

Q.P. SET CODE
B

MT - X

Seat No.

2013 ___ ___ 1100 - MT - X - MATHEMATICS (71) ALGEBRA - SET - B (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) Two coins are tossed, write sample space and n(s).
- (ii) Is following list of number an Arithmetic Progression? Justify.
3, 5, 7, 9, 11,
- (iii) If $D_y = -15$ and $D = -5$ are the values of the determinants for certain simultaneous equations in x and y, find y.
- (iv) Write the quadratic equation in standard form $ax^2 + bx + c = 0$
 $3y^2 = 8y - 5$
- (v) Write the co-ordinates of the point of intersection of X-axis and Y-axis.
- (vi) If $\sum f_i u_i = 595$ and $\sum f_i = 50$, find \bar{u}

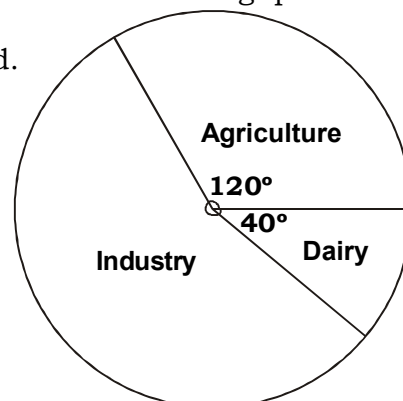
Q.2. Solve ANY FOUR of the following :

8

- (i) Solve the following quadratic equation by factorization method.
 $6x^2 - 7x - 13 = 0$
- (ii) Mangala started doing physical exercise 10 minutes for the first day. She will increase the time of exercise by 5 minutes per day, till she reaches 45 minutes. How many days are required to reach 45 minutes ?

(iii) The following diagram represents the sectorwise loan amount in crores of Rs. distributed by a bank. From the information answer the following questions :

- (a) If the dairy sector received Rs. 20 crores, then find the total loan disbursed.
 (b) Find the loan amount for agriculture sector and also for industrial sector.



- (iv) If a card is drawn from a pack of 52 cards, find the probability of getting not a black card
- (v) Find the eighteenth term of the A. P. : 1, 7, 13, 19,
- (vi) Without actually solving the simultaneous equations given below, decide whether simultaneous equations have unique solution, no solution or infinitely many solutions.
 $3y = 2 - x$; $3x = 6 - 9y$

Q.3. Solve ANY THREE of the following :

9

- (i) Solve the following simultaneous equations using Cramer's rule :
 $4x + 3y - 4 = 0$; $6x = 8 - 5y$
- (ii) For an A. P. if $t_4 = 12$, and $d = -10$, then find its general term.
- (iii) In the following experiment write the sample space S, number of sample point n (S), event A, B, C and n (A), n (B), n (C). Also find complementary events, mutually exclusive events :
 A die is thrown. A is the event that prime number comes up, B is the event that the number is divisible by three comes up, C is the event that a perfect square number comes up.
- (iv) Following is the componentwise expenditure per article. Draw a pie chart:

Component	Expenditure (in Rs.)
Raw material	800
Labour	300
Transportation	100
Packing	100
Taxes	140

- (v) Represent the following data using histogram.

Height of students (cm.)	140-144	145-149	150-154	155-159
Number of students	2	12	10	4

Q.4. Solve ANY TWO of the following :

8

- (i) Two dice are thrown, find the probability of getting :
- The sum of the numbers on their upper faces is divisible by 9.
 - The sum of the numbers on their upper faces is at the most 3.
 - The number on the upper face of the first die is less than the number on the upper face of the second die.
- (ii) For an A.P. given below find t_{20} and S_{10} . $\frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \dots$
- (iii) Solve the following equation :
 $(y^2 + 5y)(y^2 + 5y - 2) - 24 = 0$

Q.5. Solve ANY TWO of the following :

10

- (i) Durga's mother gave some 10 rupee notes and some 5 rupee notes to her, which amounts to Rs. 190. Durga said, 'if the number of 10 rupee notes and 5 rupee notes would have been interchanged, I would have Rs. 185 in my hand.' So how many notes of rupee 10 and rupee 5 were given to Durga ?
- (ii) Following table gives age distribution of people suffering from 'Asthama due to air pollution in certain city. Find mean age of persons suffering from 'Asthama' by step deviation method.

Age in years	7-11	11-15	15-19	19-23	23-27	27-31	31-35	35-39
No. of people	5	9	13	21	16	15	12	9

- (iii) Tinu takes 9 days more than his father to do a certain piece of work. Together they can do the work in 6 days. How many days will tinu take to do that work.

