Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Supplementary Examination, 2024
MATHEMATICS 041 PAPER CODE 30(B)/S

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 two 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	**In Q1-Q20, if a candidate attempts the question more than once (without cancelling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**

10	**<u>In Q21-Q38, 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".</u>**
11	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
12	A full scale of marks _____ (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.
13	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.
14	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 on 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.
15	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.
16	Any un assessed portion, non-carrying over of marks to the title page, or totalling 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.
17	The Examiners should acquaint themselves with the guidelines given in the "**Guidelines for spot Evaluation**" before starting the actual evaluation.
18	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.
19	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(B)/S)

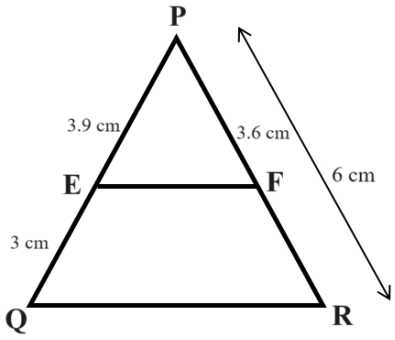
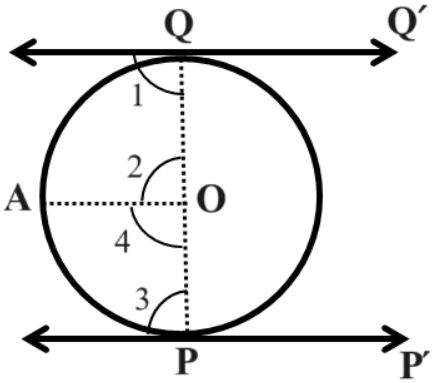
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **This section comprises Multiple Choice Questions (MCQs) 1 mark each.**	
1	If 5 times the 5^{th} term of an A.P. is equal to 9 times the 9^{th} term, then its 14^{th} term is : (A) 5 (B) 9 (C) 0 (D) 14	
Sol.	(C) 0	1
2	If the sum and the product of the roots of the quadratic equation $ax^2 + 6x + 4a = 0$ are equal, then 'a' is equal to : (A) $\frac{3}{2}$ (B) $-\frac{3}{2}$ (C) $\frac{2}{3}$ (D) $-\frac{2}{3}$	
Sol.	(B) $-\frac{3}{2}$	1
3	If the lines given by $3x + 2ky = 2$ and $2x + 5y = 1$ are parallel, then the value of k is : (A) $-\frac{5}{4}$ (B) $\frac{2}{5}$ (C) $\frac{15}{4}$ (D) $\frac{3}{2}$	
Sol.	(C) $\frac{15}{4}$	1

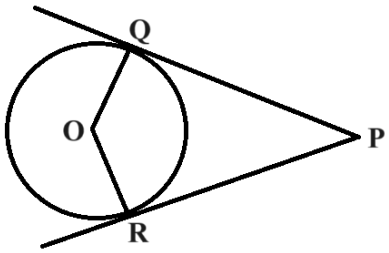
4	If α and β are the zeroes of the polynomial $2x^2 + 5x + 1$, then the value of $\alpha + \beta + 3\alpha\beta$ is : (A) -4 (B) $-\frac{3}{2}$ (C) 1 (D) -1	
Sol.	(D) – 1	1
5	If $a = 2^4 \times 3^3$, $b = 2^3 \times 3^2 \times 5$, $c = 3^n \times 5^2$ and LCM (a, b, c) = $(5^2 \times 3^4 \times 2^4)$, then n is : (A) 1 (B) 2 (C) 3 (D) 4	
Sol.	(D) 4	1
6	In the following frequency distribution : Height (in cm) : 120 – 125 | 125 – 130 | 130 – 135 | 135 – 140 | 140 – 145 Number of students : 17 | 12 | 13 | 8 | 10 the sum of the upper limit of the modal class and the lower limit of the median class is : (A) 250 (B) 255 (C) 260 (D) 245	
Sol.	(B) 255	1
7	If the median and mode of a frequency distribution are 26 and 29 respectively, then the mean is : (A) 27·5 (B) 24·5 (C) 28·4 (D) 25·8	
Sol.	(B) 24.5	1

