Date: 17/02/2026

Question Paper Code

430/1/1

SET-1

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar, Gurugram, Haryana-122015

Time: 3 Hrs. | Max. Marks: 80

MATHEMATICS (Basic)

CBSE Class-X (2026)

Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions carefully and follow them:

(i) This question paper contains **38** questions. **All** questions are **compulsory**.

(ii) This question paper is divided into **FIVE** sections. Sections - **A, B, C, D** and **E**.

(iii) In **Section A**, Question numbers **1** to **18** are multiple choice questions (MCQs) and question numbers **19** and **20** are Assertion–Reason based questions of 1 mark each.

(iv) In **Section B**, Question numbers **21** to **25** are very short answer (VSA) type questions, carrying **2** marks each.

(v) In **Section C**, Question numbers **26** to **31** are short answer (SA) type questions, carrying **3** marks each.

(vi) In **Section D**, Question numbers **32** to **35** are long answer (LA) type questions carrying **5** marks each.

(vii) In **Section E**, Question numbers **36** to **38** are **case-based** 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 of **2** marks in Section **E**.

(ix) Draw neat diagrams wherever required. Take π = 22/7 wherever required, if not stated.

(x) Use of calculators is **not allowed.**

SECTION-A

Question numbers 1 to 20 are multiple choice questions of 1 mark each.

1. The HCF of $2^2 \cdot 3^3$ and $3^2 \cdot 2^3$ is: **[1]**

(a) 1 (b) 2.3

(c) $2^2 \cdot 3^2$ (d) $2^3 \cdot 3^3$

Answer (c) **[1]**

Sol. Given: $2^2.3^3$ ...(i)

$3^2.2^3$ ...(ii)

$\therefore$ HCF = $2^2.3^2$ (smallest powers of common factors are taken)

2. A letter is selected from the letters of the word FEBRUARY. The probability that it is a vowel is: **[1]**

(a) $\frac{1}{8}$ (b) $\frac{2}{8}$

(c) $\frac{3}{8}$ (d) $\frac{3}{7}$

Answer (c) **[1]**

Sol. FEBRUARY $\Rightarrow n(S) = 8$

Vowel : A, E, U $\Rightarrow n(E) = 3$

$$P(E) = P(\text{vowel}) = \frac{n(E)}{n(S)} = \frac{3}{8}$$

3. Which of the following numbers will not end with 0 for any natural number n ? **[1]**

(a) $4n$ (b) 4^n

(c) $3^n + 1$ (d) 10^{n+1}

Answer (b) **[1]**

Sol. $4n \Rightarrow 4 \times 5 = 20$, ends with 0.

$4^n \Rightarrow 4, 16, 64, \dots$, not end with 0.

$3^{n+1} \Rightarrow 3^{2+1} = 10$, end with 0.

$10^{n+1} \Rightarrow 10^{1+1} = 100$, end with 0.

4. The system of linear equations $px + qy = r$ and $p_1x + q_1y = r_1$ has a unique solution, if: **[1]**

(a) $pq \neq p_1q_1$ (b) $pp_1 \neq qq_1$

(c) $pq_1 \neq qp_1$ (d) $pqr \neq p_1q_1r_1$

Answer (c) **[1]**

Sol. For unique solution

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$$

$$\Rightarrow \frac{p}{p_1} \neq \frac{q}{q_1}$$

$$\Rightarrow pq_1 \neq qp_1$$

5. Which of the equations among the following is/are quadratic equation(s)? **[1]**

$q_1 : x^2 + x = (x+1)^2$, $q_2 : x - 1 = x^2 - 1$, $q_3 : x^4 = x^2$, $q_4 : \sqrt{x} = x^2\sqrt{x} + 1$

(a) q_1 only (b) q_1, q_2 and q_3 only

(c) q_2 only (d) q_2 and q_4 only

Answer (c) **[1]**

Sol. q_1: $x^2 + x = (x+1)^2 \Rightarrow x^2 + x = x^2 + 1 + 2x$

$\Rightarrow x = 1 + 2x$

$\Rightarrow x + 1 = 0$, Not a quadratic equation

q_2: $x - 1 = x^2 - 1 \Rightarrow x^2 - x - 1 + 1 = 0$

$\Rightarrow x^2 - x = 0$

$\therefore$ It is a quadratic equation

q_3: $x^4 = x^2 \Rightarrow x^4 - x^2 = 0$

$\Rightarrow$ Highest power is 4

$\therefore$ Not a quadratic equation

q_4: $\sqrt{x} = x^2\sqrt{x} + 1$

it contains $\sqrt{x}$ (i.e. surds)

$\therefore$ It is not quadratic equation

$\therefore$ only q_2 is quadratic equation

6. The discriminant of the quadratic equation $ax^2 + x + a = 0$ is : **[1]**

(a) $\sqrt{1-4a^2}$ (b) $1-4a^2$

(c) $4a^2 - 1$ (d) $\sqrt{4a^2-1}$

Answer (b) **[1]**

Sol. Given: $ax^2 + x + a = 0$

Discriminant $= b^2 - 4ac$

$= (1)^2 - 4 \cdot a \cdot a$

$= 1 - 4a^2$

7. The distance between points (3, 0) and (0, –3) is : **[1]**

(a) 3 units (b) 6 units

(c) $\sqrt{6}$ units (d) $\sqrt{18}$ units

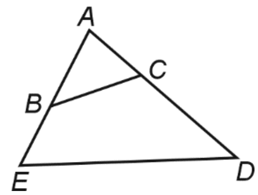
Answer (d) **[1]**

Sol. Distance $= \sqrt{(3-0)^2 + (0+3)^2}$

$= \sqrt{9+9}$

$= \sqrt{18}$ units.

