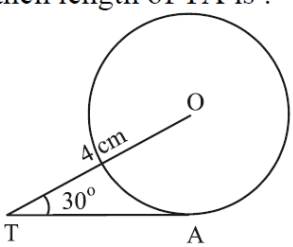
Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Secondary School Examination, 2023
MATHEMATICS PAPER CODE 30/4/3

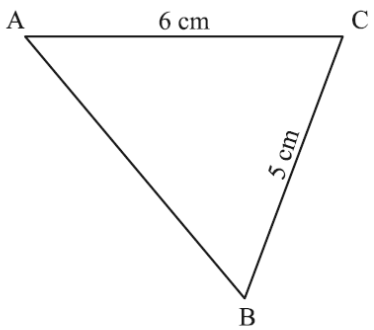
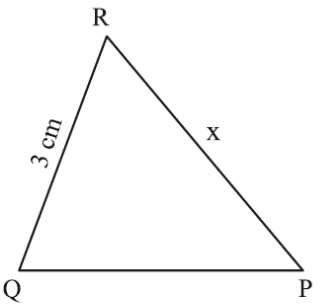
General Instructions: -

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.

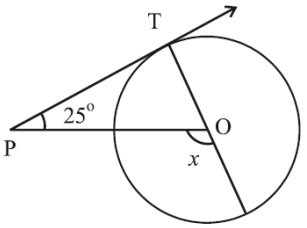
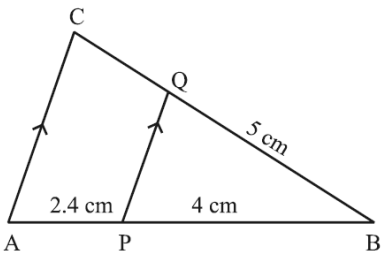
13	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions 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 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.
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: 30/4/3)

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 pair of linear equations $2x = 5y + 6$ and $15y = 6x - 18$ represents two lines which are : (a) intersecting (b) parallel (c) coincident (d) either intersecting or parallel	
Sol.	(c) Coincident	**1**
2.	In the given figure, TA is a tangent to the circle with centre O such that OT = 4 cm, $\angle OTA = 30^\circ$, then length of TA is : (a) $2\sqrt{3}$ cm (b) 2 cm (c) $2\sqrt{2}$ cm (d) $\sqrt{3}$ cm 	
Sol.	(a) $2\sqrt{3}$ cm	**1**
3.	The ratio of HCF to LCM of the least composite number and the least prime number is : (a) 1:2 (b) 2:1 (c) 1:1 (d) 1:3	
Sol.	(a) 1 : 2	**1**
4.	If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then sun's elevation is : (a) 60° (b) 45° (c) 30° (d) 90°	
Sol.	(a) 60°	**1**

5.	  In the given figure, $\Delta ABC \sim \Delta QPR$. If AC = 6 cm, BC = 5 cm, QR = 3 cm and PR = x; then the value of x is : (a) 3.6 cm (b) 2.5 cm (c) 10 cm (d) 3.2 cm	
Sol.	(b) 2.5 cm	**1**
6.	The distance of the point (– 6, 8) from origin is : (a) 6 (b) – 6 (c) 8 (d) 10	
Sol.	(d) 10	**1**
7.	The next term of the A.P. : $\sqrt{7}$, $\sqrt{28}$, $\sqrt{63}$ is : (a) $\sqrt{70}$ (b) $\sqrt{80}$ (c) $\sqrt{97}$ (d) $\sqrt{112}$	
Sol.	(d) $\sqrt{112}$	**1**
8.	$(\sec^2\theta - 1)(\text{cosec}^2\theta - 1)$ is equal to : (a) – 1 (b) 1 (c) 0 (d) 2	
Sol.	(b) 1	**1**
9.	Two dice are thrown together. The probability of getting the difference of numbers on their upper faces equals to 3 is : (a) $\frac{1}{9}$ (b) $\frac{2}{9}$ (c) $\frac{1}{6}$ (d) $\frac{1}{12}$	
Sol.	(c) $\frac{1}{6}$	**1**

