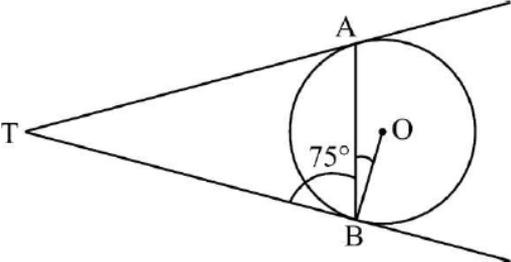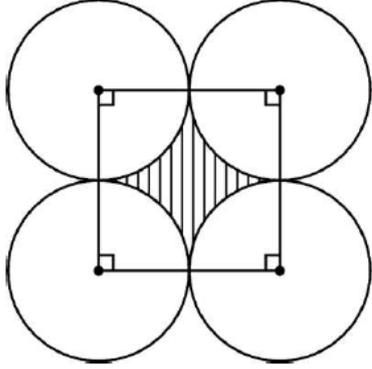|	
	Marking Scheme **Strictly Confidential** **(For Internal and Restricted use only)** **Secondary School Supplementary Examination, 2024** **MATHEMATICS 041 PAPER CODE 30/S/3**

General Instructions: -

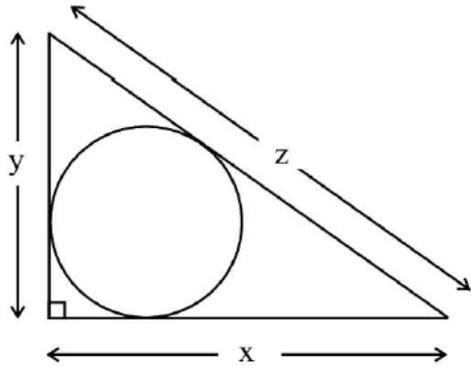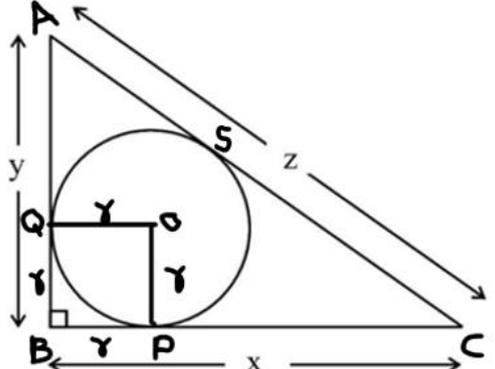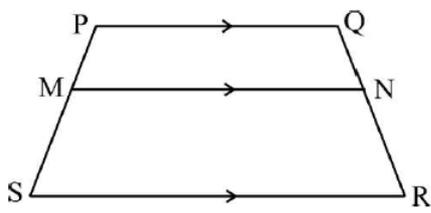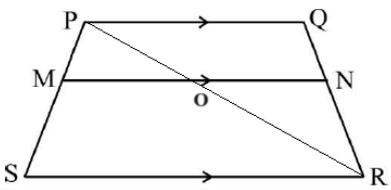|	
1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested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

Q. No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
	SECTION A **This section comprises Multiple Choice Questions (MCQs) 1 mark each.**	
1	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
2	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)　$\dfrac{7}{36}$　　　　　　　　　(B)　$\dfrac{5}{36}$ (C)　$\dfrac{2}{9}$　　　　　　　　　(D)　$\dfrac{1}{4}$	
Sol.	(A) $\dfrac{7}{36}$	1
3	If (k, 3) is the point of intersection of the lines represented by x + py = 6 and x = 15, then (k, p) will be : (A)　(15, 3)　　　　　　　　　(B)　(15, − 3) (C)　(3, 15)　　　　　　　　　(D)　(−15, 3)	
Sol.	(B) (15, −3)	1
4	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
5	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