8. If $\Delta ABC \sim \Delta ADE$ in the adjoining figure, then which of the following is true? **[1]**



(a) $\frac{AB}{BE} = \frac{AC}{CD}$

(b) $\frac{AB}{AD} = \frac{AC}{AE}$

(c) $\frac{AB}{BC} = \frac{AE}{DE}$

(d) $\frac{AC}{AD} = \frac{AB}{AE}$

Answer (b) **[1]**

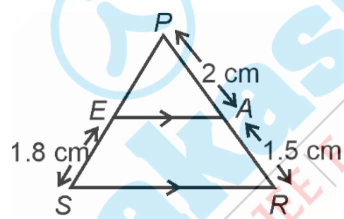
Sol. $\Delta ABC \sim \Delta ADE$

$$\frac{AB}{AD} = \frac{BC}{DE} = \frac{AC}{AE}$$

$$\frac{AB}{AD} = \frac{AC}{AE}$$

option (b) is correct

9. In the adjoining figure, if $EA \parallel SR$ and $\text{PE} = x$ cm, then the value of $5x$ is : **[1]**



(a) 2.4 cm

(b) 12 cm

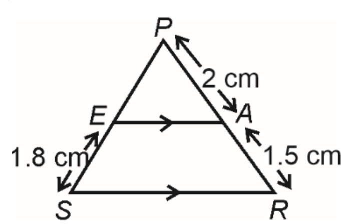
(c) 1.35 cm

(d) 6.75 cm

Answer (b) **[1]**

Sol. $EA \parallel SR$

$PE = x$ cm



$$\frac{PE}{ES} = \frac{PA}{AR}$$

$$\frac{x}{1.8} = \frac{2}{1.5}$$

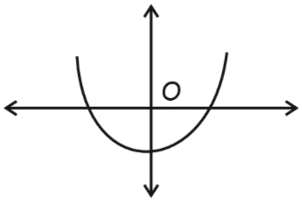
$$\Rightarrow x = \frac{2 \times 1.8}{1.5} = 2.4 \text{ cm}$$

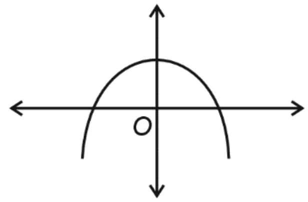
$\therefore\ PE = 2.4$ cm

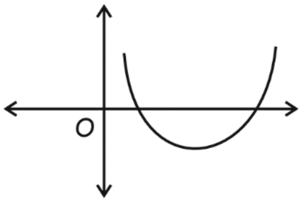
$\therefore\ 5x = 5(2.4)$ cm $= 12$ cm

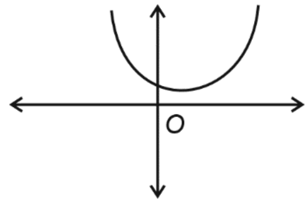
option (b) is correct

10. Which of the following graphs represents a polynomial with both zeroes being positive? **[1]**

(a)


(b)


(c)


(d)


Answer (c) **[1]**

Sol. Graph of polynomial in option (c) cuts x-axis at points which are on right side of origin.

11. The system of equations $x = 2$ and $x = 3$ has : **[1]**

(a) unique solution $(2,3)$
(b) two solutions $(2,0)$ and $(3,0)$
(c) no solution
(d) infinitely many solutions

Answer (c) **[1]**

Sol. x = 2 and x = 3 represent parallel lines which have no common point.

12. The numbers $x, x+4$ and $x+8$ are in A.P. with common difference : **[1]**

(a) x
(b) $4+x$
(c) 4
(d) 0

Answer (c) **[1]**

Sol. $d = a_3 - a_2$

$d = a_2 - a_1 = (x+4) - x = 4$ and $d = a_3 - a_2 = (x+8) - (x+4) = 4$

So, common difference = 4

13. Which of the following statements is **not** true ? **[1]**

(a) $\sin 0° = \cos 0°$
(b) $\tan 30° = \cot 60°$
(c) $\sin 30° = \cos 60°$
(d) $\sin 45° = \dfrac{1}{\sec 45°}$

Answer (a) **[1]**

Sol. $\sin 0° = 0$ and $\cos 0° = 1$

$\therefore \sin 0° \neq \cos 0°$

14. If $\sqrt{3}\sin \text{A} = \cos\text{A}$, then the measure of A is : **[1]**

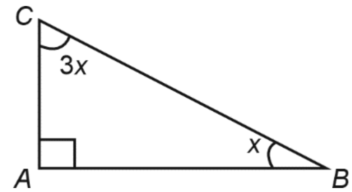
(a) 90°
(b) 60°
(c) 45°
(d) 30°

Answer (d) **[1]**

Sol. $\sqrt{3}\sin A = \cos A \Rightarrow \dfrac{\sin A}{\cos A} = \dfrac{1}{\sqrt{3}} \Rightarrow \tan A = \dfrac{1}{\sqrt{3}}$

$\therefore A = 30°$

15. In the adjoining figure, the angle of elevation of the point C from the point B, is : **[1]**



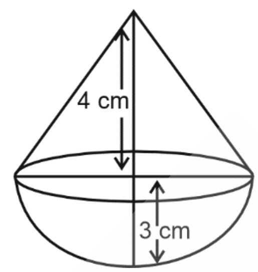
(a) 30° (b) 45°

(c) 22.5° (d) 67.5°

Answer (c) **[1]**

Sol. $3x + x = 90° \Rightarrow x = 22.5°$

16. In the adjoining figure, the slant height of the conical part is : **[1]**



(a) 4 cm (b) 7 cm

(c) 5 cm (d) 25 cm

Answer (c) **[1]**

Sol. Base radius of cone will be same as the radius of hemisphere.

$\therefore\ l = \sqrt{r^2 + h^2}$

$= \sqrt{3^2 + 4^2}$

= 5 cm

17.

