Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2025
MATHEMATICS (Standard) (Q.P. CODE 30/5/2)

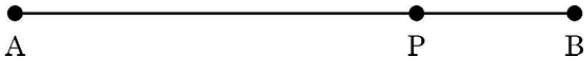
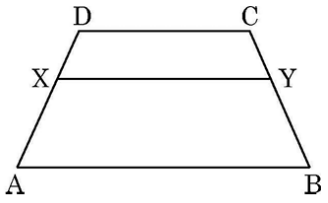
General Instructions: -

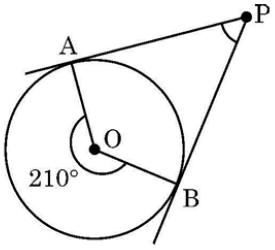
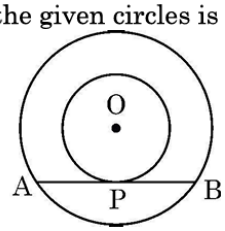
1.	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested 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 IPC."**
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.

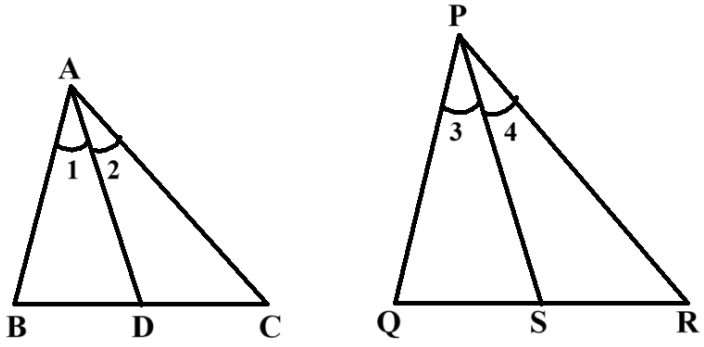
9.	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note "Extra Question".
10.	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11.	A full scale of marks _____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 un assessed 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.

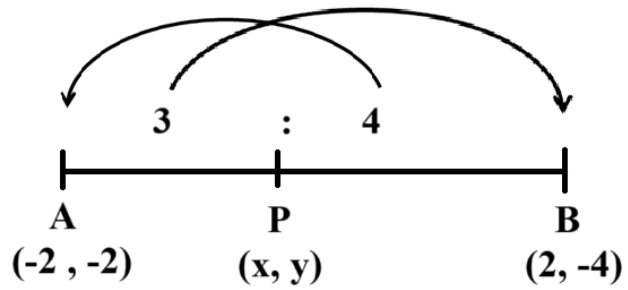
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/5/2)

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **This section consists of 20 multiple choice questions of 1 mark each.**	
1.	Following data shows the marks obtained by 100 students in a class test : **Marks obtained** | 20 | 29 | 28 | 33 | 42 | 38 | 43 | 25 **Number of students** | 6 | 28 | 24 | 15 | 2 | 4 | 1 | 20 The median will be the average of which two observations ? (A) 29 and 33 (B) 25 and 28 (C) 28 and 29 (D) 33 and 38	
Sol.	(C) 28 and 29	**1**
2.	The probability of getting a composite number greater than 3 on throwing a die is (A) $\frac{1}{6}$ (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$	
Sol.	(B) $\frac{1}{3}$	**1**
3.	$\left(\sqrt{3}+2\right)^2+\left(\sqrt{3}-2\right)^2$ is a/an (A) positive rational number (B) negative rational number (C) positive irrational number (D) negative irrational number	
Sol.	(A) positive rational number	**1**
4.	Let $a = p^2 q^3 r^n$ and $b = p^3 q^m r^2$, where p, q, r are prime numbers. If LCM of a and b is $p^3 q^4 r^3$, then the value of $3n - 2m$ is (A) –1 (B) 1 (C) 3 (D) –3	
Sol.	(B) 1	**1**
5.	For any prime number p, if p divides a^2, where a is any real number then p also divides (A) a (B) $a^{\frac{1}{2}}$ (C) $a^{\frac{3}{2}}$ (D) $a^{\frac{1}{8}}$	
Sol.	(A) a	**1**

