4)$ and $R(0, 0)$. The length of PM is
(a) $2\sqrt{17}$ units (b) $2\sqrt{15}$ units (c) $\sqrt{101}$ units (d) 10 units
15. The arc of a circle is of length $6\pi \text{ cm}$ and the sector it bounds has an area of $24\pi \text{ cm}^2$. The radius of the circle is
(a) 4 cm (b) 8 cm (c) 16 cm (d) 18 cm
16. The mean and median of the data are 35.5 and 32 respectively. The value of mode for this data is
(a) 23 (b) 26 (c) 25 (d) 30
17. A flying kite is tied to a point on the ground with the help of a string. The string makes an angle θ with the ground level such that $\tan \theta = \frac{12}{5}$. If the length of the string is 52 m, then the height of the kite above the ground is
(a) 40 cm (b) 45.5 cm (c) 48 cm (d) 50 cm
18. 2 cards of diamonds and 4 cards of spades are missing from a pack of 52 cards. A card is drawn at random from this pack. The probability of getting a card of heart is
(a) $\frac{13}{52}$ (b) $\frac{13}{46}$ (c) $\frac{11}{52}$ (d) $\frac{11}{46}$

Followings are **Assertion-Reason based questions**.

In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

19. **Assertion (A) :** If three vertices of a parallelogram taken in order are $(-1, -6)$, $(2, -5)$ and $(7, 2)$, then its fourth vertex is $(4, 1)$.

Reason (R) : Diagonals of a parallelogram bisect each other.

20. **Assertion (A) :** If zeroes of the polynomial $(2k-1)x^2 + 4x - 3$ are reciprocal of each other, then $k = -1$.

Reason (R) : If $a = c$, then zeroes of the polynomial $ax^2 + bx + c$, $a \neq 0$ are reciprocal of each other.

SECTION B

(Question numbers 21 to 25 carry 2 marks each.)

21. (A) A hall has a length of 9.75 m, breadth of 6.75 m and height of 5.25 m. What is the length of the longest unmarked ruler that can exactly measure the dimensions of the hall?

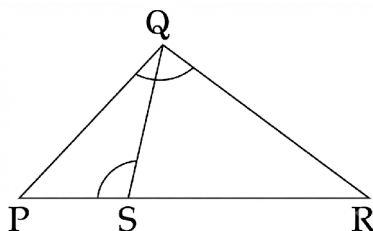
OR

(B) There are three bells placed at different swings in a park, which toll at intervals of 5, 6 and 8 minutes, respectively. They all toll together when the park opens for the visitors at 10:00 a.m. How many more times do they all toll together till the park is closed at 7:00 p.m.?

22. (A) ABCD is a trapezium, in which AB is parallel to DC and its diagonals intersect each other at the point O. Show that $\frac{AO}{BO} = \frac{CO}{DO}$.

OR

(B) In the given figure, if $\angle PQR = \angle QSP$, $PQ = 6$ cm and $PS = 3$ cm, then find the length of PR.



FOR VISUALLY IMPAIRED STUDENTS

In a right-angled triangle ABC, right-angled at B, a perpendicular BD is drawn to the hypotenuse AC. Prove that the triangle BCD is similar to triangle ACB.

23. If $\tan \theta = \frac{1}{\sqrt{5}}$, then find the value of $\frac{\operatorname{cosec}^2 \theta - \sec^2 \theta}{\operatorname{cosec}^2 \theta + \sec^2 \theta}$.
24. Find the area of a sector of a circle with diameter 28 cm, if the length of the corresponding arc is 22 cm.
25. Two dice are thrown simultaneously. Find the probability that the product of the numbers appearing on them is a prime number.

SECTION C

(Question numbers 26 to 31 carry 3 marks each.)

26. Given that $\sqrt{3}$ is irrational number, prove that $(2 + 3\sqrt{3})$ is an irrational number.
27. If α and β are the zeroes of the quadratic polynomial $2x^2 - 8x + 5$, then find the value of $\left(\alpha + \frac{1}{\beta}\right) \times \left(\beta + \frac{1}{\alpha}\right)$.

28. (A) Ridhi drew a polygon with n sides. The smallest exterior angle is 8° and each subsequent exterior angle is 4° more than the previous exterior angle. Find the number of sides of the polygon that Ridhi had drawn.

OR

- (B) Find the sum of integers between 1 and 400 that are multiples of 4 as well as of 5.
29. Prove that the parallelogram circumscribing a circle is a rhombus.
30. In what ratio does the x-axis divide the line segment joining the points $(-4, -6)$ and $(-1, 7)$? Also, find the coordinates of the point of division.
31. (A) During a math class, Ms. Isha wrote the expression given below on the board and asked the students to simplify it.

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

Jyoti solved it in her note book as follows.

$$\begin{aligned} & \frac{\cos \theta}{1 - \sin \theta} + \frac{1 - \sin \theta}{\cos \theta} \\ &= \frac{\cos^2 \theta + (1 - \sin \theta)^2}{(1 - \sin \theta) \times \cos \theta} \quad \dots(\text{step 1}) \end{aligned}$$

$$= \frac{\cos^2 \theta + \cos^2 \theta}{(1 - \sin \theta) \times \cos \theta} \quad \dots(\text{step 2})$$

$$= \frac{2 \cos^2 \theta}{(1 - \sin \theta) \times \cos \theta} \quad \dots(\text{step 3})$$

$$= \frac{2 \cos \theta}{(1 - \sin \theta)} \quad \dots(\text{step 4})$$

Identify the step in which Jyoti has made error (s), if any. Rectify the same and find the correct answer.

OR

(B) If $\frac{1}{\sin x - \cos x} = \frac{\operatorname{cosec} x}{\sqrt{2}}$, then prove that $\left(\frac{1}{\sin x + \cos x} \right)^2 = \frac{\sec^2 x}{2}$.

SECTION D

(Question numbers 32 to 35 carry 5 marks each.)

32. In a rectangular park measuring $50 \text{ m} \times 40 \text{ m}$, the gram panchayat plans to construct a rectangular swimming pool in the middle, surrounded by a uniform-width grass strip throughout the park. Find the dimensions of the swimming pool, if the area of the grassy strip is 1184 m^2 .
33. Prove that a line drawn parallel to one side of a triangle to intersect the other two sides in distinct points, divides the other two sides in the same ratio.
PQRS is a trapezium with $PQ \parallel SR$. X and Y are points on non-parallel sides PS and QR respectively such that $XY \parallel PQ$. Show that $\frac{PX}{XS} = \frac{QY}{YR}$.
34. (A) A tent is in the shape of a cylinder surmounted by a conical top. If the height and radius of the cylindrical part are 3 m and 14 m respectively, and the total height of the tent is 13.5 m, then find the area of the canvas required for making the tent, keeping a provision of 26 m^2 of canvas

for stitching and wastage. Also, find the cost of the canvas to be purchased at the rate of ₹250 per m^2 .

