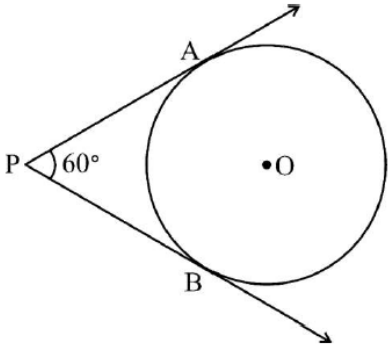
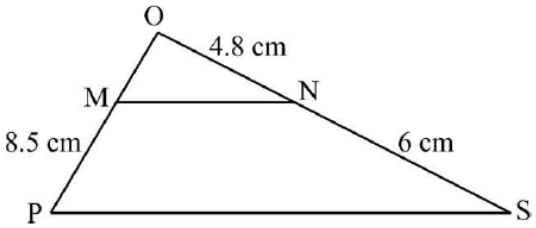
	Marking Scheme **Strictly Confidential** **(For Internal and Restricted use only)** **Secondary School Supplementary Examination, 2024** **MATHEMATICS 041 PAPER CODE 30/S/1**
General Instructions: -	
1	You are aware that evaluation is the most important process in the actual and correct assessment of 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	**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 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.

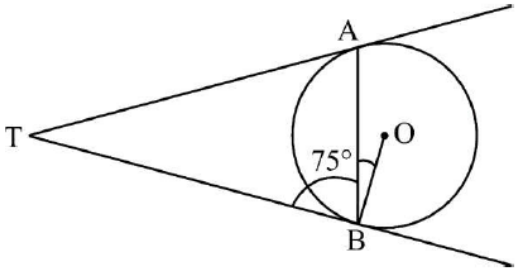
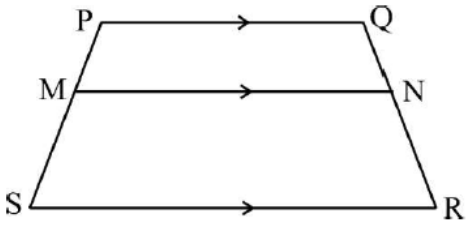
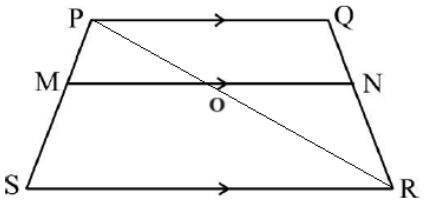
MARKING SCHEME
MATHEMATICS (Subject Code–041)
(PAPER CODE: 30/S/1)

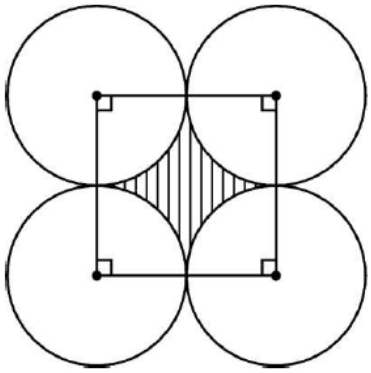
Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **This section comprises Multiple Choice Questions (MCQs) 1 mark each.**	
1	If x = 5 is a solution of the quadratic equation $2x^2 + (k - 1)x + 10 = 0$, then the value of k is : (A) 11 (B) – 11 (C) 13 (D) – 13	
Sol.	(B) -11	**1**
2	Two positive integers m and n are expressed as $m = p^5q^2$ and $n = p^3q^4$, where p and q are prime numbers. The LCM of m and n is : (A) p^8q^6 (B) p^3q^2 (C) p^5q^4 (D) $p^5q^2 + p^3q^4$	
Sol.	(C) p^5q^4	**1**
3	The pair of equations x = 2a and y = 3b (a, b ≠ 0) graphically represents straight lines which are : (A) coincident (B) parallel (C) intersecting at (2a, 3b) (D) intersecting at (3b, 2a)	
Sol.	(C) intersecting at (2a, 3b)	**1**
4	If k + 7, 2k – 2 and 2k + 6 are three consecutive terms of an A.P., then the value of k is : (A) 15 (B) 17 (C) 5 (D) 1	
Sol.	(B) 17	**1**

