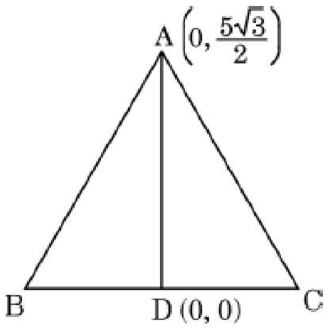
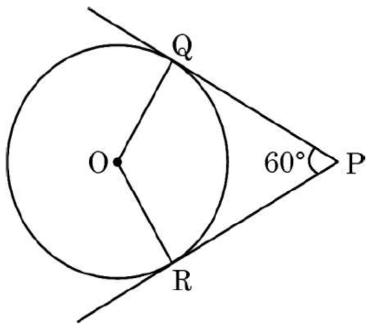
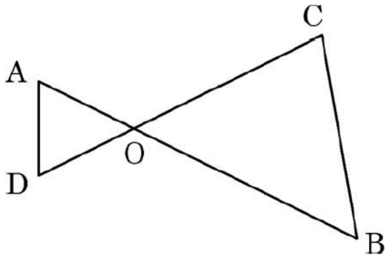
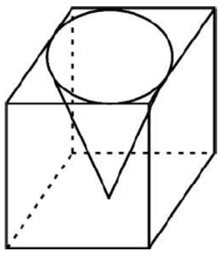
	Marking Scheme **Strictly Confidential** **(For Internal and Restricted use only)** **Secondary School Examination, 2026** **MATHEMATICS (STANDARD) (041) (PAPER CODE 30/3/3)**
<u>General Instructions: -</u>	
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the Spot Evaluation Guidelines carefully.
2.	**"Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, Evaluation done and several other aspects. It's leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in News Paper/Website etc. may invite action under various rules of the Board and BNS."**
3.	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and due marks be awarded to them. In Class-X, while evaluating the Competency-based questions, please try to understand given answer and even if reply is not from Marking Scheme but correct competency is enumerated by the candidate, due marks should be awarded.**
4.	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5.	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6.	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X" be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**
7.	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written on the left-hand margin and encircled. This may be followed strictly.
8.	If a question does not have any parts, marks must be awarded on the left-hand margin and encircled. This may also be followed strictly.

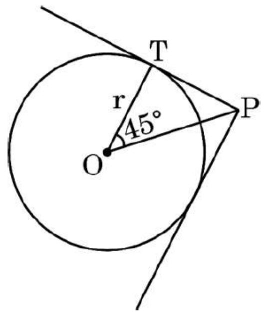
9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note **“Extra Question”**.
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks **0 to 80** (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.
12.	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
13.	Ensure that you do not make the following common types of errors committed by the Examiner in the past:- ● Leaving answer or part thereof unassessed in an answer book. ● Giving more marks for an answer than assigned to it. ● Wrong totalling of marks awarded to an answer. ● Wrong transfer of marks from the inside pages of the answer book to the title page. ● Wrong question wise totalling on the title page. ● Wrong totalling of marks of the two columns on the title page. ● Wrong grand total. ● Marks in words and figures not tallying/not same. ● Wrong transfer of marks from the answer book to Online Award List. ● Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) ● Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14.	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
15.	Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16.	The Examiners should acquaint themselves with the guidelines given in the “**Guidelines for spot Evaluation**” before starting the actual evaluation.
17.	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
18.	The candidates are entitled to obtain Photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/3/3)

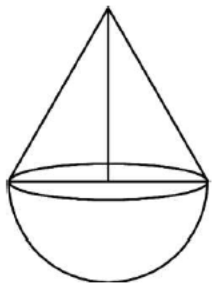
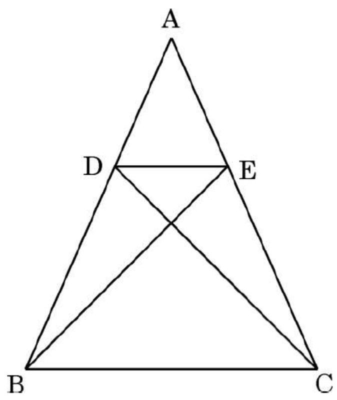
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Step	Marks
	SECTION A This section has **20** Multiple Choice Questions (MCQs) carrying 1 mark each.		
1.	The number of multiples of 6 lying between 25 and 363 is : (A) 56 (B) 56·5 (C) 57 (D) 58		
Sol.	(A) 56		**1**
2.	Two dice are rolled together. The probability that the sum of the numbers obtained is divisible by 6, is : (A) $\frac{1}{6}$ (B) $\frac{11}{36}$ (C) $\frac{1}{12}$ (D) $\frac{1}{4}$		
Sol.	(A) $\frac{1}{6}$		**1**
3.	In the given figure, Δ ABC is an equilateral triangle. AD is a median of the triangle joining the points $A\left(0, \frac{5\sqrt{3}}{2}\right)$, D(0, 0). Points B and C are (in same order) :  (A) (– 5, 0), (5, 0) (B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$ (C) (– 10, 0), (10, 0) (D) $(-5\sqrt{3}, 0), (5\sqrt{3}, 0)$		
Sol.	(B) $\left(-\frac{5}{2}, 0\right), \left(\frac{5}{2}, 0\right)$		**1**

