MT

2014 ___ ___ 1100 **Seat No.** | | | | | | | |

MT - MATHEMATICS (71) ALGEBRA - PRELIM II - PAPER - 6 (E)

Time : 2 Hours **(Pages 3)** **Max. Marks : 40**

Note :

(i) All questions are compulsory.

(ii) Use of calculator is not allowed.

Q.1. Solve ANY Five of the following : **5**

(i) Write the first five terms of the following Arithmetic Progressions where, the common difference 'd' and the first term 'a' is given :
a = 6, d = 6

(ii) Determine whether the given values of 'x' is a roots of given quadratic equation.
$x^2 + x - 1 = 0$, x = 2

(iii) Find the value of discriminant of the following equations :
$x^2 + x + 1 = 0$

(iv) If x = 5 and y = 3 is the solution of 3x + ky = 3, find k.

(v) If A = 150, $\bar{d}$ = -13.6 and h = 20 then find mean.

(vi) For a pie diagram, θ = 60°, Total = 54000, find the data.

Q.2. Solve ANY FOUR of the following : **8**

(i) Find S_{10} if a = 6 and d = 3.

(ii) From the quadratic equation if its roots are.
0 and – 6

(iii) What is the equation of Y - axis? Hence, find the point of intersection of Y -axis. and the line y = 3x + 2.

(iv) In each of the following experiments write the sample space S, number of sample points n (S), events P, Q, R using set and n (P), n (Q) and n (R). Find the events among the events defined above which are : complementary events, mutually exclusive events and exhaustive events.
There are 3 red, 3 white and 3 green balls in a bag. One ball is drawn at random from a bag :
P is the event that ball is red.
Q is the event that ball is not green.
R is the event that ball is red or white.

(v) Which term of on A.P. is 93, if a = 150 and d = -3.

(vi) A coin is tossed three times then, find the probability of
(a) getting head on middle coin
(b) getting exactly one tail

Q.3. Solve ANY THREE of the following : 9

(i) A meeting hall has 20 seats in the first row, 24 seats in the second row, 28 seats in the third row, and so on and has in all 30 rows. How many seats are there in the meeting hall ?

(ii) Solve the given quadratic equation by completing square.
$z^2 + 4z - 7 = 0$

(iii) One card is drawn from a well- shuffled deck of 52 cards. Find the probability of getting
(a) king of red colour. (b) a face card. (c) a red face card.

(iv) There are 30 tickets numbered from 1 to 30 in box. A ticket is drawn. What is the probability that the ticket drawn
(a) bears an odd number.
(b) bears a number which is a perfect square.

(v) Number of students admitted in different faculties of a college are given below :

Faculty	Science	Commerce	Arts	Law	Home science
No. of students	1000	1200	650	450	300

Draw a pie diagram and represent the above data.

Q.4. Solve ANY TWO of the following : 8

(i) Solve the given simultaneous equations using graphical method : $4x = y - 5$; $y = 2x + 1$

(ii) Draw frequency curve for the following data on land holding :

Area in hecters	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80
No. of farmers	58	103	208	392	112	34	12

(iii) Obtain the sum of the 56 terms of an A. P. whose 19^{th} and 38^{th} terms are 52 and 148 respectively.

Q.5. Solve ANY TWO of the following : 10

(i) Solve the following equation :

$(x^2 + 2x)(x^2 + 2x - 11) + 24 = 0$

(ii) Following table shows distribution of monthly expenditure (in Rs.) done by households in a certain village on electricity :

Monthly expenditure	150 - 225	225 - 300	300 - 375	375 - 450	450 - 525	525 - 600	600 and above
No. of households	65	171	196	75	53	26	14

Find median expenditure done by a household on electricity per month.

(iii) A person deposits Rs. x in savings bank account at the rate of 5% per annum and Rs. y in fixed deposit at 10% per annum. At the end of one year he gets Rs. 400 as total interest. If the deposits Rs. y in savings bank account and Rs. x in fixed deposit he would get Rs. 350 as total interest. Find the total amount he deposited.