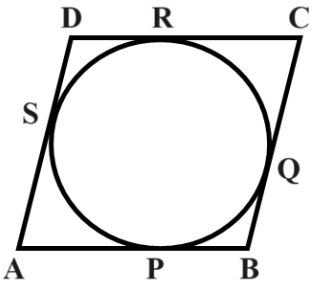
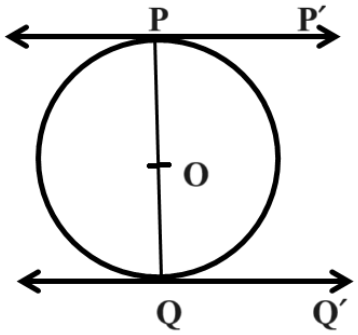
8	The probability for a leap year (selected at random) to have 52 Mondays and 53 Sundays is : (A) $\frac{1}{366}$ (B) $\frac{1}{52}$ (C) $\frac{2}{7}$ (D) $\frac{1}{7}$	
Sol.	(D) $\frac{1}{7}$	1
9	The probability that in a family of three children, there will be at least two boys, is : (A) $\frac{1}{8}$ (B) $\frac{7}{8}$ (C) $\frac{4}{8}$ (D) $\frac{6}{8}$	
Sol.	(C) $\frac{4}{8}$	1
10	A hemispherical bowl is made of steel of thickness 0·30 cm. The inner radius of the bowl is 3 cm. The volume of steel used (in cu cm) is : (A) 595·8 π (B) 5·958 π (C) 6 π (D) 59·58 π	
Sol.	(B) 5.958 π	1
11	A sector of a circle with central angle 120° and area $\frac{264}{7}$ sq cm is cut from a circle. The radius of the circle (in cm) is : (A) 6 (B) 5 (C) 7 (D) 12	
Sol.	(A) 6	1

12	If $\text{cosec}\,\theta = \sqrt{10}$, then the value of $\sec\,\theta$ is : (A) $\frac{3}{\sqrt{10}}$ (B) $\frac{\sqrt{10}}{3}$ (C) $\frac{1}{\sqrt{10}}$ (D) $\frac{2}{\sqrt{10}}$	
Sol.	(B) $\frac{\sqrt{10}}{3}$	1
13	$\frac{\sin^3 A + \cos^3 A}{\sin A + \cos A} + \sin A \cos A$ on simplification gives : (A) 1 (B) 2 (C) $1 + 2 \sin A \cos A$ (D) 0	
Sol.	(A) 1	1
14	The angle of depression of a car parked on the road from the top of a 75 m high tower is 30°. The distance of the car from the base of the tower is : (A) $75\sqrt{3}$ m (B) $50\sqrt{3}$ m (C) $25\sqrt{3}$ m (D) 75 m	
Sol.	(A) $75\sqrt{3}$ m	1
15	In two concentric circles with centre O, the radius of the outer circle is 50 cm. Chord AB of the outer circle is tangent to the inner circle at D. If length of AB is 96 cm, then the radius of the inner circle is : (A) 14 cm (B) 7 cm (C) 24 cm (D) 15 cm	
Sol.	(A) 14 cm	1
16	In two Δs ABC and PQR, if $\frac{AB}{QR} = \frac{BC}{QP} = \frac{AC}{PR}$, then (A) Δ PQR ~ Δ CAB (B) Δ PQR ~ Δ ABC (C) Δ PQR ~ Δ CBA (D) Δ PQR ~ Δ BCA	
Sol.	(C) $\Delta PQR \sim \Delta CBA$	1

17	In a Δ ABC, a line DE is drawn parallel to BC to intersect AB at D and AC at E. If AD = 2 cm, BD = 3 cm and DE = 4 cm, then the length of BC (in cm) is : (A) 6 (B) 10 (C) $\frac{8}{3}$ (D) $\frac{20}{3}$	
Sol.	(B) 10	1
18	The points (– 2, – 2), (6, – 2) and (2, 1) are the vertices of : (A) a right angled triangle (B) an isosceles triangle (C) an isosceles right triangle (D) a scalene triangle	
Sol.	(B) an isosceles triangle	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 Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of 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) :* Two cubes each with 12 cm edge are joined end to end. The surface area of the resulting cuboid = 2 × (surface area of one cube). *Reason (R) :* The surface area of a cuboid = 2 (lb + bh + hl), where l, b, h respectively are its length, breadth and height.	
Sol.	(D) Assertion (A) is false, but Reason (R) is true.	1
20	*Assertion (A) :* The eighth term of the A.P. $\frac{1}{m}, \frac{1+2m}{m}, \frac{1+4m}{m}, \ldots$ is $\frac{1+14m}{m}$. *Reason (R) :* The n^{th} term of A.P. $(a_n) = a + (n-1)\,d$.	
Sol.	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).	1