Class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Frequency	3	5	7	9	11

The upper limit of the median class of the above data is : **[1]**

(a) 10 (b) 20

(c) 30 (d) 40

Answer (d) **[1]**

Sol. Total sum of frequency = 35

$\therefore\ \frac{N}{2} = 17.5$

$\therefore$ Cumulative frequency of class 30–40 is 24 which is just greater than $\frac{N}{2}$.

Median class = 30–40

18. If for a data, median is 5 and mode is 4, then mean is equal to : **[1]**

(a) 7 (b) 11

(c) $\frac{11}{2}$ (d) $\frac{14}{3}$

Answer (c) **[1]**

Sol. Mode = 3 Median – 2 Mean

4 = 3 × 5 – 2 Mean

2 Mean = 15 – 4 = 11

Mean = $\frac{11}{2}$

(Assertion-Reason based questions)

Directions : Question numbers 19 and 20 are Assertion and Reason based questions. Two statements are given, one labelled and Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(A) Both, Assertion (A) and Reason (R) are true and Reason (R) is correct explanation of Assertion (A)

(B) Both, Assertion (A) and Reason (R) are true but Reason (R) is **not** correct explanation for Assertion (A)

(C) Assertion (A) is true but Reason (R) is false

(D) Assertion (A) is false but Reason (R) is true

19. **Assertion (A):** From a bag containing 5 red balls, 2 white balls and 3 green balls, the probability of drawing a non-white ball is $\frac{4}{5}$.

Reason (R): For any event $E, P(E) + P(\text{ not } E) = 1$ **[1]**

Answer (a)

Sol. Assertion: 5R, 2W, 3G

P(not W) = $\frac{5+3}{5+2+3}$

= $\frac{8}{10}$ = $\frac{4}{5}$

Reason: for any event,

P(E) + P(not E) = 1 always true.

20. **Assertion (A):** $7 \times 2 + 3$ is a composite number.

Reason (R): A composite number has more than two factors. **[1]**

Answer (d)

Sol. A: $7 \times 2 + 3$ is a composite number.

∴ 17 is not a composite number.

Assertion is false statement [∵ A composite number has more than two factors]

Reason is correct statement .

Option (d) is correct.

SECTION-B

Question numbers 21 to 25 are very short answer type questions of 2 marks each.

21. Find the coordinates of the point which divides the line segment joining the points $A(-6, 10)$ and $B(3, -8)$ in the ratio 2 : 7. **[2]**

Sol. 2 : 7
$A(-6, 10)$ —— $P(h, k)$ —— $B(3, -8)$

Let point $P(h, k)$ divides the line segment AB in the ratio of 2 : 7. **[½]**

$h = \frac{2\times 3 + 7\times(-6)}{2+7}$ [By section formula] **[1]**

$= \frac{6-42}{9}$

$= -4$ **[½]**

$k = \frac{2\times(-8)+7\times 10}{2+7}$

$= \frac{-16+70}{9}$

$= 6$

$\therefore$ Point is $(-4, 6)$

22. (A) One zero of a quadratic polynomial is twice the other. If the sum of zeroes is (–6), find the polynomial. **[2]**

OR

(B) If one zero of the polynomial $x^2 - 5x - c$ is (–1), find the value of c. Also, find the other zero. **[2]**

Sol. (A) Let one zero be 'α'

then, other zero will be '2α' **[½]**

$\because$ sum of zeroes = –6

$\alpha + 2\alpha = -6$

$\therefore \boxed{\alpha = -2}$ **[½]**

Any polynomial can be written as

$\Rightarrow K[x^2 -$ (sum of zeroes) x + Product of zeroes], K is non-zero constant.

$\Rightarrow K[x^2 - (-6)x + \alpha(2\alpha)]$ **[½]**

$\Rightarrow K[x^2 + 6x + 2\alpha^2]$

$\Rightarrow [x^2 + 6x + 8]$ By taking $K = 1$ **[½]**

OR

(B) Let, $P(x) = x^2 - 5x - c$

One zeroes is (–1)

$\therefore P(-1) = 0$ **[½]**

$\Rightarrow (-1)^2 - 5(-1) - c = 0$

$\Rightarrow 1 + 5 - c = 0$

$\Rightarrow c = 6$ **[½]**

$\therefore$ $P(x) = x^2 - 5x - 6$ **[½]**

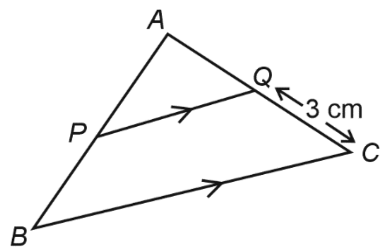
For other zero,

$-1+\beta = \frac{-(-5)}{1}$

$\therefore$ $\beta = 5 + 1$

$\beta = 6$ **[½]**

23. In the adjoining figure, $AP = \frac{1}{2}AB$ and $PQ \parallel BC$. If CQ = 3 cm, then find the length of AC. **[2]**



Sol. As $PQ||BC$,

so, $\frac{AP}{PB} = \frac{AQ}{QC}$ [By BPT] **[½]**

$\Rightarrow \frac{1}{1} = \frac{AQ}{3}$ $\left[\because AP = PB = \frac{1}{2}AB\right]$ **[½]**

$\Rightarrow AQ = 3$ cm **[½]**

$\therefore$ $AC = AQ + QC = 3 + 3$

= 6 cm **[½]**

24. (A) Evaluate : $\sin^2 30° - \cos^2 45° + \cot^2 60°$ **[2]**

OR

(B) If $\sin (A + 2B) = 2 \cos 60°$ and $A = 3B$, find the measures of A and B. **[2]**

Sol. (A) Given : $\sin^2 30° - \cos^2 45° + \cot^2 60°$

$\Rightarrow \left(\frac{1}{2}\right)^2 - \left(\frac{1}{\sqrt{2}}\right)^2 + \left(\frac{1}{\sqrt{3}}\right)^2$ **[½]**