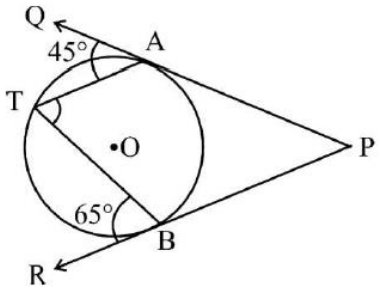
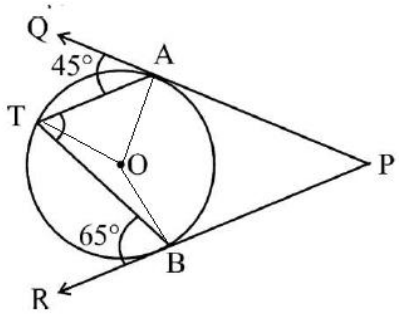
5	In the given figure, PA and PB are two tangents drawn to the circle with centre O and radius 5 cm. If $\angle APB = 60°$, then the length of PA is :  (A) $\frac{5}{\sqrt{3}}$ cm (B) $5\sqrt{3}$ cm (C) $\frac{10}{\sqrt{3}}$ cm (D) 10 cm	
Sol.	(B) $5\sqrt{3}$ cm	**1**
6	In the given figure, if M and N are points on the sides OP and OS respectively of ΔOPS, such that MN $\parallel$ PS, then the length of OP is :  (A) 6.8 cm (B) 17 cm (C) 15.3 cm (D) 9.6 cm	
Sol.	(C) 15.3 cm	**1**
7	All queens, jacks and aces are removed from a pack of 52 playing cards. The remaining cards are well-shuffled and one card is picked up at random from it. The probability of that card to be a king is : (A) $\frac{1}{10}$ (B) $\frac{1}{13}$ (C) $\frac{3}{10}$ (D) $\frac{3}{13}$	
Sol.	(A) $\frac{1}{10}$	**1**
8	PQ is a diameter of a circle with centre O(2, – 4). If the coordinates of the point P are (– 4, 5), then the coordinates of the point Q will be : (A) (– 3, 4.5) (B) (– 1, 0.5) (C) (4, – 5) (D) (8, – 13)	
Sol.	(D) (8, −13)	**1**

9	The value of $\left(\sin^2 \theta + \frac{1}{1+\tan^2 \theta} \right)$ is : (A) 0 (B) 2 (C) 1 (D) – 1	
Sol.	(C) 1	**1**
10	A cap is cylindrical in shape, surmounted by a conical top. If the volume of the cylindrical part is equal to that of the conical part, then the ratio of the height of the cylindrical part to the height of the conical part is : (A) 1 : 2 (B) 1 : 3 (C) 2 : 1 (D) 3 : 1	
Sol.	(B) 1: 3	**1**
11	The 7^{th} term from the end of the A.P. : – 8, – 5, – 2, ..., 49 is : (A) 67 (B) 13 (C) 31 (D) 10	
Sol.	(C) 31	**1**
12	The diagonals of a rhombus ABCD intersect at O. Taking 'O' as the centre, an arc of radius 6 cm is drawn intersecting OA and OD at E and F respectively. The area of the sector OEF is : (A) 9π cm^2 (B) 3π cm^2 (C) 12π cm^2 (D) 18π cm^2	
Sol.	(A) 9π cm^2	**1**
13	The probability of getting a chocolate flavoured ice cream at random, in a lot of 600 ice creams is 0.055. The number of chocolate flavoured ice creams in the lot is : (A) 33 (B) 55 (C) 11 (D) 44	
Sol.	(A) 33	**1**
14	If $\tan^2 \theta + \cot^2 \alpha = 2$, where $\theta = 45°$ and $0° \leq \alpha \leq 90°$, then the value of α is : (A) 30° (B) 45° (C) 60° (D) 90°	
Sol.	(B) 45°	**1**

15	The point on x-axis which is equidistant from the points (5, – 3) and (4, 2) is : (A) (4.5, 0) (B) (7, 0) (C) (0.5, 0) (D) (– 7, 0)	
Sol.	(B) (7, 0)	**1**
16	If the length of an arc of a circle subtending an angle 60° at its centre is 22 cm, then the radius of the circle is : (A) $\sqrt{21}$ cm (B) 21 cm (C) $\sqrt{42}$ cm (D) 42 cm	
Sol.	(B) 21 cm	**1**
17	If the length of the shadow on the ground of a pole is $\sqrt{3}$ times the height of the pole, then the angle of elevation of the Sun is : (A) 30° (B) 45° (C) 60° (D) 90°	
Sol.	(A) 30°	**1**
18	Two dice are thrown at the same time and the product of the numbers appearing on them is noted. The probability that the product of the numbers lies between 8 and 13 is : (A) $\frac{7}{36}$ (B) $\frac{5}{36}$ (C) $\frac{2}{9}$ (D) $\frac{1}{4}$	
Sol.	(A) $\frac{7}{36}$	**1**
	Directions : In Question **19** and **20**, **Assertion (A)** and **Reason (R)** are given. Select the correct option from the following : (A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true. Reason (R) does not give correct explanation of (A). (C) Assertion (A) is true but Reason (R) is not true. (D) Assertion (A) is not true but Reason (R) is true.	