6	In Δ XYZ, XY = 6 cm. If M and N are two points on XY and XZ respectively such that MN ∥ YZ and XN = $\frac{1}{4}$ XZ, then the length of XM is : ![triangle XYZ with M on XY and N on XZ, MN parallel to YZ] (A)　1.2 cm　　　　　　　　(B)　1.5 cm (C)　2 cm　　　　　　　　(D)　4 cm	
Sol.	(B) 1.5 cm	1
7	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
8	A line segment joining the points P(–5, 11) and Q is divided internally by the point M(2, – 3) such that PM : MQ = 7 : 2. The coordinates of Q are : (A)　(4, – 7)　　　　　　　　(B)　(27.5, – 52) (C)　(– 7, 4)　　　　　　　　(D)　$\left(\frac{4}{9}, \frac{1}{9}\right)$	
Sol.	(A) (4, −7)	1
9	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

10	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**

11	Two A.P.s have the same first term. The common difference of the first A.P. is – 3 and of the second A.P. is – 5. The difference of the 6th term of the second A.P. from that of the first A.P. is :

(A)   2   (B)   – 8

(C)   – 10   (D)   10

Sol.	(D) 10	**1**

12	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**

13	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 :
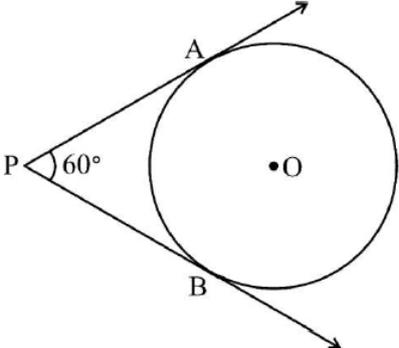
(A) $\dfrac{5}{\sqrt{3}}$ cm   (B) $5\sqrt{3}$ cm

(C) $\dfrac{10}{\sqrt{3}}$ cm   (D)   10 cm

Sol.	(B) $5\sqrt{3}$ cm	**1**

14	If $5 \tan \theta = 2$, then the value of $\dfrac{10 \sin \theta - 2\cos \theta}{5 \sin \theta + 3\cos \theta}$ is :	
	(A) $\dfrac{2}{5}$ (B) $\dfrac{5}{2}$	
	(C) 1 (D) $\dfrac{46}{31}$	
Sol.	(A) $\dfrac{2}{5}$	1
15	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) $\dfrac{1}{10}$ (B) $\dfrac{1}{13}$	
	(C) $\dfrac{3}{10}$ (D) $\dfrac{3}{13}$	
Sol.	(A) $\dfrac{1}{10}$	1
16	If the sector of a circle with diameter 14 cm makes an angle 90° at the centre, then the perimeter of the sector is :	
	(A) 25 cm (B) 11 cm	
	(C) 36 cm (D) 22 cm	
Sol.	(A) 25 cm	1
17	The value of $\left(\sin^2 \theta + \dfrac{1}{1 + \tan^2 \theta} \right)$ is :	
	(A) 0 (B) 2	
	(C) 1 (D) − 1	
Sol.	(C) 1	1
18	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

	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(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 $= \pi \times 14^2 \times \frac{1}{4} - \frac{1}{2} \times 14^2$ $\qquad\qquad\qquad\qquad = (154 - 98) = 56$ Hence, area of minor segment $= 56 \text{ cm}^2$	**1** **1**	
	OR		

21(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 $= 42$ cm^2	½ 1 ½
22	Check whether there is any natural number 'n' for which $(14)^n$ ends with the digit '0' or '5'.	
Sol.	$(14)^n = 2^n 7^n$ as it does not have 5 as the prime factor Hence, it cannot end with the digit 0 or 5	1 1
23(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	
23(b)	Find the value of x such that, $3 \tan^2 60° - x \sin^2 45° + \frac{3}{4} \sec^2 30° = 2 \csc^2 30°$	
Sol.	$3 \tan^2 60° - x \sin^2 45° + \frac{3}{4} \sec^2 30° = 2 \csc^2 30°$ $\Rightarrow 3(\sqrt{3})^2 - x\left(\frac{1}{\sqrt{2}}\right)^2 + \frac{3}{4}\left(\frac{2}{\sqrt{3}}\right)^2 = 2(2)^2$ $\Rightarrow 9 - \frac{x}{2} + 1 = 8$ $\Rightarrow x = 4$	1 1