Best Of Luck 🍀

A.P. SET CODE

B

MT - X

2013 __ __ 1100 - **MT - X - MATHEMATICS (71) ALGEBRA - SET - B (E)**

Time : 2 Hours

Preliminary Model Answer Paper

Max. Marks : 40

A.1. Solve ANY FIVE of the following :	
(i) When 2 coins are tossed $S = \{ HH, HT, TH, TT \}$ $n(S) = 4$	1
(ii) $t_1 = 3, t_2 = 5, t_3 = 7, t_4 = 9, t_5 = 11$ $t_2 - t_1 = 5 - 3 = 2$ $t_3 - t_2 = 7 - 5 = 2$ $t_4 - t_3 = 9 - 7 = 2$ $t_5 - t_4 = 11 - 9 = 2$ \therefore The difference between any two consecutive terms is 2 which is constant. \therefore The sequence is an A.P.	1
(iii) $D_y = -15$ and $D = -5$ By Cramer's rule, $y = \frac{D_y}{D}$ $\therefore y = \frac{-15}{-5}$ $\therefore y = 3$	1
(iv) $3y^2 = 8y - 5$ $\therefore 3y^2 - 8y + 5 = 0$	1
(v) The co-ordinates of point of intersection of X-axis and Y-axis is (0, 0)	1
(vi) $\bar{u} = \frac{\sum f_i u_i}{\sum f_i}$ $= \frac{595}{50} = 11.9$	1

<p>A.2. Solve ANY Four of the following :</p> <p>(i)</p> <p>(ii)</p> <p>(iii)</p>	<p>$6x^2 - 7x - 13 = 0$</p> <p>$\therefore 6x^2 - 13x + 6x - 13 = 0$</p> <p>$\therefore x(6x - 13) + 1(6x - 13) = 0$</p> <p>$\therefore (6x - 13)(x + 1) = 0$</p> <p>$\therefore 6x - 13 = 0$ or $x + 1 = 0$</p> <p>$\therefore 6x = 13$ or $x = -1$</p> <p>$\therefore x = \frac{13}{6}$ or $x = -1$</p> <p>Since the workout time is Mangala increased by 5 minutes everyday after the first day, the successive workout times are in A.P. Workout time for first day (a) = 10 minutes. Increases in workout time (d) = 5 minutes Let No. of days required to reach workout time of 45 minutes be 'n' days.</p> <p>$t_n = 45$</p> <p>$\therefore t_n = a + (n - 1) d$</p> <p>$\therefore 45 = 10 + (n - 1) 5$</p> <p>$\therefore 45 = 10 + 5n - 5$</p> <p>$\therefore 45 = 5 + 5n$</p> <p>$\therefore 45 - 5 = 5n$</p> <p>$\therefore 5n = 40$</p> <p>$\therefore n = 8$</p> <p>$\therefore 8$ days required to reach work out time of 45 minutes.</p> <p>(a) Let the total loan disbursed be Rs. x crores The measure of central angle for dairy sector is 40°. \therefore Dairy sector received Rs. 20 crores of the total loan i.e. x</p> <p>$\therefore \frac{40}{360} \times x = 20$ crores</p> <p>$\therefore x = \frac{20 \text{ crores} \times 360}{40}$</p> <p>$\therefore x = 180$ crores</p> <p>\therefore Total loan disbursed is Rs. 180 crores.</p> <p>(b) Measure of central angle for agriculture sector is 120°</p> <p>\therefore Amount disbursed for agriculture sector = $\frac{120}{360} \times 180$ = Rs. 60 crores</p> <p>Measure of central angle for industrial sector is 200°</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
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	$\therefore \text{Amount disbursed for industrial sector} = \frac{200}{360} \times 180$ $= \text{Rs. } 100 \text{ crores.}$	1
(iv)	<p>There are 52 cards in a pack of playing card.</p> $\therefore n(S) = 52$ <p>Let B be the event that the card drawn is not a black card Total no. of red cards = 26</p> $\therefore n(B) = 26$ $P(B) = \frac{n(B)}{n(S)}$ $\therefore P(B) = \frac{26}{52}$ $\therefore P(B) = \frac{1}{2}$	1
(v)	<p>For the given A.P. 1, 7, 13, 19,</p> <p>Here, $a = t_1 = 1$ $d = t_2 - t_1 = 7 - 1 = 6$</p> <p>We know,</p> $t_n = a + (n - 1) d$ $\therefore t_{18} = a + (18 - 1) d$ $\therefore t_{18} = 1 + 17(6)$ $\therefore t_{18} = 1 + 102$ $\therefore t_{18} = 103$ <p>\therefore Eighteenth term of A.P. is 103.</p>	1
(vi)	$3y = 2 - x$ $\therefore x + 3y = 2$ <p>Comparing with $a_1x + b_1y = c_1$ we get, $a_1 = 1, b_1 = 3, c_1 = 2$</p> $3x = 6 - 9y$ $\therefore 3x + 9y = 6$ <p>Comparing with $a_2x + b_2y = c_2$ we get, $a_2 = 3, b_2 = 9, c_2 = 6$</p> $\therefore \frac{a_1}{a_2} = \frac{1}{3}$ $\therefore \frac{b_1}{b_2} = \frac{3}{9} = \frac{1}{3}$ $\therefore \frac{c_1}{c_2} = \frac{2}{6} = \frac{1}{3}$	1

