Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
MATHEMATICS PAPER CODE 30(B)

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. Its' 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.**
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 totaled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in 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 canceling the previous attempt), marks shall be awarded for the first attempt only and the other answer scored out with a note "Extra Question".**
10	**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".**
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 totaling 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 totaling on the title page. ● Wrong totaling 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 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.
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 totaled 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))

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A Questions no. 1 to 18 are multiple choice questions (MCQs) and questions number 19 and 20 are Assertion-Reason based questions of 1 mark each	
1.	The greatest number which divides both 30 and 80, leaving remainder 2 and 3 respectively, is : (a) 10 (b) 7 (c) 11 (d) 14	
Sol.	(b) 7	1
2.	The ratio of HCF and LCM of the least prime number and the least composite number, is : (a) 1 : 2 (b) 2 : 1 (c) 1 : 3 (d) 1 : 1	
Sol.	(a) 1:2	1
3.	The value of t for which the pair of linear equations $(t + 3)x - 3y = t$; $tx + ty + 12 = 0$ have infinitely many solutions, is : (a) 6 (b) 0 (c) – 6 (d) 12	
Sol.	(c) – 6	1
4.	The number of zeroes of a quadratic polynomial, whose graph intersects the y-axis at exactly one point and does not intersect the x-axis, is : (a) 0 (b) 1 (c) 2 (d) 3	
Sol.	(a) 0	1

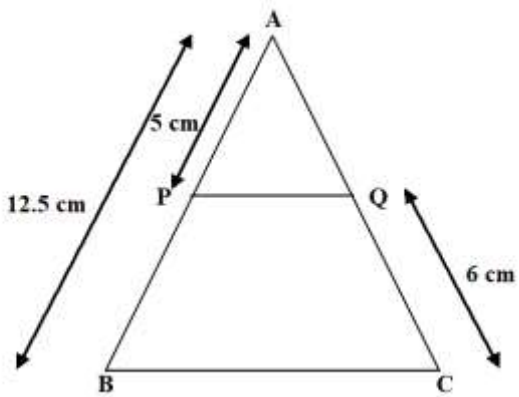
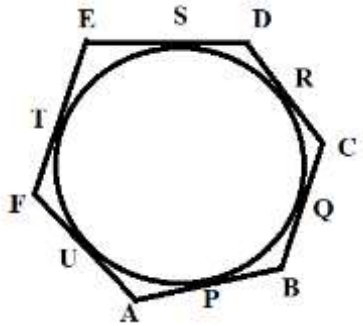
5.	If $ax^2 + bx + c = 0$ has equal roots, then the value of a is : (a) $-\frac{b}{4c}$ (b) $\frac{b^2}{4c}$ (c) $-\frac{b^2}{4c}$ (d) $\frac{b^2}{4ac}$	
Sol.	(b) $\frac{b^2}{4c}$	1
6.	The point P on y-axis equidistant from the points (– 2, 7) and (3, 6) is : (a) (0, 1) (b) (4, 0) (c) (0, 4) (d) (0, –1)	
Sol.	(c) (0,4)	1
7.	The ratio in which the x-axis divides the line segment joining the points A(– 6, 5) and B(– 4, –1) is : (a) 1 : 5 (b) 1 : 7 (c) 5 : 1 (d) 7 : 1	
Sol.	(c) 5:1	1
8.	The point which lies on the perpendicular bisector of the line segment joining the points A(– 3, – 4) and B(3, 4) is : (a) (0, 0) (b) (0, 3) (c) (3, 0) (d) (– 3, 0)	
Sol.	(a) (0, 0)	1
9.	In two triangles PQR and LMN, if $\frac{PQ}{MN} = \frac{QR}{LN} = \frac{PR}{LM}$, then : (a) Δ LMN ~ Δ RPQ (b) Δ LMN ~ Δ PQR (c) Δ RQP ~ Δ LMN (d) Δ QRP ~ Δ LMN	
Sol.	(a) $\Delta LMN \sim \Delta RPQ$	1