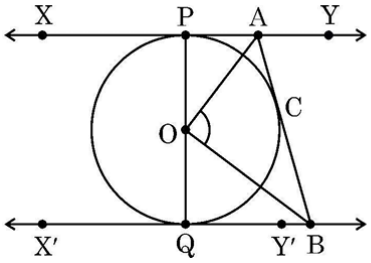
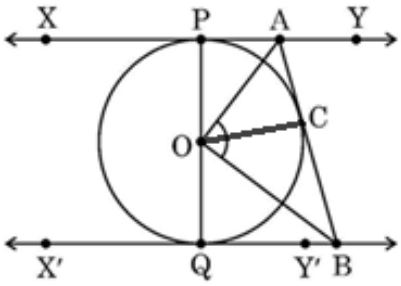
6.	The point P divides the line segment AB in the ratio 3 : 1 as shown below :  The value of $\frac{AB}{PB}$ is (A) 3 (B) $\frac{1}{4}$ (C) 4 (D) $\frac{1}{3}$	
Sol.	(C) 4	**1**
7.	If $x^2 + bx + b = 0$ has two real and distinct roots, then the value of b can be (A) 0 (B) 4 (C) 3 (D) –3	
Sol.	(D) – 3	**1**
8.	Which of the following equations is a quadratic equation ? (A) $x^3 = (x-1)^3 + 3x^2$ (B) $x^3 = (x+1)^3$ (C) $x^2 = \sqrt{x}$ (D) $x^2 + 1 = \frac{1}{x}$	
Sol.	(B) $x^3 = (x + 1)^3$	**1**
9.	A piggy bank contains ₹ 1 coins and ₹ 2 coins in the ratio 9 : 11 respectively. The piggy bank is accidently dropped and a coin pops out of it. The probability that it is a ₹ 2 coin is (A) $\frac{9}{11}$ (B) 0.45 (C) 0.55 (D) $\frac{1}{11}$	
Sol.	(C) 0.55	**1**
10.	Which of the following statements is false ? (A) Two right triangles are always similar. (B) Two squares are always similar. (C) Two equilateral triangles are always similar. (D) Two circles are always similar.	
Sol.	(A) Two right triangles are always similar.	**1**
11.	In the adjoining figure, ABCD is a trapezium in which XY $\|\|$ AB $\|\|$ CD. If $AX = \frac{2}{3}AD$, then CY : YB =  (A) 2 : 3 (B) 3 : 2 (C) 1 : 3 (D) 1 : 2	
Sol.	(D) 1 : 2	**1**

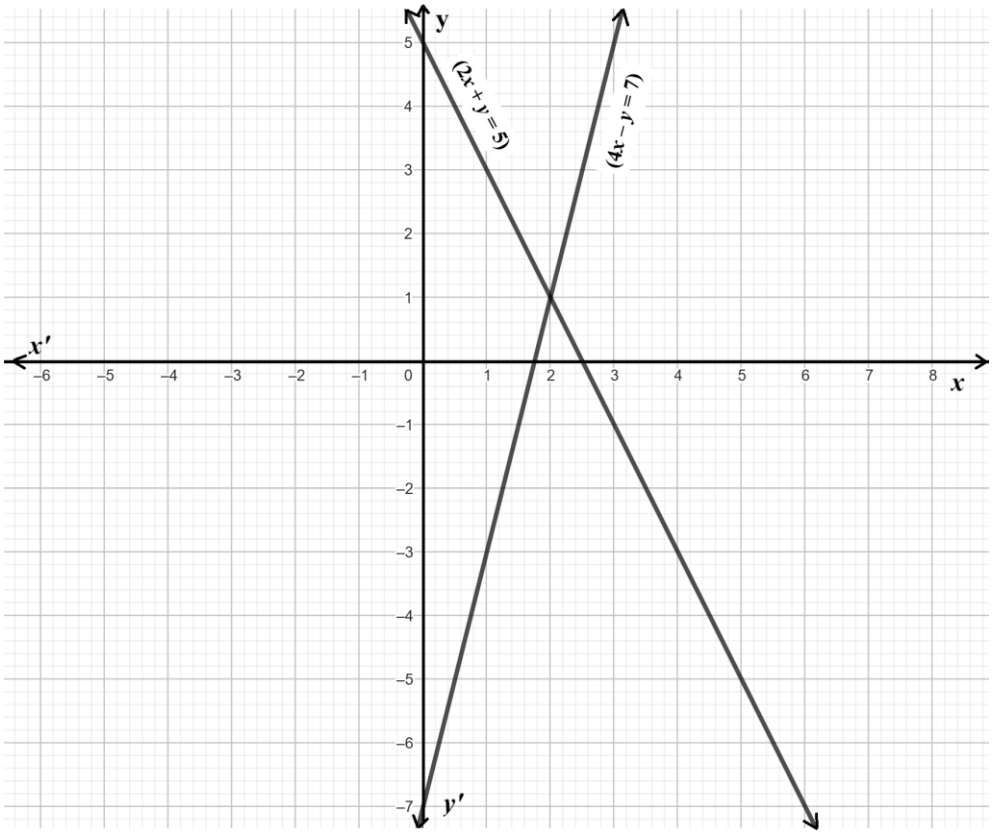
12.	The value of $\frac{2\tan 60^\circ}{1-\tan^2 60^\circ}$ is same as the value of (A) $-\tan 30^\circ$ (B) $-\tan 60^\circ$ (C) $2\sin 60^\circ$ (D) $2\cos 60^\circ$	
Sol.	(B) $-\tan 60°$	**1**
13.	Which of the following statements is false ? (A) Infinite number of tangents can be drawn to a circle. (B) Infinite number of tangents can be drawn to a circle from a point outside the circle. (C) Infinite number of secants can be drawn to a circle from a point outside the circle. (D) Angle between tangent and diameter at point of contact is 90°.	
Sol.	(B) Infinite number of tangents can be drawn to a circle from a point outside the circle.	**1**
14.	In the adjoining figure, PA and PB are tangents to a circle with centre O. The measure of angle APB is  (A) 210° (B) 150° (C) 105° (D) 30°	
Sol.	(D) 30°	**1**
15.	An observer 1.8 m tall stands away from a chimney at a distance of 38.2 m along the ground. The angle of elevation of top of chimney from the eyes of observer is 45°. The height of chimney above the ground is (A) 38.2 m (B) 36.4 m (C) 40 m (D) $(38.2)\sqrt{2}$ m	
Sol.	(C) 40 m	**1**
16.	In the adjoining figure, the sum of radii of two concentric circles is 16 cm. The length of chord AB which touches the inner circle at P is 16 cm. The difference of the radii of the given circles is  (A) 8 cm (B) 4 cm (C) 2 cm (D) 3 cm	
Sol.	(B) 4 cm	**1**