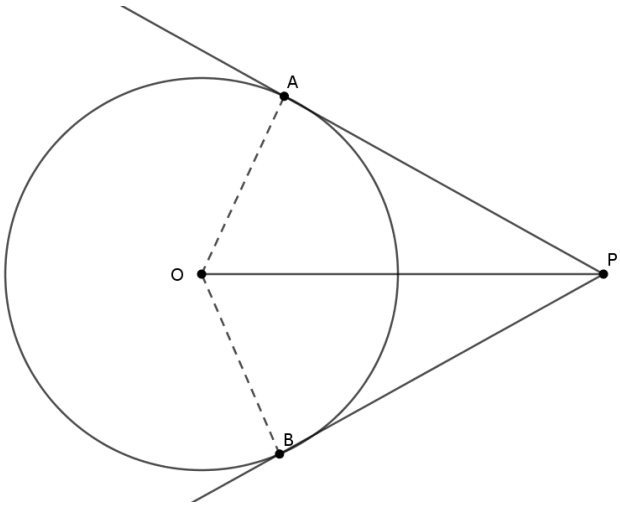
10.	A card is drawn at random from a well-shuffled pack of 52 cards. The probability that the card drawn is not an ace is : (a) $\frac{1}{13}$ (b) $\frac{9}{13}$ (c) $\frac{4}{13}$ (d) $\frac{12}{13}$	
Sol.	(d) $\frac{12}{13}$	**1**
11.	The roots of the equation $x^2 + 3x - 10 = 0$ are : (a) 2, –5 (b) –2, 5 (c) 2, 5 (d) –2, –5	
Sol.	(a) 2, – 5	**1**
12.	If α, β are zeroes of the polynomial x^2-1, then value of $(\alpha + \beta)$ is : (a) 2 (b) 1 (c) –1 (d) 0	
Sol.	(d) 0	**1**
13.	If α, β are the zeroes of the polynomial $p(x) = 4x^2 - 3x - 7$, then $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ is equal to : (a) $\frac{7}{3}$ (b) $\frac{-7}{3}$ (c) $\frac{3}{7}$ (d) $\frac{-3}{7}$	
Sol.	(d) $-\frac{3}{7}$	**1**
14.	What is the area of a semi-circle of diameter 'd' ? (a) $\frac{1}{16}\pi d^2$ (b) $\frac{1}{4}\pi d^2$ (c) $\frac{1}{8}\pi d^2$ (d) $\frac{1}{2}\pi d^2$	
Sol.	(c) $\frac{1}{8}\pi d^2$	**1**
15.	For the following distribution : **Marks Below** | **10** | **20** | **30** | **40** | **50** | **60** **Number of Students** | **3** | **12** | **27** | **57** | **75** | **80** The modal class is : (a) 10-20 (b) 20-30 (c) 30-40 (d) 50-60	
Sol.	(c) 30-40	**1**

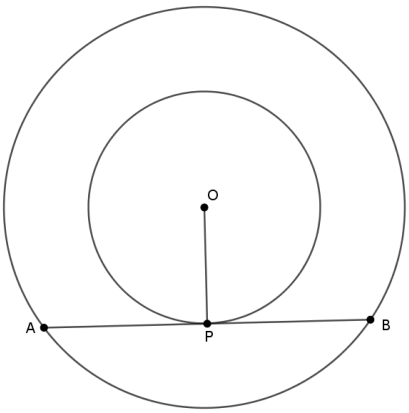
16.	In the given figure, PT is a tangent at T to the circle with centre O. If $\angle TPO = 25^\circ$, then x is equal to : (a) 25° (b) 65° (c) 90° (d) 115° 	
Sol.	(d) 115°	**1**
17.	In the given figure, PQ||AC. If BP = 4 cm, AP = 2.4 cm and BQ = 5 cm, then length of BC is : (a) 8 cm (b) 3 cm (c) 0.3 cm (d) $\frac{25}{3}$ cm 	
Sol.	(a) 8 cm	**1**
18.	The points (– 4, 0), (4, 0) and (0, 3) are the vertices of a : (a) right triangle (b) isosceles triangle (c) equilateral triangle (d) scalene triangle	
Sol.	(b) isosceles triangle	**1**
	DIRECTIONS : In the question number **19** and **20**, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option out of the following :	
19.	**Assertion (A) :** The probability that a leap year has 53 Sundays is $\frac{2}{7}$. **Reason (R) :** The probability that a non-leap year has 53 Sundays is $\frac{5}{7}$. (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 and 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.	