10.	If Δ ABC ~ Δ DEF, AB = 6 cm, DE = 9 cm, EF = 6 cm and FD = 12 cm, then the perimeter of Δ ABC is : (a) 28 cm (b) 28·5 cm (c) 18 cm (d) 23 cm	
Sol.	(c) 18 cm	1
11.	Quadrilateral ABCD circumscribes a circle. If BC = 7 cm, CD = 4 cm and AD = 3 cm, then the length of AB is : (a) 3 cm (b) 4 cm (c) 7 cm (d) 6 cm	
Sol.	(d) 6 cm	1
12.	If $\sqrt{3}\tan 2\theta = 3$, $0° < 2\theta < 90°$, then the value of $\sin\theta + \sqrt{3}\cos\theta$ is : (a) 2 (b) $\sqrt{3}$ (c) $\frac{\sqrt{3}+1}{\sqrt{2}}$ (d) 1	
Sol.	(a) 2	1
13.	If $\cos\theta + \sin\theta = \sqrt{2}\cos\theta$, then $\cos\theta - \sin\theta$ equals : (a) $\frac{1}{\sqrt{2}}\sin\theta$ (b) $\sqrt{2}\sin\theta$ (c) $2\sin\theta$ (d) $\frac{1}{2}\sin\theta$	
Sol.	(b) $\sqrt{2}\sin\theta$	1
14.	If $\tan(A+B) = \sqrt{3}$ and $\tan(A-B) = \frac{1}{\sqrt{3}}$, $0° < A+B < 90°$, $A > B$, then the values of A and B respectively are : (a) 60°, 30° (b) 60°, 45° (c) 45°, 15° (d) 60°, 15°	
Sol.	(c) 45°, 15°	1

15.	The difference of the areas (in cm^2) of two segments of a circle of radius 5 cm, formed by a chord subtending an angle of 90° at the centre is : (a) $\left(\frac{25\pi}{4} - \frac{25}{2}\right)$ (b) $\left(\frac{25\pi}{2} + 25\right)$ (c) $\left(\frac{15\pi}{4} - \frac{7}{2}\right)$ (d) $\left(\frac{7\pi}{4} - \frac{3}{2}\right)$	
Sol.	(b) $\left(\frac{25\pi}{2} + 25\right)$	1
16.	The area (in cm^2) of a sector of a circle of radius 21 cm cut off by an arc of length 22 cm is : (a) 441 (b) 321 (c) 231 (d) 221	
Sol.	(c) 231	1
17.	A 'top' is of the shape of a cone mounted over a hemisphere of same radius. The radius of hemisphere is 3·5 cm and the total height of the top is 15·5 cm. The total surface area of the 'top' (in cm^2) is : (a) 2145 (b) 21·45 (c) 215·4 (d) 214·5	
Sol.	(d) 214.5	1

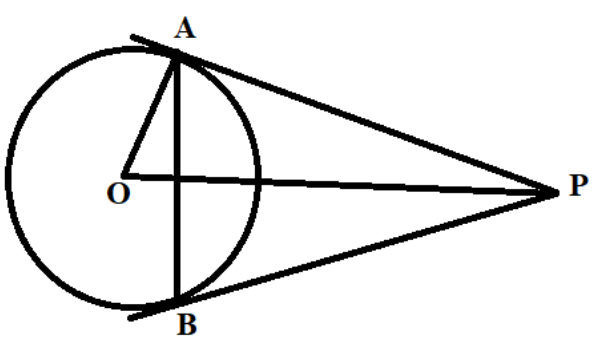
18.	In the following frequency distribution : *Height (in cm)* | *Number of Students* 100 – 115 | 15 115 – 130 | 13 130 – 145 | 11 145 – 160 | 10 160 – 175 | 11 the sum of the lower limit of the modal class and the upper limit of the median class is : (a) 230 (b) 260 (c) 245 (d) 275	
Sol.	(c) 245	1
	For Questions number 19 and 20, two statements are given — one labelled as Assertion (A) and the other 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 and Reason (R) is false. (d) Assertion (A) is false and Reason (R) is true.	