24	In the given figure, x, y and z are the sides of a right triangle, where z is the hypotenuse. Prove that the radius r of the circle which touches the sides of the triangle is given by $r = \dfrac{x + y - z}{2}$.	
Sol.		
	Clearly OQBP is a square	½
	OP = OQ = QB = BP = r	
	CS = PC = x – r	½
	AS = AQ = y – r	
	AC = z = AS + CS = x – r + y – r	½
	Gives $r = \dfrac{x+y-z}{2}$	½
25	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 $\dfrac{PM}{MS} = \dfrac{QN}{NR}$.	
Sol.	Join PR	½

	PQ ∥ SR and MN ∥ PQ ⇒ MN ∥ SR In Δ PSR, $\dfrac{PM}{MS} = \dfrac{PO}{OR}$ … (i) In Δ PQR, $\dfrac{PO}{OR} = \dfrac{QN}{NR}$ … (ii) From (i) and (ii), $\dfrac{PM}{MS} = \dfrac{QN}{NR}$	½ ½ ½

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SECTION C

This section comprises of Short Answer (SA) type questions of 3 marks each.

</div>

26(a)	If a hexagon PQRSTU circumscribes a circle, prove that, PQ + RS + TU = QR + ST + UP	
Sol.	 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 ⟹ PQ+RS+TU = UP+ST+QR	Correct figure **1** **1½** ½

<div align="center">

OR

</div>

26(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. 	
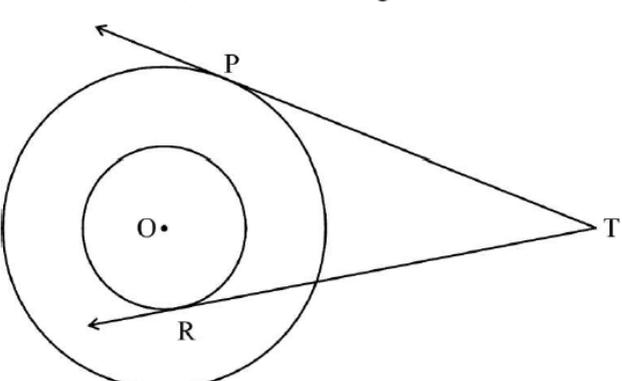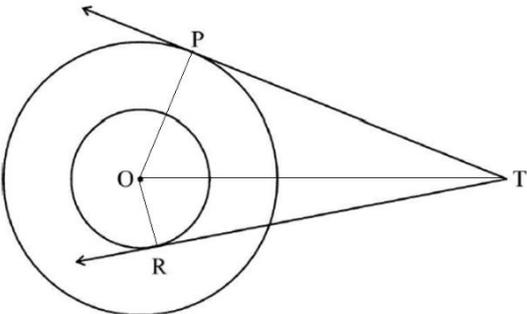
Sol.	 Join OR, OP and OT In Δ ORT, $OT^2 = OR^2 + TR^2 = 3^2 + (4\sqrt{10})^2 = 169$ ∴ OT = 13 cm In Δ OPT, $TP^2 = OT^2 - TP^2 = 13^2 - 5^2 = 144$ ∴ TP = 12 cm	**1** **1** **1**
27	Prove that : $$\left(\tan\alpha + \frac{1}{\cos\alpha}\right)^2 + \left(\tan\alpha - \frac{1}{\cos\alpha}\right)^2 = 2\left(\frac{1+\sin^2\alpha}{1-\sin^2\alpha}\right)$$	
Sol.	$\text{LHS} = \left(\frac{\sin\alpha}{\cos\alpha} + \frac{1}{\cos\alpha}\right)^2 + \left(\frac{\sin\alpha}{\cos\alpha} - \frac{1}{\cos\alpha}\right)^2$ $= \left(\frac{\sin\alpha+1}{\cos\alpha}\right)^2 + \left(\frac{\sin\alpha-1}{\cos\alpha}\right)^2$ $= \frac{\sin^2\alpha + 2\sin\alpha + 1 + \sin^2\alpha - 2\sin\alpha + 1}{1-\sin^2\alpha}$ $= \frac{2(1+\sin^2\alpha)}{1-\sin^2\alpha} = \text{RHS}$	**1** **½** **1** **½**
28	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	$f_i u_i$	
	10-20	9	15	-3	-27	**1½ marks for correct table**
	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	