Sol.	(c) Assertion (A) is true but Reason (R) is false	**1**
20.	**Assertion (A) :** a, b, c are in A.P. if and only if $2b = a + c$. **Reason (R) :** The sum of first n odd natural numbers is n^2. (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 and 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.	
Sol.	(b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of Assertion (A).	**1**
	SECTION B **This section comprises very short answer (VSA) type questions of 2 marks each.**	
21(A).	Find the sum and product of the roots of the quadratic equation $2x^2 - 9x + 4 = 0$.	
Sol.	$2x^2 - 9x + 4 = 0$ $a = 2, b = -9, c = 4$ Let α, β be roots of $2x^2 - 9x + 4 = 0$ Sum $= \alpha + \beta = -\frac{b}{a} = \frac{9}{2}$ Product of roots $= \alpha\beta = \frac{c}{a} = \frac{4}{2} = 2$	**1** **1**
21(B).	Find the discriminant of the quadratic equation $4x^2 - 5 = 0$ and hence comment on the nature of roots of the equation.	
Sol.	$4x^2 - 5 = 0$ $a = 4, b = 0, c = -5$ Discriminant $= b^2 - 4ac = 0 - 4(4)(-5) = 80 > 0$ $\Rightarrow$ roots are real and distinct.	**$1\frac{1}{2}$** **$\frac{1}{2}$**

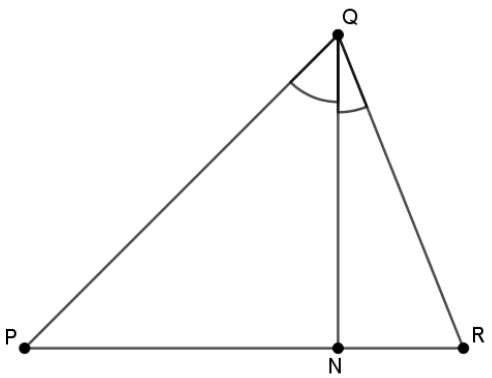
22(A).	Evaluate $2\sec^2\theta + 3\operatorname{cosec}^2\theta - 2\sin\theta\cos\theta$ if $\theta = 45^\circ$.	
Sol.	$2\sec^2 45^\circ + 3\operatorname{cosec}^2 45^\circ - 2\sin 45^\circ \cos 45^\circ$ $= 2\left(\sqrt{2}\right)^2 + 3\left(\sqrt{2}\right)^2 - 2\left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{\sqrt{2}}\right)$ $= 4 + 6 - 1 = 9$	$1\frac{1}{2}$ $\frac{1}{2}$
22(B).	If $\sin\theta - \cos\theta = 0$, then find the value of $\sin^4\theta + \cos^4\theta$.	
Sol.	$\sin\theta - \cos\theta = 0 \Rightarrow \sin\theta = \cos\theta \Rightarrow \tan\theta = 1$ $\Rightarrow \theta = 45^\circ$ $\sin^4 45^\circ + \cos^4 45^\circ = \left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{\sqrt{2}}\right)^4$ $= \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$	$\frac{1}{2}$ 1 $\frac{1}{2}$
23.	If a fair coin is tossed twice, find the probability of getting 'atmost one head'.	
Sol.	Total outcomes are HH, HT, TH, TT Favourable outcomes are HT, TH, TT P (at most one head) = $\frac{3}{4}$	$\frac{1}{2}$ $\frac{1}{2}$ 1
24.	Two numbers are in the ratio 2 : 3 and their LCM is 180. What is the HCF of these numbers ?	