19	*Assertion (A)* : If the graph of a polynomial intersects the x-axis at exactly two points, then the number of zeroes of that polynomial is 2. *Reason (R)* : The number of zeroes of a polynomial is equal to the number of points where the graph of the polynomial intersects x-axis.	
Sol.	(A) Both Assertion (A) and Reason (R) are true. Reason (R) is the correct explanation of Assertion (A)	**1**
20	*Assertion (A)* : TA and TB are two tangents drawn from an external point T to a circle with centre 'O'. If $\angle$ TBA = 75° then $\angle$ ABO = 25°.  *Reason (R)* : The tangent drawn at any point of a circle is perpendicular to the radius through the point of contact.	
Sol.	(D) Assertion (A) is not true but Reason (R) is true.	**1**
	SECTION B **This section comprises of Very Short Answer (VSA) type questions of 2 marks each.**	
21	PQRS is a trapezium with PQ ‖ SR. If M and N are two points on the non-parallel sides PS and QR respectively, such that MN is parallel to PQ, then show that $\frac{PM}{MS} = \frac{QN}{NR}$. 	
Sol.	Join PR  PQ ‖ SR and MN ‖ PQ ⇒ MN ‖ SR In Δ PSR, $\frac{PM}{MS} = \frac{PO}{OR}$ … (i) In Δ PQR, $\frac{PO}{OR} = \frac{QN}{NR}$ … (ii) From (i) and (ii), $\frac{PM}{MS} = \frac{QN}{NR}$	½ ½ ½ ½

22	Prove that $7 - 3\sqrt{5}$ is an irrational number, given that $\sqrt{5}$ is an irrational number.	
Sol.	Assuming $7 - 3\sqrt{5}$ to be a rational number. Let $7 - 3\sqrt{5} = \frac{a}{b}$ where a and b are integers & $b \neq 0$ $\Rightarrow \sqrt{5} = \frac{7b-a}{3b}$ Here RHS is rational but LHS is irrational. Therefore our assumption is wrong. Hence, $7 - 3\sqrt{5}$ is an irrational number.	½ **1** ½
23(a)	A chord is subtending an angle of 90° at the centre of a circle of radius 14 cm. Find the area of the corresponding minor segment of the circle.	
Sol.	Area of minor segment $= \pi \times 14^2 \times \frac{1}{4} - \frac{1}{2} \times 14^2$ $= (154 - 98) = 56$ Hence, area of minor segment $= 56\ \text{cm}^2$	**1** **1**
	OR	
23(b)	Find the area of the shaded region if length of radius of each circle is 7 cm. Each circle touches the other two externally. 	
Sol.	Side of square $= 14$ cm Area of shaded region = area of square – area of 4 quadrants $= 14^2 - 4 \times \frac{22}{7} \times 7^2 \times \frac{90}{360}$ $= (196 - 154) = 42$ Hence, area of shaded region $= 42\ \text{cm}^2$	½ **1** ½