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

$\qquad = 44.5$

Hence, mean age is 44.5 years

1
½

---

29   If α, β are the zeroes of the polynomial $3x^2 - 13x - 10$, then find the value of $(3\alpha + 1)(3\beta + 1)$.

Sol. α, β are zeroes of $3x^2 - 13x - 10$

$\therefore \alpha + \beta = \dfrac{13}{3}, \quad \alpha\beta = \dfrac{-10}{3}$

$(3\alpha + 1).(3\beta + 1) = 9\alpha\beta + 3(\alpha + \beta) + 1$

$\qquad\qquad\qquad\qquad = -30 + 13 + 1$

$\qquad\qquad\qquad\qquad = -16$

1
½
1
½

---

30   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 $= \dfrac{42}{14} + \dfrac{56}{14} + \dfrac{70}{14}$

$\qquad\qquad\qquad\qquad\qquad = 12$

1½
1
½

31(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

½

½

1

	$x = 8$ and $y = 4$	½
	Hence, the required number is 48	½

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31(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

<table>
<tr><td colspan="3" align="center">SECTION D
This section comprises of Long Answer (LA) type questions of 5 marks each.</td></tr>
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32(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, $(x - 7)^2 = 5x + 1$ $\implies x^2 - 19x + 48 = 0$ $\implies (x - 16)(x - 3) = 0$ $\implies x = 16, 3$ $x \neq 3$ $\therefore x = 16$ Hence, the present age of Nidhi $= 16$ years	2 1 1 1

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32(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, $\frac{1800}{x} - \frac{1800}{x+15} = 20$ $\implies x^2 + 15x - 1350 = 0$ $\implies (x + 45)(x - 30) = 0$ $x \neq -45$ $\therefore x = 30$ So, the number of books bought initially $= 30$	 2 1 1 1

33	In the following table, the median age of 200 spectators of a football match is 32. Find the missing frequencies p and q.		

Age (in years)	Number of Spectators
0 – 10	20
10 – 20	p
20 – 30	50
30 – 40	60
40 – 50	32
50 – 60	q

Sol.

Age (in years)	Number of consumers	Cumulative frequency
0 – 10	20	20
10 – 20	p	20 + p
20 – 30	50	70 + p
30 – 40	60	130 + P
40 – 50	32	162 + p
50 – 60	q	162 + p + q
Total	162 + p + q	

1 mark for correct table

$162 + p + q = 200$
$\Rightarrow p + q = 38 \dots$ (i)
Median $= 32 \therefore 30 - 40$ is the median class.
$\Rightarrow 32 = 30 + \dfrac{(100 - 70 - p)}{60} \times 10$
Solving, we get $p = 18$
From (i), $q = 20$

1

½
1½
½
½

34(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 $= \dfrac{21}{2}$ cm

½

(i)   Volume of the wood left = volume of cube – volume of hemisphere
$$= 21^3 - \frac{2}{3} \times \frac{22}{7} \times \left(\frac{21}{2}\right)^3$$
$$= 6835.5 \text{ cm}^3$$