17.	A cone of height 12 cm and slant height 13 cm is surmounted on a hemisphere having radius equal to that of cone. The entire height of the solid is (A) 17 cm (B) 18 cm (C) 22 cm (D) 23 cm	
Sol.	(A) 17 cm	**1**
18.	If x median + y mean = z mode; is the empirical relationship between mean, median and mode, then the value of $x + y + z$ is (A) 6 (B) 3 (C) 2 (D) 1	
Sol.	(C) 2	**1**
	Directions : In Question Numbers **19** and **20**, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option from following : (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.	
19.	**Assertion (A) :** For an A.P., 3,6,9, …, 198, 10^{th} term from the end is 168. **Reason (R) :** If 'a' and 'l' are the first term and last term of an A.P. with common difference 'd', then n^{th} term from the end of the given A.P. is $l - (n - 1)\,d$.	
Sol.	(D) Assertion (A) is false, but Reason (R) is true.	**1**
20	**Assertion (A) :** For an acute angle θ, $\sec\theta = 3 \Rightarrow \tan\theta = 2\sqrt{2}$. **Reason (R) :** $\sec^2\theta = 1 - \tan^2\theta$ for all values of θ.	
Sol.	(C) Assertion (A) is true, but Reason (R) is false.	**1**
	SECTION B **This section has 5 very short answer type questions of 2 marks each.**	
21.	AD and PS are angle bisectors of $\angle A$ and $\angle P$ of triangles ABC and PQR. If $\Delta ABC \sim \Delta PQR$, prove that $\Delta ACD \sim \Delta PRS$.	
Sol.	Correct figure  Δ ABC ~ Δ PQR $\therefore \angle$ BAC = $\angle$ QPR $\Rightarrow \frac{1}{2}\angle$ BAC = $\frac{1}{2}\angle$ QPR $\Rightarrow \angle 2 = \angle 4$ and $\angle C = \angle R$ $\therefore \Delta$ ACD ~ Δ PRS	½ ½ ½ ½