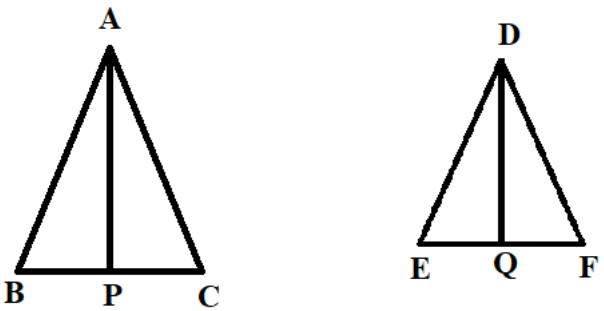
19.	*Assertion (A) :* If the Mean and the Median of a distribution are 169 and 170 respectively, then its Mode is 172. *Reason (R) :* The relation between Mean, Median and Mode is : Mode = 3 Median – 2 Mean.	
Sol.	(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).	1
20.	*Assertion (A) :* The probability of randomly drawing a card with an even number from a box containing cards numbered 1 to 100 is $\frac{1}{2}$. *Reason (R) :* P (event) = $\frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$	
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 comprises of Very Short Answer (VSA) type questions of 2 marks each.	
21. (a)	For what values of k does the pair of equations given below have a unique solution ? $6x + ky + 9 = 0;\quad 2x + 3y + 4 = 0$	
Sol.	For unique solution $\frac{6}{2} \neq \frac{k}{3}$ $\Rightarrow k \neq 9$ For all values of k except 9	1 1
	OR	
21. (b)	Solve the following pair of linear equations by elimination method : $7x - 2y = 3;\quad 11x - \frac{3}{2}y = 8$	

Sol.	$[7x - 2y = 3] \times 3$ $[22x - 3y = 16] \times 2$ $21x - 6y = 9$ $44x - 6y = 32$ $\Rightarrow 23x = 23$ $\Rightarrow x = 1$ and $y = 2$	 1 1
22.	P and Q are respectively the points on the sides AB and AC of a triangle ABC such that AB = 12·5 cm, AP = 5 cm and CQ = 6 cm. If PQ ‖ BC, then find the length of AQ.	
Sol.	 **PB = 12.5 – 5 = 7.5 cm** $\frac{AP}{PB} = \frac{AQ}{QC} \Rightarrow \frac{5}{7.5} = \frac{AQ}{6}$ **$\Rightarrow$AQ = 4 cm**	 ½ 1 ½
23.	If a hexagon ABCDEF circumscribes a circle, show that AB + CD + EF = BC + DE + FA.	
Sol.		

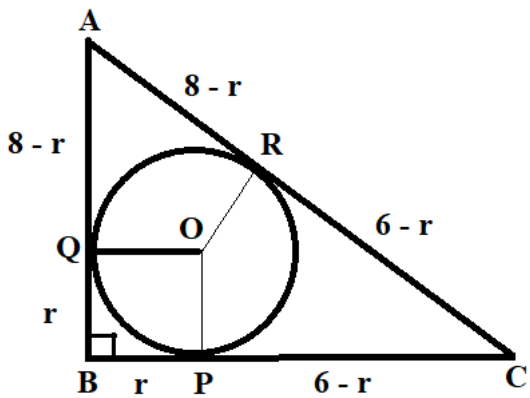
	PB = BQ ----① RC = QC ----② RD = DS ----③ ET = SE ----④ TF = FU ----⑤ AP = AU ----⑥ Tangents from an external point. Adding ①, ②, ③, ④, ⑤ and ⑥, we get (AP+ PB)+(RC + RD)+(ET + TF) = (BQ + QC)+(DS + SE)+(FU + AU) $\Longrightarrow$ AB + CD + EF = BC + DE + FA	1 1
24(a).	Evaluate : $\frac{5\cos^2 60° + 4\sec^2 30° - \tan^2 45°}{\sin^2 30° + \sin^2 60°}$	
Sol.	$\frac{5\left(\frac{1}{2}\right)^2+4\left(\frac{2}{\sqrt{3}}\right)^2-(1)^2}{\left(\frac{1}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2}$ $= \frac{67}{12}$	1½ ½
	OR	
24(b).	Prove that : $\frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A} = 2\sec A$	
Sol.	LHS = $\frac{cos^2\ A + (1+\sin A)^2}{(1+\sin A)\ (\cos A)} = \frac{(cos^2\ A + \sin^2 A) + 1 + 2\sin A}{(1+\sin A)\ (\cos A)}$ $= \frac{2(1+\sin A)}{(1+\sin A)\ (\cos A)}$ = 2 sec A = RHS	½ 1 ½
25.	The length of the minute-hand of a clock is 14 cm. Find the area swept by the minute-hand in 20 minutes.	
Sol.	Angle subtended by minute hand in 20 minutes = $\frac{360°}{60} \times 20 = 120°$ r = 14 Area = $\frac{22}{7} \times 14 \times 14 \times \frac{120}{360}$ $= \frac{616}{3}$ or 205.33 $\therefore$ required area is $\frac{616}{3}$ cm^2 or 205.33 cm^2	½ 1 ½