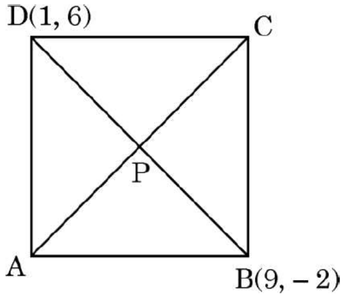
4.	The median and mode of a distribution are 25·2 and 26·1 respectively. The mean of the distribution is : (A) 24·75 (B) 24·25 (C) 24·3 (D) 25·5		
Sol.	(A) 24.75		**1**
5.	It is given that Δ ABC ~ Δ QRP such that AB = 9 cm, BC = 5 cm and PR = 2 cm. Length of side QR is : (A) 0·9 cm (B) $\frac{5}{18}$ cm (C) $\frac{10}{9}$ cm (D) 3·6 cm		
Sol.	(D) 3.6 cm		**1**
6.	A polynomial p(x), which has sum of its zeroes equal to their product, is : (A) $3x^2 + 2x + 2$ (B) $3x^2 - 2x - 3$ (C) $3x^2 - 2x + 2$ (D) $x^2 - 3x + 2$		
Sol.	(C) $3x^2 - 2x + 2$		**1**
7.	In the given figure, PQ and PR are tangents to a circle with centre O and radius 3 cm. If $\angle$ QPR = 60°, then the length of each tangent is :  (A) $3\sqrt{3}$ cm (B) 3 cm (C) 6 cm (D) $\sqrt{3}$ cm		
Sol.	(A) $3\sqrt{3}$ cm		**1**

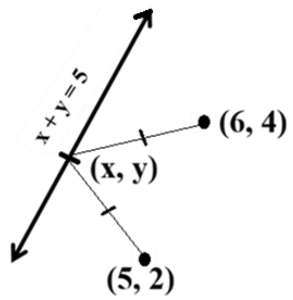
8.	In the given figure, OA × OB = OC × OD. Which of the following option is correct ?  (A) $\angle A = \angle C$ (B) $\angle A = \angle B$ (C) $\angle A = \angle D$ (D) $\Delta OAD \sim \Delta OBC$		
Sol.	(A) $\angle A = \angle C$		**1**
9.	The value of $(\frac{1}{2}\tan^2 45° - \cos^2 60°)$ is : (A) 0 (B) $-\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $-\frac{1}{4}$		
Sol.	(C) $\frac{1}{4}$		**1**
10.	A cone of maximum size is carved out from a solid cube of edge length l. The volume of the cone is :  (A) $\frac{\pi l^3}{12}$ (B) $\frac{\pi l^3}{3}$ (C) $l^3\left(1-\frac{\pi}{3}\right)$ (D) $\frac{\pi l^3}{8}$		
Sol.	(A) $\frac{\pi l^3}{12}$		**1**
11.	$(3 \times 11 \times 13 + 3)$ is : (A) a prime number (B) divisible by 13 (C) a composite number (D) an odd number		
Sol.	(C) a composite number		**1**

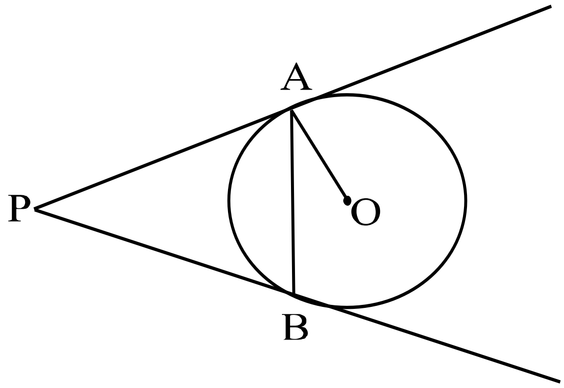
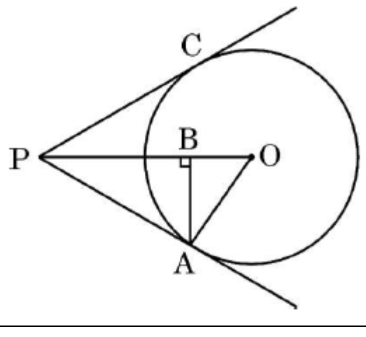
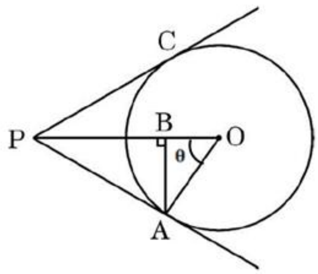
12.	Given that $\sin 2\alpha = \frac{\sqrt{3}}{2}$, the value of $\sin 3\alpha$ is : (A) $\frac{3\sqrt{3}}{4}$ (B) $\frac{1}{2}$ (C) 1 (D) $\frac{\sqrt{3}}{4}$		
Sol.	(C) 1		**1**
13.	If the length of the shadow of a tower is $\sqrt{3}$ times that of its height, then altitude of the Sun is : (A) 45° (B) 30° (C) 60° (D) 15°		
Sol.	(B) 30°		**1**
14.	Equation of a line coincident with $2\cdot5x - 2y = 3$ is : (A) $5x - 4y = 3$ (B) $5x - 4y + 6 = 0$ (C) $15x - 12y - 3 = 0$ (D) $5x - 4y - 6 = 0$		
Sol.	(D) $5x - 4y - 6 = 0$		**1**
15.	The n^{th} term of the A.P. $\frac{-1}{3}, \frac{2}{3}, \frac{5}{3}, \frac{8}{3}, \ldots$ is : (A) $3n - 4$ (B) $n - \frac{4}{3}$ (C) $\frac{n-2}{3}$ (D) $\frac{n-4}{3}$		
Sol.	(B) $n - \frac{4}{3}$		**1**
16.	In the given figure, PT is a tangent to the circle with centre O and radius r. If $\angle POT = 45°$, then the length of OP is :  (A) $r\sqrt{2}$ (B) $\sqrt{2r}$ (C) $2r$ (D) r^2		
Sol.	(A) $r\sqrt{2}$		**1**