22.	All the face cards are removed from the pack of 52 cards and a card is drawn at random from the remaining cards. Find the probability that the card so drawn is (i) a spade. (ii) not an ace.	
Sol.	Remaining cards = 52 – 12 = 40 (i) P (a spade) = $\frac{10}{40}$ or $\frac{1}{4}$ (ii) P (not an ace) = $\frac{36}{40}$ or $\frac{9}{10}$	**1** **1**
23 (a)	The cost of 2 kg apples and 1 kg of grapes on a day was found to be ₹ 320. The cost of 4 kg apples and 2 kg grapes was found to be ₹ 600. If cost of 1 kg of apples and 1 kg of grapes is ₹ x and ₹ y respectively, represent the given situation algebraically as a system of equations and check whether the system so obtained is consistent or not.	
Sol.	$2x + y = 320$ $4x + 2y = 600$ Here, $\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \frac{b_1}{b_2} = \frac{1}{2}, \frac{c_1}{c_2} = \frac{320}{600} = \frac{8}{15}$ As $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ ∴ System of equations is not consistent.	½ ½ ½ ½
	OR	
23 (b)	Solve for x and y : $\sqrt{2}\,x + \sqrt{3}\,y = 5$ and $\sqrt{3}\,x - \sqrt{8}\,y = -\sqrt{6}$	
Sol.	$(\sqrt{2}\,x + \sqrt{3}y = 5) \times \sqrt{3} \Rightarrow \sqrt{6}\,x + 3y = 5\sqrt{3}$ $(\sqrt{3}\,x - \sqrt{8}y = -\sqrt{6}) \times \sqrt{2} \Rightarrow \sqrt{6}\,x - 4y = -2\sqrt{3}$ Solving the equations, we get $x = \sqrt{2}$ and $y = \sqrt{3}$	½ ½ ½ + ½
24.	The coordinates of the end points of the line segment AB are A(–2, –2) and B(2, –4). P is the point on AB such that BP = $\frac{4}{7}$ AB. Find the coordinates of point P.	
Sol.	 P (x, y) divides AB in the ratio 3: 4 x = $\frac{3\times 2 + 4\times(-2)}{4+3} \Rightarrow x = -\frac{2}{7}$	 ½ ½

	$y = \frac{3\times(-4)+4\times(-2)}{4+3} \Rightarrow y = -\frac{20}{7}$	½
	$\therefore$ Coordinates of P are $\left(-\frac{2}{7}, -\frac{20}{7}\right)$	½
25 (a)	It is given that sin (A – B) = sin A cos B – cos A sin B. Use it to find the value of sin 15°.	
Sol.	sin 15° = sin (45° – 30°) = sin 45° cos 30° – cos 45° sin 30° $= \frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}} \times \frac{1}{2}$ $= \frac{\sqrt{3}-1}{2\sqrt{2}}$ or $\frac{\sqrt{6}-\sqrt{2}}{4}$	½ **1** ½
	OR	
25 (b)	If sin A = y, then express cos A and tan A in terms of y.	
Sol.	cos A = $\sqrt{1-\sin^2 A} = \sqrt{1-y^2}$ tan A = $\frac{\sin A}{\cos A} = \frac{y}{\sqrt{1-y^2}}$	**1** **1**
	SECTION C **This section has 6 short answer type questions of 3 marks each.**	
26 (a)	Prove the following trigonometric identity : $\frac{1+\text{cosec A}}{\text{cosec A}} = \frac{\cos^2 A}{1-\sin A}$	
Sol.	LHS = $\frac{1+\frac{1}{\sin A}}{\frac{1}{\sin A}}$ = sin A + 1 $= \frac{(\sin A+1)(1-\sin A)}{1-\sin A}$ $= \frac{1-\sin^2 A}{1-\sin A}$ $= \frac{\cos^2 A}{1-\sin A}$ = RHS	½ **1** ½ ½ ½
	OR	
26 (b)	Let 2A + B and A + 2B be acute angles such that sin(2A + B) = $\frac{\sqrt{3}}{2}$ and tan(A + 2B) = 1. Find the value of cot(4A – 7B).	
Sol.	sin (2A + B) = $\frac{\sqrt{3}}{2} \Rightarrow$ 2A + B = 60° --- ① tan (A + 2B) = 1 $\Rightarrow$ A + 2B = 45° --- ② Solving ① & ②, we get A = 25° and B = 10° cot (4A – 7B) = cot 30° = $\sqrt{3}$	½ ½ ½ + ½ ½ ½