	$\therefore \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ <p>\therefore The simultaneous equations $3y = 2 - x$ and $3x = 6 - 9y$ have infinitely many solutions.</p>	1
A.3.	<p>Solve ANY THREE of the following :</p>	
(i)	$4x + 3y - 4 = 0$ $\therefore 4x + 3y = 4$ $6x = 8 - 5y$ $\therefore 6x + 5y = 8$ $D = \begin{vmatrix} 4 & 3 \\ 6 & 5 \end{vmatrix} = (4 \times 5) - (6 \times 3) = 20 - 18 = 2$ $D_x = \begin{vmatrix} 4 & 3 \\ 8 & 5 \end{vmatrix} = (4 \times 5) - (3 \times 8) = 20 - 24 = -4$ $D_y = \begin{vmatrix} 4 & 4 \\ 6 & 8 \end{vmatrix} = (4 \times 8) - (4 \times 6) = 32 - 24 = 8$ <p>By Cramer's rule,</p> $x = \frac{D_x}{D} = \frac{-4}{2} = -2$ $y = \frac{D_y}{D} = \frac{8}{2} = 4$ <p>$\therefore x = -2$ and $y = 4$ is the solution of given simultaneous equations.</p>	1
(ii)	<p>Given : For an A.P. $t_4 = 12$, $d = -10$ Find : General term $\{t_n\}$ Sol. $t_n = a + (n - 1)d$ $\therefore t_4 = a + (4 - 1)d$ $\therefore 12 = a + 3(-10)$ $\therefore 12 = a - 30$ $\therefore a = 12 + 30$ $\therefore a = 42$ $t_n = a + (n - 1)d$ $\therefore t_n = 42 + (n - 1)(-10)$ $\therefore t_n = 42 - 10n + 10$ $\therefore t_n = 52 - 10n$ \therefore The general term of A.P. is $52 - 10n$.</p>	1

(iii)

A die is thrown

$$\therefore S = \{1, 2, 3, 4, 5, 6\}$$

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

A is the event that a prime number comes up

$$\therefore A = \{2, 3, 5\}$$

$$\therefore n(A) = 3$$

B is the event that a number divisible by 3 comes up

$$\therefore B = \{3, 6\}$$

$$\therefore n(B) = 2$$

C is the event that a perfect square number comes up

$$\therefore C = \{1, 4\}$$

$$\therefore n(C) = 2$$

$$B \cap C = \phi$$

B and C are mutually exclusive events.

$$A \cap C = \phi$$

 \therefore A and C are mutually exclusive events.

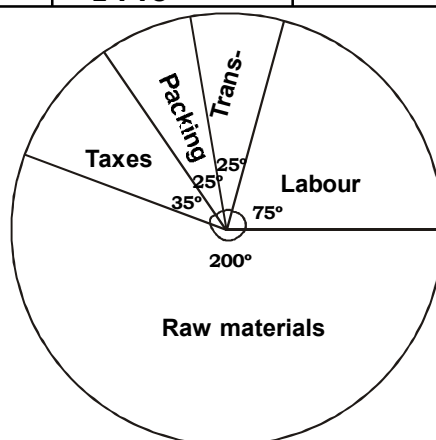
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(iv)

Component	Expenditure	Measure of central angle
Raw material	800	$\frac{800}{1440} \times 360^\circ = 200^\circ$
Labour	300	$\frac{300}{1440} \times 360^\circ = 75^\circ$
Transportation	100	$\frac{100}{1440} \times 360^\circ = 25^\circ$
Packing	100	$\frac{100}{1440} \times 360^\circ = 25^\circ$
Taxes	140	$\frac{140}{1440} \times 360^\circ = 35^\circ$
Total	1440	360°