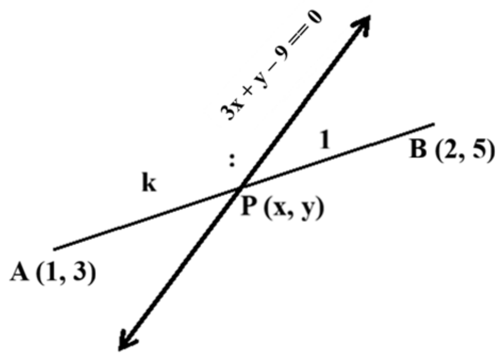
17.	The roots of the quadratic equation $(x-1)^2 = 16$ are : (A) 5, 3 (B) 4, – 4 (C) 5, – 3 (D) – 5, 3		
Sol.	(C) 5, – 3		**1**
18.	If the roots of the quadratic equation $\sqrt{3}\,x^2 - kx + 2\sqrt{3} = 0$ are real and equal, then the value(s) of k is/are : (A) $\pm\sqrt{24}$ (B) 0 (C) 4 (D) – 5		
Sol.	(A) $\pm\sqrt{24}$		**1**
	*Questions number **19** and **20** are Assertion and Reason based questions. Two statements are given, one labelled as 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 the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the 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) :* $\tan 2\theta$ is not defined at $\theta = 45°$. *Reason (R) :* $\sin 90° \neq \cos 90°$.		
Sol.	(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).		**1**
20.	*Assertion (A) :* Radius is the smallest distance of a tangent from the centre of the circle. *Reason (R) :* Radius is perpendicular to the tangent.		
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).		**1**

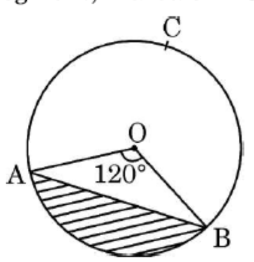
	SECTION B This section has **5** Very Short Answer (VSA) type questions carrying 2 marks each.		
21.	A toy is in the form of a cone mounted on a hemisphere of radius 7 cm. The total height of the toy is 31 cm. Find the total surface area of the toy. 		
Sol.	Height of conical part = 31 – 7 = 24 cm Slant height of conical part = $\sqrt{(7)^2 + (24)^2}$ = 25 cm TSA of the toy = CSA of conical part + CSA of hemispherical part $= \frac{22}{7} \times 7 \times 25 + 2 \times \frac{22}{7} \times 7 \times 7$ = 858 cm^2 So, the total surface area of the toy is 858 cm^2.	**I** **II** **III**	½ **1** ½
22.	In the given figure, Δ ABE ≅ Δ ACD. Prove that Δ ADE ~ Δ ABC.  		
Sol.	Given ΔABE ≅ Δ ACD ∴ AB = AC ⇒ $\frac{AB}{AC} = 1$ --- (i) and AE = AD ⇒ $\frac{AD}{AE} = 1$ --- (ii) From (i) and (ii), we get $\frac{AB}{AC} = \frac{AD}{AE} \Rightarrow \frac{AE}{AC} = \frac{AD}{AB}$ & ∠A = ∠A ∴ ΔADE ~ Δ ABC	$\left.\right\}$ **I** **II** **III**	$\left.\right\}$ **1** ½ ½