Best Of Luck 👍

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MT - MATHEMATICS (71) ALGEBRA - PRELIM II - PAPER - 6 (E)

Time : 2 Hours **Preliminary Model Answer Paper** **Max. Marks : 40**

A.1. **Attempt ANY FIVE of the following :**

(i) $a = 6, d = 6$

Here, $t_1 = a = 6$

$t_2 = t_1 + d = 6 + 6 = 12$

$t_3 = t_2 + d = 12 + 6 = 18$

$t_4 = t_3 + d = 18 + 6 = 24$

$t_5 = t_4 + d = 24 + 6 = 30$

$\therefore$ The first five terms of A.P. are 6, 12, 18, 24 and 30. **1**

(ii) $x^2 + x - 1 = 0, x = 2$

Putting $x = 2$ in L.H.S., we get,

L.H.S. $= (2)^2 + 2 - 1$

$= 4 + 1$

$= 5$

$\neq$ R.H.S.

$\therefore$ L.H.S. $\neq$ R.H.S.

Thus equation is not satisfied.

So 2 is not the root of the given quadratic equation. **1**

(iii) $x^2 + x + 1 = 0$

Comparing with $ax^2 + bx + c = 0$

we have $a = 1, b = 1, c = 1$

$\Delta = b^2 - 4ac$

$= (1)^2 - 4\ (1)\ (1)$

$= 1 - 4$

$= -3$

$\therefore$ $\Delta = -3$ **1**

(iv) $\because$ $x = 5$ and $y = 3$ is the solution of $3x + ky = 3$, it satisfies the equation.

$\therefore$ Substituting $x = 5$ and $y = 3$ in the equation we get,

$3\ (5) + k\ (3) = 3$

$\therefore$ $15 + 3k = 3$

$\therefore \quad 3k = 3 - 15$

$\therefore \quad 3k = -12$

$\therefore \quad k = \frac{-12}{3}$

$\therefore \quad \boxed{k = -4}$ **1**

(v) Mean (x) $= A + \bar{d}$

$= 150 + (-13.6)$

$= 150 - 13.6$

$= 136.4$

$\therefore$ Mean is 136.4 units **1**

(vi) $\theta = \frac{\text{Data}}{\text{Total}} \times 360$

$\therefore \quad 60 = \frac{\text{Data}}{54000} \times 360$

$\therefore \quad \text{Data} = \frac{60 \times 54000}{360}$

$\therefore \quad \boxed{\text{Data} = 9000}$ **1**

A.2. Solve ANY Four of the following :

(i) For an A.P. a = 6, d = 3 **1**

$S_n = \frac{n}{2}[2a + (n - 1)\, d]$

$\therefore \quad S_{10} = \frac{10}{2}[2a + (10 - 1)\, 1]$

$\therefore \quad S_{10} = 5\,[2\,(6) + 9\,(3)]$

$\therefore \quad S_{10} = 5\,(12 + 27)$

$\therefore \quad S_{10} = 5\,(39)$

$\therefore \quad \boxed{S_{10} = 195}$ **1**

(ii) The roots of the quadratic equation are 0 and – 6

Let $\alpha = 0$ and $\beta = -6$

$\therefore \quad \alpha + \beta = 0 + (-6) = 0 - 6 = -6$ **1**

$\alpha \,.\, \beta = 0 \times -6 = 0$

We know that,

$x^2 - (\alpha + \beta)\, x + \alpha \,.\, \beta = 0$

$\therefore \quad x^2 - (-6)\, x + 0 = 0$

$\therefore \quad x^2 + 6x = 0$

The required quadratic equation is $x^2 + 6x = 0$ **1**

(iii) The equation of Y-axis is x = 0 — 1

Let the point of intersection of the line y = 3x + 2 with Y-axis be (0, k)

$\because$ (0, k) lies on the line it satisfies the equation

$\therefore$ Substituting x = 0 and y = k in the equation we get,

$k = 3(0) + 2$

$\therefore k = 2$

$\therefore$ The point of intersection of the line y = 3x + 2 with Y-axis is (0, 2). — 1

(iv) Let 3 red balls, 3 white balls and 3 green balls be denoted as R_1, R_2, R_3, W_1, W_2, W_3 and G_1, G_2, G_3 respectively.