24	In the given figure, PAQ and PBR are tangents to the circle with centre 'O' at the points A and B respectively. If T is a point on the circle such that $\angle$ QAT = 45° and $\angle$ TBR = 65°, then find $\angle$ ATB.  	
Sol.	Join OA, OB and OT  Now $\angle ATO = \angle TAO = 90° - 45 = 45°$ and $\angle BTO = \angle TBO = 90° - 65° = 25°$ $\Rightarrow \angle ATB = \angle ATO + \angle BTO$ $= 45° + 25° = 70°$	½ ½ ½ ½
25(a)	If cos (A + B) = $\frac{1}{2}$ and tan (A – B) = $\frac{1}{\sqrt{3}}$, where $0 \leq$ A + B $\leq 90°$, then find the value of sec (2A – 3B).	
Sol.	$\cos(A + B) = \frac{1}{2} \Rightarrow$ A + B = 60° … (i) $\tan(A - B) = \frac{1}{\sqrt{3}} \Rightarrow$ A – B = 30° … (ii) Solving (i) and (ii), we get $A = 45°$ and $B = 15°$ $\Rightarrow \sec(2A - 3B) = \sec(90° - 45°)$ $= \sec 45° = \sqrt{2}$	½ ½ ½ ½
	OR	
25(b)	Find the value of x such that, $3 \tan^2 60° - x \sin^2 45° + \frac{3}{4} \sec^2 30° = 2 \operatorname{cosec}^2 30°$	
Sol.	$3 \tan^2 60° - x \sin^2 45° + \frac{3}{4}\sec^2 30° = 2 \operatorname{cosec}^2 30°$ $\Rightarrow 3(\sqrt{3})^2 - x\left(\frac{1}{\sqrt{2}}\right)^2 + \frac{3}{4}\left(\frac{2}{\sqrt{3}}\right)^2 = 2(2)^2$ $\Rightarrow 9 - \frac{x}{2} + 1 = 8$ $\Rightarrow x = 4$	**1** **1**
	SECTION C **This section comprises of Short Answer (SA) type questions of 3 marks each.**	

26

The government rescued 100 people after a train accident. Their ages were recorded in the following table. Find their mean age.

Age (in years)	Number of people rescued
10 – 20	9
20 – 30	14
30 – 40	15
40 – 50	21
50 – 60	23
60 – 70	12
70 – 80	6

Sol.

Age (in years)	Number of people rescued (f_i)	x_i	u_i	f_iu_i
10-20	9	15	-3	-27
20-30	14	25	-2	-28
30-40	15	35	-1	-15
40-50	21	45	0	0
50-60	23	55	1	23
60-70	12	65	2	24
70-80	6	75	3	18
Total	100			-5

1½ marks for correct table

Mean Age $= 45 + \frac{(-5)}{100} \times 10$

$= 44.5$ **1**

Hence, mean age is 44.5 years ½

27

Prove that :

$$\left(\frac{1+\tan^2 A}{1+\cot^2 A}\right) = \frac{(1-\tan A)^2}{(1-\cot A)^2}$$

LHS $= \frac{1+tan^2A}{1+\frac{1}{tan^2A}}$ **1**

$= tan^2A$ ½

RHS $= \frac{(1-\tan A)^2}{\left(1-\frac{1}{\tan A}\right)^2}$ **1**

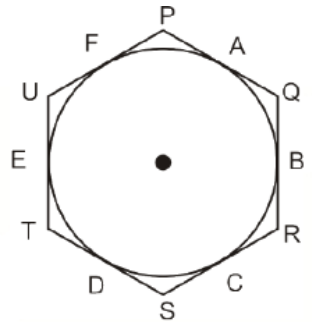
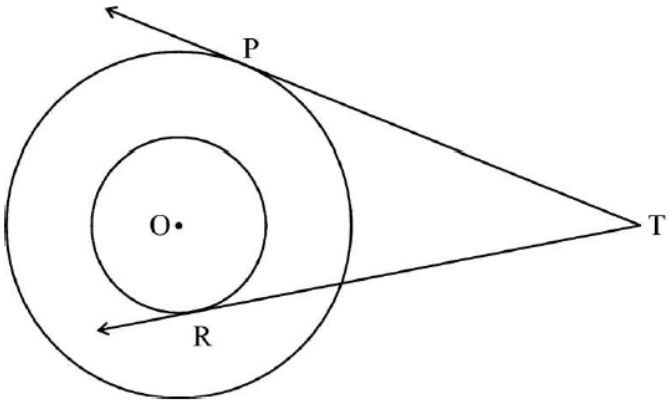
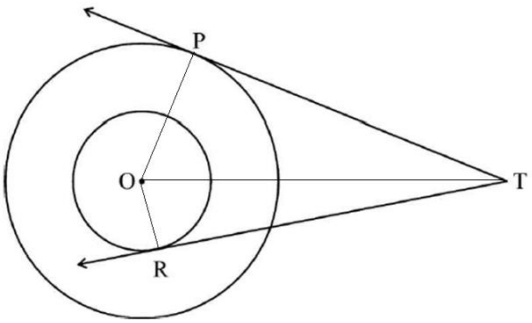
$= tan^2A$ ½

$\therefore$ LHS = RHS

28(a)