	SECTION C This section comprises of Short Answer (SA) type questions of 3 marks each.	
26.	**Prove that $\sqrt{3}$ is an irrational number.**	
Sol.	Let $\sqrt{3}$ be a rational number. $\therefore \sqrt{3} = \frac{p}{q}$, where $q \neq 0$ and let p & q are coprimes. $3q^2 = p^2 \Rightarrow p^2$ is divisible by 3 $\Rightarrow$ p is divisible by 3 $\Rightarrow p = 3a$, where 'a' is some integer ----- (i) $9a^2 = 3q^2 \Rightarrow q^2 = 3a^2 \Rightarrow q^2$ is divisible by 3 $\Rightarrow$ q is divisible by 3 $\Rightarrow q = 3b$, where 'b' is some integer ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are coprimes. $\therefore \sqrt{3}$ is an irrational number.	½ 1 ½ 1
27.	**If α and β are the zeroes of the polynomial $3x^2 + 5x + k$ such that $\alpha^2 + \beta^2 + \alpha\beta = \frac{19}{9}$, then find the value of k.**	
Sol.	$\alpha + \beta = -\frac{5}{3}$ and $\alpha\beta = \frac{k}{3}$ $\alpha^2 + \beta^2 + \alpha\beta = \frac{19}{9} \Rightarrow (\alpha + \beta)^2 - \alpha\beta = \frac{19}{9}$ $\frac{25}{9} - \frac{k}{3} = \frac{19}{9} \Rightarrow \frac{k}{3} = \frac{2}{3}$ $\Rightarrow k = 2$	½ 1 1 ½
28(a).	**A 2-digit number is 4 times the sum of its digits and twice the product of the digits. Find the number.**	
Sol.	Let the unit's digit be 'x' and ten's digit be y $\therefore$ Number is $10y + x$ $\therefore 10y + x = 4(x + y)$ or $3x - 6y = 0$ or $x = 2y$ _____ (i) $10y + x = 2xy$ $\Rightarrow 10y + 2y = 4y^2 \Rightarrow 4y^2 - 12y = 0 \Rightarrow 4y(y - 3) = 0$ $y = 0$ or $y = 3$ $\therefore$ y = 0, x = 0, y = 3, then x = 6 $\therefore$ required number is 3.	½ ½ ½ ½ 1
	OR	