P is the event that the ball is red

$P = \{ R_1, R_2, R_3 \}$

$\therefore$ $n(P) = 3$ — 1

Q is the event that the ball is not green

$Q = \{ R_1, R_2, R_3, W_1, W_2, W_3 \}$

$\therefore$ $n(Q) = 6$

R is the event that the ball is red or white

$R = \{ R_1, R_2, R_3, W_1, W_2, W_3 \}$

$\therefore$ $n(R) = 6$ — 1

(v) For an A.P. a = 150, d = -3, t_n = 93

$t_n = a + (n-1)d$

$\therefore 93 = 150 + (n-1)(-3)$ — 1

$\therefore -57 - 3 = -3n$

$\therefore -60 = -3n$

$\therefore n = 20$

$\therefore$ 20^{th} term of an A.P. is 93 — 1

(vi) When a coin tossed three times

S = { HHH, HTH, THH, TTH, HHT, HTT, THT, TTT }

n (S) = 8

(a) Let A be the event of getting head on middle coin

A = { HHH, THH, HHT, THT }

n (A) = 4

$P(A) = \frac{n(A)}{n(S)}$

$\therefore$ P (A) = $\frac{4}{8}$

$\therefore$ $\boxed{\text{P (A)} = \frac{1}{2}}$ **1**

(b) Let B be the event of getting exactly one tail

B = { HTH, THH, HHT }

n (B) = 3

P (B) = $\frac{n(B)}{n(S)}$

$\therefore$ $\boxed{\text{P (B)} = \frac{3}{8}}$ **1**

A.3. Solve ANY THREE of the following :

(i) The no. of seats in each row are as follows 20, 24, 28, ...

The no. of seats in each row form an A.P. with **1**

First term (a) = 20

Difference between the no. of seats in two successive rows (d) = 4

Total no. of rows (n) = 30

Total no. of seats in 30 rows (S_{30}) = ?

$S_n = \frac{n}{2}[2a + (n - 1)\,d]$ **1**

$\therefore$ $S_{30} = \frac{30}{2}[2\,(20) + (30 - 1)\,4]$

$\therefore$ $S_{30} = 15\,[40 + 116]$

$\therefore$ $S_{30} = 15\,(156)$

$\therefore$ $S_{30} = 2340$

$\therefore$ Total no. of seats in the meeting hall is 2340. **1**

(ii) $z^2 + 4z - 7 = 0$

$\therefore$ $z^2 + 4z = 7$ ..... (i)

Third term = $\left(\frac{1}{2} \times \text{coefficient of } z\right)^2$

= $\left(\frac{1}{2} \times 4\right)^2$ **1**

= $(2)^2$

= 4

Adding 4 to both the sides of (i) we get,

$z^2 + 4z + 4 = 7 + 4$

$\therefore$ $(z + 2)^2 = 11$

$\therefore \quad (z + 2)^2 = \left(\sqrt{11}\right)^2$ **1**

Taking square root on both the sides, we get;

$z + 2 = \pm\sqrt{11}$

$\therefore \quad z = -2 \pm \sqrt{11}$

$\therefore \quad z = -2 + \sqrt{11}$ or $z = -2 - \sqrt{11}$

$\therefore$ $-2 + \sqrt{11}$ and $-2 - \sqrt{11}$ are the roots of the given quadratic equation. **1**

(iii) There are 52 cards in a pack

$\therefore \quad n(S) = 52$

(a) Let A be the event that card drawn is a king of red colour

$\because$ There are 2 kings of red colour

$n(A) = 2$

$P(A) = \dfrac{n(A)}{n(S)}$

$\therefore \quad P(A) = \dfrac{2}{52}$

$\therefore \quad P(A) = \dfrac{1}{26}$ **1**

(b) Let B be the event that card drawn is a face card

$\because$ There are 3 face cards is each of the 4 types

$\therefore$ The total no. of face cards $n(B) = 4 \times 3 = 12$

$\therefore \quad P(B) = \dfrac{n(B)}{n(S)}$

$\therefore \quad P(B) = \dfrac{12}{52}$

$\therefore \quad P(B) = \dfrac{3}{13}$ **1**

(c) Let C be the event that the card drawn is a red face card

$\because$ There are 3 face cards is each of the 2 red types

$\therefore$ The total no. of red face cards $n(C) = 2 \times 3 = 6$

$P(C) = \dfrac{n(C)}{n(S)}$

$\therefore \quad P(C) = \dfrac{6}{52}$

$\therefore \quad P(C) = \dfrac{3}{26}$ **1**

(iv) When 1 ticket is drawn from a box containing 30 tickets numbered from 1 to 30.

S = { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 } **1**

$\therefore$ n (S) = 30

(a) Let A be the event that the ticket drawn bears an odd number

A = { 1, 3, 5, 7, 9, 11, 15, 17, 19, 21, 23, 25, 27, 29 }

n (A) = 15

$P(A) = \frac{n(A)}{n(S)}$

$\therefore P(A) = \frac{15}{30}$

$\therefore \boxed{P(A) = \frac{1}{2}}$ **1**

(b) Let B be the event that the ticket drawn bears a number which is a perfect square.

B = { 1, 4, 9, 16, 25 }

n (B) = 5

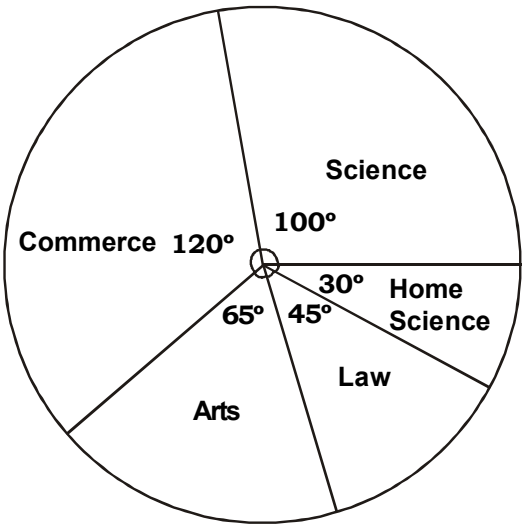
$P(B) = \frac{n(B)}{n(S)}$

$\therefore P(B) = \frac{5}{30}$

$\therefore \boxed{P(B) = \frac{1}{6}}$ **1**

(v)

Faculty	**No. of students**	**Measure of central angle (θ)**
Science	1000	$\frac{1000}{3600} \times 360^\circ = 100^\circ$
Commerce	1200	$\frac{1200}{3600} \times 360^\circ = 120^\circ$
Arts	650	$\frac{650}{3600} \times 360^\circ = 65^\circ$ **1**
Law	450	$\frac{450}{3600} \times 360^\circ = 45^\circ$
Home science	300	$\frac{300}{3600} \times 360^\circ = 30^\circ$
Total	**3600**	**360°**



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A.4. **Solve ANY TWO of the following :**