If a hexagon PQRSTU circumscribes a circle, prove that,

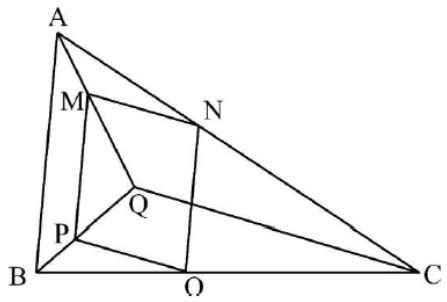
PQ + RS + TU = QR + ST + UP

Sol.	 Correct figure In the given figure, PA = PF … (1) AQ = BQ … (2) RC = RB … (3) CS = DS … (4) ET = TD … (5) UE = UF … (6) Adding (1), (2),(3), (4), (5) and (6), PA + AQ + RC + CS + ET + UE = PF + BQ + BR + DS + TD + UF $\Longrightarrow$ PQ+RS+TU = UP+ST+QR	**1** **1½** **½**
	OR	
28(b)	In the given figure, two concentric circles have radii 3 cm and 5 cm. Two tangents TR and TP are drawn to the circles from an external point T such that TR touches the inner circle at R and TP touches the outer circle at P. If $TR = 4\sqrt{10}$ cm, then find the length of TP. 	
Sol.	 Join OR, OP and OT In Δ ORT, $OT^2 = OR^2 + TR^2 = 3^2 + (4\sqrt{10})^2 = 169$ $\therefore$ OT = 13 cm In Δ OPT,	**1** **1**

	$TP^2 = OT^2 - TP^2 = 13^2 - 5^2 = 144$ $\therefore TP = 12$ cm	**1**
29	Find a quadratic polynomial whose sum of the zeroes is 8 and difference of the zeroes is 2.	
Sol.	Let the zeroes be α and β $\therefore \alpha + \beta = 8$ and $\alpha - \beta = 2$ Solving above two equations, we get $\alpha = 5$ and $\beta = 3$ So, the quadratic polynomial is $x^2 - 8x + 15$	**1** **1** **1**
30(a)	The sum of the digits of a 2-digit number is 12. Seven times the number is equal to four times the number obtained by reversing the order of the digits. Find the number.	
Sol.	Let the unit's place digit be x and ten's place digit be y $\therefore$ Number = $10y + x$ According to question, $x + y = 12$ …(i) and $7(10y + x) = 4(10x + y)$ $x - 2y = 0$ …(ii) Solving (i) and (ii), we get $x = 8$ and $y = 4$ Hence, the required number is 48	½ ½ **1** ½ ½
	OR	
30(b)	Find the values of x and y from the following pair of linear equations : $62x + 43y = 167$ $43x + 62y = 148$	
Sol.	$62x + 43y = 167$ …(i) $43x + 62y = 148$ …(ii) Adding (i) and (ii) and simplifying, we get $x + y = 3$ …(iii) Subtracting (ii) from (i) and simplifying, we get $x - y = 1$ …(iv) Solving (iii) and (iv) to get $x = 2$ and $y = 1$	**1** **1** **1**
31	A school has invited 42 Mathematics teachers, 56 Physics teachers and 70 Chemistry teachers to attend a Science workshop. Find the minimum number of tables required, if the same number of teachers are to sit at a table and each table is occupied by teachers of the same subject.	
Sol.	HCF (42, 56, 70) = 14 Minimum number of tables required $= \frac{42}{14} + \frac{56}{14} + \frac{70}{14}$ $= 12$	**1½** **1** ½
	SECTION D **This section comprises of Long Answer (LA) type questions of 5 marks each.**	

32

In the given figure, MNOP is a parallelogram and AB ∥ MP. Prove that QC ∥ PO.



Sol.

$MP \parallel AB$

$\Rightarrow \Delta QMP \sim \Delta QAB$ ½

$\Rightarrow \frac{MP}{AB} = \frac{QP}{QB}$ … (i) **1**

Now, $NO \parallel MP \parallel AB$

$\Rightarrow \Delta CNO \sim \Delta CAB$ ½

$\Rightarrow \frac{NO}{AB} = \frac{CO}{CB}$ …(ii) **1**

As $MP = NO$ ½

From (i) and (ii), $\frac{CO}{CB} = \frac{QP}{QB}$ **1**

$\frac{CO}{CB} - 1 = \frac{QP}{QB} - 1$

or $\frac{BO}{OC} = \frac{BP}{PQ}$

$\therefore QC \parallel PO$ ½

33

An age-wise list of number of literate people in a block is prepared in the following table. There are total 100 people and their median age is 41.5 years. Information about two groups are missing, which are denoted by x and y. Find the value of x and y.