$\Rightarrow \frac{1}{4} - \frac{1}{2} + \frac{1}{3}$ **[½]**

$\Rightarrow \frac{3-6+4}{12}$ **[½]**

$\Rightarrow \frac{1}{12}$ **[½]**

OR

(B) Given;

$\sin(A + 2B) = 2\cos 60°$ and $A = 3B$

$\sin(A+2B) = 2 \times \frac{1}{2}$ **[½]**

$\sin(A + 2B) = 1 = \sin 90°$ …(i) **[½]**

Put $A = 3B$ in (i), we get

$\sin(3B + 2B) = \sin 90°$

$\sin 5B = \sin 90°$

$\Rightarrow 5B = 90°$

$\therefore B = 18°$ **[½]**

$\Rightarrow A = 3 \times 18°$

$A = 54°$ **[½]**

25. A box consists of 60 wall clocks, out of which 40 are good, 15 have minor defects and the remaining are broken. A trader will reject the box, if the clock taken out from the box is broken. The trader randomly takes out one clock from the box. What is the probability that: **[2]**

(i) the box will be rejected?

(ii) the clock taken out of the box has minor defect?

Sol. Total number of possible outcomes = 60

(i) Number of favourable outcomes

$= 60 - (40 + 15)$ **[½]**

$= 5$

$\therefore$ Required probability $= \dfrac{5}{60}$

$= \dfrac{1}{12}$ **[½]**

(ii) Number of favourable outcomes = 15 **[½]**

$\therefore$ Required probability $= \dfrac{15}{60}$

$= \dfrac{1}{4}$ **[½]**

SECTION-C

Question numbers 26 to 31 are short answer type questions of 3 marks each.

26. Given that $\sqrt{5}$ is an irrational number, prove that $3 + 2\sqrt{5}$ is also an irrational number. **[3]**

Sol. We will use method of contradiction.

Let us assume that $3 + 2\sqrt{5}$ is rational.

So, $3 + 2\sqrt{5} = \dfrac{p}{q}$ where p and q are co-primes integers.

$\Rightarrow \quad 2\sqrt{5} = \dfrac{p}{q} - 3$

$\Rightarrow \quad 2\sqrt{5} = \dfrac{p - 3q}{q}$

$\Rightarrow \quad \sqrt{5} = \dfrac{p - 3q}{2q}$

Now, $\frac{p-3q}{2q}$ is a rational number then $\sqrt{5}$ will also be rational. But it is a fact that $\sqrt{5}$ is irrational.

So, our assumption is wrong, therefore $3+2\sqrt{5}$ is irrational.

27. (A) Solve the following system of equations graphically:

$x + 3y = 6$ and $2x - 3y = 12$

Also, find the area of the triangle formed by the lines $x + 3y = 6$, $x = 0$ and $y = 0$. **[3]**

OR

(B) One of the supplementary angles exceeds the other by 120°. Express the given information as a system of linear equations in two variables. Hence, find the measure of both the angles. **[3]**

Sol. (A) Let, $x + 3y = 6$ …(i)

x	0	6
y	2	0

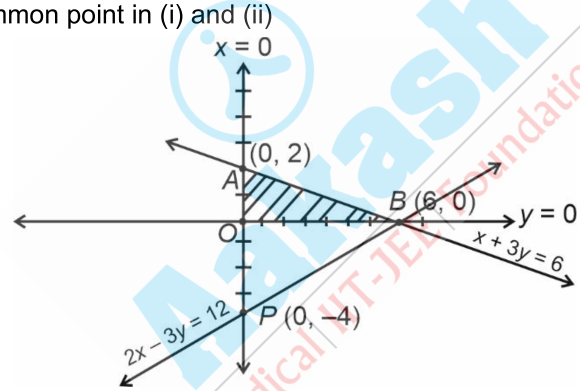
Say point $A(0, 2)$ and $B(6, 0)$ **[½]**

Also, $2x - 3y = 12$ …(ii)

x	0	6
y	–4	0

Say point $P(0, -4)$ and $B(6, 0)$ **[½]**

Note point (6, 0) is common point in (i) and (ii)



Required area of triangle is ΔAOB

$\therefore$ ar(ΔAOB) $= \frac{1}{2} \times OB \times OA$ **[½]**

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

$= 6$ unit^2 **[½]**

OR

(B) Let, two angles be x and y

So, $x + y = 180°$ …(i) [$\because$ For supplementary angle] **[½]**

Also $x - y = 120°$ …(ii) [By given conditions] **[½]**

From (i) and (ii), we get

$$\begin{array}{r} x + y = 180° \\ x - y = 120° \\ \hline 2x = 300° \end{array}$$ **[½]**

$\therefore\ x = \frac{300^\circ}{2} = 150^\circ$ **[½]**

Now, put x = 150°l in (i), we get

150° + y = 180° **[½]**

y = 180° – 150°

$\therefore\ y = 30^\circ$ **[½]**

So, x = 150° and y = 30°

28. If the point $P(x, y)$ is equidistant from the points (3, 6) and (–3, 4) obtain the relation between x and y. Hence, find the coordinates of point P if it lies on x-axis. **[3]**

Sol. Distance between points (x_1, y_1) and (x_2, y_2) is $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

According to question, let point $P(x, y)$ is equidistant from points $A(3, 6)$ and $B(-3, 4)$.