OR

(B) A solid wooden toy is in the form of hemisphere surmounted by a cone of the same radius. The radius of hemisphere is 3.5 cm and the total wood used in making the toy is $166\frac{5}{6} \text{ cm}^3$.

Find the height of the conical part. Also, find the cost of painting the hemispherical part of the toy at the rate of ₹15 per cm^2 .

35. (A) Manish is standing on level ground and observes a kite flying 200 m away from him at an angle of elevation of 30° . Mahesh, standing on the roof of a 50 m high building on the opposite side of the kite, observes the same kite at an angle of elevation of 45° . Find the distance between the kite and Mahesh.

OR

(B) The angles of depression of two ships from the top of a lighthouse and on the same side of it are found to be 45° and 30° . If the ships are 200 m apart and one ship is exactly behind the other, then find the height of lighthouse.

SECTION E

(Question numbers 36 to 38 carry 4 marks each.)

This section contains **three Case-study / Passage based questions**.

Each question has **three sub-parts** (i), (ii) and (iii). Two sub-parts are of 1 mark each while the remaining third sub-part (with internal choice) is of 2 marks.

36. A student entrepreneur started a company that manufactures sanitizers in two sizes - small and large. The cost of a small bottle of sanitizer is ₹10 and that of a large bottle is ₹15. In June, the company sold 1000 bottles and recorded a total sale of ₹12,750. Seeing the increased demand, the company decided to increase the price of both sanitizer bottles by ₹2 each. In the next month, the company sold 2500 bottles and recorded a total sale of ₹34,250.

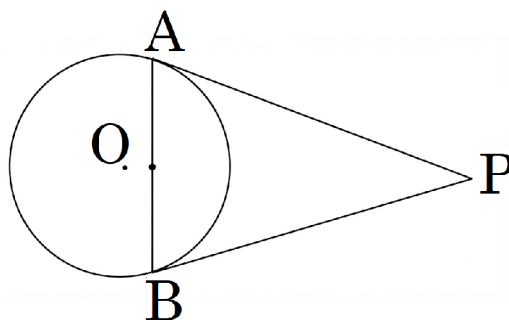
Based on the above information, answer the following questions.

- (i) Form a linear equation in two variables representing the sale for June.
- (ii) Form a linear equation in two variables representing the sale for July.
- (iii) (A) How many sanitizer bottles of each type were actually sold in June?

OR

- (iii) (B) How many sanitizer bottles of each type were sold in July?

37. In a technology park in Hyderabad, a company installed a circular meditation garden for its employees as shown in the figure.



Arjun, a designer, stood at a point P outside the garden and drew two tangents PA and PB to the circular boundary. The radius of the garden is 9 m, and the distance of point P from the centre O is 18 m. For preparing safety guidelines, Arjun needed the lengths of the tangents. During a demonstration to interns, he asked them to compute the angle formed between the two tangents using the properties of circle.

Based on the above information, answer the following questions.

- (i) What is the measure of $\angle OAP$?
- (ii) Calculate the length of the tangent PA.
- (iii) (A) Calculate the measure of $\angle AOB$.

OR

- (iii) (B) In the above design, if PA and PB were inclined at 60° , then what would be their length?

38. A school conducted a weekly test for Class X students, before the commencement of the pre-board examination and recorded their scores (out of 50). To analyse performance patterns, the academic coordinator grouped the marks into intervals. The grouped frequency distribution is as below.

Marks Obtained	0-10	10-20	20-30	30-40	40-50
Number of students	3	6	12	15	14

The academic coordinator computed the central tendencies to judge overall learning level, the most common performance range and to understand consistency across the batch for planning the remedial sessions.

Based on the above information, answer the following questions.

- (i) Identify the class with the most common performance range.
- (ii) Find the class interval containing the median.
- (iii) (A) What is the average performance of the students?

OR

- (iii) (B) Find the mode of the data.

KEY HIGHLIGHTS



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DETAILED SOLUTIONS (Mathematics Standard - 041)

SECTION A

01. (b) $\because 134 - 4 = 130$ and $188 - 6 = 182$.

Note that, $130 = 2 \times 5 \times 13$ and $182 = 2 \times 7 \times 13$

$$\therefore \text{HCF}(130, 182) = 2 \times 13 = 26.$$

02. (c) Substituting $q = p + r$ in $f(x)$, we get $f(x) = px^2 + (p+r)x + r$
 $\Rightarrow f(x) = (x+1)(px+r)$

Taking $f(x) = 0$, we get $(x+1)(px+r) = 0$

$$\Rightarrow x = -1, x = -\frac{r}{p} \text{ are the zeroes of } f(x).$$

03. (b) Note that, $(5, -1)$ is a solution of $3x - 3y = 18$ also, but this will make the system of equations as consistent and dependent.

Only $2x - 3y = 13$ fulfills the given condition of having only one point of intersection.

04. (c) As $(1-p)$ is a root of the quadratic equation $x^2 + px + 1 - p = 0$

$$\therefore (1-p)^2 + p(1-p) + 1 - p = 0$$

$$\Rightarrow (1-p)[(1-p) + p + 1] = 0$$

$$\Rightarrow 2(1-p) = 0$$

$$\Rightarrow p = 1$$

Now quadratic equation will be $x^2 + x = 0 \Rightarrow x(x+1) = 0 \Rightarrow x = 0, -1$

So, the roots will be 0, -1.

05. (a) Since $a_n = a + (n-1)d$

$$\Rightarrow -62 = 10 + (n-1)(-3)$$

$$\Rightarrow -72 = (n-1)(-3)$$

$$\Rightarrow 24 = (n-1)$$

$$\Rightarrow n = 25$$

Thus, $\left(\frac{25+1}{2}\right)^{\text{th}}$ term = 13^{th} term is the middle term.

$$\therefore a_{13} = a + 12d = 10 + 12 \times (-3) = 10 - 36 = -26.$$

06. (d) Ratio of perimeters of similar triangles = ratio of their corresponding sides

$$\therefore \frac{56}{70} = \frac{14}{\text{corresponding side}}$$

$$\Rightarrow \frac{4}{5} = \frac{14}{\text{corresponding side}}$$

$$\Rightarrow \text{corresponding side} = \frac{14 \times 5}{4}$$

$$\Rightarrow \text{corresponding side} = \frac{7 \times 5}{2} = 17.5.$$

07. (a) Midpoint of AB will lie on the perpendicular bisector of the line segment joining the points A(-3, -4) and B(3, 4).

$$\therefore \text{Coordinates of midpoint of A and B are } \left(\frac{-3+3}{2}, \frac{-4+4}{2}\right) = (0, 0).$$

08. (c) $\tan(A+B) = \sqrt{3} \Rightarrow A+B = 60^\circ \dots(i)$

$$\tan(A - B) = \frac{1}{\sqrt{3}} \Rightarrow A - B = 30^\circ \dots(ii)$$

Solving (i) and (ii), we get $A = 45^\circ$, $B = 15^\circ$.