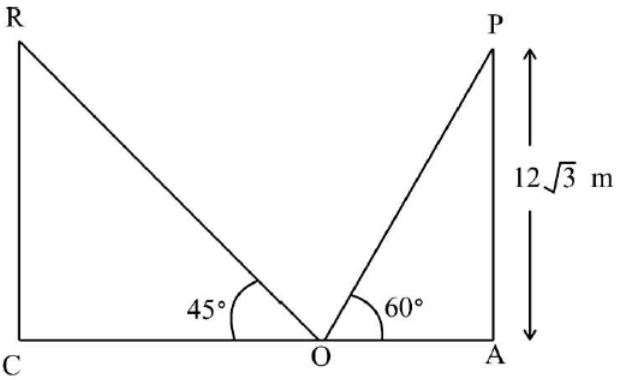
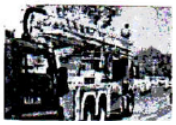
Age (in years)	Number of literate people
10 – 20	15
20 – 30	x
30 – 40	12
40 – 50	20
50 – 60	y
60 – 70	8
70 – 80	10

Sol.

Age (in years)	Number of literate people (f_i)	Cumulative frequency
$10 - 20$	15	15
$20 - 30$	x	$15 + x$
$30 - 40$	12	$27 + x$
$40 - 50$	20	$47 + x$
$50 - 60$	y	$47 + x + y$
$60 - 70$	8	$55 + x + y$
$70 - 80$	10	$65 + x + y$

1 mark for correct table

	$65 + x + y = 100$ $\Rightarrow x + y = 35$ …(i) Median $= 41.5 \therefore 40 - 50$ is the median class. $\Rightarrow\ 41.5 = 40 + \frac{50-27-x}{20} \times 10$ Solving, we get $x = 20$ From (i), $y = 15$	**1** ½ **1½** ½ ½
34(a)	If Nidhi were 7 years younger than what she actually is, then the square of her age (in years) would be 1 more than 5 times her actual age. What is her present age ?	
Sol.	Let the present age of Nidhi be x years. According to question, $(x-7)^2 = 5x + 1$ $\Rightarrow\ x^2 - 19x + 48 = 0$ $\Rightarrow (x-16)(x-3) = 0$ $\Rightarrow x = 16, 3$ $x \neq 3$ $\therefore x = 16$ Hence, the present age of Nidhi $= 16$ years	**2** **1** **1** **1**
	OR	
34(b)	A shopkeeper buys a number of books for ₹ 1,800. If he had bought 15 more books for the same amount, then each book would have cost him ₹ 20 less. Find how many books he bought initially.	
Sol.	Let the number of books bought initially be x According to question, $\frac{1800}{x} - \frac{1800}{x+15} = 20$ $\Rightarrow\ x^2 + 15x - 1350 = 0$ $\Rightarrow (x+45)(x-30) = 0$ $x \neq -45$ $\therefore x = 30$ So, the number of books bought initially = 30	**2** **1** **1** **1**
35(a)	The largest possible hemisphere is drilled out from a wooden cubical block of side 21 cm such that the base of the hemisphere is on one of the faces of the cube. Find : (i) the volume of wood left in the block, (ii) the total surface area of the remaining solid.	
Sol.	Diameter of hemisphere = side of the cube = 21 cm $\therefore$ radius of hemisphere = $\frac{21}{2}$ cm (i) Volume of the wood left = volume of cube – volume of hemisphere $= 21^3 - \frac{2}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3$	½ **1**