27.	In the adjoining figure, XY and X′Y′ are parallel tangents to a circle with centre O. Another tangent AB touches the circle at C intersecting XY at A and X′Y′ at B. Prove that AB subtends right angle at the centre of the circle; or ∠AOB = 90°.  	
Sol.	Join OC.  	½
	ΔPOA ≅ ΔCOA	½
	∠POA = ∠COA	½
	Similarly, ∠QOB = ∠COB	½
	∠POA + ∠QOB + ∠COA + ∠COB = 180°	½
	⟹ 2 (∠COA + ∠COB) = 180°	
	⟹ ∠COA + ∠COB = 90°	
	∴ ∠AOB = 90°	½
28 (a)	Prove that $\sqrt{3}$ is an irrational number.	
Sol.	Let $\sqrt{3}$ be a rational number.	
	∴ $\sqrt{3} = \frac{p}{q}$, where q ≠ 0 and let p & q be coprimes.	½
	⟹ $3q^2 = p^2$	
	⟹ p^2 is divisible by 3.	
	⟹ p is divisible by 3. ----- ①	**1**
	Let p = 3a, where 'a' is some integer	
	∴ $9a^2 = 3q^2$	
	⟹ $q^2 = 3a^2$	
	⟹q^2 is divisible by 3	
	⟹ q is divisible by 3 ----- ②	**1**
	∴ 3 divides both p & q.	
	① and ② leads to contradiction as p and q are coprimes.	½
	Hence, $\sqrt{3}$ is an irrational number.	
	OR	

28 (b)	State true or false for each of the following statements and justify in each case : (i) $2 \times 3 \times 5 \times 7 + 7$ is a composite number. (ii) $2 \times 3 \times 5 \times 7 + 1$ is a composite number.	
Sol.	(i) True, $\because 2 \times 3 \times 5 \times 7 + 7 = 7 \times (2 \times 3 \times 5 + 1)$ has more than two factors. (ii) False, $\because 2 \times 3 \times 5 \times 7 + 1 = 211$ has only two factors.	**1** ½ **1** ½
29.	Obtain the zeroes of the polynomial $p(x) = 2x^2 - 5x - 3$. Hence, obtain a polynomial each of whose zeroes is one less than each of the zero of $p(x)$.	
Sol.	$p(x) = 2x^2 - 5x - 3$ $= (x - 3)(2x + 1)$ $\therefore$ Zeroes are 3, $-\frac{1}{2}$ New zeroes are 2, $-\frac{3}{2}$ Sum of new zeroes = $2 + \left(-\frac{3}{2}\right) = \frac{1}{2}$ Product of new zeroes = $2 \times \left(-\frac{3}{2}\right) = -3$ $\therefore$ Required polynomial is $x^2 - \frac{1}{2}x - 3$ or $2x^2 - x - 6$	**1** ½ ½ ½ ½
30	Solve the following system of equations graphically : $2x + y = 5$ and $4x - y = 7$. Hence, write the coordinates of the points where given lines meet y-axis.	
Sol.	Correct graph  	**2**

	Solution is (2, 1) or x = 2, y = 1 Given lines meet y-axis at (0, 5) and (0, – 7)	½ ½
31.	Find a relation between x and y such that P(x, y) is equidistant from the points A(3, 5) and B(7, 1). Hence, write the coordinates of the points on x-axis and y-axis which are equidistant from points A and B.	
Sol.	PA = PB $\Rightarrow$ $PA^2 = PB^2$ $(x-3)^2 + (y-5)^2 = (x-7)^2 + (y-1)^2$ $\Rightarrow x - y = 2$ ∴ Required point on x-axis is (2, 0) & required point on y-axis is (0, – 2)	½ **1** ½ ½ ½
	SECTION D **This section has 4 long answer questions of 5 marks each.**	
32	During a medical checkup, height of 35 students of a class were recorded as follows : **Height (in cm)** | 90-100 | 100-110 | 110-120 | 120-130 | 130-140 | 140-150 **Number of Students** | 3 | 2 | 4 | 5 | 14 | 7 Find the difference between the mean height and median height.	
Sol.		

Height (in cm)	Number of Students (f_i)	x_i	$u_i = \frac{x_i - 115}{10}$	$f_i u_i$	cf
90 – 100	3	95	– 2	– 6	3
100 – 110	2	105	– 1	– 2	5
110 – 120	4	115 = a	0	0	9
120 – 130	5	125	1	5	14
130 – 140	14	135	2	28	28
140 – 150	7	145	3	21	35
Total	35			46	

Correct table **1½**

Mean = $115 + \frac{46}{35} \times 10$ **1**

$= \frac{897}{7}$ or 128.14 approx. ½

∴ Mean height is $\frac{897}{7}$ cm or 128.14 cm approx.