09. (d) Total outcomes = 96

Perfect square numbers are 4, 9, 16, 25, 36, 49, 64, 81

Perfect cubes are 8, 27, 64

$\therefore$ Common number is 64.

Number of favorable outcomes = 10

$$\therefore P(\text{either a perfect square or a perfect cube}) = \frac{10}{96} = \frac{5}{48}.$$

10. (b) $\therefore 21 \text{ cm} = 21 \times 10^{-5} \text{ km}$

$$\text{Total revolutions} = \frac{\text{Total distance}}{\text{Circumference}} = \frac{66}{\frac{22}{7} \times 21 \times 10^{-5}} = \frac{66 \times 10^5 \times 7}{22 \times 21} = 10^5.$$

11. (b) Side of cube = 4 cm

Dimensions of resulting cuboid: length = 8 cm ; breadth = 4 cm ; height = 4 cm .

$$\text{Total surface area} = 2(8 \times 4 + 4 \times 4 + 4 \times 8) = 160 \text{ cm}^2.$$

12. (d) Let the number of men be x and the number of women be y .

$$\text{Then } \frac{38x + 30y}{x + y} = 35$$

$$\Rightarrow 38x + 30y = 35x + 35y$$

$$\Rightarrow 38x - 35x = 35y - 30y$$

$$\Rightarrow 3x = 5y$$

$$\Rightarrow \frac{x}{y} = \frac{5}{3}$$

$$\therefore \text{Percentage of women} = \left(\frac{3}{8} \times 100 \right) \% = 37.5\%.$$

13. (a) Total outcomes = 36

Favorable outcomes : (1, 1), (1, 2), (1, 3), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3).

$$\therefore \text{Required probability} = \frac{9}{36} = \frac{1}{4}.$$

14. (a) Coordinates of midpoint of QR is $M\left(\frac{6+0}{2}, \frac{4+0}{2}\right) = M(3, 2).$

$$\therefore \text{Median (PM)} = \sqrt{(5-3)^2 + (-6-2)^2} = \sqrt{4+64} = \sqrt{68} = 2\sqrt{17} \text{ units}.$$

15. (b) $A = \frac{1}{2} l \times r$

$$\Rightarrow 24\pi = \frac{1}{2} \times 6\pi \times r$$

$$\Rightarrow r = 4 \times 2$$

$$\therefore r = 8 \text{ cm}.$$

16. (c) Mode = 3 Median - 2 Mean

$$\Rightarrow \text{Mode} = 3 \times 32 - 2 \times 35.5$$

$$\Rightarrow \text{Mode} = 96 - 71$$

$$\therefore \text{Mode} = 25.$$

17. (c) In $\triangle ABC$,

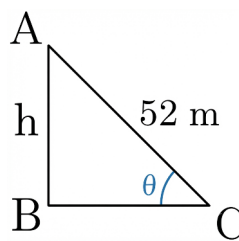
$$\tan \theta = \frac{12}{5}$$

$$\therefore \sin \theta = \frac{\tan \theta}{\sqrt{1 + \tan^2 \theta}} = \frac{\frac{12}{5}}{\sqrt{1 + \frac{144}{25}}} = \frac{\frac{12}{5}}{\frac{13}{5}} = \frac{12}{13}$$

$$\text{Now } \sin \theta = \frac{AB}{AC}$$

$$\Rightarrow \frac{12}{13} = \frac{h}{52}$$

$$\Rightarrow h = 48 \text{ m.}$$



18. (b) Total remaining cards = $52 - (2 + 4) = 46$

$$\therefore \text{Required probability} = \frac{13}{46}$$

19. (a) Let $A(-1, -6)$, $B(2, -5)$ and $C(7, 2)$; also let $D(x, y)$.

Since the Midpoint of AC = Midpoint of BD

$$\Rightarrow \left(\frac{-1+7}{2}, \frac{-6+2}{2} \right) = \left(\frac{x+2}{2}, \frac{y-5}{2} \right)$$

$$\Rightarrow (3, -2) = \left(\frac{x+2}{2}, \frac{y-5}{2} \right)$$

On comparing the coordinates, we get $\frac{x+2}{2} = 3$, $\frac{y-5}{2} = -2$ i.e., $x = 4$, $y = 1$. Clearly, $D(4, 1)$.

$\therefore$ Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

20. (a) For the statement in Reason (R), let one of the zeroes of $ax^2 + bx + c$, $a \neq 0$ be α .

Then product of roots = $\alpha \times \frac{1}{\alpha} = \frac{c}{a} \Rightarrow 1 = \frac{c}{a}$ i.e., $a = c$. Clearly, Reason (R) is true.

We shall use this result of Reason (R) in the statement given in Assertion (A).

$\therefore$ The zeroes of $(2k-1)x^2 + 4x - 3$ are reciprocal of each other, so coefficient of $x^2 = \text{constant}$

$$\Rightarrow (2k-1) = -3$$

$$\Rightarrow -2 = (2k)$$

$\therefore k = -1$. Clearly, Assertion (A) is true.

$\therefore$ Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).

SECTION B

21. (A) Length = $9.75 \text{ m} = 975 \text{ cm}$, breadth = $6.75 \text{ m} = 675 \text{ cm}$, height = $5.25 \text{ m} = 525 \text{ cm}$.

The length of the longest unmarked ruler = $\text{HCF}(975, 675, 525)$

$$= \text{HCF}(3 \times 5^2 \times 13, 3^3 \times 5^2, 3 \times 5^2 \times 7)$$

$$= 3 \times 5^2 = 75$$

Hence, the length of longest unmarked ruler is 75 cm or 0.75 m .

OR

(B) $\text{LCM}(5, 6, 8) = \text{LCM}(5, 2 \times 3, 2^3) = 2^3 \times 3 \times 5 = 120$.

That is, all the bells toll together after an interval of 120 minutes or 2 hours .

Thus, all the bells will again toll together at 12:00 p.m., 2:00 p.m., 4:00 p.m. and 6:00 p.m. i.e., 4 times.

So, the bells will toll together 4 more times, till the park is closed at 7:00 p.m.