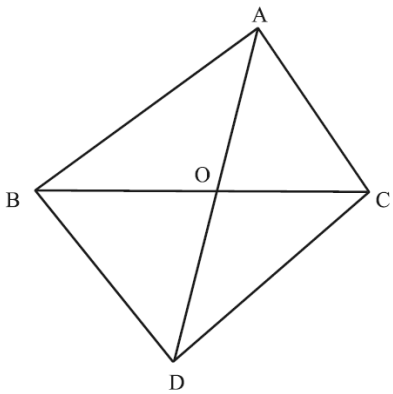
Sol.	Let the numbers be 2x, 3x LCM = 6x = 180 $\Rightarrow$ x = 30 $\therefore$ Numbers are 60, 90 HCF (60, 90) = 30	**1** **1**
25.	If one zero of the polynomial $p(x) = 6x^2 + 37x - (k - 2)$ is reciprocal of the other, then find the value of k.	
Sol.	$p(x) = 6x^2 + 37x - (k - 2)$ Let the zeroes be α, $\frac{1}{\alpha}$ Product of zeroes = $\alpha \cdot \frac{1}{\alpha} = -\frac{(k-2)}{6}$ $6 = -k + 2 \Rightarrow k = -4$	**$\frac{1}{2}$** **1** **$\frac{1}{2}$**
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	
26.	Find the value of 'p' for which one root of the quadratic equation $px^2 - 14x + 8 = 0$ is 6 times the other.	
Sol.	Let roots of the quadratic equation be α, 6α $px^2 - 14x + 8 = 0$ $\therefore \alpha + 6\alpha = \frac{14}{p} \Rightarrow 7\alpha = \frac{14}{p} \Rightarrow \alpha = \frac{2}{p}$ and $\alpha \cdot 6\alpha = \frac{8}{p} \Rightarrow 6\alpha^2 = \frac{8}{p} \Rightarrow 6 \cdot \frac{4}{p^2} = \frac{8}{p}$ $\Rightarrow p = 3$	**1** **1+$\frac{1}{2}$** **$\frac{1}{2}$**

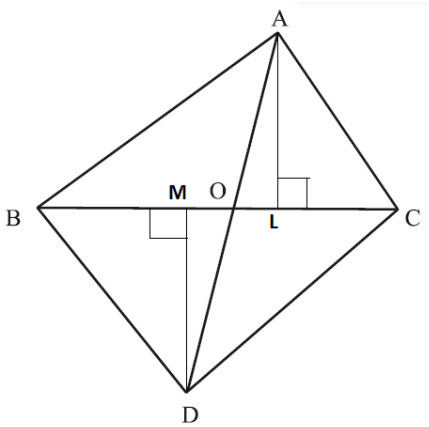
27.	From an external point, two tangents are drawn to a circle. Prove that the line joining the external point to the centre of the circle bisects the angle between the two tangents.	
Sol.	Given : PA and PB are tangents drawn from an external point P to the circle with centre O.  To prove: $\angle OPA = \angle OPB$ Construction: Join OA, OB Proof: In Δ OPA and Δ OPB OP = OP (common) OA = OA (radii) $\angle OAP = \angle OBP$ (each 90°, radius $\perp$ tangents) $\therefore \Delta OPA \cong \Delta OPB$ (RHS) $\Rightarrow \angle OPA = \angle OPB$ (CPCT)	**1 mark for correct figure** **$\frac{1}{2}$** **1** **$\frac{1}{2}$**

28.	Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which touches the smaller circle.	
Sol.	AB is the chord of larger circle touching the smaller circle at P.  OA = 5 cm, OP = 3 cm To find AB OP ⊥ AB (radius ⊥ tangent) AB is the chord of larger circle and OP ⊥ AB ∴ AP = PB In right-angled Δ AOP, $AP^2 = 5^2 - 3^2 = 16$ AP = 4 cm ∴ AB = 2AP = 8 cm	**$\frac{1}{2}$** **1** **1** **$\frac{1}{2}$**
29(A).	How many terms are there in an A.P. whose first and fifth terms are – 14 and 2, respectively and the last term is 62.	
Sol.	$a = -14$, $a_5 = 2 \Rightarrow a + 4d = 2$ $-14 + 4d = 2 \Rightarrow d = 4$ $a_n = 62 \Rightarrow a + (n-1)d = 62$ $-14 + (n-1)4 = 62 \Rightarrow n = 20$	**1** **1** **1**