(i) $4x = y - 5$ $\quad y = 2x + 1$

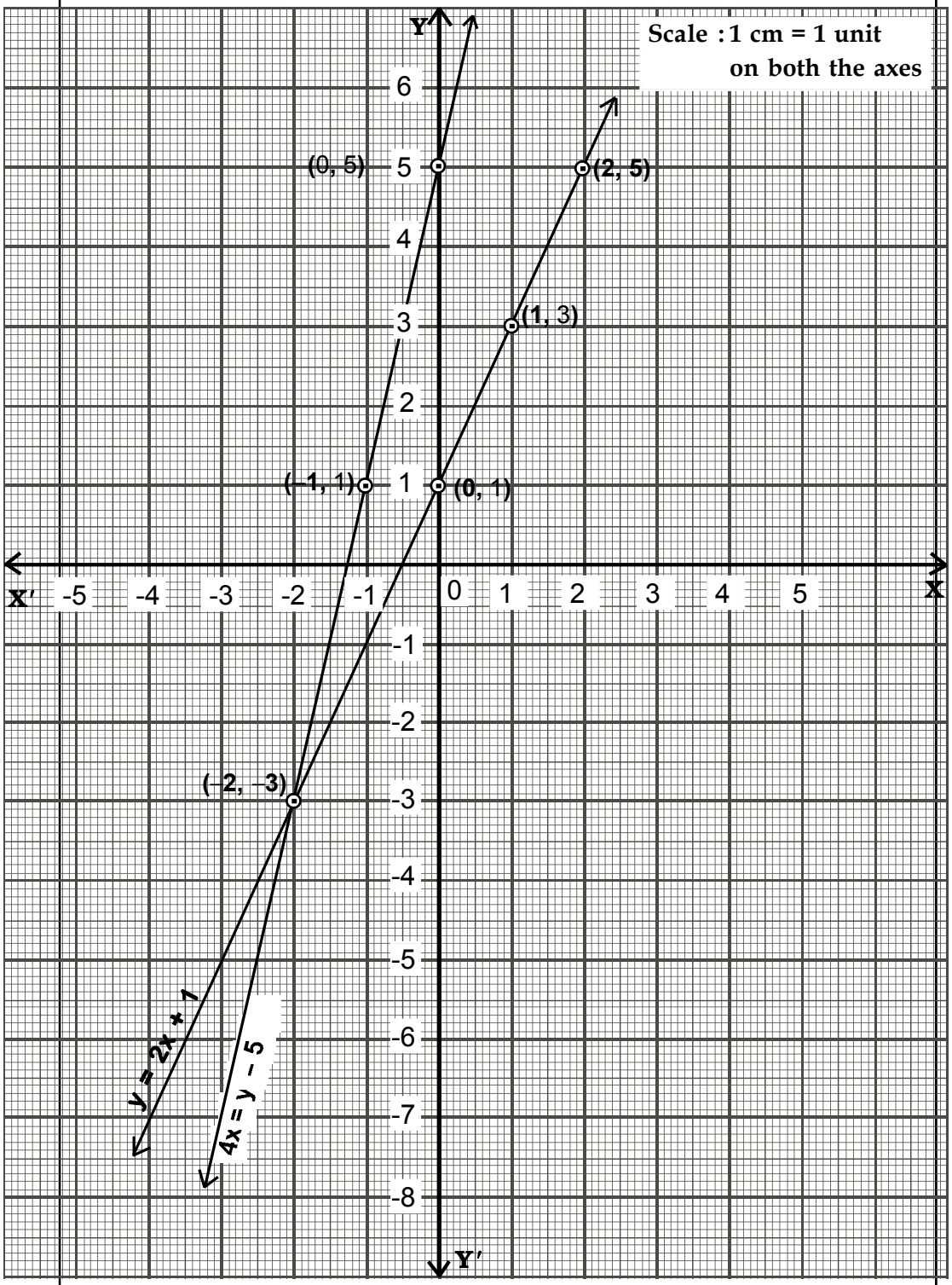
$\therefore \quad 4x + 5 = y$

$\therefore \quad y = 4x + 5$

x	0	–1	–2
y	5	1	–3
(x, y)	(0, 5)	(–1, 1)	(–2, –3)

x	0	1	2
y	1	3	5
(x, y)	(0, 1)	(1, 3)	(2, 5)