Median Class is 130 – 140 ½

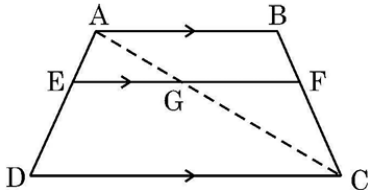
Median = $130 + \frac{\frac{35}{2} - 14}{14} \times 10$ ½

= 132.5 ½

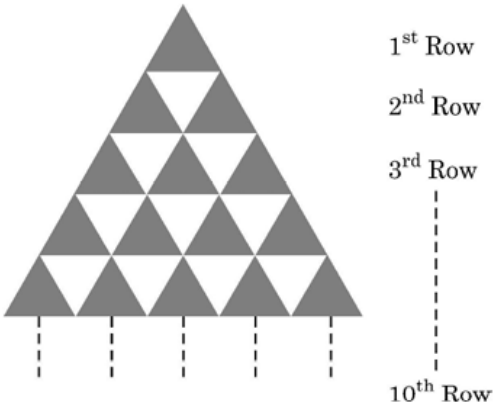
∴ Median height is 132.5 cm

Difference of mean height and median height = 132.5 – 128.14 = 4.36 cm ½

33 (a)	A 2-digit number is seven times the sum of its digits and two (2) more than 5 times the product of its digits. Find the number.	
Sol.	Let digit at unit place be x and digit at tens place be y ∴ Number = 10y + x ATQ	**1**

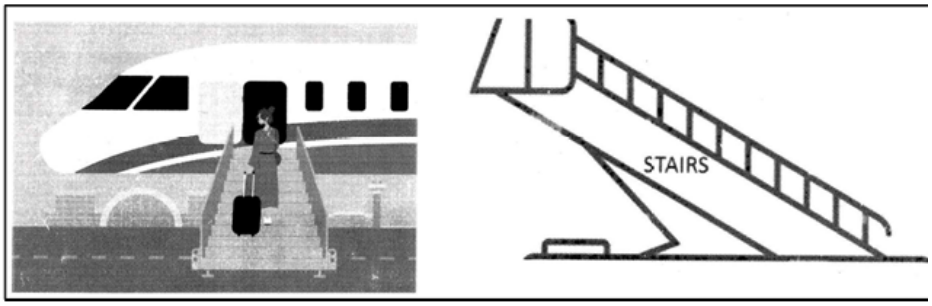
	$10y + x = 7(x + y)$ $\Rightarrow \quad 3y = 6x$ or $y = 2x$ --- ① Also, $10y + x = 5xy + 2$ --- ② from ① and ②, we get $10x^2 - 21x + 2 = 0$ $\Rightarrow \quad (x - 2)(10x - 1) = 0$ $\therefore x = 2$ So, $y = 4$ $\therefore$ Required number is 42.	**1** ½ **1** ½ ½ ½
	OR	
33 (b)	Find the value(s) of p for which the quadratic equation given as $(p + 4)\,x^2 - (p + 1)\,x + 1 = 0$ has real and equal roots. Also, find the roots of the equation(s) so obtained.	
Sol.	For real and equal roots, D = 0 $\therefore \quad [-(p + 1)]^2 - 4(p + 4) = 0$ $\Rightarrow p^2 - 2p - 15 = 0$ $\Rightarrow (p - 5)(p + 3) = 0$ $\therefore p = 5, -3$ For p = 5, $9x^2 - 6x + 1 = 0$ $\Rightarrow (3x - 1)(3x - 1) = 0$ $\therefore x = \frac{1}{3}, \frac{1}{3}$ For p = – 3, $x^2 + 2x + 1 = 0$ $\Rightarrow (x + 1)(x + 1) = 0$ $\therefore x = -1, -1$ Hence roots are $\frac{1}{3}, \frac{1}{3}$ and – 1, – 1 for p = 5 and p = – 3 respectively.	½ ½ **1** **1** **1** **1**
34.	State the converse of basic proportionality theorem. Also find $\frac{BF}{FC}$ in the following figure, given that AB ||DC ||EF and $\frac{AE}{ED} = \frac{2}{3}$. Also, find the length of EF if AB = 10 cm and DC = 15 cm.  	
Sol.	Correct statement of converse of Basic Proportionality Theorem. In Δ ADC, EG ‖ DC $\Rightarrow \frac{AE}{ED} = \frac{AG}{GC} = \frac{2}{3}$ In Δ ABC, GF ‖ AB $\Rightarrow \frac{AG}{GC} = \frac{BF}{FC} = \frac{2}{3}$ Δ AEG ~ Δ ADC	**1** **1** **1** ½