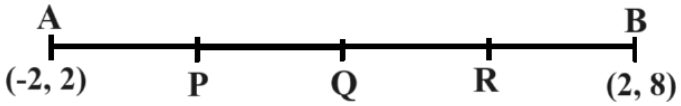
	SECTION B **This section comprises of Very Short Answer (VSA) type questions of 2 marks each.**	
21	E and F are points on the sides PQ and PR respectively of a Δ PQR. If PE = 3·9 cm, EQ = 3 cm, PF = 3·6 cm and PR = 6 cm, find whether EF $\|\|$ QR.	
Sol.	 FR = 6 – 3.6 = 2.4 cm $\frac{PE}{EQ} = \frac{3.9}{3} = 1.3$ and $\frac{PF}{FR} = \frac{3.6}{2.4} = 1.5$ Since $\frac{PE}{EQ} \neq \frac{PF}{FR}$, therefore EF $\nparallel$ QR.	½ ½ + ½ ½
22(a)	Prove that the line segment joining the points of contact of two parallel tangents to a circle passes through its centre.	
Sol.	 QQ′ $\|\|$ PP′ Let P and Q be the points of contact and O is the centre of the circle. Join OP and OQ. Draw OA $\|\|$ QQ′. $\because$ QQ′ $\perp$ OQ $\Rightarrow \angle 1 = 90° \Rightarrow \angle 2 = 90°$ ------ (i) Since OQ′ $\|\|$ PP′ $\therefore$ OA $\|\|$ PP′ and hence $\angle 4 = 90°$ ------ (ii) Adding (i) and (ii), $\angle 2 + \angle 4 = 180°$ or $\angle POQ = 180°$ $\therefore$ POQ is a straight line.	½ ½ ½ ½
	OR	

22(b)	Two tangents PQ and PR are drawn from an external point P to a circle with centre O. Prove that QORP is a cyclic quadrilateral.	
Sol.	 PQ ⊥ OQ ⟹ ∠PQO = 90° and PR ⊥ OR ⟹ ∠PRO = 90° ∴ ∠PQO + ∠PRO = 180° Since opposite angles of quadrilateral QORP are supplementary, therefore QORP is a cyclic quadrilateral.	½ ½ 1
23	If 12 cosec A = 13, then find the value of $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A}$.	
Sol.	$\sin A = \frac{12}{13} \Longrightarrow \cos A = \frac{5}{13}$ Hence $\frac{2\sin A - 3\cos A}{4\sin A - 9\cos A} = \frac{2\times\frac{12}{13} - 3\times\frac{5}{13}}{4\times\frac{12}{13} - 9\times\frac{5}{13}} = 3$	1 1
24	The length of the minute hand of a wall clock is 21 cm. Find the area swept by the minute hand in 45 minutes.	
Sol.	Angle swept by minute hand in 45 minutes = 270° Length of minute hand (r) = 21 cm ∴ Area swept = $\frac{270}{360} \times \frac{22}{7} \times 21 \times 21$ = 1039.5 Therefore, area swept by the minute hand in 45 minutes is 1039.5 cm^2.	½ 1 ½
25(a)	Find whether each of the following is an irrational number or a rational number. (i) $(\sqrt{5}-\sqrt{3})^2$ (ii) $(5+\sqrt{3})(5-\sqrt{3})$	
Sol.	(i) $(\sqrt{5}-\sqrt{3})^2 = 8 - 2\sqrt{15}$ So, $(\sqrt{5}-\sqrt{3})^2$ is an irrational number. (ii) $(5+\sqrt{3})(5-\sqrt{3}) = 25 - 3 = 22$ So, $(5+\sqrt{3})(5-\sqrt{3})$ is a rational number.	1 1
	OR	