$\therefore\ PA = PB$

$\Rightarrow\ PA^2 = PB^2$ [on squaring both sides]

$\Rightarrow\ (x-3)^2 + (y-6)^2 = (x+3)^2 + (y-4)^2$ **[½]**

$\Rightarrow\ x^2 + 9 - 6x + y^2 + 36 - 12y = x^2 + 9 + 6x + y^2 + 16 - 8y$ **[½]**

$\Rightarrow\ -6x - 12y + 45 = 6x - 8y + 25$

$\Rightarrow\ -12x - 4y = -20$

$\Rightarrow\ 3x + y = 5$ **[1]**

If point $P(x, y)$ lies on x-axis,

Then $y = 0$

$\therefore\ 3x + 0 = 5$ **[½]**

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

$\therefore$ Point P is $\left(\frac{5}{3}, 0\right)$. **[½]**

29. (A) Prove that : $\frac{\sin A - \tan A}{\sin A + \tan A} = \frac{1 - \sec A}{1 + \sec A}$ **[3]**

OR

(B) If $\sin x = p$, then prove that :

(i) $\cot x = \frac{\sqrt{1-p^2}}{p}$ (ii) $\frac{1+\tan^2 x}{1+\cot^2 x} = \frac{p^2}{1-p^2}$

Sol. (A) $\text{L.H.S.} = \frac{\sin A - \tan A}{\sin A + \tan A}$

$\Rightarrow \frac{\sin A - \frac{\sin A}{\cos A}}{\sin A + \frac{\sin A}{\cos A}}$ **[1]**

$\Rightarrow \frac{\sin A(\cos A - 1)}{\sin A(\cos A + 1)}$ **[½]**

$\Rightarrow \frac{\cos A - 1}{\cos A + 1}$ **[½]**

$$\Rightarrow \frac{\frac{1}{\sec A}-1}{\frac{1}{\sec A}+1}$$ **[½]**

$$\Rightarrow \frac{1-\sec A}{1+\sec A} = \text{R.H.S.}$$ **[½]**

OR

(B) Given, $\sin x = p$.

(i) To prove, $\cot x = \frac{\sqrt{1-p^2}}{p}$

$\because \sin^2 x + \cos^2 x = 1$ **[½]**

$p^2 + \cos^2 x = 1$

$\therefore \cos x = \sqrt{1-p^2}$ **[½]**

Now, $\cot x = \frac{\cos x}{\sin x} = \frac{\sqrt{1-p^2}}{p}$ **[½]**

Hence proved.

(ii) To prove : $\frac{1+\tan^2 x}{1+\cot^2 x} = \frac{p^2}{1-p^2}$

$\Rightarrow \frac{\sec^2 x}{\text{cosec}^2 x}$ (By use of identity) **[½]**

$\Rightarrow \frac{\sin^2 x}{\cos^2 x}$

$\Rightarrow \tan^2 x$

$\Rightarrow \left[\frac{p}{\sqrt{1-p^2}}\right]^2 \quad \left[\because \tan x = \frac{1}{\cot x}\right]$ **[½]**

$\Rightarrow \frac{p^2}{1-p^2}$ **[½]**

$\therefore \frac{1+\tan^2 x}{1+\cot^2 x} = \frac{p^2}{1-p^2}$

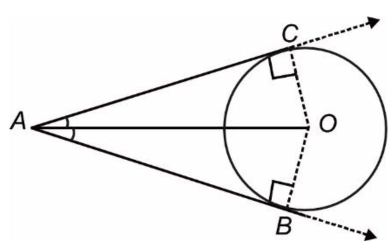
Hence proved.

30. Prove that the lengths of tangents drawn from an external point to a circle are equal. **[3]**

Sol. Given : AB and AC are two tangents from a point A to a circle $C(O, r)$. **[3]**

To Prove : $AB = AC$

Construction : Join OA, OB and OC.



Proof : In ΔOBA and ΔOCA,

$OB = OC$ [Radii of the same circle]

$OA = OA$ [Common side]

$\angle OBA = \angle OCA = 90°$

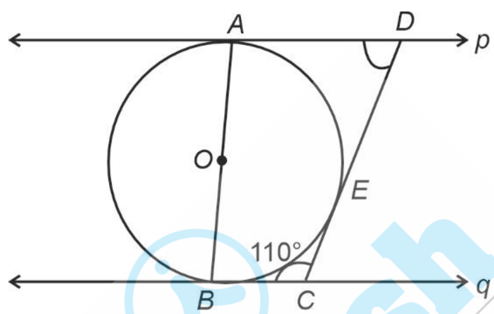
[Each 90° because tangent is perpendicular to radius at the point of contact]

$\Delta OBA \cong \Delta OCA$ [By R.H.S. congruency]

$\Rightarrow AB = AC$ [CPCT]

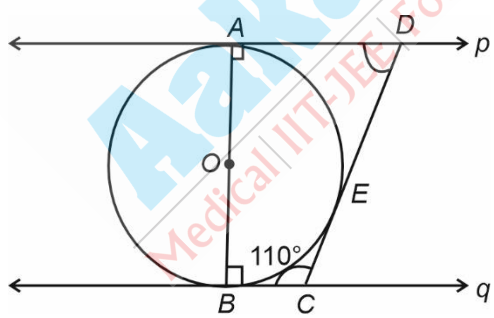
Hence proved.

31. In the adjoining figure, AB is the diameter of the circle with centre O. Two tangents p and q are drawn to the circle at point A and B respectively. Prove that $p \parallel q$. Further, a line CD touches the circle at E and $\angle BCD = 110°$. Find the measure of $\angle ADC$. **[3]**



Sol. Given that,

O is centre of circle and p, q are tangents at point A and B.



As we know, tangent to a circle is perpendicular to the radius at the point of contact

$OB \perp q$ and $OA \perp p$

$\Rightarrow$ $\angle OBC = 90°$ and $\angle OAD = 90°$ **[1]**

Since, $\angle ABC + \angle BAD = 90° + 90°$

$= 180°$

$\Rightarrow$ Tangents p and q are parallel to each other. **[1]**

$\because$ CD is tangent as well as transversed line

$\therefore$ By co-interior angles,

$\angle ADC + \angle BCD = 180°$ **[½]**

$\angle ADC + 110° = 180°$

$\therefore$ $\angle ADC = 70°$

Or, $\angle D = 70°$ **[½]**

SECTION-D

Question numbers 32 to 35 are long answer type questions of 5 marks each.