29(B).	Which term of the A.P. : 65, 61, 57, 53, ... is the first negative term ?	
Sol.	65, 61, 57, 53, ... $a = 65, d = -4$ Let a_n be the first negative term $a_n < 0 \Rightarrow a + (n-1)d < 0$ $65 + (n-1)(-4) < 0 \Rightarrow \quad 69 - 4n < 0$ $n > \frac{69}{4}$ $\therefore$ Least positive integral value of n which satisfies $n > \frac{69}{4}$ is 18 $\therefore$ 1^{st} negative term of AP = 18	**$\frac{1}{2}$** **1** **1** **$\frac{1}{2}$**
30(A).	Prove that $\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A$	
Sol.	LHS $= \frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \frac{\sin A\,(1 - 2\sin^2 A)}{\cos A\,(2\cos^2 A - 1)}$ $= \frac{\sin A[1 - 2(1 - \cos^2 A)]}{\cos A[2\cos^2 A - 1]} = \frac{\sin A[1 - 2 + 2\cos^2 A]}{\cos A\,[2\cos^2 A - 1]}$ $= \frac{\sin A[2\cos^2 A - 1]}{\cos A\,[2\cos^2 A - 1]} = \tan A = \text{RHS}$	**1** **1** **1**
30(B).	Prove that $\sec A\,(1 - \sin A)\,(\sec A + \tan A) = 1$.	
Sol.	LHS $= \sec A\,(1 - \sin A)\,(\sec A + \tan A)$ $= \frac{1}{\cos A}(1 - \sin A)\left(\frac{1}{\cos A} + \frac{\sin A}{\cos A}\right)$	**1**

	$= \frac{1}{\cos A}(1 - \sin A)\frac{(1 + \sin A)}{\cos A}$ $= \frac{1 - \sin^2 A}{\cos^2 A} = \frac{\cos^2 A}{\cos^2 A} = 1 = RHS$	**1** **1**
31.	Prove that $\sqrt{5}$ is an irrational number.	
Sol.	Let $\sqrt{5}$ be a rational number. $\therefore \sqrt{5} = \frac{p}{q}$, where $q \neq 0$ and let p & q be co-primes. $5q^2 = p^2 \Rightarrow p^2$ is divisible by 5 $\Rightarrow$ p is divisible by 5 $\Rightarrow p = 5a$, where 'a' is some integer ----- (i) $25a^2 = 5q^2 \Rightarrow q^2 = 5a^2 \Rightarrow q^2$ is divisible by 5 $\Rightarrow$ q is divisible by 5 $\Rightarrow q = 5b$, where 'b' is some integer ----- (ii) (i) and (ii) leads to contradiction as 'p' and 'q' are co-primes. $\therefore \sqrt{5}$ is an irrational number.	½ 1 ½ 1
	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	
32(A).	In a ΔPQR, N is a point on PR, such that $QN \perp PR$. If $PN \times NR = QN^2$, prove that $\angle PQR = 90^o$.	
Sol.	 $PN \times NR = QN^2$ $\frac{PN}{QN} = \frac{QN}{NR}$	**1 mark for correct figure**

	$\angle PNQ = \angle QNR$ $\Delta PNQ \sim \Delta QNR$ $\Rightarrow \angle 2 = \angle P$ and $\angle 1 = \angle R$ $\Rightarrow \angle 1 + \angle 2 = \angle P + \angle R$ $\Rightarrow \angle PQR = \angle P + \angle R$ In ΔPQR, $\angle P + \angle PQR + \angle R = 180°$ $\Rightarrow 2\angle PQR = 180° \Rightarrow \angle PQR = 90°$	$1\frac{1}{2}$ **1** **1** $\frac{1}{2}$
32(B).	In the given figure, ΔABC and ΔDBC are on the same base BC. If AD intersects BC at O, prove that $\frac{\text{ar } (\Delta ABC)}{\text{ar } (\Delta DBC)} = \frac{AO}{DO}$  	

Sol.	 Draw AL ⊥ BC and DM ⊥ BC In ΔAOL and ΔDOM, $\angle AOL = \angle DOM$ $\angle ALO = \angle DMO$ $\Delta AOL \sim \Delta DOM$ $\Rightarrow \frac{AL}{DM} = \frac{AO}{DO}$.....(i) $\frac{ar(\Delta \text{ ABC})}{ar(\Delta \text{ DBC})} = \frac{\frac{1}{2} \times \text{BC} \times \text{AL}}{\frac{1}{2} \times \text{BC} \times \text{DM}}$ $= \frac{AL}{DM} = \frac{AO}{DO}$ [using (i)]	**1** **2** **$\frac{1}{2}$** **1** **$\frac{1}{2}$**
33.	A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in the figure. If the height of the cylinder is 10 cm and its base is of radius 3.5 cm, find the total surface area of the article.	
Sol.	Height of cylinder = 10 cm	