28(b).	Solve for x and y : $\frac{ax}{b} + \frac{by}{a} = a - b$ $ax - by = 2ab$	
Sol.	$a^2x + b^2y = ab(a - b)$ $ax - by = 2ab \Rightarrow a^2x - aby = 2a^2b$ $\Rightarrow b^2y + aby = a^2b - ab^2 - 2a^2b = - ab^2 - a^2b = - ab(a + b)$ $b(a + b)y = - ab(a + b)$ $\Rightarrow y = - a$ $\Rightarrow x = b$	½ ½ 1 ½ ½
29(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.	 Let $\angle APB = \theta$ $\Rightarrow \angle PAB = 90° - \frac{1}{2}\theta$ $\angle OAB = 90° - \angle PAB$ $= 90° - 90° + \frac{1}{2}\theta = \frac{1}{2}\theta$ $\Rightarrow \theta = \angle APB = 2\angle OAB$	½ ½ 1 1
	OR	

29(b).	If AP and DQ are medians of triangles ABC and DEF respectively, where $\Delta ABC \sim \Delta DEF$, then prove that $\frac{AB}{DE} = \frac{AP}{DQ}$.	
Sol.	 $\Delta ABC \sim \Delta DEF$ $\therefore \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ and $\angle A = \angle D$, $\angle B = \angle E$ & $\angle C = \angle F$ $\Longrightarrow \frac{AB}{DE} = \frac{2BP}{2EQ} = \frac{AC}{DF}$ and $\angle B = \angle E$ $\therefore \Delta ABP \sim \Delta DEQ$ So, $\frac{AB}{DE} = \frac{AP}{DQ}$	1 1 1
30.	Prove that $\frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A} = 1 + \sec A \operatorname{cosec} A.$	
Sol.	LHS $= \frac{\tan A}{1 - \frac{1}{\tan A}} + \frac{\frac{1}{\tan A}}{1 - \tan A}$ $= \frac{\tan^2 A}{\tan A - 1} - \frac{1}{\tan A(\tan A - 1)}$ $= \frac{\tan^3 A - 1}{\tan A(\tan A - 1)} = \frac{(\tan A - 1)(\tan^2 A + \tan A + 1}{\tan A(\tan A - 1)}$ $= \tan A + 1 + \cot A$ $= 1 + \frac{\sin^2 A + \cos^2 A}{\cos A \sin A} = 1 + \sec A \cdot \operatorname{cosec} A = RHS$	½ ½ 1 1

31.	**20 cards, numbered 1 to 20 are mixed thoroughly and then a card is drawn at random. Find the probability that the number on the drawn card is a multiple of 3 or 5.**	
Sol.	Number of favourable outcomes = 9 (3, 5, 6, 9, 10, 12, 15, 18, 20) $\therefore$ P (multiple of 3 or 5) = $\frac{9}{20}$	1½ 1½
	SECTION D This section comprises of Long Answer (LA) type questions of 5 marks each.	
32(a).	**If -3 is a root of the quadratic equation $3x^2 + 14x + p = 0$, find p and hence find k so that the roots of the quadratic equation $x^2 + k(4x + k - 4) + p = 0$ are equal.**	
Sol.	(-3) is a root of $3x^2 + 14x + p = 0$ $\Rightarrow 27 - 42 + p = 0$ $\Rightarrow p = 15$ Now, $x^2 + 4kx + (k^2 - 4k + 15) = 0$ has equal roots $\therefore D = 0$ $\Rightarrow 16k^2 - 4(k^2 - 4k + 15) = 0$ or $4k^2 - k^2 + 4k - 15 = 0$ $3k^2 + 4k - 15 = 0$ $\Rightarrow (3k - 5)(k + 3) = 0$ $\Rightarrow k = \frac{5}{3}, -3$	1 1 ½ 1½ 1
	OR	
32(b).	**Three consecutive natural numbers are such that the square of the middle number exceeds the difference of the squares of the other two by 60. Find the numbers.**	
Sol.	Let three consecutive natural numbers be x, x + 1, x + 2 $\Rightarrow (x+1)^2 - ((x+2)^2 - (x)^2) = 60$	1 1