	$= 6835.5 \text{ cm}^3$ (ii) Total surface area of remaining solid = TSA of cube − base area of hemisphere + CSA of hemisphere $= 6 \times 21^2 - \frac{22}{7} \times \left(\frac{21}{2}\right)^2 + 2 \times \frac{22}{7} \times \left(\frac{21}{2}\right)^2$ $= 2992.5 \text{ cm}^2$	**1** **1½** **1**
	OR	
35(b)	A solid toy is in the form of a hemisphere surmounted by a right circular cone. Ratio of the radius of the cone to its slant height is 3 : 5. If the volume of the toy is $240\pi \text{ cm}^3$, then find the total height of the toy.	
Sol.	Let the radius and the slant height of the cone be $3x$ cm and $5x$ cm respectively ∴ height of the cone $(h) = \sqrt{(5x)^2 - (3x)^2} = 4x$ cm According to question, volume of toy $= 240\pi$ $\Rightarrow \frac{2}{3}\pi(3x)^3 + \frac{1}{3}\pi(3x)^2(4x) = 240\pi$ Solving, we get $x = 2$ ∴ Total height of toy $= [4(2) + 3(2)]$ cm $= 14$ cm	**½** **1** **1½** **1** **1**
	SECTION E **This section comprises of 3 case study-based questions of 4 marks each.**	
36	Due to short circuit, a fire has broken out in New Home Complex. Two buildings, namely X and Y have mainly been affected. The fire engine has arrived and it has been stationed at a point which is in between the two buildings. A ladder at point O is fixed in front of the fire engine. The ladder inclined at an angle 60° to the horizontal is leaning against the wall of the terrace (top) of the building Y. The foot of the ladder is kept fixed and after some time it is made to lean against the terrace (top) of the opposite building X at an angle of 45° with the ground. Both the buildings along with the foot of the ladder, fixed at 'O' are in a straight line.  (Building X)  (Building Y)	

	Based on the above given information, answer the following questions : (i) Find the length of the ladder. *1* (ii) Find the distance of the building Y from point 'O', i.e. OA. *1* (iii) (a) Find the horizontal distance between the two buildings. *2* **OR** (b) Find the height of the building X. *2*	
Sol.	(i) In ΔOAP, $\frac{OP}{12\sqrt{3}} = coesc\ 60° = \frac{2}{\sqrt{3}}$ $\Rightarrow OP = 24$ m $\therefore$ Length of ladder is 24 m (ii) In ΔOAP, $\frac{OA}{12\sqrt{3}} = \cot 60° = \frac{1}{\sqrt{3}}$ $\Rightarrow OA = 12$ m $\therefore$ the distance of the building Y from point O ie.,OA is 12 m (iii) (a) $OP = OR = 24$ m $\therefore$ In ΔOCR, $\frac{OC}{24} = \cos 45° = \frac{1}{\sqrt{2}}$ $\Rightarrow OC = 12\sqrt{2}$ m $\therefore$ distance between two buildings $= OA + OC$ $= (12 + 12\sqrt{2})$ m or $12(1 + \sqrt{2})$ m **OR** (iii) (b) $OP = OR = 24$ m $\therefore$ In ΔOCR, $\frac{RC}{24} = \sin 45° = \frac{1}{\sqrt{2}}$ $\Rightarrow RC = 12\sqrt{2}$ m $\therefore$ height of building X is $12\sqrt{2}$ m	½ ½ ½ ½ ½ **1** ½ ½ **1** ½

37

A school has decided to plant some endangered trees on 51st World Environment Day in the nearest park. They have decided to plant those trees in few concentric circular rows such that each succeeding row has 20 more trees than the previous one. The first circular row has 50 trees.

Based on the above given information, answer the following questions :

(i) How many trees will be planted in the 10^{th} row ? *1*

(ii) How many more trees will be planted in the 8^{th} row than in the 5^{th} row ? *1*

(iii) (a) If 3200 trees are to be planted in the park, then how many rows are required ? *2*

OR

(b) If 3200 trees are to be planted in the park, then how many trees are still left to be planted after the 11^{th} row ? *2*

Sol.