1



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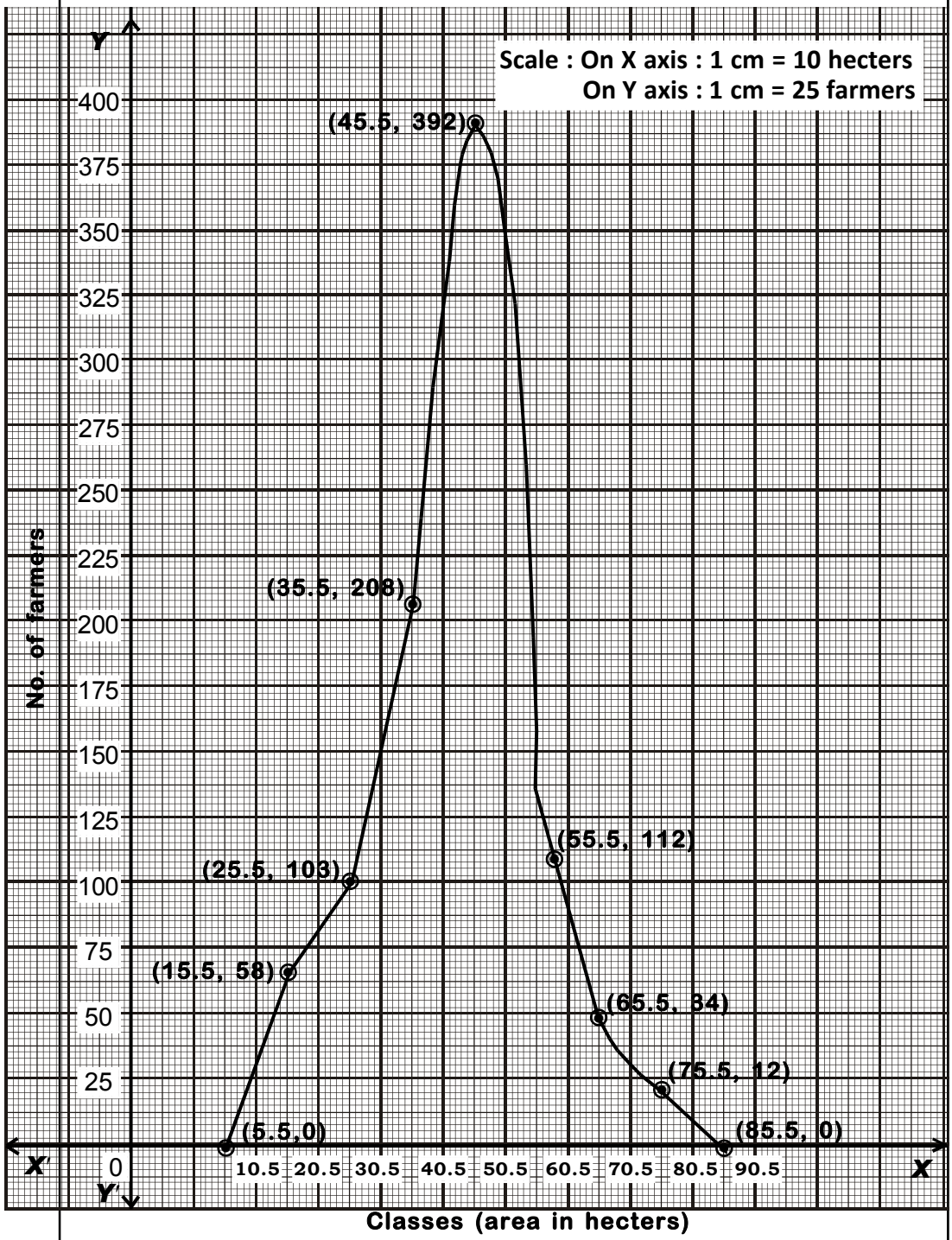
∴ x = – 2 and y = – 3 is the solution of given simultaneous equations. 1

(ii)

Area in hecters	11 - 20	21 - 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80
No. of farmers	58	103	208	392	112	34	12

1



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(iii) $t_{19} = 52$, $t_{38} = 148$ **1**

$t_n = a + (n - 1)\,d$

$\therefore\ t_{19} = a + (19 - 1)\,d$

$\therefore\ 52 = a + 18d$

$\therefore\ a + 18d = 52$ .....(i)

$t_{38} = a + (38 - 1)\,d$

$\therefore\ 148 = a + 37d$

$\therefore\ a + 37d = 148$ .....(ii)

Adding (i) and (ii) we get,

$$\begin{array}{rrrr} a & + & 18d & = 52 \\ a & + & 37d & = 148 \\ \hline 2a & + & 55d & = 200 \end{array}$$

$S_n = \frac{n}{2}\,[2a + (n - 1)d]$ **1**

$\therefore\ S_{56} = \frac{56}{2}\,[2a + (56 - 1)\,d]$

$\therefore\ S_{56} = \frac{56}{2}\,[2a + 55d]$

$\therefore\ S_{56} = \frac{56}{2}\,[200]$

$\therefore\ S_{56} = 5600$

$\therefore$ Sum of first 56 terms of A.P. is 5600. **1**

A.5. Solve ANY TWO of the following :