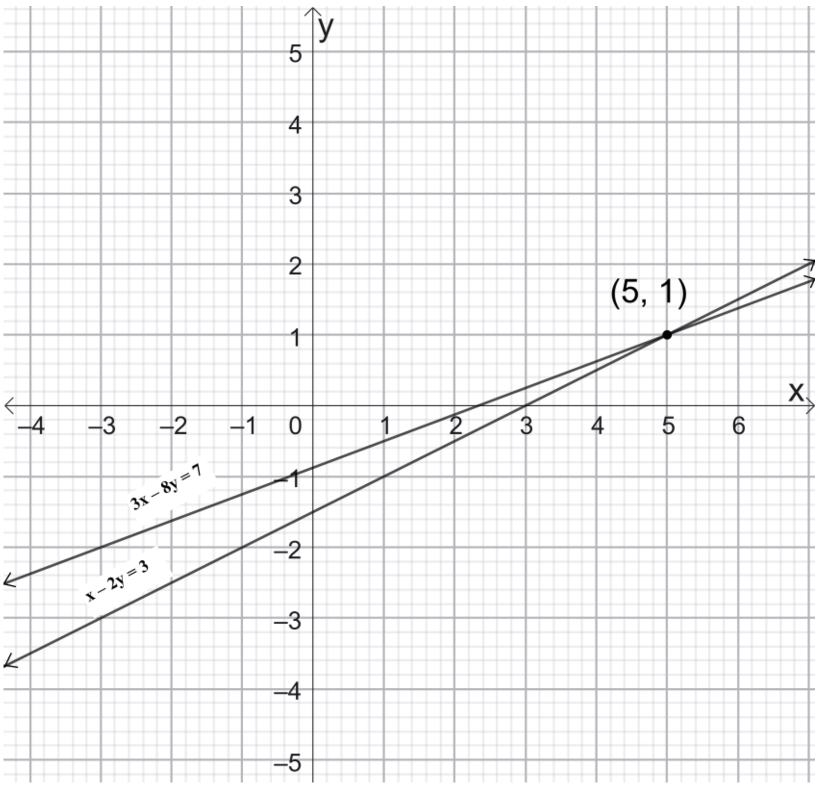
23 (a)	In an A.P., the first term is 4 and the last term is 31. If sum of all the terms is 175, find the number of terms and the common difference.		
Sol.	Here a = 4, l = 31 $S_n = 175$ $\Rightarrow \frac{n}{2}(4 + 31) = 175$ $\Rightarrow n = 10$ So, $a_{10} = 31$ $\Rightarrow 4 + 9d = 31$ $\Rightarrow d = 3$	 **I** **II** **III** **IV**	 ½ ½ ½ ½
	OR		
23 (b)	How many terms of the A.P. 21, 18, 15, …. must be added to get the sum zero ?		
Sol.	$d = 18 - 21 = -3$ $S_n = 0$ $\Rightarrow \frac{n}{2}[2 \times 21 + (n-1) \times (-3)] = 0$ $\Rightarrow n^2 - 15n = 0 \Rightarrow n(n-15) = 0$ $\Rightarrow n = 0, 15$ Since 'n' is a natural number. $\therefore n = 15$	**I** **II** **III**	½ **1** ½
24.	Find the length of the plank that can be used to measure the lengths 4 m 20 cm and 5 m 4 cm exactly, in the least time.		
Sol.	4 m 20 cm = 420 cm and 5 m 4 cm = 504 cm Size of plank should be maximum, so we will find HCF (420, 504) $420 = 2^2 \times 3 \times 5 \times 7$ and $504 = 2^3 \times 3^2 \times 7$ HCF (420, 504) = 84 $\therefore$ the required length of the plank is 84 cm	**I** **II** **III**	½ **1** ½
25 (a)	Diagonals AC and BD of square ABCD intersect at P. Coordinates of points B and D are (9, – 2) and (1, 6) respectively.  		

	(i) Find the co-ordinates of point P. (ii) Find the length of the side of the square.		
Sol.	(i) Coordinates of P are $\left(\frac{9+1}{2}, \frac{-2+6}{2}\right) = (5, 2)$ (ii) $2\ AB^2 = BD^2$ $\Rightarrow 2\ AB^2 = (9-1)^2 + (-2-6)^2$ $\Rightarrow AB = 8$ Hence, the length of the side of square is 8 units.	**I** **II** **III**	**1** ½ ½
	OR		
25 (b)	Find the coordinates of a point on the line x + y = 5 which is equidistant from (6, 4) and (5, 2).		
Sol.	 Let the required point be (x, y) which is equidistant from (6, 4) and (5, 2) $\therefore (6-x)^2 + (4-y)^2 = (5-x)^2 + (2-y)^2$ $\Rightarrow 2x + 4y = 23$ --- (i) Since point (x, y) also lies on the line x + y = 5 $\therefore x + y = 5$ --- (ii) Solving (i) and (ii), we get $x = -\frac{3}{2}$ and $y = \frac{13}{2}$ So, the coordinates of the required point are $\left(-\frac{3}{2}, \frac{13}{2}\right)$	**I** **II** **III**	**1** ½ ½
	SECTION C This section has **6** Short Answer (SA) type questions carrying 3 marks each.		
26.	Prove that $\sqrt{2}$ is an irrational number.		
Sol.	Let $\sqrt{2}$ be a rational number. $\therefore \sqrt{2} = \frac{p}{q}$, where $q \neq 0$ and p & q are coprime. $2q^2 = p^2 \Rightarrow p^2$ is divisible by 2 $\Rightarrow$ p is divisible by 2 ----- (i) Let $p = 2a$, where 'a' is some integer $4a^2 = 2q^2 \Rightarrow q^2 = 2a^2 \Rightarrow q^2$ is divisible by 2 $\Rightarrow$ q is divisible by 2 ----- (ii)	**I** **II** **III**	½ **1** **1**

	(i) and (ii) leads to contradiction as ‘p’ and ‘q’ are coprime. $\therefore \sqrt{2}$ is an irrational number.	**IV**	½
27 (a)	Two tangents PA and PB are drawn to a circle with centre O from an external point P. Prove that $\angle APB = 2\angle OAB$.		
Sol.	 Correct figure.	**I**	½
	$OA \perp AP$		
	$\therefore \angle PAB = 90° - \angle OAB$ --- (i)	**II**	½
	PA = PB		
	$\therefore \angle PAB = \angle PBA$		
	Hence, $\angle APB = 180° - 2\angle PAB$	**III**	**1**
	Using (i), $\angle APB = 180° - 2(90° - \angle OAB)$	**IV**	½
	$\Rightarrow \angle APB = 2\angle OAB$	**V**	½
	OR		
27 (b)	In the given figure, PA is the tangent to the circle with centre O such that OA = 10 cm, AB = 8 cm and $AB \perp OP$. Find the length of PB. 		
Sol.			