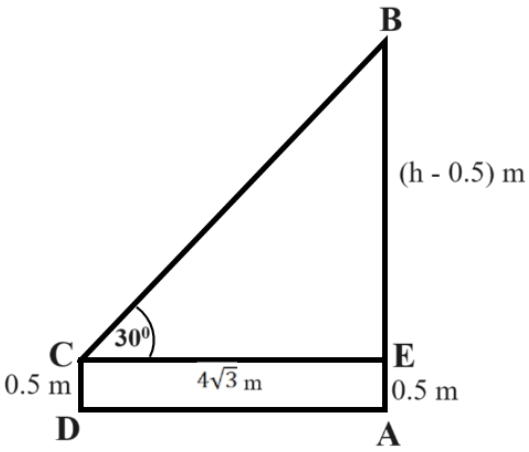
25(b)	Find the smallest 4-digit number exactly divisible by 15, 24 and 36.	
Sol.	LCM (15, 24, 36) = 360 Therefore, the smallest 4-digit number which is a multiple of 360 is 360 × 3 = 1080 which is divisible by 15, 24 & 36.	1 1
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	
26(a)	Prove that the parallelogram circumscribing a circle is a rhombus.	
Sol.	 Here AP = AS, BP = BQ, CR = CQ, DR = DS ∴ AB + CD = AP + BP + CR + DR = AS + BQ + CQ + DS = (AS + DS) + (BQ + CQ) = AD + BC ⟹ 2AB = 2 AD (∵ AB = CD, BC = AD) ⟹ AB = AD or ABCD is a rhombus.	1 1 ½ ½
	OR	
26(b)	Prove that the tangents drawn at the ends of a diameter of a circle are parallel.	
Sol.	 PQ is diameter of the circle. Therefore ∠P′PQ = ∠Q′QP = 90° ⟹ ∠P′PQ + ∠Q′QP = 180° ⟹ PP′ ‖ QQ′	 1 1 1

27	Places A and B are 160 km apart on a highway. One car starts from A and another from B at the same time. If the cars travel in the same direction at different speeds, they meet in 4 hours. If they travel towards each other, they meet in 1 hour 36 minutes. What are the speeds of the two cars ?	
Sol.	Let the speed of two cars be x km/h & y km/h respectively ($x > y$). Therefore $4x - 4y = 160$ or $x - y = 40$ ---- (i) 1 hour 36 minutes = 1.6 hours $\therefore 1.6x + 1.6y = 160$ or $x + y = 100$ --- (ii) Solving (i) and (ii), we have $x = 70$ and $y = 30$ $\therefore$ speed of two cars are 70 km/h and 30 km/h respectively.	1 1 1
28(a)	If α and β are the zeroes of the quadratic polynomial $f(x) = 6x^2 + 11x - 10$, find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$.	
Sol.	$f(x) = 6x^2 + 11x - 10$ $\alpha + \beta = -\frac{11}{6}$ and $\alpha\beta = -\frac{10}{6}$ $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta}$ $\therefore \frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\left(-\frac{11}{6}\right)^2 - 2\left(-\frac{10}{6}\right)}{\left(-\frac{10}{6}\right)}$ $= -\frac{241}{60}$	1 1 1
	OR	
28(b)	Find the zeroes of the polynomial $2t^2 - 9t - 45$ and verify the relationship between the zeroes and the coefficients of the polynomial.	
Sol.	$2t^2 - 9t - 45 = 2t^2 - 15t + 6t - 45$ $= (2t - 15)(t + 3)$ $\therefore$ zeroes of the polynomial are $\frac{15}{2}$ and -3. Sum of the zeroes = $\frac{15}{2} + (-3) = \frac{9}{2} = \frac{-(\text{coefficient of } t)}{\text{coefficient of } t^2}$ Product of the zeroes = $\frac{15}{2} \times (-3) = -\frac{45}{2} = \frac{\text{constant term}}{\text{coefficient of } t^2}$	 1 1 ½ ½
29	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{a}{b}$, where a, b are coprime and $b \neq 0$. $\Rightarrow a^2 = 5b^2 \Rightarrow a^2$ is divisible by 5. $\Rightarrow$ a is divisible by 5. ----- (i)	 ½ 1