	$\Rightarrow \frac{AE}{AD} = \frac{AG}{AC} = \frac{EG}{DC}$ $\Rightarrow \frac{2}{5} = \frac{EG}{DC}$ $\Rightarrow EG = \frac{2}{5} \times 15 = 6$ cm Similarly, $\Delta CFG \sim \Delta CBA$ and $\frac{FC}{BF} = \frac{3}{2}$ $\Rightarrow \frac{FC}{BC} = \frac{GF}{AB} = \frac{3}{5}$ $\Rightarrow GF = \frac{3}{5} \times 10 = 6$ cm EF = EG + GF = 6 + 6 = 12 cm	½ ½ ½
35 (a)	From one of the faces of a solid wooden cube of side 14 cm, maximum number of hemispheres of diameter 1.4 cm are scooped out. Find the total number of hemispheres that can be scooped out. Also, find the total surface area of the remaining solid.	
Sol.	Total number of hemispheres = $\frac{14 \times 14}{1.4 \times 1.4}$ = 100 Total Surface Area of remaining solid = Surface Area of Cube + Curved Surface Area of 100 hemispheres – Area of 100 circles $= 6 \times 14 \times 14 + 100 \times 2 \times \frac{22}{7} \times 0.7 \times 0.7 - 100 \times \frac{22}{7} \times 0.7 \times 0.7$ = 1330 cm^2 ∴ Total surface area of remaining solid is 1330 cm^2.	**1** **1** **2** **1**
	OR	
35 (b)	From a solid cylinder of height 24 cm and radius 5 cm, two cones of height 12 cm and radius 5 cm are hollowed out. Find the volume and surface area of the remaining solid.	
Sol.	Volume of remaining solid = Volume of cylinder –Volume of two cones $= \frac{22}{7} \times 5 \times 5 \times 24 - 2 \times \frac{1}{3} \times \frac{22}{7} \times 5 \times 5 \times 12$ $= \frac{8800}{7}$ or 1257.14 cm^3 approx. $l = \sqrt{(12)^2 + (5)^2} = 13$ cm Surface Area of remaining solid = Curved Surface Area of cylinder + Curved Surface Area of two cones $= 2 \times \frac{22}{7} \times 5 \times 24 + 2 \times \frac{22}{7} \times 5 \times 13$ $= \frac{8140}{7}$ or 1162.85 cm^2 approx.	**1** **1** **1** **1** **1**

	SECTION E **This section has 3 case study based questions of 4 marks each.**	
36.	In an equilateral triangle of side 10 cm, equilateral triangles of side 1 cm are formed as shown in the figure below, such that there is one triangle in the first row, three triangles in the second row, five triangles in the third row and so on.  Based on given information, answer the following questions using Arithmetic Progression. (i) How many triangles will be there in bottom most row ? (ii) How many triangles will be there in fourth row from the bottom ? (iii) (a) Find the total number of triangles of side 1 cm each till 8th row. **OR** (iii) (b) How many more number of triangles are there from 5th row to 10th row than in first 4 rows ? Show working.	
Sol.	Given A.P. is 1, 3, 5, … (i) $a_{10} = 1 + 9 \times 2 = 19$ (ii) a_4 (from bottom) $= 19 + 3 \times (-2) = 13$ (iii) (a) $S_8 = \frac{8}{2} \times [2 \times 1 + 7 \times 2]$ $= 64$ **OR** (iii) (b) Number of triangles from 5th row to 10th row $= S_{10} - S_4$ $= \frac{10}{2} \times [2 \times 1 + 9 \times 2] - \frac{4}{2} \times [2 \times 1 + 3 \times 2]$ $= 84$ Number of triangles in first 4 rows, $S_4 = \frac{4}{2} \times [2 \times 1 + 3 \times 2]$ $= 16$ Required number of triangles $= 84 - 16 = 68$	**1** **1** **1** **1** **1** ½ ½

37.

Passenger boarding stairs, sometimes referred to as boarding ramps, stair cars or aircraft steps, provide a mobile means to travel between the aircraft doors and the ground. Larger aircraft have door sills 5 to 20 feet (1 foot = 30 cm) high. Stairs facilitate safe boarding and de-boarding.



An aircraft has a door sill at a height of 15 feet above the ground. A stair car is placed at a horizontal distance of 15 feet from the plane.

Based on given information, answer the questions given in part (i) and (ii).

(i) Find the angle at which stairs are inclined to reach the door sill 15 feet high above the ground.

(ii) Find the length of stairs used to reach the door sill.