	In right angled ΔOBA, OB = $\sqrt{(10)^2-(8)^2}$ = 6 cm Let $\angle$AOB = θ So, tan θ = $\frac{8}{6}$ --- (i) In right angled ΔOAP $\frac{AP}{10}$ = tan θ $\therefore \frac{AP}{10} = \frac{8}{6}$ [using (i)] $\Rightarrow$ AP = $\frac{40}{3}$ cm $\therefore$ OP = $\sqrt{\left(\frac{40}{3}\right)^2+(10)^2} = \frac{50}{3}$ cm PB = OP – OB = $\frac{50}{3}$ – 6 = $\frac{32}{3}$ cm or 10.6 cm **Alternate solution:** In right angled ΔOBA, OB = $\sqrt{(10)^2-(8)^2}$ = 6 cm In right angled ΔPBA $PA^2 = PB^2 + (8)^2 = PB^2 + 64$ --- (i) In right angled ΔPAO $PA^2 = OP^2 - (10)^2 = (PB + 6)^2 - 100$ --- (ii) From (i) and (ii), we have $PB^2 + 64 = (PB + 6)^2 - 100 \Rightarrow PB = \frac{32}{3}$ cm or 10.6 cm	I II III IV V VI I II III IV	½ ½ ½ ½ ½ ½ ½ ½ 1 1
28.	Determine the ratio in which the line 3x + y – 9 = 0 divides the line segment joining the points (1, 3) and (2, 5). Find the point of intersection.		
Sol.	 Let the line 3x + y – 9 = 0 divides the line segment joining the points A (1, 3) and B (2, 5) in the ratio k : 1 at point P (x, y). $\therefore$ Coordinates of point P are $\left(\frac{2k+1}{k+1}, \frac{5k+3}{k+1}\right)$	I II	½ ½

	Since point P (x, y) lies on line 3x + y – 9 = 0,		
	$\therefore 3\left(\frac{2k+1}{k+1}\right) + \left(\frac{5k+3}{k+1}\right) - 9 = 0$	**III**	½
	$\Rightarrow k = \frac{3}{2}$		
	Therefore, the required ratio is 3 : 2.	**IV**	½
	Coordinates of P are $\left(\frac{1\times 2 + 2\times 3}{2+3}, \frac{3\times 2+5\times 3}{2+3}\right) = \left(\frac{8}{5}, \frac{21}{5}\right)$	**V**	**1**
29 (a)	If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that $\tan\theta + \cot\theta = 1$		
Sol.	$(\sin\theta + \cos\theta)^2 = (\sqrt{3})^2$	**I**	½
	$\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$		
	$\Rightarrow \sin\theta\cos\theta = 1$ --- (i)	**II**	**1**
	LHS = $\tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{\sin^2\theta+\cos^2\theta}{\cos\theta\sin\theta} = \frac{1}{\cos\theta\sin\theta}$	**III**	**1**
	= 1 [using (i)]	**IV**	½
	= RHS		
	OR		
29 (b)	Prove that : $(\sin A + \sec A)^2 + (\cos A + \operatorname{cosec} A)^2 = (1 + \sec A \operatorname{cosec} A)^2$		
Sol.	LHS = $\left(\sin A + \frac{1}{\cos A}\right)^2 + \left(\cos A + \frac{1}{\sin A}\right)^2$	**I**	½
	$= \sin^2 A + \frac{1}{\cos^2 A} + \frac{2\sin A}{\cos A} + \cos^2 A + \frac{1}{\sin^2 A} + \frac{2\cos A}{\sin A}$	**II**	**1**
	$= 1 + \left(\frac{1}{\sin^2 A} + \frac{1}{\cos^2 A}\right) + 2\left(\frac{\sin A}{\cos A} + \frac{\cos A}{\sin A}\right)$		
	$= 1 + \frac{1}{\cos^2 A\sin^2 A} + \frac{2}{\cos A\ \sin A}$	**III**	**1**
	$= 1 + \sec^2 A\operatorname{cosec}^2 A + 2\sec A\operatorname{cosec} A$		
	$= (1 + \sec A \operatorname{cosec} A)^2$ = RHS	**IV**	½
30.	In the given figure, chord AB subtends an angle of 120° at the centre of the circle with radius 7 cm. Find (i) perimeter of major sector OACB, and (ii) area of the shaded segment, if area of Δ OAB = 21·2 cm^2. 		
Sol.	(i) Perimeter of major sector = length of major arc ACB + 2 × radius		
	$= \frac{(360-120)}{360} \times 2 \times \frac{22}{7} \times 7 + 2 \times 7$	**I**	**1**
	$= \frac{130}{3}$ cm or 43.3 cm	**II**	½