	Let a = 5m, where 'm' is any natural number. $\Rightarrow b^2 = 5m^2 \Rightarrow b^2$ is divisible by 5. $\Rightarrow$ b is divisible by 5. ----- (ii) From (i) and (ii), a and b have common factors which is contrary to our assumption. Hence, $\sqrt{5}$ is an irrational number.	1 ½
30	Prove that $\sqrt{\sec^2 A + \text{cosec}^2 A} = \tan A + \cot A$.	
Sol.	L.H.S. = $\sqrt{(1 + \tan^2 A) + (1 + \cot^2 A)}$ $= \sqrt{\tan^2 A + \cot^2 A + 2}$ $= \sqrt{(\tan A + \cot A)^2}$ $= (\tan A + \cot A)$ = R.H.S.	1 ½ 1 ½
31	The table below shows the daily expenditure on food of 25 households in a locality : Daily expenditure (in ₹) : | 200 – 250 | 250 – 300 | 300 – 350 | 350 – 400 | 400 – 450 Number of households : | 4 | 5 | 12 | 2 | 2 Find the mean daily expenditure on food.	
Sol.	Daily expenditure (in ₹) | Number of households (f_i) | x_i | $u_i = \frac{x_i - 325}{50}$ | $f_i u_i$ 200 – 250 | 4 | 225 | – 2 | – 8 250 – 300 | 5 | 275 | – 1 | – 5 300 – 350 | 12 | 325 = a | 0 | 0 350 – 400 | 2 | 375 | 1 | 2 400 – 450 | 2 | 425 | 2 | 4 Total | 25 | | | – 7 Correct table Mean = $325 + \frac{(-7)}{25} \times 50$ $= 311$ Therefore, the mean daily expenditure on food is ₹ 311.	1½ 1 ½

	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	
32(a)	Some students planned a picnic. The total budget for food was ₹ 500, but 5 of them failed to go and thus the cost of food for each student increased by ₹ 5. How many students attended the picnic ?	
Sol.	Let number of students who attended picnic be x. A.T.Q. $\frac{500}{x} - \frac{500}{x+5} = 5$ $\Rightarrow x^2 + 5x - 500 = 0$ $\Rightarrow (x + 25)(x - 20) = 0$ $\Rightarrow x = -25, x = 20$ But number of students can't be negative. Hence, $x = 20$ Therefore, number of students who attended picnic is 20.	 2 1 1 1
	OR	
32(b)	Find the value of p if the equation $(2p+1)x^2 - (7p+2)x + 7p - 3 = 0$ has real and equal roots.	
Sol.	Given equation has real and equal roots if $\{-(7p + 2)\}^2 - 4(2p + 1)(7p - 3) = 0$ $\Rightarrow 7p^2 - 24p - 16 = 0$ $\Rightarrow (7p + 4)(p - 4) = 0$ $\Rightarrow p = -\frac{4}{7}, p = 4$	 2 1 1 1
33	Find the coordinates of the points which divide the line segment joining A (– 2, 2) and B (2, 8) into four equal parts.	
Sol.	Let points P, Q and R divide the line segment joining A (– 2, 2) and B (2, 8) into four equal parts.  ∴ P divides AB in the ratio 1 : 3 or AP : PB = 1 : 3 So, coordinates of P = $\left(\frac{1\times 2+3\times(-2)}{1+3}, \frac{1\times 8+3\times 2}{1+3}\right) = \left(-1, \frac{7}{2}\right)$ ∴ Q divides AB in the ratio 1 : 1 or AQ : QB = 1 : 1 So, coordinates of P = $\left(\frac{1\times 2+1\times(-2)}{1+1}, \frac{1\times 8+1\times 2}{1+1}\right) = (0, 5)$ ∴ R divides AB in the ratio 3 : 1 or AR : RB = 3 : 1 So, coordinates of P = $\left(\frac{3\times 2+1\times(-2)}{3+1}, \frac{3\times 8+1\times 2}{3+1}\right) = \left(1, \frac{13}{2}\right)$	½ 1½ 1½ 1½
34	If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, then prove that the other two sides are divided in the same ratio.	
Sol.	Correct given, to prove. Correct proof.	2 3