32. (A) Express $\frac{24}{18-x}-\frac{24}{18+x}=1$ as a quadratic equation in standard form and find the discriminant of the quadratic equation, so obtained. Also, find the roots of the equation. **[5]**

OR

(B) The sum of squares of two positive numbers is 100. If one number exceeds the other by 2, find the numbers. **[5]**

Sol. (A) Given equation is

$$\frac{24}{18-x}-\frac{24}{18+x}=1$$

$$\Rightarrow \frac{24(18+x)-24(18-x)}{(18-x)(18+x)}=1$$ **[½]**

$$\Rightarrow \frac{24\{(18+x)-(18-x)\}}{18^2-x^2}=1$$

$$\Rightarrow \frac{24(2x)}{324-x^2}=1$$ **[1]**

$$\Rightarrow 48x=324-x^2$$

$$\Rightarrow \boxed{x^2+48x-324=0}$$ **[1]**

Here $a = 1$, $b = 48$, $c = -324$ **[½]**

Discriminant $(D) = b^2 - 4ac$

$= 48^2 - 4(1)(-324)$

$= 2304 + 1296$

$= 3600$ **[1]**

Roots are $\frac{-b\pm\sqrt{D}}{2a}$

$\therefore$ Root = $\frac{-48\pm\sqrt{3600}}{2\times1}$

$= \frac{-48+60}{2}, \frac{-48-60}{2}$

$= 6, -54$ **[1]**

OR

(B) One number excess the other by 2

Let those numbers be x and $x + 2$

According to question, $x^2+(x+2)^2=100$

$$\Rightarrow x^2+x^2+2^2+2(x)(2)=100$$ **[1]**

$\Rightarrow x^2 + x^2 + 4 + 4x = 100$

$\Rightarrow 2x^2 + 4x - 96 = 0$

$\Rightarrow x^2 + 2x - 48 = 0$

[on dividing both sides by 2]

On comparing with standard form,

$ax^2 + bx + c = 0$ **[½]**

$a = 1, b = 2, c = -48$ **[½]**

Roots are given by $\dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

So, Roots = $\dfrac{-2 \pm \sqrt{2^2 - 4 \times 1 \times (-48)}}{2 \times 1}$ **[1]**

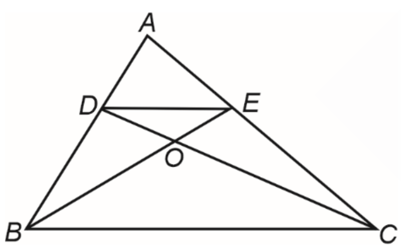
$= \dfrac{-2 \pm \sqrt{4 + 192}}{2}$

$= \dfrac{-2 \pm 14}{2}$

6, –8 ($\because$ –8 is rejected)

$\therefore$ Numbers are 6 and (6 + 2) or $\boxed{\text{6 and 8}}$ **[1]**

33. In the adjoining figure, $\Delta ABE \cong \Delta ACD$.



Prove that :

(i) $\Delta ADE \sim \Delta ABC$

(ii) $\Delta BOD \sim \Delta COE$ **[5]**

Sol. Given, $\Delta ABE \cong \Delta ACD$

From congruency criterion,

$AB = AC$

$AE = AD$ **[½]**

$\angle ABE = \angle ACD$ **[½]**

(i) To prove : $\Delta ADE \sim \Delta ABC$

$\because AD = AE$

$AB = AC$ **[½]**

Thus, $\dfrac{AD}{AE} = \dfrac{AB}{AC}$ **[½]**

Since, $\angle A$ is common i.e.

$\angle DAE = \angle BAC$ **[½]**

$\therefore$ By SAS similarity

$\Delta ADE \sim \Delta ABC$ **[½]**

(ii) To prove : $\Delta BOD \sim \Delta COE$

From figure, $\angle BOD = \angle COE$ [Vertically opposite angle] **[½]**

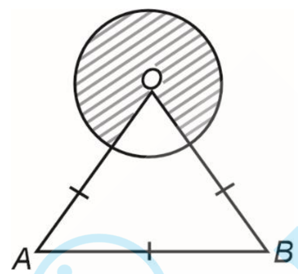
Also, $\angle ABE = \angle ACD$ **[½]**

$\because$ Two angles are equal in ΔBOD and ΔCOE **[½]**

$\therefore$ By use of AA similarity,

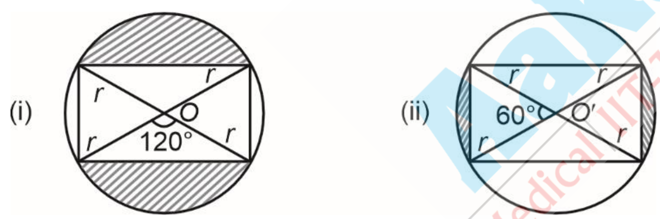
$\Delta BOD \sim \Delta COE$ **[½]**

34. (A) In the adjoining figure, ΔOAB is an equilateral triangle and the area of the shaded region is $750\ \pi\ cm^2$. Find the perimeter of the shaded region. **[5]**



OR

(B) O and O' are the centres of the circles of radius r as shown in figures (i) and (ii) respectively.



Find the ratio of area of shaded region in figure (i) to that of area of shaded region in figure (ii). **[5]**

Sol. (A) Let radius of shaded region be 'r' cm.