	$x^2 - 2x - 63 = 0$ $(x - 9)(x + 7) = 0$ $x \neq -7, x = 9$ $\therefore$ Numbers are 9, 10 and 11	1 1 1
33.	Prove that the lengths of the tangents drawn from an external point to a circle are equal. Using this result, find the radius of a circle inscribed in a right-angled triangle ABC with $\angle B = 90°$, AB = 8 cm and BC = 6 cm.	
Sol.	Correct Given, to prove & construction Correct proof  Let OP = OQ = r $\Rightarrow$ PC = CR = 6 – r AQ = AR = 8 – r $\Rightarrow$ AC = 14 – 2r but AC = $\sqrt{8^2 + 6^2} = 10$ 14 – 2r = 10 $\Rightarrow$ 2r = 4 $\Rightarrow$ r = 2 cm	1½ 1½ 1 ½ ½
34(a).	From a solid cone, whose height is 16 cm and radius of base is 12 cm, a right circular cylindrical cavity of height 3 cm and radius 4 cm is hollowed out such that bases of cone and cylinder form concentric circles. Find the volume of the remaining solid.	

Sol.	Volume = $\frac{1}{3}\pi(12)^2 \times 16 - \pi(4)^2 \times 3$ $= 768\pi - 48\pi$ $= 720 \times \frac{22}{7} = \frac{15840}{7}$ or 2262.86 $\therefore$ required volume is $\frac{15840}{7}$ cm^3 or 2262.86 cm^3	(1+1) (1+1) 1
	OR	
34(b).	A hemispherical depression is cut off from one face of a cubical wooden block such that the diameter 14 cm of the hemisphere is equal to the edge of the cube. Determine the surface area of the remaining solid.	
Sol.	r = 7 cm edge of cube a = 14 cm Surface area of remaining cube = $6(14)^2 - \pi(7)^2 + 2\pi(7)^2$ $\therefore$ Total S.A. of the remaining solid = $6(14)^2 + \pi(7)^2$ $= 6(14)^2 + \frac{22}{7} \times 7 \times 7$ $= 1176 + 154 = 1330$ cm^2	1 1 1 1 1
35.	The table below shows the daily expenditure on food of 25 households in a locality.	

Daily Expenditure (in ₹)	*Number of Households*
100 – 150	4
150 – 200	5
200 – 250	12
250 – 300	2
300 – 350	2

Find the mean daily expenditure on food.

Sol.

x	125	175	225	275	325	SUM
f	4	5	12	2	2	25
fx	500	875	2700	550	650	5275

Correct table — 3

Mean = $\frac{\sum fx}{\sum f} = \frac{5275}{25}$ — 1

$= 211$ — 1

So, mean daily expenditure on food is ₹ 211.

SECTION E

This section comprises of 3 case-study based questions of 4 marks each.

36.

Case Study – 1

Ravindra took a loan of ₹ 3,45,000 from a bank to buy a car, and decided to pay back by ₹ 2,000 at the end of the first month and then increased the instalment amount by ₹ 200 each month.

Based on the above, answer the following questions :

(a) Find the amount paid by him in 10^{th} instalment.

(b) Find the total amount paid by him in first 10 instalments.

(c) In how many instalments would he clear his total loan ?

OR

(c) What amount will he be able to clear in his first 45 instalments ?

Sol.

(a) $a_{10} = 2000 + 9(200) = 3800$ — 1

So, amount paid in 10^{th} instalment is ₹3800.

(b) $S_{10} = 5\,[2000 + 3800] = 29000$ — 1

So, total amount paid in first 10 instalment is ₹ 29000

(c) $345000 = \frac{n}{2}[4000 + (n-1)200] = n\,[2000 + (n-1)100]$ — 1

$n^2 + 19n - 3450 = 0 \Rightarrow (n + 69)(n - 50) = 0$ — ½

$n = 50$ or -69

But number of instalments is always positive.