(i) $(x^2 + 2x)(x^2 + 2x - 11) + 24 = 0$ **1**

Substituting $x^2 + 2x = m$ we get,

$m(m - 11) + 24 = 0$

$\therefore\ m^2 - 11m + 24 = 0$

$\therefore\ m^2 - 8m - 3m + 24 = 0$

$\therefore\ m(m - 8) - 3(m - 8) = 0$

$\therefore\ (m - 8)(m - 3) = 0$

$\therefore\ m - 8 = 0$ or $m - 3 = 0$

$\therefore\ m = 8$ or $m = 3$ **1**

Resubstituting $m = x^2 + 2x$ we get,

$x^2 + 2x = 8$ or $x^2 + 2x = 3$

$\therefore\ x^2 + 2x - 8 = 0$ ..... (i) or $x^2 + 2x - 3 = 0$ .....(ii)

From (i), $x^2 + 2x - 8 = 0$

$\therefore\ x^2 + 4x - 2x - 8 = 0$ **1**

$\therefore\ x(x + 4) - 2(x + 4) = 0$

$\therefore \quad (x + 4)(x - 2) = 0$

$\therefore \quad x + 4 = 0 \text{ or } x - 2 = 0$

$\therefore \quad x = -4 \text{ or } x = 2$ **1**

From (ii), $x^2 + 2x - 3 = 0$

$\therefore \quad x^2 + 3x - x - 3 = 0$

$\therefore \quad x(x + 3) - 1(x + 3) = 0$

$\therefore \quad (x + 3)(x - 1) = 0$

$\therefore \quad x + 3 = 0 \text{ or } x - 1 = 0$

$\therefore \quad x = -3 \text{ or } x = 1$

$\therefore$ x = – 4 or x = 2 or x = – 3 or x = 1. **1**

(ii)

Classes (Monthly exp.)	**Frequency (f_i) (No. of households)**	**Cumulative frequency less than type**
150 - 225	65	65
225 - 300	171	236 → *c.f.*
300 - 375	196 → *f*	432
375 - 450	75	507
450 - 525	53	560
525 - 600	26	586
600 and above	14	600
Total	**600 → N**	

1

Here total frequency = Σf_i = N = 600 **1**

$\therefore \quad \frac{N}{2} = \frac{600}{2} = 300$

Cumulative frequency (less than type) which is just greater than 300 is 432. Therefore corresponding class 300 - 375 is median class.

L = 300, N = 600, *c.f.* = 236, f = 196, h = 75 **1**

$$\text{Median} = L + \left(\frac{N}{2} - c.f.\right)\frac{h}{f}$$

$$= 300 + \left(\frac{600}{2} - 236\right)\frac{75}{196}$$ **1**

$$= 300 + (300 - 236)\frac{75}{196}$$

$$= 300 + (64)\frac{75}{196}$$

$$= 300 + 16\left(\frac{75}{49}\right)$$

$= 300 + \frac{1200}{49}$

$= 300 + 24.49$

$= 324.49$

$\therefore$ Median of monthly expenditure is Rs. 324.49. **1**

(iii) Amount deposited in savings account = Rs. x

Amount deposited in fixed deposit account = Rs. y **1**

Total amount deposited = Rs. (x + y)

Interest received on Rs. x = $\frac{5x}{100}$ **1**

Interest received on Rs. y = $\frac{10y}{100}$

As per the first given condition,

$$\frac{5x}{100} + \frac{10y}{100} = 400$$

Multiplying throughout by 100 we get,

$5x + 10y = 40000$ .....(i) **1**

As per second condition,

$$\frac{5y}{100} + \frac{10x}{100} = 350$$

Multiplying throughout by 100

$5y + 10x = 35000$

$10x + 5y = 35000$ ......(ii) **1**

Adding (i) and (ii)

$5x + 10y = 40000$

$10x + 5y = 35000$

$15x + 15y = 75000$

Dividing throughout by 15, we get

$x + y = 5000$

$\therefore$ Total amount deposited is Rs. 5000. **1**

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