	So, perimeter of major sector is $\frac{130}{3}$ cm or 43.3 cm (ii) Area of shaded segment = Area of minor sector – Area of ΔOAB $= \frac{120}{360} \times \frac{22}{7} \times 7 \times 7 - 21.2$ $= 30.1\ cm^2$ So, area of shaded segment is $30.1\ cm^2$.	 **III** **IV**	 **1** ½
31.	Find two consecutive negative integers, sum of whose squares is 481.		
Sol.	Let two consecutive negative integers be x and (x + 1) According to given statement, $x^2 + (x + 1)^2 = 481$ $\Rightarrow x^2 + x - 240 = 0$ $\Rightarrow (x + 16)(x - 15) = 0$ $\therefore x = -16$ or 15 x = 15 does not satisfy the given condition. So, required integers are – 16 and – 15.	 **I** **II** **III** **IV**	 **1** ½ **1** ½
	SECTION D This section has **4** Long Answer (LA) type questions carrying 5 marks each.		
32 (a)	Solve the following system of equations graphically : $x - 2y = 3, \ 3x - 8y = 7$		
Sol.	 Correct graph of equation x – 2y = 3	**I**	**2**

	Correct graph of equation 3x – 8y = 7 Correct solution x = 5 and y = 1	**II** **III**	**2** ½ + ½
	OR		
32 (b)	Five years ago, Adil was thrice as old as Bharat. Ten years later Adil shall be twice as old as Bharat. To know the present ages of Adil and Bharat : (i) form the linear equations representing the above information. (ii) show that the system of equations is consistent with unique solution. (iii) find the present ages of Adil and Bharat.		
Sol.	Let the present ages of Adil and Bharat be 'x' years and 'y' years respectively. (i) According to the given statements $(x - 5) = 3 \times (y - 5)$ $\Rightarrow x - 3y = -10$ --- 1 $(x + 10) = 2 \times (y + 10)$ $\Rightarrow x - 2y = 10$ --- 2 (ii) Here, $\frac{a_1}{a_2} = \frac{1}{1}, \frac{b_1}{b_2} = \frac{-3}{-2}$ or $\frac{3}{2}$ Since $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ Therefore, system of equations is consistent with unique solution. (iii) Solving equations 1 & 2, we get x = 50 and y = 20 Therefore, the present ages of Adil and Bharat are 50 years and 20 years respectively.	**I** **II** **III** **IV**	**1** **1** **1** **1 + 1**
33.	Find the mean and the mode of the following frequency distribution :		

Class	*Frequency*
0 – 15	9
15 – 30	15
30 – 45	35
45 – 60	20
60 – 75	11
75 – 90	13
90 – 105	17

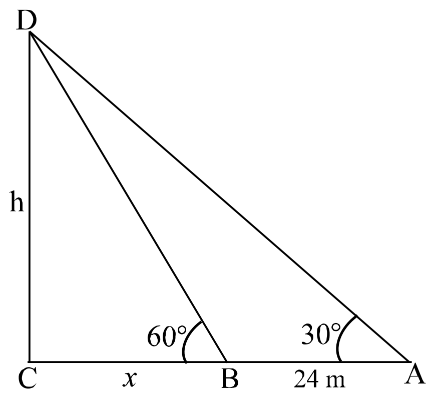
Sol.

Class	f_i	x_i	$u_i = \frac{x_i - 52.5}{15}$	f_iu_i
0 – 15	9	7.5	–3	–27
15 – 30	15	22.5	–2	–30
30 – 45	35	37.5	–1	–35
45 – 60	20	52.5	0	0
60 – 75	11	67.5	1	11
75 – 90	13	82.5	2	26
90 – 105	17	97.5	3	51
Total	**120**			**–4**

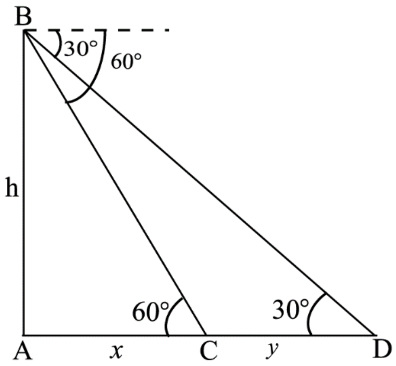
Correct table	**I**	**2**
Mean = 52.5 + $\frac{(-4)}{120}$ ×15 = 52	**II**	**1**
Modal class is 30 – 45.	**III**	½
Mode = 30 + $\left(\frac{35-15}{2\times 35 - 15 - 20}\right)$ ×15	**IV**	**1**
= 38.5 (approx.)	**V**	½

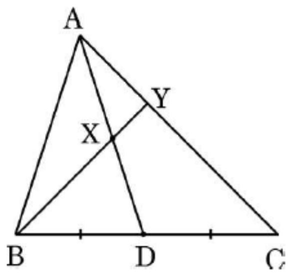
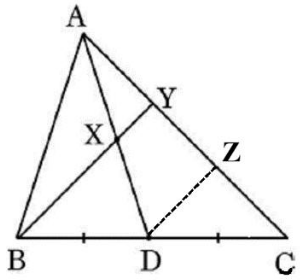
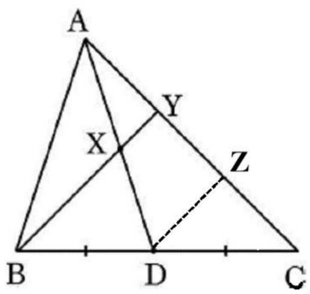
34 (a) The angle of elevation of the top of a building from a point A, on the ground, is 30°. On moving a distance of 24 m towards its base to the point B, the angle of elevation changes to 60°. Find the height of the building and distance of point A from the base of the building. (Take $\sqrt{3}$ = 1·73)