Radius of cylinder = radius of hemisphere = $3{\cdot}5 = \frac{7}{2}$ cm **1**

Total surface area of the article

= CSA of cylinder + CSA of 2 hemispheres

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

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

$= 2 \times \frac{22}{7} \times \frac{7}{2}(10 + 2 \times \frac{7}{2})$ **$1\frac{1}{2} + 1\frac{1}{2}$**

$= 22 \times 17 = 374\ cm^2$ **1**

34. The monthly expenditure on milk in 200 families of a Housing Society is given below :

Monthly Expenditure (in ₹)	**1000-1500**	**1500-2000**	**2000-2500**	**2500-3000**	**3000-3500**	**3500-4000**	**4000-4500**	**4500-5000**
Number of families	**24**	**40**	**33**	***x***	**30**	**22**	**16**	**7**

Find the value of x and also, find the median and mean expenditure on milk.

Sol.

Monthly Exp. (in ₹)	x	f_i	c_f	d	$x_i f_i$
1000 – 1500	1250	24	24	– 3	– 72
1500 – 2000	1750	40	64	– 2	– 80
2000 – 2500	2250	33	97	– 1	– 33
2500 – 3000	2750	x=28	125	0	0
3000 – 3500	3250	30	155	1	30

2 for correct table

3500 – 4000	3750	22	177	2	44
4000 – 4500	4250	16	193	3	48
4500 – 5000	4750	7	200	4	28
Total					– 35

$172 + x = 200 \quad \Rightarrow x = 28$ **1**

l = lower limit of median class = 2500

$\frac{N}{2} = \frac{200}{2} = 100$

C = 97, f = 28, h = 500

$$\text{Median} = l + \frac{\frac{N}{2} - C}{f} \times h$$

$$= 2500 + \frac{100 - 97}{28} \times 500$$

$$= 2500 + \frac{3}{28} \times 500 = 2553{\cdot}6$$ **1**

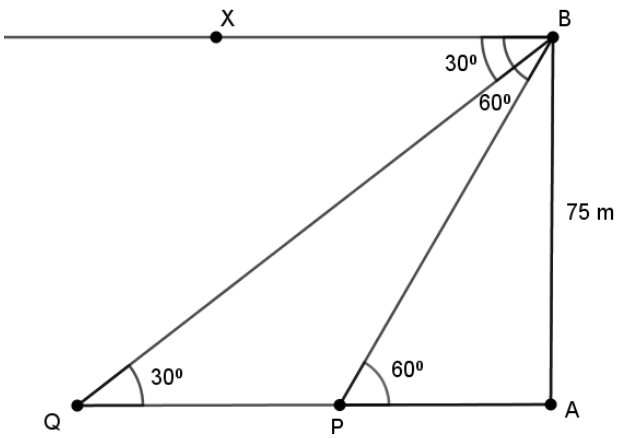
Median Expenditure = ₹ 2553·6

$$\text{Mean} = 2750 - \frac{35 \times 500}{200} = 2750 - 87{\cdot}5 = 2662{\cdot}5$$ **1**

Mean Expenditure = ₹ 2662·5

35(A). A straight highway leads to the foot of a tower. A man standing on the top of the 75 m high tower observes two cars at angles of depression of 30° and 60°, which are approaching the foot of the tower. If one car is exactly behind the other on the same side of the tower, find the distance between the two cars. (use $\sqrt{3} = 1.73$)

Sol.



1 mark for correct figure

AB = Height of tower = 75 m

P, Q are positions of cars

$\angle$ XBQ = $\angle$ BQA = 30°

$\angle$ XBP = $\angle$ BPA = 60°

In Δ APB, $\tan 60° = \frac{75}{AP} \Rightarrow AP = \frac{75}{\sqrt{3}} = 25\sqrt{3}$ $\quad 1\frac{1}{2}$

In Δ AQB, $\tan 30° = \frac{75}{AQ} \Rightarrow AQ = 75\sqrt{3}$ $\quad 1\frac{1}{2}$