22. (A) In $\triangle AOB$ and $\triangle COD$,

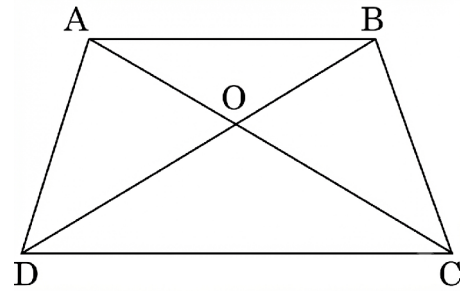
$$\angle OAB = \angle OCD \quad [\text{Alternate interior angles}]$$

$$\angle OBA = \angle ODC \quad [\text{Alternate interior angles}]$$

$$\therefore \triangle AOB \sim \triangle COD \quad [\text{AA-criterion}]$$

$$\text{Hence, } \frac{AO}{CO} = \frac{BO}{DO}$$

$$\Rightarrow \frac{AO}{BO} = \frac{CO}{DO}.$$



OR

- (B) In $\triangle PRQ$ and $\triangle PQS$,

$$\angle PQR = \angle QSP \quad [\text{Given}]$$

$$\angle QPR = \angle QPS \quad [\text{Common}]$$

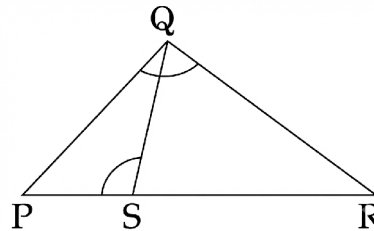
$$\therefore \triangle PRQ \sim \triangle PQS \quad [\text{AA-criterion}]$$

$$\text{Therefore, } \frac{PQ}{PS} = \frac{PR}{PQ}$$

$$\Rightarrow \frac{6}{3} = \frac{PR}{6}$$

$$\Rightarrow PR = \frac{36}{3}$$

$$\therefore PR = 12 \text{ cm.}$$



FOR VISUALLY IMPAIRED STUDENTS

In triangle BCD and triangle ACB,

$$\angle BDC = \angle ABC \quad [\text{Each } 90^\circ]$$

$$\angle BCD = \angle ACB \quad [\text{Common}]$$

$$\therefore \triangle BCD \sim \triangle ACB \quad [\text{AA-criterion}]$$

23. $\tan \theta = \frac{1}{\sqrt{5}} \Rightarrow \cot \theta = \sqrt{5}$

$$\therefore \sec^2 \theta = 1 + \tan^2 \theta = 1 + \frac{1}{5} = \frac{6}{5}$$

$$\text{and } \operatorname{cosec}^2 \theta = 1 + \cot^2 \theta = 1 + 5 = 6.$$

$$\text{Now } \frac{\operatorname{cosec}^2 \theta - \sec^2 \theta}{\operatorname{cosec}^2 \theta + \sec^2 \theta} = \frac{6 - \frac{6}{5}}{6 + \frac{6}{5}} = \frac{24}{36} = \frac{2}{3}.$$

24. Radius = $\frac{28}{2} = 14 \text{ cm}$

$$\text{Area of sector} = \frac{1}{2} l \times r = \frac{1}{2} \times 22 \times 14 = 154 \text{ cm}^2.$$

25. Total number of outcomes = 36

Favorable outcomes = (1, 2), (1, 3), (1, 5), (2, 1), (3, 1), (5, 1) i.e., 6 outcomes.

$$\therefore \text{Required probability} = \frac{6}{36} = \frac{1}{6}.$$

SECTION C

26. Let us assume that $(2 + 3\sqrt{3})$ is a rational number.

Then there must exist co-prime positive integers a and b such that $(2 + 3\sqrt{3}) = \frac{a}{b}$

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

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

Since a and b are integers so, $\frac{a - 2b}{3b}$ is rational.

That implies, $\sqrt{3}$ is rational.

This contradicts the fact that $\sqrt{3}$ is an irrational number. So, our assumption is wrong.

Hence, $(2 + 3\sqrt{3})$ is an irrational number.

27. For $2x^2 - 8x + 5$, Product of the zeroes $(\alpha\beta) = \frac{5}{2}$.

$$\begin{aligned} \text{Now } \left(\alpha + \frac{1}{\beta}\right) \times \left(\beta + \frac{1}{\alpha}\right) &= \left(\frac{\alpha\beta + 1}{\beta}\right) \left(\frac{\alpha\beta + 1}{\alpha}\right) = \frac{(\alpha\beta + 1)(\alpha\beta + 1)}{\alpha\beta} \\ &= \frac{\left(\frac{5}{2} + 1\right) \left(\frac{5}{2} + 1\right)}{\frac{5}{2}} \\ &= \frac{\frac{7}{2} \times \frac{7}{2}}{\frac{5}{2}} \\ &= \frac{49}{4} \times \frac{2}{5} = \frac{49}{10}. \end{aligned}$$

28. (A) Let the number of sides of polygon is n .

The exterior angles of the given polygon are in A.P.

Here $a = 8$, $d = 4$.

Since the sum of all the exterior angles of a polygon is 360° .

$$\therefore S_n = 360$$

$$\Rightarrow \frac{n}{2} [2 \times 8 + (n-1)4] = 360$$

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

$$\Rightarrow n[8 + (n-1)2] = 360$$

$$\Rightarrow n[2n + 6] = 360$$

$$\Rightarrow 2n(n + 3) = 360$$

$$\Rightarrow n(n + 3) = 180$$

$$\Rightarrow n^2 + 3n - 180 = 0$$

$$\Rightarrow n^2 + 15n - 12n - 180 = 0$$

$$\Rightarrow (n + 15)(n - 12) = 0$$

$$\because n \neq -15 \quad \therefore n - 12 = 0 \Rightarrow n = 12.$$

So, the number of sides in the given polygon is 12.

OR

(B) The integers between 1 and 400 that are multiples of 4 as well as of 5 are basically multiples of 20 i.e., 20, 40, 60, ..., 380.

Here $a = 20$, $d = 40 - 20 = 20$.

$$\text{As } a_n = 380 \quad \therefore a + (n-1)d = 380$$

$$\Rightarrow 20 + (n-1) \times 20 = 380$$

Divide by 20 both the sides, we get

$$1 + (n-1) \times 1 = 19$$

$$\Rightarrow 1 + n - 1 = 19$$

$$\Rightarrow n = 19$$

$$\text{Now using } S_n = \frac{n}{2}[a_1 + a_n], \text{ we get } S_n = \frac{19}{2}[20 + 380] = \frac{19}{2} \times 400 = 19 \times 200 = 3800.$$

29. ABCD is a parallelogram. Therefore, opposite sides are equal.

That is, $AB = CD$ and $BC = AD$.

Since the lengths of tangents drawn from an external point to a circle are equal.