$\angle AOB = 60°$

$\therefore$ Area of shaded region

750π = area of major sector with central angle of 300°

$750\pi = \pi \times r^2 \times \frac{300}{360}$ **[1]**

$\Rightarrow 750 = r^2 \times \frac{5}{6}$

$\Rightarrow r^2 = 900$

$r = 30$ cm **[1]**

Now, perimeter of shaded region

$= r + r +$ major arc length

$= r + r + 2\pi r - 2\pi r \times \frac{\theta}{360°}$ **[1]**

$= 30 + 30 + 2\pi \times 30\left(1 - \frac{60}{360}\right)$ **[1]**

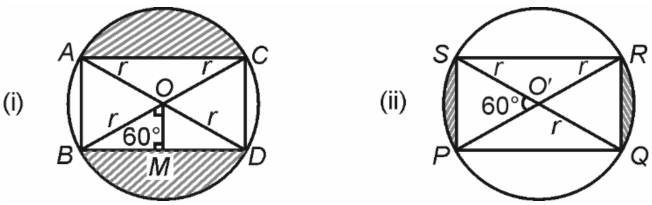
$= 60 + 60\pi \times \frac{5}{6}$

$= 60 + 50\pi$

= 217 cm (approx.) **[1]**

OR

(B) (i) (ii)



Area of Segment = Area of sector – area of triangle *BOD* **[½]**

$= \pi r^2 \times \frac{120°}{360°} - 2 \times \frac{1}{2} \times BD \times OM$

$= \frac{\pi r^2}{3} - 2 \times \frac{1}{2} \times 2 \times BM \times OM$

$= \frac{\pi r^2}{3} - 2 \times r\sin 60° \times r\cos 60°$

$= \frac{\pi r^2}{3} - 2r^2 \times \frac{\sqrt{3}}{2} \times \frac{1}{2} = \frac{\pi r^2}{3} - \frac{\sqrt{3}r^2}{2}$

$\therefore$ Shaded area of figure (i) = $2 \times r^2\left(\frac{\pi}{3} - \frac{\sqrt{3}}{2}\right)$ **[1]**

In figure (ii)

Area of segment = Area of sector – area of Δ

$= \pi r^2 \times \frac{60°}{360°} - \frac{\sqrt{3}}{4}r^2$ [$\because$ Area of equilateral triangle is $\frac{\sqrt{3}}{4} \times (\text{side})^2$]

$= \frac{\pi r^2}{6} - \frac{\sqrt{3}}{4}r^2$

$= r^2\left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right)$ **[1]**

$\therefore$ Shaded area of figure (ii)

$= 2 \times r^2\left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right)$ **[1]**

Required ratio

$= \frac{2 \times r^2\left(\frac{\pi}{3} - \frac{\sqrt{3}}{4}\right)}{2 \times r^2\left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right)}$ **[½]**

$= \frac{4\pi - 3\sqrt{3}}{2\pi - 3\sqrt{3}}$ **[1]**

35. The mode of the following data is 3.286 :

Family size	1-3	3-5	5-7	7-9	9-11
Number of families	7	8	2	2	1

Find the mean and median of the above data. **[5]**

Sol. Mode = 3.286 for given table

Family size	1-3	3-5	5-7	7-9	9-11
Number of families	7	8	2	2	1

For mean,

Class	**Frequency (*f*)**	**Midpoint (*x*)**	***f* × *x***
1-3	7	2	14
3-5	8	4	32
5-7	2	6	12
7-9	2	8	16
9-11	1	10	10
	$\sum f = N = 20$		$\sum f \times x = 84$

[2]

$\therefore$ Mean $= \dfrac{\sum f \times x}{\sum f} = \dfrac{84}{20}$

$\therefore$ Mean = 4.2 **[1]**

By use of empirical formula

Mode = 3 median – 2 mean **[½]**

3.286 = 3 Median – 2 × 4.2

3.286 = 3 Median – 8.4 **[½]**

Median $= \dfrac{3.286 + 8.4}{3}$

$= \dfrac{11.686}{3}$

Median = 3.895 **[1]**

SECTION-E

Question numbers 36 to 38 are case-based questions of 4 marks each.

36. A watermelon vendor arranged the watermelons similar to shown in the adjoining picture:

The number of watermelons in subsequent rows differ by '*d*'. The bottommost row has 101 watermelons and the topmost row has 1 watermelon.

There are 21 rows from bottom to top.

Based on the above information, answer the following questions :

(i) Find the value of '*d*'.

(ii) How many watermelons will be there in the 15th row from the bottom?

(iii) (a) Find the total number of watermelons from bottom to top.

OR

(iii) (b) If the number of watermelons in the nth row from top is equal to number of watermelons in the nth row from bottom, find the value of *n*.

Sol. This forms an Arithmetic Progression.

Bottom row (first term) $a = 101$

Top row (Last term) $l = 1$

Number of rows $(n) = 21$

Common difference = d.

(i) $l = a + (n - 1)d$ **[½]**

$1 = 101 + (21 - 1)d$

$\Rightarrow d = \dfrac{-100}{20}$

$d = -5$ **[½]**

(ii) $a_n = a + (n-1)d$

$a_{15} = 101 + (15-1)(-5)$ **[½]**

$a_{15} = 101 + 14(-5)$

$a_{15} = 101 - 70$

$a_{15} = 31$ **[½]**

There will be 31 watermelons in the 15th row from the bottom.

(iii) (a) $S_n = \dfrac{n}{2}(a+l)$ **[½]**

$S_{21} = \dfrac{21}{2}(101+1)$ **[½]**

$= \dfrac{21}{2}(102)$

$= 21 \times 51$

$= 1071$ **[1]**

$\therefore$ The total number of watermelons from bottom to top is 1071

OR

(b) Sequence from bottom to top is an AP.