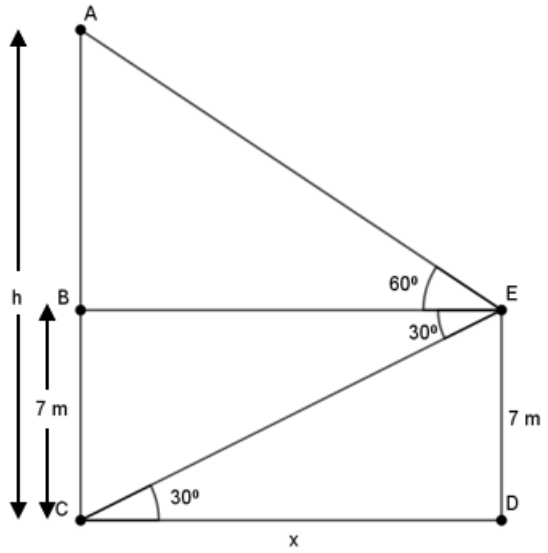
Distance between the cars = PQ = AQ – AP

$= 75\sqrt{3} - 25\sqrt{3} = 50\sqrt{3}$ $\quad \frac{1}{2}$

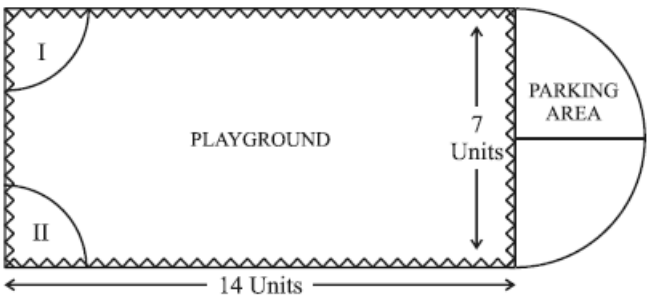
$= 50 \times 1{\cdot}73 = 86{\cdot}5$ m $\quad \frac{1}{2}$

35(B). From the top of a 7 m high building, the angle of elevation of the top of a cable tower is 60^o and the angle of depression of its foot is 30^o. Determine the height of the tower.

Sol.

	 Let AC be h m, BC = DE = 7 m, AB = (h−7) m $\angle AEB = 60^\circ$ and $\angle BEC = 30^\circ$ $\therefore \angle ECD = 30^\circ$ Let CD be x m $\frac{DE}{CD} = \frac{7}{x} = \tan 30° \Rightarrow x = 7\sqrt{3}$ $\Rightarrow BE = 7\sqrt{3}$ Again $\frac{AB}{BE} = \tan 60^\circ$ $\Rightarrow \frac{h-7}{7\sqrt{3}} = \sqrt{3}$ $\Rightarrow h = 28$ $\therefore$ Height of tower = 28 m	**1 mark for correct figure** **$1\frac{1}{2}$** **1** **1** **$\frac{1}{2}$**
	SECTION E **This section comprises of 3 case-study based questions of 4 marks each.**	

36. Governing council of a local public development authority of Dehradun decided to build an adventurous playground on the top of a hill, which will have adequate space for parking.



After survey, it was decided to build rectangular playground, with a semi-circular area allotted for parking at one end of the playground. The length and breadth of the rectangular playground are 14 units and 7 units, respectively. There are two quadrants of radius 2 units on one side for special seats.

Based on the above information, answer the following questions :

(i) What is the total perimeter of the parking area ?

(ii) (a) What is the total area of parking and the two quadrants ?

OR

(b) What is the ratio of area of playground to the area of parking area ?

(iii) Find the cost of fencing the playground and parking area at the rate of ₹ 2 per unit.

Sol.