Therefore, $BP = BQ$ (Tangents from point B) ... (i)

$CR = CQ$ (Tangents from point C) ... (ii)

$DR = DS$ (Tangents from point D) ... (iii)

$AP = AS$ (Tangents from point A) ... (iv)

Adding (i), (ii), (iii) and (iv), we get

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

That is, $BP + AP + CR + DR = BC + AD$

$$\Rightarrow AB + CD = BC + AD$$

Substitute $CD = AB$ and $AD = BC$, then we get

$$AB + AB = BC + BC$$

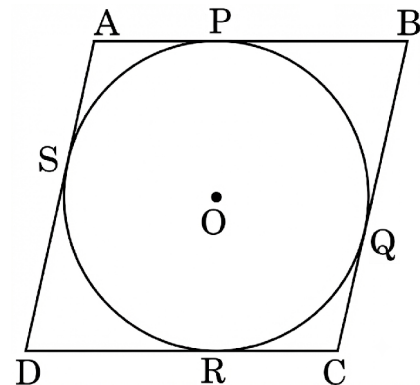
$$\Rightarrow 2 \times AB = 2 \times BC$$

$$\Rightarrow AB = BC$$

Hence, $AB = BC = CD = DA$.

This implies that all the four sides are equal.

Therefore, the parallelogram circumscribing a circle is a rhombus.



30. Let $A(-4, -6)$ and $B(-1, 7)$

Let x-axis divides the line segment joining the points $A(-4, -6)$ and $B(-1, 7)$ at $P(x, 0)$ in the ratio $k:1$.

$$\begin{array}{ccc} A & k:1 & B \\ (-4, -6) & P & (-1, 7) \end{array}$$

$$\text{Then } P\left(\frac{k \times (-1) + 1 \times (-4)}{k+1}, \frac{k \times (7) + 1 \times (-6)}{k+1}\right) = P(x, 0)$$

$$\Rightarrow P\left(\frac{-k-4}{k+1}, \frac{7k-6}{k+1}\right) = P(x, 0)$$

$$\text{On comparing the y-coordinates from both the sides, we get } \frac{7k-6}{k+1} = 0$$

$$\Rightarrow 7k - 6 = 0$$

$$\Rightarrow 7k = 6$$

$$\Rightarrow k = \frac{6}{7}.$$

Hence point P divides AB in the ratio 6 : 7.

Further, the coordinates of P are $\left(-\frac{34}{13}, 0\right)$.

31. (A) Jyoti made error in step 2.
The correct solution is as under.

$$\begin{aligned} & \frac{\cos \theta}{1 - \sin \theta} + \frac{1 - \sin \theta}{\cos \theta} \\ &= \frac{\cos^2 \theta + (1 - \sin \theta)^2}{(1 - \sin \theta) \times \cos \theta} \\ &= \frac{\cos^2 \theta + 1 - 2 \sin \theta + \sin^2 \theta}{(1 - \sin \theta) \times \cos \theta} \\ &= \frac{\sin^2 \theta + \cos^2 \theta + 1 - 2 \sin \theta}{(1 - \sin \theta) \times \cos \theta} \\ &= \frac{2 - 2 \sin \theta}{(1 - \sin \theta) \times \cos \theta} \\ &= \frac{2(1 - \sin \theta)}{(1 - \sin \theta) \cos \theta} \\ &= \frac{2}{\cos \theta} = 2 \sec \theta. \end{aligned}$$

$$[\because \sin^2 \theta + \cos^2 \theta = 1]$$

OR

(B) Given that $\frac{1}{\sin x - \cos x} = \frac{\operatorname{cosec} x}{\sqrt{2}}$

$$\Rightarrow \frac{1}{\sin x - \cos x} = \frac{1}{\sqrt{2} \sin x}$$

$$\Rightarrow \sin x - \cos x = \sqrt{2} \sin x$$

Squaring both the sides, we get $(\sin x - \cos x)^2 = (\sqrt{2} \sin x)^2$

$$\Rightarrow \sin^2 x - 2 \sin x \cos x + \cos^2 x = 2 \sin^2 x$$

$$\Rightarrow \sin^2 x + 2 \sin x \cos x = \cos^2 x$$

$$\Rightarrow \sin^2 x + 2 \sin x \cos x + \cos^2 x = \cos^2 x + \cos^2 x$$

[Adding $\cos^2 x$ both the sides]

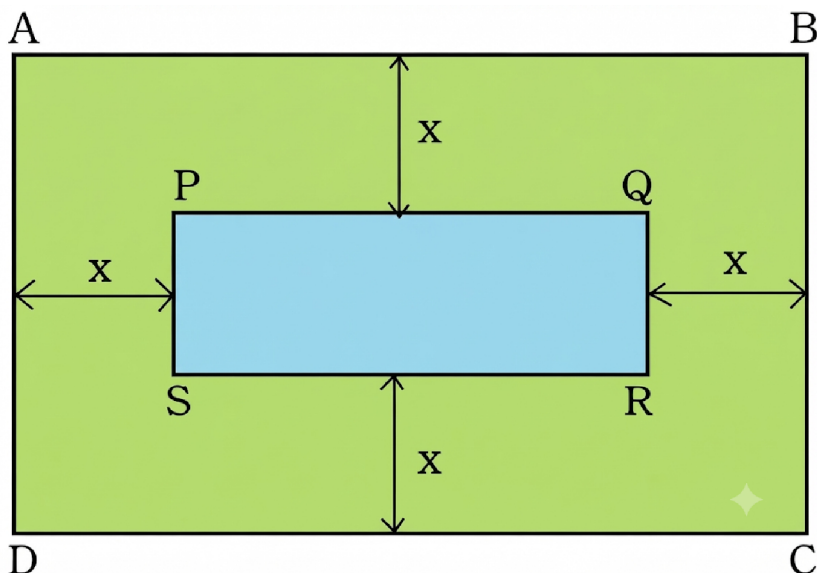
$$\Rightarrow (\sin x + \cos x)^2 = 2 \cos^2 x$$

$$\Rightarrow \frac{1}{(\sin x + \cos x)^2} = \frac{1}{2 \cos^2 x}$$

Hence, $\left(\frac{1}{\sin x + \cos x}\right)^2 = \frac{\sec^2 x}{2}.$

SECTION D

32. Refer the diagram shown.



ABCD is a rectangular park and PQRS is the swimming pool.

Let x be the uniform width of the grass strip.

Then length of the swimming pool, $PQ = (50 - 2x)$ m,

Also the breadth of the swimming pool, $QR = (40 - 2x)$ m.

Now, the area of rectangular park – area of swimming pool = area of grass strip

$$\therefore 50 \times 40 - (50 - 2x) \times (40 - 2x) = 1184$$

$$\Rightarrow 2000 - [2000 - 100x - 80x + 4x^2] = 1184$$

$$\Rightarrow -4x^2 + 180x = 1184 \quad \Rightarrow x^2 - 45x + 296 = 0$$

$$\Rightarrow x^2 - 37x - 8x + 296 = 0$$

$$\Rightarrow (x - 8)(x - 37) = 0$$

$$\because x \neq 37 \therefore (x - 8) = 0 \Rightarrow x = 8$$

Thus, length of the swimming pool, $PQ = (50 - 2x)$ m $= (50 - 16)$ m $= 34$ m,

Also the breadth of the swimming pool, $QR = (40 - 2x)$ m $= (40 - 16)$ m $= 24$ m.