101, 96, 91, … 1

n^{th} row from bottom

$a_n = 101 + (n-1)(-5)$ **[½]**

$= 101 - 5(n-1)$

n^{th} row from top

If there are 21 rows total, then n^{th} row from top = (21 – n + 1) = (22 - n)th term from bottom **[½]**

$a_{22-n} = 101 - 5((22-n)-1)$

$= 101 - 5(21-n)$ **[½]**

$101 - 5(n-1) = 101 - 5(21-n)$

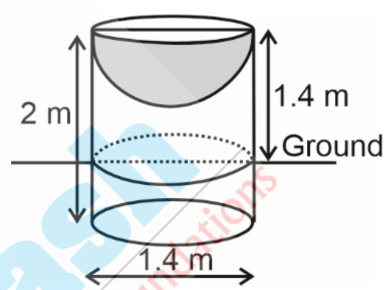
$106 - 5n = -4 + 5n$

$106 + 4 = 5n + 5n$ **[½]**

$110 = 10n$

$n = 11$

37. As a part of school project, Mishika and Sahaj created a bird-bath from the cylindrical log of wood by scooping out the hemispherical depression from one end of the cylinder as shown in the figure given below. Cylinder has a length 2 m out of which 0.6 m is in earth and the diameter is 1.4 m .



On the basis of the above information, answer the following questions :

(i) Write the radius of the hemispherical depression. **[1]**

(ii) Find the volume of water that can be filled in the hemispherical depression in terms of π. **[1]**

(iii) (a) Find the total surface area of log of wood above the ground after making the bird-bath. **[2]**

OR

(iii) (b) Compute the volume of log of wood above the ground after making the bird-bath. **[2]**

Sol. (i) Radius = $\frac{1.4}{2}$ = 0.7m **[1]**

(ii) volume of hemisphere = $\frac{2}{3}\pi r^3$

$= \frac{2}{3}\pi \times 0.7 \times 0.7 \times 0.7$

$= \frac{2}{3}\pi \times \frac{7}{10} \times \frac{7}{10} \times \frac{7}{10}$

$= \frac{686}{3000}\pi$

$= \frac{343}{1500}\pi$

$= 0.2286\ \pi m^3$ (approx)

(iii) (a) Total surface area of log of wood above the ground

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

$= 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 0.7 \times (1.4 + 0.7)$

$= \frac{44}{10} \times 2.1$

$= 9.24\ m^2$

Or

(iii) (b) volume of required part

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

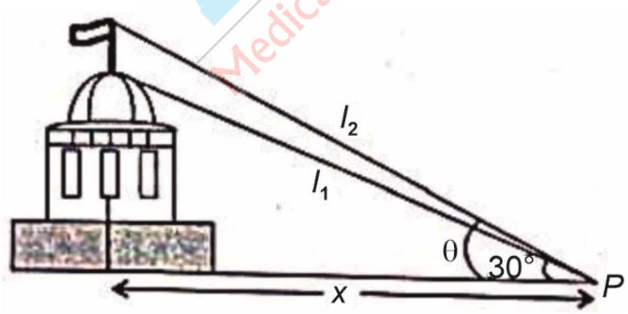
$= \pi r^2 \left(h - \frac{2}{3}r\right)$

$= \frac{22}{7} \times 0.7 \times 0.7 \times \left(1.4 - \frac{2}{3} \times 0.7\right)$

$= \frac{22}{7} \times 0.49 \times (1.4 - 0.467)$

$= 1.436\ m^3$ (approx)

38. A flagstaff, 7.32 m long is fitted at the top of 10 m tall building. The flagstaff is supported by the ropes which are tied to the point P on the ground which is x m away from the base of the building. It is given that l_1 is the length of rope from point P to the base of the flagstaff and l_2 is the length of rope from point P to the top of flagstaff. Rope l_1 makes an angle of 30° with the horizontal and θ be the angle which rope l_2 makes with the horizontal as shown in the figure.



Based on the above information, answer the following questions :

(Use $\sqrt{2} = 1.4$ and $\sqrt{3} = 1.732$)

(i) Find the value of x **[1]**

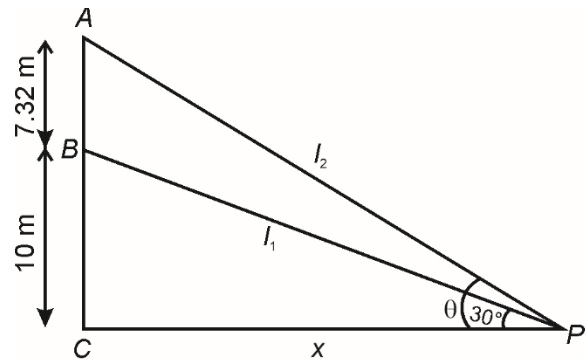
(ii) Find the measure of angle θ **[1]**

(iii) (a) Find the total length of ropes needed to support the flagstaff. **[2]**

OR

(iii) (b) Which rope is longer l_1 or l_2 and by how much? **[2]**

Sol. (i) In ΔBCP,



$$\tan 30° = \frac{BC}{CP}$$

$$\frac{1}{\sqrt{3}} = \frac{10}{x}$$

$$\therefore \quad x = 10\sqrt{3}$$

$$x = 10 \times 1.732$$

$$x = 17.32 \text{ m}$$ **[1]**

(ii) In ΔACP,

$$\tan\theta = \frac{AC}{CP}$$

$$= \frac{AB + BC}{x}$$

$$= \frac{7.32 + 10}{17.32}$$

$$\tan\theta = 1$$

$$\therefore \ \theta = 45°$$ **[1]**

(iii) as $\sin 30° = \frac{10}{l_1}$

$$\frac{1}{2} = \frac{10}{l_1}$$

$$l_1 = 20 \text{ m}$$ **[½]**

$$l_2 = \sqrt{(17.32)^2 + (17.32)^2}$$

$$= 17.32\sqrt{2}$$

$$= 17.32 \times 1.4$$

$$l_2 = 24.248 \text{ m}$$ **[1]**

Required length = $l_1 + l_2 = 20 \text{ m} + 24.248 \text{ m}$

$$= 44.248 \text{ m}$$

$$\approx 44.25 \text{ m}$$ **[½]**

(iii) (b)

$$\therefore \ l_2 - l_1 = 24.25 - 20$$

= 4.25 m **[1]**

$\therefore$ l_2 is larger by 4.25 m **[1]**

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