35(a)	A solid is in the form of a right circular cylinder with hemispherical ends. The total height of the solid is 58 cm and the diameter of the cylinder is 28 cm. Find the total surface area of the solid.	
Sol.	Height of cylindrical part = 58 – 14 – 14 = 30 cm Radius of cylindrical as well as hemispherical parts = 14 cm TSA of the solid = $4 \times \frac{22}{7} \times (14)^2 + 2 \times \frac{22}{7} \times 14 \times 30$ = 5104 cm^2 Therefore, total surface area of the solid is 5104 cm^2.	1 ½ 2 1½
	OR	
35(b)	From a solid cylinder of height 36 cm and diameter 14 cm, a conical cavity of radius 7 cm and height 24 cm is drilled out. Find the volume of the remaining solid.	
Sol.	Radius of cylinder = 7 cm Volume of the remaining solid = $\frac{22}{7} \times (7)^2 \times 36 - \frac{1}{3} \times \frac{22}{7} \times (7)^2 \times 24$ = 5544 – 1232 = 4312 cm^3 Therefore, volume of the remaining solid is 4312 cm^3.	½ 1½+1½ ½ + ½ ½
	SECTION E **This section comprises of 3 case study based questions of 4 marks each.**	
36	**Case Study – 1** Hari wants to participate in a 200 m race. He can currently run that distance in 51 seconds, and with each day of practice, he hopes to take 2 seconds less than the previous day. He wants to do it in 31 seconds. Based on the above information, answer the following questions : (i) Write the A.P. which represents the above situation. (ii) Find the minimum number of days he needs to practice to achieve the goal. (iii) (a) Find the expression for the n^{th} term of the A.P. **OR** (b) If he wants to do it in 21 seconds, how many minimum days will he take ?	
Sol.	(i) 51, 49, 47, 45, …, 31 (ii) Here a = 51 & d = – 2 31 = 51 + (n – 1) (– 2) $\Rightarrow$ n = 11 So, minimum 11 days he need to practice to achieve the goal.	1 ½ ½

	(iii) (a) $a_n = 51 + (n - 1)(-2)$ $\Rightarrow a_n = 53 - 2n$ **OR** (b) $21 = 51 + (n - 1)(-2)$ $\Rightarrow n = 16$ So, minimum 16 days he need to practice to achieve the goal.	1 1 1 1
37	**Case Study – 2** A class VI student went to a park and went up the slide to play. The angle of elevation of the slide is 30°, but the base from which the angle of elevation is measured is 50 cm above the ground level and the distance of this point from the bottom of the staircase (which is vertical) is $4\sqrt{3}$ m. Based on the above information, answer the following questions: (i) Write the angle of depression from the top of the slide to its base. (ii) (a) Find the height of the staircase. **OR** (b) Find the length of the slide. (iii) Will the angle of elevation increase or decrease if the staircase was made taller ?	
Sol.	Let AB be the staircase.  (i) 30° (ii) (a) $\tan 30° = \frac{1}{\sqrt{3}} = \frac{h-0.5}{4\sqrt{3}}$ $\Rightarrow h = 4.5$ So, height of the staircase is 4.5 m **OR** (b) $\cos 30° = \frac{\sqrt{3}}{2} = \frac{4\sqrt{3}}{l}$ $\Rightarrow l = 8$ So, length of the slide is 8 m. (iii) Angle of elevation will increase.	 1 1 1 1 1 1

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Case Study – 3

A survey was conducted by the Education Ministry of India to record the teacher–student ratio in various higher secondary schools of India. The following distribution was given by the Ministry :

Number of students/teacher :	15 – 20	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45
Number of Schools :	3	8	9	10	3	2

Based on the above information, answer the following questions :

(i) Write the modal class.

(ii) Write the median class.

(iii) (a) Find the mode of the data.

OR

(b) Find the median of the data.

Sol.

Number of students / teachers	Number of school (f)	(cf)
15 – 20	3	3
20 – 25	8	11
25 – 30	9	20
30 – 35	10	30
35 – 40	3	33
40 – 45	2	35

(i) Modal class is 30 – 35. 1

(ii) Median class is 25 – 30. 1

(iii) (a) Mode $= 30 + \frac{(10-9)}{(2\times 10-9-3)} \times 5$ 1½

$= 30.625$ ½

(b) Median $= 25 + \left(\frac{\frac{35}{2}-11}{9}\right) \times 5$ 1½

$= 28.61$ approx. ½