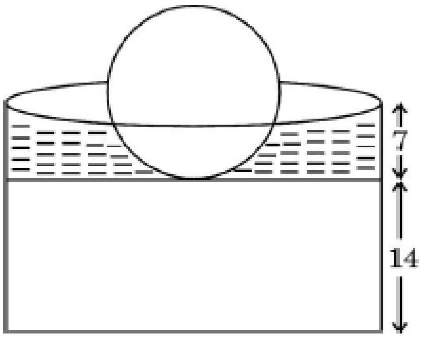
Sol.

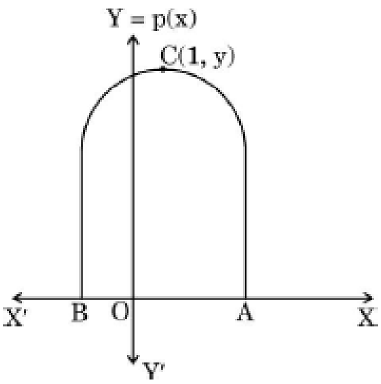


Correct figure	**I**	**1**
Let CD be the building of height ‘h’ m.		
In right angled Δ DCA		
$\frac{h}{x+24} = \tan 30° = \frac{1}{\sqrt{3}}$	**II**	**1**
⇒ x + 24 = h$\sqrt{3}$ --- (i)	**III**	½

	In right angled Δ DCB		
	$\frac{h}{x} = \tan 60° = \sqrt{3}$	**IV**	**1**
	⇒ h = $x\sqrt{3}$ --- (ii)	**V**	½
	Solving (i) and (ii), we get		
	x = 12 and h = $12\sqrt{3}$ = 12 × 1.73 = 20.76	**VI**	½
	∴ AC = 24 + 12 = 36	**VII**	½
	Hence, height of the building is 20.76 m and distance of point A from the base of the building is 36 m.		
	OR		
34 (b)	A tower stands vertically on the ground. A man standing at the top of the tower observes his friend at an angle of depression of 30°, who is approaching the foot of the tower with a uniform speed. 30 seconds later, the angle of depression changes to 60°. Find the time taken by his friend to reach the foot of the tower from this point.		
Sol.			
	Correct figure	**I**	**1**
	Let AB be the tower of height 'h' m.		
	In right angled Δ BAD		
	$\frac{h}{x+y} = \tan 30° = \frac{1}{\sqrt{3}}$	**II**	**1**
	⇒ h = $\frac{x+y}{\sqrt{3}}$ --- (i)	**III**	½
	In right angled Δ BAC		
	$\frac{h}{x} = \tan 60° = \sqrt{3}$	**IV**	**1**
	⇒ h = $x\sqrt{3}$ --- (ii)	**V**	½
	Using (i) and (ii),		
	$y = 2x$	**VI**	½
	Time taken to cover the distance y = 30 sec		
	∴ Time taken to cover the distance x = 30 × $\frac{x}{y}$ = 30 × $\frac{x}{2x}$ = 15	**VII**	½
	Hence, the required time taken is 15 seconds.		

35.	In Δ ABC, AD is a median. X is a point on AD such that AX : XD = 2 : 3. BX is extended so that it intersects AC at Y. Prove that BX = 4 XY. 		
Sol.			
	Draw DZ ∥ BY.	**I**	½
	In ΔCBY, DZ ∥ BY		
	$\therefore \frac{CD}{DB} = \frac{CZ}{ZY} = 1$	**II**	**1**
	Therefore, DZ = $\frac{1}{2}$ BY --- (i)	**III**	½
	In ΔADZ, DZ ∥ XY		
	So, Δ AXY ~ Δ ADZ		
	$\therefore \frac{AX}{AD} = \frac{XY}{DZ}$	**IV**	**1**
	$\Rightarrow \frac{2}{5} = \frac{XY}{DZ}$ or DZ = $\frac{5}{2}$ XY ---- (ii)	**V**	½
	Using (i) and (ii),		
	BY = 5 XY	**VI**	**1**
	Therefore BX = BY – XY = 4 XY	**VII**	½
	Alternate solution:		
			
	Draw DZ ∥ BY.	**I**	½
	Δ AXY ~ Δ ADZ	**II**	½
	$\therefore \frac{AX}{AD} = \frac{XY}{DZ} \Rightarrow \frac{2}{2+3} = \frac{XY}{DZ}$		