1
1

(ii)   Total surface area of remaining solid = TSA of cube – base area of hemisphere
                    + CSA of hemisphere

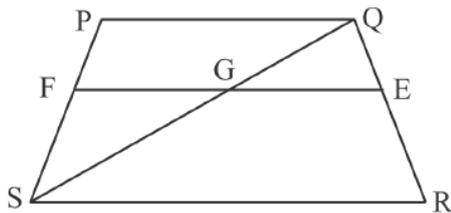|		$$= 6 \times 21^2 - \frac{22}{7} \times \left(\frac{21}{2}\right)^2 + 2 \times \frac{22}{7} \times \left(\frac{21}{2}\right)^2$$ $$= 2992.5 \text{ cm}^2$$	**1½** **1**
		OR	
34(b)		A solid toy is in the form of a hemisphere surmounted by a right circular cone. Ratio of the radius of the cone to its slant height is 3 : 5. If the volume of the toy is 240π 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 $\therefore$ 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 $x = 2$ $\therefore$ Total height of toy $= [4(2) + 3(2)]$ cm $= 14$ cm	**½** **1** **1½** **1** **1**
35		In trapezium PQRS, PQ ∥ SR and SR = 2 PQ. A line segment FE drawn parallel to PQ intersects PS at F and QR at E such that $\dfrac{QE}{ER} = \dfrac{3}{4}$. Diagonal QS intersects FE at G. Prove that $\dfrac{FE}{PQ} = \dfrac{10}{7}$.	
Sol.		GE ∥ PQ and PQ ∥ SR $\Rightarrow$ GE ∥ SR $\therefore \Delta QGE \sim \Delta QSR$ $\Rightarrow \dfrac{GE}{SR} = \dfrac{QE}{QR} = \dfrac{3}{7}$ Given, SR = 2 PQ $\Rightarrow \dfrac{GE}{PQ} = \dfrac{6}{7}$ ... (i) Now, FG ∥ PQ $\therefore \Delta SFG \sim \Delta SPQ$ $\Rightarrow \dfrac{FG}{PQ} = \dfrac{SF}{SP}$ Also, $\dfrac{SF}{SP} = \dfrac{RE}{RQ} = \dfrac{4}{7}$ $\Rightarrow \dfrac{FG}{PQ} = \dfrac{4}{7}$ ... (ii) Adding (i) and (ii), $\dfrac{FE}{PQ} = \dfrac{6}{7} + \dfrac{4}{7} = \dfrac{10}{7}$	**1** **½** **½** **1** **1** **½** **½**
		SECTION E **This section comprises of 3 case study-based questions of 4 marks each.**	

36	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 10th row ?	*1*
	(ii) How many more trees will be planted in the 8th row than in the 5th 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 11th row ?	*2*
Sol.	Here $a = 50$ and $d = 20$	
	(i) Number of trees planted in 10th 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
	$= 3200 - \frac{11}{2}[2 \times 50 + 10 \times 20]$	1
	$= 1550$	½
	Hence, number of trees left are 1550	