(i) Total perimeter = $\pi r + 2r$

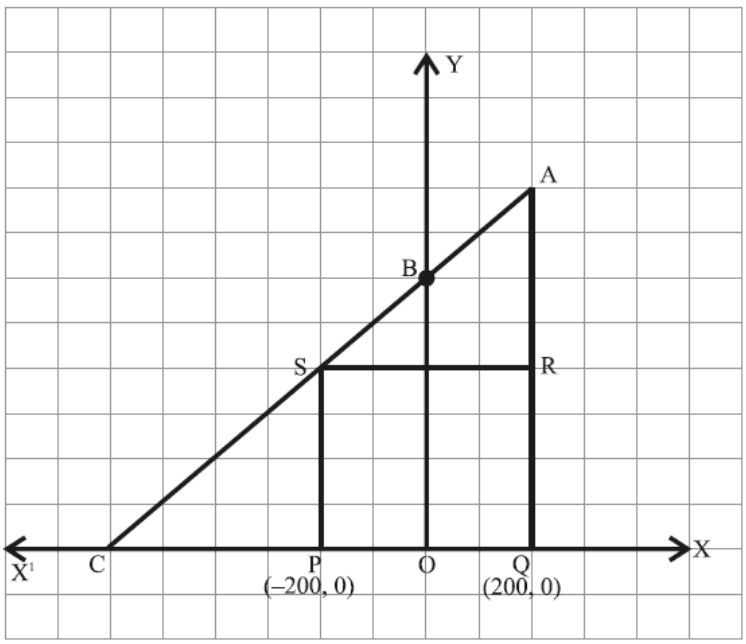
$$= \frac{22}{7} \times \frac{7}{2} + 7 = 18 \text{ units}$$ **1**

(ii) (a) Area of parking $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{77}{4}$ **1**

Area of quadrants $= 2 \cdot \frac{22}{7} \times 2 \times 2 \times \frac{1}{4} = \frac{44}{7}$ **$\frac{1}{2}$**

Total Area $= \frac{77}{4} + \frac{44}{7} = \frac{715}{28}$ or 25·54 sq. units **$\frac{1}{2}$**

	OR (ii) (b) $\frac{\text{Area of playground}}{\text{Area of parking}} = \frac{98}{77/4} = \frac{56}{11} = 56 : 11$ (iii) Required Perimeter = $2(l + b) + \frac{2\pi r}{2}$ $= 2(14 + 7) + \frac{22}{7} \times \frac{7}{2} = 53$ units Cost of fencing = $53 \times 2 =$ ₹ 106	**1+1** **$\frac{1}{2}$** **$\frac{1}{2}$**
37.	Two schools 'P' and 'Q' decided to award prizes to their students for two games of Hockey ₹ x per student and Cricket ₹ y per student. School 'P' decided to award a total of ₹ 9,500 for the two games to 5 and 4 students respectively; while school 'Q' decided to award ₹ 7,370 for the two games to 4 and 3 students respectively.  Based on the above information, answer the following questions : (i) Represent the following information algebraically (in terms of x and y). (ii) (a) What is the prize amount for hockey ? **OR** (b) Prize amount on which game is more and by how much ? (iii) What will be the total prize amount if there are 2 students each from two games ?	
Sol.	(i) 5x + 4y = 9500 _____ (1) 4x + 3y = 7370 _____ (2) (ii) (a) Solving (1) and (2), x = 980 ∴ Prize Amount for Hockey = ₹ 980 **OR** (ii) (b) On solving x = 980, y = 1,150	**$\frac{1}{2}$** **$\frac{1}{2}$** **1** **1** **1**

	∴ Prize Amount for Cricket is more by ₹ (1,150 – 980) = ₹ 170 (iii) 2(x + y) = 2(980 + 1150) = 2(2130) = ₹ 4,260	**1** **1**
38.	Jagdish has a field which is in the shape of a right angled triangle AQC. He wants to leave a space in the form of a square PQRS inside the field for growing wheat and the remaining for growing vegetables (as shown in the figure). In the field, there is a pole marked as O.  Based on the above information, answer the following questions : (i) Taking O as origin, coordinates of P are (–200, 0) and of Q are (200, 0). PQRS being a square, what are the coordinates of R and S ? (ii) (a) What is the area of square PQRS ? **OR** (b) What is the length of diagonal PR in square PQRS ? (iii) If S divides CA in the ratio K:1, what is the value of K, where point A is (200, 800) ?	
Sol.	(i) R(200, 400), S(– 200, 400)	$\frac{1}{2}+\frac{1}{2}$

	(ii) (a) side PQ = (200+200) m = 400 m Area of square PQRS = 400 × 400 = 160000 sq. units **OR** (ii) (b) Diagonal PR = $\sqrt{(400)^2 + (400)^2}$ = $\sqrt{3200}$ or $400\sqrt{2}$ (iii) $C(-600,0); A(200,800); S(-200,400)$ S divides CA in the ratio k: 1 $-200 = \frac{k(200)+1(-600)}{k+1}$ $\Rightarrow k = 1$	**1** **1** **1** **1** **1**