33. **GIVEN:** A $\triangle ABC$ in which $DE \parallel BC$, and DE intersects AB in D and AC in E .

TO PROVE: $\frac{AD}{DB} = \frac{AE}{EC}$.

CONSTRUCTION: Join BE and CD . Also draw $EN \perp BA$ and $DM \perp CA$.

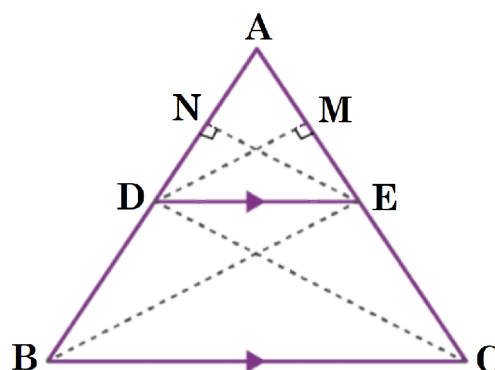
PROOF: As $EN \perp BA$, therefore EN is the height of the triangles ADE and DBE .

$$\because \text{Area of } \triangle = \frac{1}{2} (\text{Base} \times \text{Height})$$

$$\text{Now, ar}(\triangle ADE) = \frac{1}{2} (AD \times EN)$$

$$\text{and, ar}(\triangle DBE) = \frac{1}{2} (DB \times EN)$$

$$\Rightarrow \frac{\text{ar}(\triangle ADE)}{\text{ar}(\triangle DBE)} = \frac{\frac{1}{2} (AD \times EN)}{\frac{1}{2} (DB \times EN)} = \frac{AD}{DB} \quad \dots(i)$$



Similarly, $\text{ar}(\text{ADE}) = \frac{1}{2}(\text{AE} \times \text{DM})$ and $\text{ar}(\text{DEC}) = \frac{1}{2}(\text{EC} \times \text{DM})$

$$\Rightarrow \frac{\text{ar}(\text{ADE})}{\text{ar}(\text{DEC})} = \frac{\frac{1}{2}(\text{AE} \times \text{DM})}{\frac{1}{2}(\text{EC} \times \text{DM})} = \frac{\text{AE}}{\text{EC}} \quad \dots(\text{ii})$$

Since $\triangle \text{DBE}$ and $\triangle \text{DEC}$ are on the same base DE and between the same parallels DE and BC.

Therefore, $\text{ar}(\text{DEC}) = \text{ar}(\text{DBE}) \quad \dots(\text{iii})$

By (i), (ii) and (iii), we get $\frac{\text{AD}}{\text{DB}} = \frac{\text{AE}}{\text{EC}}$.

Given : $\text{PQ} \parallel \text{SR} \parallel \text{XY}$.

To prove : $\frac{\text{PX}}{\text{XS}} = \frac{\text{QY}}{\text{YR}}$.

Construction : Join QS which intersects XY at M.

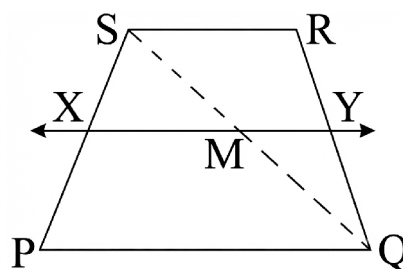
Proof : In $\triangle \text{PQS}$, $\text{XM} \parallel \text{PQ}$ ($\because \text{XY} \parallel \text{PQ}$)

$$\frac{\text{PX}}{\text{XS}} = \frac{\text{QM}}{\text{MS}} \quad (\text{By using BPT}) \quad \dots(\text{i})$$

In $\triangle \text{SQR}$, $\text{MY} \parallel \text{RS}$ ($\because \text{XY} \parallel \text{SR}$)

$$\frac{\text{QY}}{\text{YR}} = \frac{\text{QM}}{\text{MS}} \quad (\text{By using BPT}) \quad \dots(\text{ii})$$

From (i) and (ii), $\frac{\text{PX}}{\text{XS}} = \frac{\text{QY}}{\text{YR}}$.



34. (A) Refer the diagram shown.

Height of conical part = $13.5 - 3 = 10.5$ m

Slant height (l) = $\sqrt{r^2 + h^2} = \sqrt{14^2 + 10.5^2} = 17.5$ m

$$\begin{aligned} \text{CSA}_1 \text{ of conical part} &= \pi r l = \frac{22}{7} \times 14 \times 17.5 \\ &= 770 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{CSA}_2 \text{ of cylindrical part} &= 2\pi r h = 2 \times \frac{22}{7} \times 14 \times 3 \\ &= 2 \times 22 \times 2 \times 3 \\ &= 264 \text{ m}^2 \end{aligned}$$

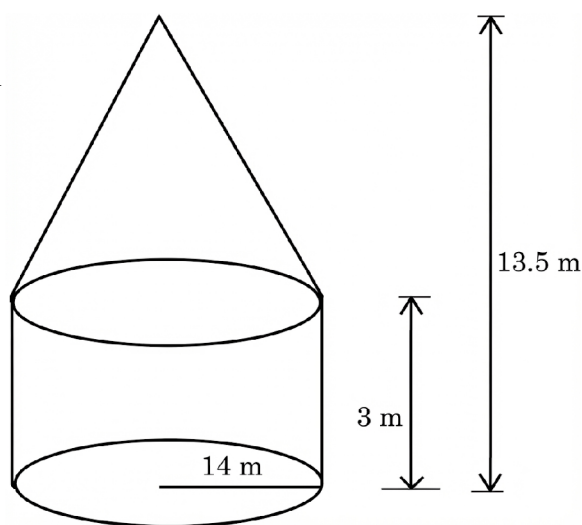
$$\begin{aligned} \text{Total area of canvas required} &= \text{CSA}_1 + \text{CSA}_2 + \text{Wastage} \\ &= 770 + 264 + 26 \\ &= 1060 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \therefore \text{Cost of canvas to be purchased} &= ₹ 250 \times 1060 \\ &= ₹ 265000. \end{aligned}$$

OR

(B) Let h cm be the height of conical part.