	$\Rightarrow$ 2 DZ = 5 XY --- (i)	**III**	**1**
	Now, Δ CDZ ~ Δ CBY		
	$\therefore \frac{CD}{CB} = \frac{DZ}{BY}$	**IV**	**½**
	But CD = $\frac{1}{2}$ BC		
	So, $\frac{DZ}{BY} = \frac{1}{2} \Rightarrow$ BY = 2 DZ --- (ii)	**V**	**1**
	From (i) and (ii), we get		
	BY = 5 XY	**VI**	**1**
	$\Rightarrow$ (BX + XY) = 5 XY		
	$\Rightarrow$ BX = 4 XY	**VII**	**½**
	SECTION E This section has **3** case study based questions carrying 4 marks each.		
36.	**Case Study – 1** A model of Leafy Ball Fountain is made to be kept on the tabletop. Water gently cascades down the ball into a decorative cylindrical pool where it is recycled. The diameter of spherical ball is 21 cm. Cylindrical pool – Outer diameter is 50 cm and inner diameter is 40 cm. Height of solid base is 14 cm. Height of water filled is 7 cm.   Observe the figure and answer the following questions : (i) Determine the total height of the fountain. (ii) Find the volume of the ball. (iii) (a) If one-third of the ball is submerged in the water, find the volume of the water filled in the pool. **OR** (iii) (b) Find the sum of the outer curved surface area of the cylindrical part and surface area of the ball.		
Sol.	(i) Total height of the fountain = 14 + 21 = 35 cm	**I**	**1**

	(ii) Volume of the ball = $\frac{4}{3} \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{21}{2}$	I	½
	= 4851 cm^3	II	½
	(iii) (a) Volume of water = Volume of inner upper part – $\frac{1}{3} \times$ Volume of the ball		
	$= \frac{22}{7} \times 20 \times 20 \times 7 - \frac{1}{3} \times 4851$	I	1
	= 7183 cm^3	II	1
	OR		
	(iii) (b) Required area = Outer CSA of cylinderical part + Surface area of the ball		
	$= 2 \times \frac{22}{7} \times 25 \times (14 + 7) + 4 \times \frac{22}{7} \times \frac{21}{2} \times \frac{21}{2}$	I	1
	= 4686 cm^2	II	1
37.	**Case Study – 2** During a theatre drama, a backdrop of building arches was used. The shape of the curve shown below can be represented by the polynomial p(x) = $-x^2 + 2x + 8$, where x is the length (in feet) on stage level.   Based on the figure given above, answer the following questions : (i) Determine the height of the arch. (ii) (a) Find zeroes of the polynomial p(x). Which points on the graph represent the zeroes ? **OR** (ii) (b) Find the span of the arch on the stage floor. (iii) Write the coordinates of the point of intersection of the above curve with the y-axis.		
Sol.	(i) p (1) = – (1)^2 + 2 × 1 + 8 = 9	I	1
	So, height of the arch is 9 feet.		

	(ii) (a) $p(x) = -x^2 + 2x + 8$		
	$= -(x-4)(x+2)$	**I**	**1**
	$\therefore$ zeroes are -2 and 4.	**II**	**½**
	Points B and A on the graph represent the zeroes.	**III**	**½**
	OR		
	(ii) (b) $p(x) = -x^2 + 2x + 8$		
	$= -(x-4)(x+2)$	**I**	**½**
	$\therefore$ zeroes are -2 and 4.	**II**	**½**
	Hence, Coordinates of point A and B are (4, 0) and (– 2, 0) respectively.		
	Span of the arch on the stage floor, $AB = 4 + 2 = 6$	**III**	**1**
	So, span of the arch on the stage floor is 6 feet.		
	(iii) $p(0) = -(0)^2 + 2 \times 0 + 8 = 8$	**I**	**½**
	$\therefore$ the given curve intersects y-axis at (0, 8)	**II**	**½**
38.	**Case Study – 3** A group of friends wanted to play cards with two identical packs together. While shuffling the cards, three cards are dropped. Rest of the cards are shuffled and one card is drawn at random. Assuming that the dropped cards were a queen of hearts, a ten of spades and an ace of clubs, answer the following questions :  (i) Find the probability that the drawn card is a face card. (ii) Find the probability that the drawn card is either a king or a queen. (iii) (a) Do you think that the probability of getting a queen was higher if none of the cards were dropped ? Justify your answer. **OR**		

	(iii) (b) Find the probability that the drawn card is a jack. Compare it with the probability when none of the cards were dropped. In which case is the probability of getting a jack higher ?		
Sol.	Total number of cards = $2 \times 52 - 3 = 101$		
	(i) P (a face card) = $\frac{23}{101}$	**I**	**1**
	(ii) P (either a king or a queen) = $\frac{15}{101}$	**I**	**1**
	(iii) (a)Yes	**I**	½
	P (a queen when no cards were dropped) = $\frac{8}{104}$	**II**	½
	P (a queen when cards were dropped) = $\frac{7}{101}$	**III**	½
	$\because \frac{8}{104} > \frac{7}{101}$ as $808 > 728$	**IV**	½
	So probability of getting a queen was higher if none of the cards were dropped.		
	OR		
	(iii) (b) P (a jack when cards were dropped) = $\frac{8}{101}$	**I**	½
	P (a jack when no cards were dropped) = $\frac{8}{104}$	**II**	½
	Since $\frac{8}{101} > \frac{8}{104}$ as $101 < 104$		
	Therefore probability of getting a jack is higher when 3 cards were dropped.	**III**	**1**