37	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.	
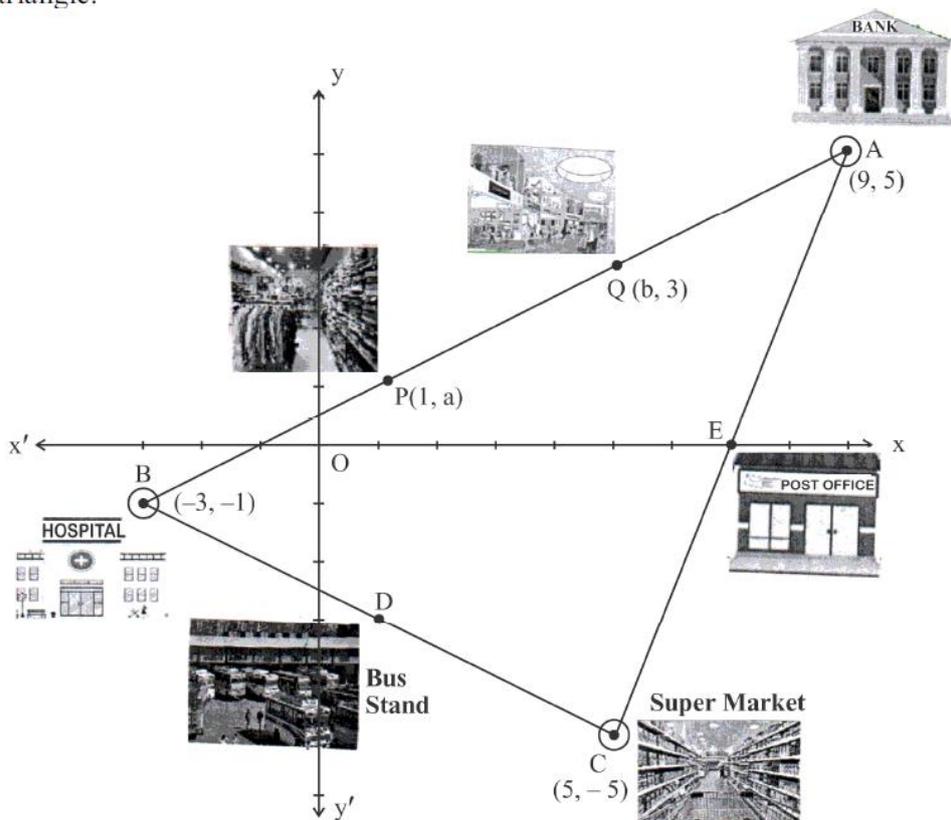
Based on the above given information, answer the following questions :

(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 $= \sqrt{(-3-9)^2 + (-1-5)^2}$	½
	$= \sqrt{180}$ units or $6\sqrt{5}$ units	½
(ii)	Coordinates of E are $\left(\frac{9+5}{2}, \frac{5+(-5)}{2}\right) = (7, 0)$	½ + ½
(iii)	(a) Coordinates of D are $\left(\frac{-3+5}{2}, \frac{-1+(-5)}{2}\right) = (1, -3)$	1
	Distance Partha need to cover $= \sqrt{(9-1)^2 + (5-(-3))^2}$	½
	$= \sqrt{128}$ units or $8\sqrt{2}$ units	½
	OR	
(iii)	(b) P is mid-point of BQ	

	$\therefore a = \frac{-1+3}{2} = 1$	1
	Q is mid-point of PA	
	$\therefore b = \frac{1+9}{2} = 5$	1

38	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,	
	$\frac{OP}{12\sqrt{3}} = coesc\ 60° = \frac{2}{\sqrt{3}}$	½
	$\Rightarrow OP = 24$ m	½
	$\therefore$ Length of ladder is 24 m	
	(ii)　In ΔOAP,	
	$\frac{OA}{12\sqrt{3}} = \cot 60° = \frac{1}{\sqrt{3}}$	½
	$\Rightarrow OA = 12$ m	½
	$\therefore$ the distance of the building Y from point O ie.,OA is 12 m	
	(iii)　(a) $OP = OR = 24$ m	½

	∴ In ΔOCR, $\frac{OC}{24} = \cos 45° = \frac{1}{\sqrt{2}}$ $\Rightarrow OC = 12\sqrt{2}$ m	**1**
	∴ distance between two buildings = OA + OC $= \left(12 + 12\sqrt{2}\right)$ m or $12(1 + \sqrt{2})$ m	½
	OR	
(iii)	(b) $OP = OR = 24$ m	½
	∴ In ΔOCR, $\frac{RC}{24} = \sin 45° = \frac{1}{\sqrt{2}}$	**1**
	$\Rightarrow RC = 12\sqrt{2}$ m	½
	∴ height of building X is $12\sqrt{2}$ m	