Here $a = 50$ and $d = 20$

(i) Number of trees planted in 10^{th} row = $a_{10} = 50 + 9 \times 20$ ½

$= 230$ ½

(ii) $a_8 - a_5 = 3 \times 20 = 60$ **1**

(iii) (a) Let $S_n = 3200$

$\Rightarrow \frac{n}{2}[2 \times 50 + (n-1) \times 20] = 3200$ ½

$\Rightarrow n^2 + 4n - 320 = 0$ ½

$\Rightarrow (n+20)(n-16) = 0$ ½

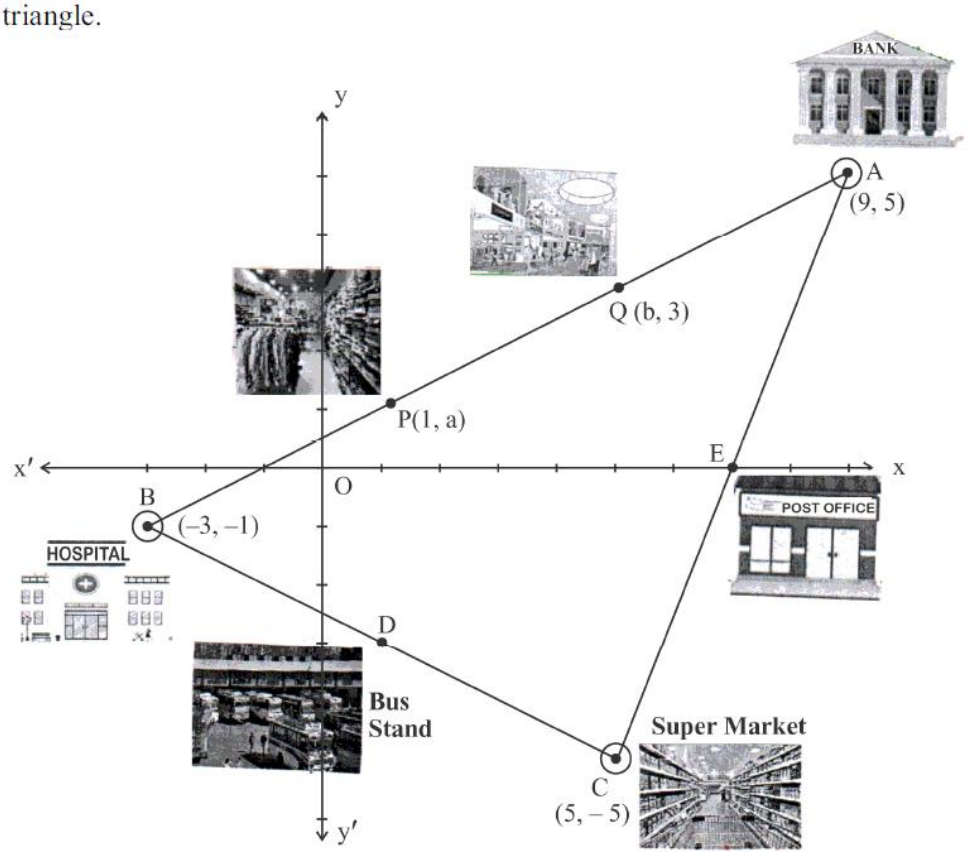
$n \neq -20$

$\therefore n = 16$ ½

Hence, required number of rows are 16

OR

(iii) (b) Required number of trees = $S_n - S_{11}$ ½

	$= 3200 - \frac{11}{2}[2 \times 50 + 10 \times 20]$ $= 1550$ Hence, number of trees left are 1550	**1** ½
38	Partha, a software engineer, lives in Jerusalem for his work. He lives in the most convenient area of the city from where bank, hospital, post office and supermarket can be easily accessed. In the graph, the bank is plotted as A(9, 5), hospital as B(– 3, – 1) and supermarket as C(5, – 5) such that A, B, C form a triangle.  Based on the above given information, answer the following questions : (i) Find the distance between the bank and the hospital. *1* (ii) In between the bank and the supermarket, there is a post office plotted at E which is their mid-point. Find the coordinates of E. *1* (iii) (a) In between the hospital and the supermarket, there is a bus stop plotted as D, which is their mid-point. If Partha wants to reach the bus stand from the bank, then how much distance does he need to cover ? *2* **OR** (b) P and Q are two different garment shops lying between the bank and the hospital, such that BP = PQ = QA. If the coordinates of P and Q are (1, a) and (b, 3) respectively, then find the values of 'a' and 'b'. *2*	
Sol.	(i) Distance between bank and hospital $= \sqrt{(-3-9)^2 + (-1-5)^2}$ $= \sqrt{180}$ units or $6\sqrt{5}$ units (ii) Coordinates of E are $\left(\frac{9+5}{2}, \frac{5+(-5)}{2}\right) = (7,0)$ (iii) (a) Coordinates of D are $\left(\frac{-3+5}{2}, \frac{-1+(-5)}{2}\right) = (1,-3)$ Distance Partha need to cover $= \sqrt{(9-1)^2 + (5-(-3))^2}$ $= \sqrt{128}$ units or $8\sqrt{2}$ units	½ ½ ½ +½ **1** ½ ½

	OR	
	(iii) (b) P is mid-point of BQ $\therefore a = \frac{-1+3}{2} = 1$ Q is mid-point of PA $\therefore b = \frac{1+9}{2} = 5$	**1** **1**