$\therefore$ Volume of wood in the toy = Volume of conical part + Volume of hemispherical part

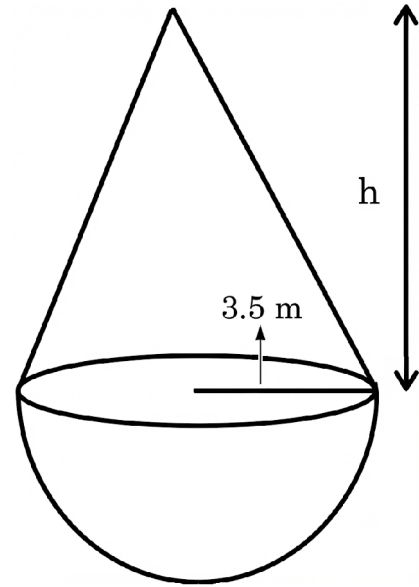


$$\begin{aligned}
 \therefore 166\frac{5}{6} \text{ cm}^3 &= \frac{1}{3}\pi r^2 h + \frac{2}{3}\pi r^3 \\
 \Rightarrow \frac{1001}{6} &= \frac{1}{3} \times \frac{22}{7} \times 3.5^2 h + \frac{2}{3} \times \frac{22}{7} \times 3.5^3 \\
 \Rightarrow \frac{1001}{2} &= 22 \times 0.5 \times 3.5 h + 2 \times 22 \times 0.5 \times 3.5^2 \\
 \Rightarrow 500.5 &= 38.5 \times h + 269.5 \\
 \Rightarrow 231 &= 38.5 \times h \\
 \Rightarrow \frac{231}{38.5} &= h \\
 \Rightarrow h &= 6 \text{ cm}
 \end{aligned}$$

Now CSA of hemispherical part = $2\pi r^2$

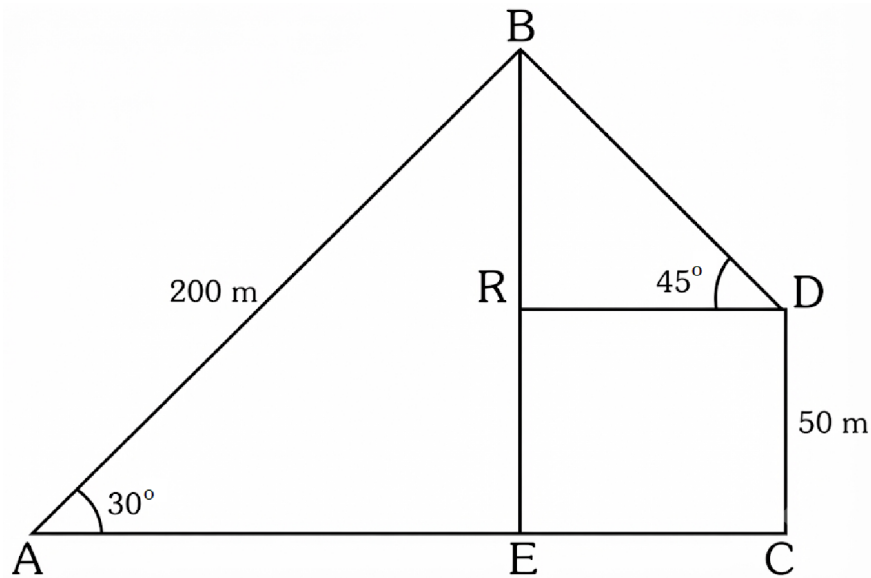
$$= 2 \times \frac{22}{7} \times 3.5^2 = 77 \text{ cm}^2$$

Cost of painting hemispherical part = ₹15 × 77
= ₹1155.



35. (A) Refer the figure shown.

Let Manish is standing at A and Mahesh is standing at D.



Distance of kite from Manish = 200 m

In right angled $\triangle AEB$,

$$\frac{BE}{200} = \sin 30^\circ$$

$$\Rightarrow BE = 200 \times \frac{1}{2} = 100 \text{ m}$$

So, $BR = BE - RE = BE - DC = 100 - 50 = 50 \text{ m}$.

Now in right angled $\triangle BRD$,

$$\frac{50}{BD} = \sin 45^\circ$$

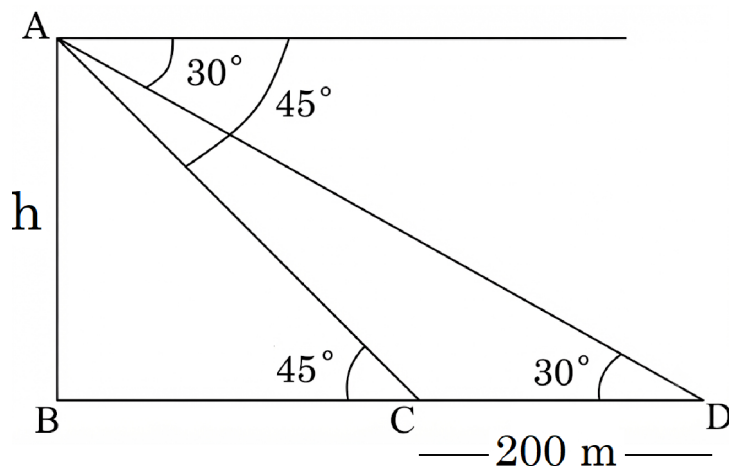
$$\Rightarrow \frac{50}{BD} = \frac{1}{\sqrt{2}}$$

$$\Rightarrow BD = 50\sqrt{2} \text{ m}$$

Hence, the distance between the kite and Mahesh is $50\sqrt{2}$ m.

OR

(B) Refer the figure shown.



Let the height of the lighthouse be h m.

In right angled $\triangle ABC$,

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

$$\Rightarrow \frac{h}{BC} = 1$$

$$\Rightarrow BC = h \dots (i)$$

In right angled $\triangle ABD$,

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

$$\Rightarrow \frac{h}{h + 200} = \frac{1}{\sqrt{3}}$$

$$[\because BD = BC + CD; \text{ by (i) } BC = h]$$

$$\Rightarrow \sqrt{3}h = h + 200$$

$$\Rightarrow (\sqrt{3} - 1)h = 200$$

$$\Rightarrow h = \frac{200}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1}$$

$$\therefore h = 100(\sqrt{3} + 1) \text{ m}$$

Hence, height of the lighthouse is $100(\sqrt{3} + 1)$ m.

SECTION E

36. Let the number of small bottles and large bottles be x and y respectively.

(i) $10x + 15y = 12750$ or $2x + 3y = 2550$

(ii) $12x + 17y = 34250$

(iii) (A) Number of bottles sold of both types in June is 1000.

So, $x + y = 1000$.

Solving $x + y = 1000$ and $2x + 3y = 2550$, we get $x = 450$ and $y = 550$.

Hence, the number of small and large bottles sold are 450 and 550 respectively.