$\therefore n = 50$ — ½

OR

	(c) $S_{45} = \frac{45}{2}[4000 + 44 \times 200]$ $= 45[2000 + 4400] = 45(6400)$ $= 288000$ So, amount cleared in first 45 instalments is ₹ 288000.	1 1
37.	**Case Study – 2** In a classroom, 4 friends Ravi, Vinod, Raghav and Vithal are seated at the points A(2, 3), B(7, 8), C(10, 5) and D(5, 0) respectively. Based on the above, answer the following questions : (a) Find the distance between Ravi and Raghav. (b) Find the distance between Vinod and Vithal. (c) Show that ABCD is a rectangle. **OR** (c) Find the perimeter of rectangle ABCD.	
Sol.	(a) $AC = \sqrt{(10-2)^2 + (5-3)^2} = \sqrt{68}$ (b) $BD = \sqrt{(7-5)^2 + (8-0)^2} = \sqrt{68}$ (c) $AB = \sqrt{25+25} = 5\sqrt{2}$ $CD = \sqrt{25+25} = 5\sqrt{2}$ $BC = \sqrt{9+9} = 3\sqrt{2}$ $AD = \sqrt{9+9} = 3\sqrt{2}$ Also AC = BD $\Rightarrow$ ABCD is a rectangle. **OR** (c) Perimeter = $2(5\sqrt{2} + 3\sqrt{2})$ $= 16\sqrt{2}$	1 1 1½ ½ 1½ ½

38.

Case Study – 3

Two lamp posts are of equal heights. A boy measured the elevation of the top of each lamp post from the mid-point of the line segment joining the feet of the lamp post, as 30°. After walking 15 m towards one of them, he measured the elevation of the top of the nearest lamp post at the point where he stands as 60°.

Based on the above, answer the following questions :

(a) Taking h (metres) as the height of each lamp post and x (metres) as the distance between the feet of two lamp posts, find a relation between x and h.

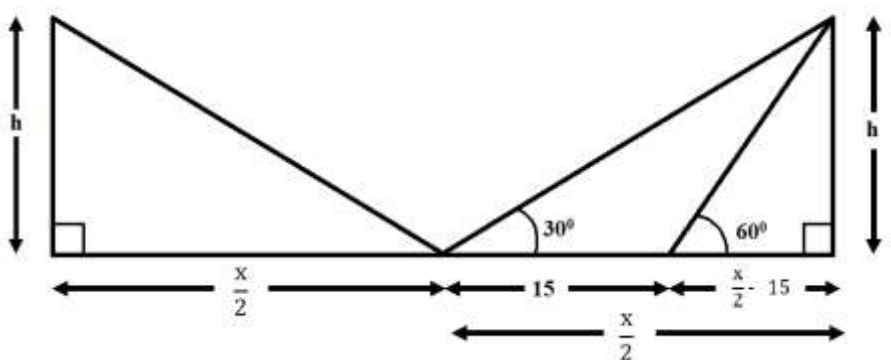
(b) After moving 15 m towards one lamp post, what is the relation between x and h ?

(c) Find the height of each lamp post.

OR

(c) Find the distance between the two lamp posts.

Sol.



(a) $\frac{h}{x/2} = \tan 30° = \frac{1}{\sqrt{3}}$

$x = 2\sqrt{3}\,h$ 1

which is the required relation.

(b) $\frac{h}{\frac{x}{2} - 15} = \tan 60°$ ½

	$\frac{2h}{x-30} = \sqrt{3}$	
	$\Rightarrow \quad 2h = \sqrt{3}(x-30)$	½
	which is the required relation.	
	(c) $\Rightarrow 2h = \sqrt{3}(2\sqrt{3}h - 30) = 6h - 30\sqrt{3}$	1
	$4h = 30\sqrt{3} \qquad \Rightarrow h = \frac{15\sqrt{3}}{2}$	1
	$\therefore$ height of each lamp post is $\frac{15\sqrt{3}}{2}$ m.	
	OR	
	(c) $x = 2\sqrt{3}h$ and $2h = \sqrt{3}(x-30)$	1
	$x = \sqrt{3} \times \sqrt{3}(x-30) = 3x - 90$	
	$\Rightarrow 2x = 90 \qquad \Rightarrow x = 45$	1
	$\therefore$ Distance between the two lamp posts is 45m.	