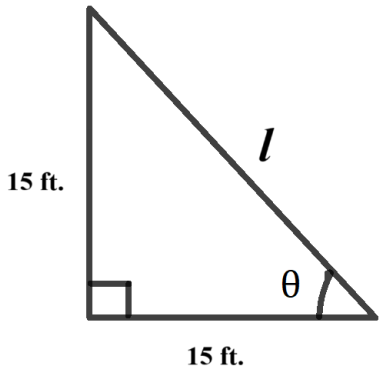
Further, answer any **one** of the following questions :

(iii) (a) If the 20 feet long stairs is inclined at an angle of 60° to reach the door sill, then find the height of the door sill above the ground. (use $\sqrt{3} = 1.732$)

OR

(iii) (b) What should be the shortest possible length of stairs to reach the door sill of the plane 20 feet above the ground, if the angle of elevation cannot exceed 30° ? Also, find the horizontal distance of base of stair car from the plane.

Sol.



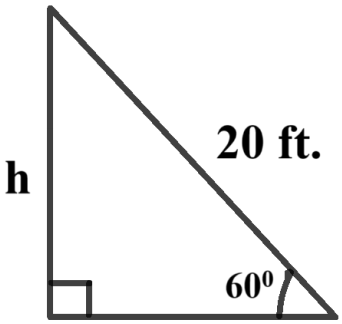
(i) $\tan\theta = \frac{15}{15} = 1$ ½

$\Rightarrow \theta = 45°$ ½

(ii) $\frac{15}{l} = \sin 45°$ ½

$\Rightarrow l = 15\sqrt{2}$ ft. or 21.21 ft. approx. ½

(iii) (a)



$\frac{h}{20} = \sin 60° = \frac{\sqrt{3}}{2}$ **1**

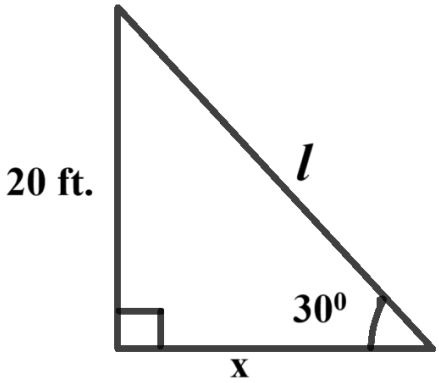
$\Rightarrow h = 10\sqrt{3}$ ½

$= 10 \times 1.732$

$= 17.32$ ft. ½

OR

(iii) (b)



$\frac{20}{l} = \sin 30° = \frac{1}{2}$ ½

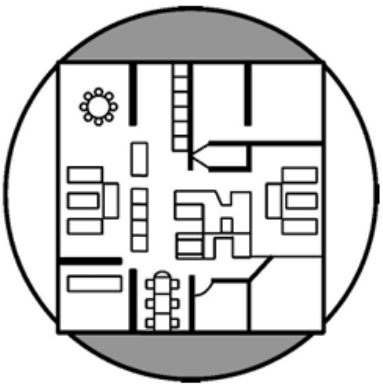
$\Rightarrow l = 40$ ft. ½

$\frac{20}{x} = \tan 30° = \frac{1}{\sqrt{3}}$ ½

$\Rightarrow x = 20\sqrt{3}$ ft. or 34.64 ft. approx. ½

38.

A farmer has a circular piece of land. He wishes to construct his house in the form of largest possible square within the land as shown below.



The radius of circular piece of land is 35 m.

Based on given information, answer the following questions :

(i) Find the length of wire needed to fence the entire land.

(ii) Find the length of each side of the square land on which house will be constructed.

(iii) (a) The farmer wishes to grow grass on the shaded region around the house. Find the cost of growing the grass at the rate of ₹ 50 per square metre.

OR

(iii) (b) Find the ratio of area of land on which house is built to remaining area of circular piece of land.

Sol.

(i) Length of wire = $2 \times \frac{22}{7} \times 35$ ½

= 220 m ½

(ii) Diagonal of square = 70 m ½

Length of each side of the square land = $\frac{70}{\sqrt{2}}$ or $35\sqrt{2}$ m ½

(iii) (a) Area on which grass is grown = Area of two segments

$= 2 \times \left[\frac{90}{360} \times \frac{22}{7} \times 35 \times 35 - \frac{1}{2} \times 35 \times 35\right]$ **1**

= 700 m^2 ½

Cost of growing the grass = 700 × 50 = ₹ 35000 ½

OR

(iii) (b) Required ratio = $\frac{\text{area of square}}{\text{area of circle} - \text{area of square}}$

$= \frac{35\sqrt{2} \times 35\sqrt{2}}{\frac{22}{7} \times 35 \times 35 - 35\sqrt{2} \times 35\sqrt{2}}$ **1½**

$= \frac{2450}{1400}$ or $\frac{7}{4}$ ½

∴ Required ratio is 7 : 4