OR

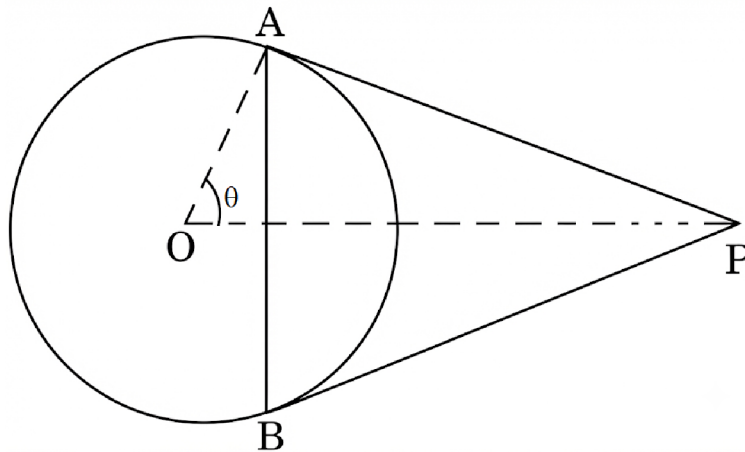
(iii) (B) Number of bottles sold of both types in July is 2500.

So, $x + y = 2500$.

Solving $x + y = 2500$ and $12x + 17y = 34250$, we get $x = 1650$ and $y = 850$.

Hence, the number of small and large bottles sold are 1650 and 850 respectively.

37. Refer the diagram shown.



(i) Since the radius is perpendicular to the tangent at the point of contact.

$\therefore \angle OAP = 90^\circ$.

(ii) In right angled $\triangle OAP$, $OP^2 = OA^2 + AP^2$

$$\Rightarrow 18^2 = 9^2 + AP^2$$

$$\Rightarrow AP^2 = 324 - 81$$

$$\Rightarrow AP^2 = 243$$

$$\Rightarrow AP = \sqrt{243} = 9\sqrt{3} \text{ m.}$$

(iii) (A) Refer the diagram shown.

In right angled $\triangle OAP$, $\cos \theta = \frac{OA}{OP}$

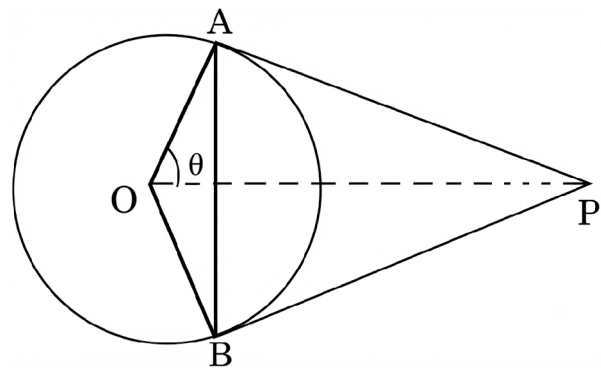
$$\Rightarrow \cos \theta = \frac{9}{18}$$

$$\Rightarrow \cos \theta = \frac{1}{2}$$

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

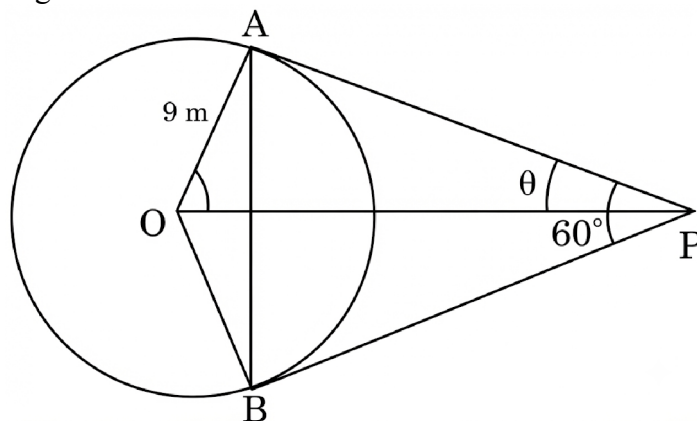
$$\therefore \theta = 60^\circ$$

Hence, $\angle AOB = 2\theta = 120^\circ$.



OR

(iii) (B) Refer the figure shown.



If tangents are inclined at 60° , then $\angle OPA = \frac{1}{2} \times 60^\circ = 30^\circ$.

In right angled $\triangle OPA$, $\tan 30^\circ = \frac{9}{AP}$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{9}{AP}$$

$$\Rightarrow AP = 9\sqrt{3} \text{ m}$$

Hence, the tangents PA and PB are of $9\sqrt{3}$ m length.

38. (i) Note that, highest frequency is 15 which corresponds to the class 30-40.

(ii) Refer the table shown below.

Marks	Number of students (f)	c.f.
0-10	3	3
10-20	6	9
20-30	12	21
30-40	15	36
40-50	14	50

Since $\frac{N}{2} = \frac{50}{2} = 25$

$\therefore$ Median class is 30-40.

(iii) (A) Refer the table shown below.

Marks (C.I.)	Number of students (f_i)	x_i	$f_i x_i$
0-10	3	5	15
10-20	6	15	90
20-30	12	25	300
30-40	15	35	525
40-50	14	45	630
Total	50		1560

$\therefore$ Average performance i.e., mean = $\frac{\sum f_i x_i}{\sum f_i} = \frac{1560}{50} = 31.2$.

OR

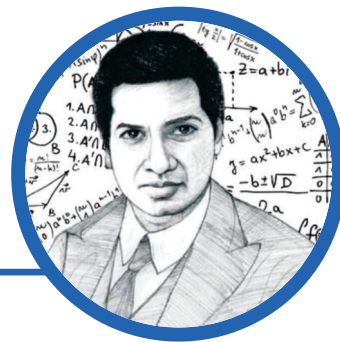
(iii) (B) Here the modal class is 30-40, $f_0 = 12$, $f_1 = 15$, $f_2 = 14$

$$\begin{aligned} \therefore \text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 30 + \left(\frac{15 - 12}{2 \times 15 - 12 - 14} \right) \times 10 \\ &= 30 + \frac{30}{4} = 30 + \frac{15}{2} = \frac{75}{2} = 37.5. \end{aligned}$$

“

An equation means nothing to me unless it expresses a thought of God.

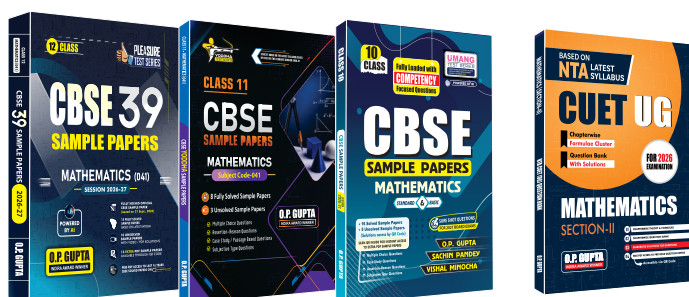
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