1

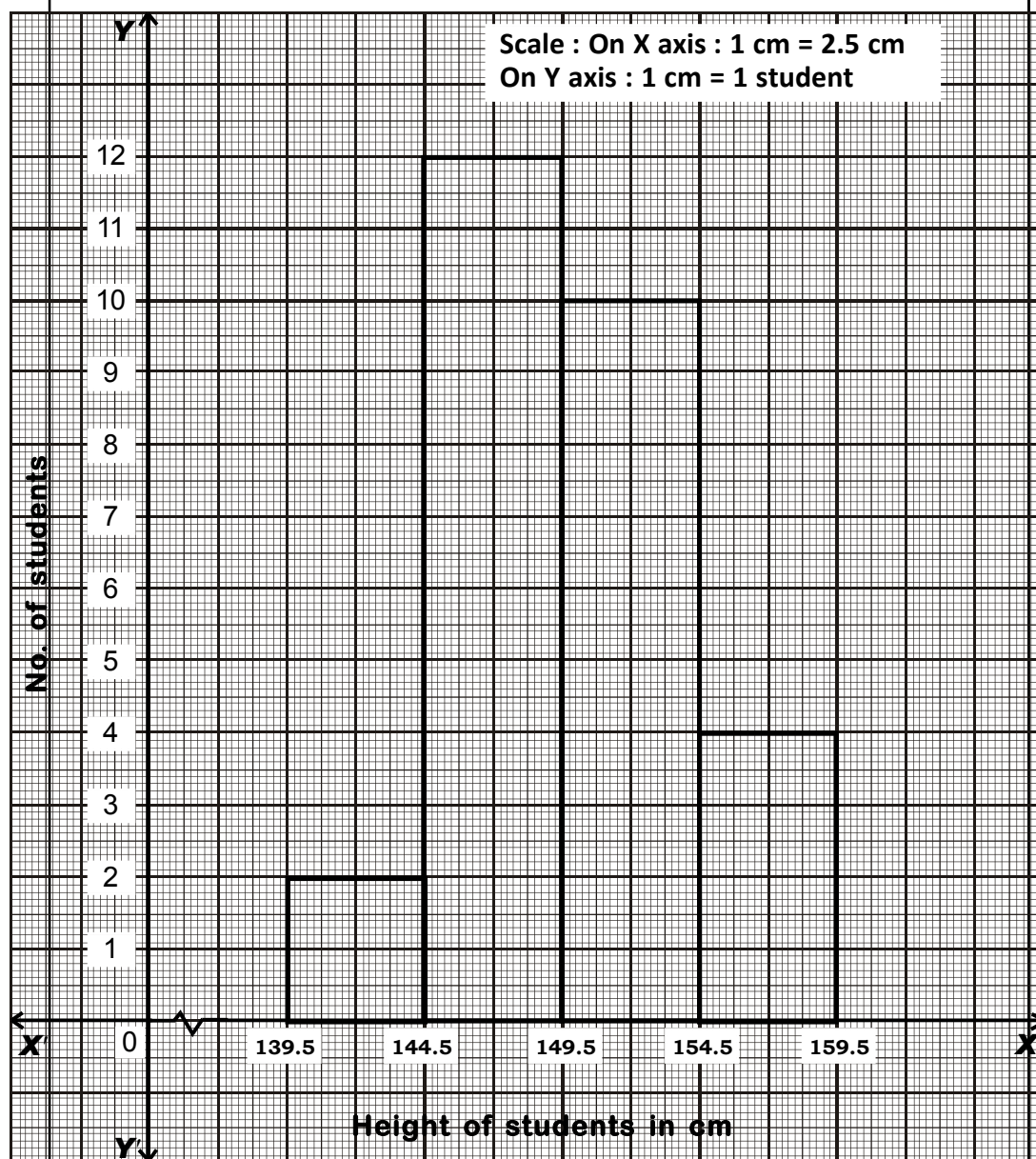


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(v)

Height of students	Continuous classes	Frequency No. of students
140 - 144	139.5 - 144.5	2
145 - 149	144.5 - 149.5	12
150 - 154	149.5 - 154.5	10
155 - 159	154.5 - 159.5	4

1



<p>A.4.</p> <p>(i)</p>	<p>Solve ANY TWO of the following :</p> <p>Two dice are thrown</p> $\therefore S = \{ (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6),$ $(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6),$ $(3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6),$ $(4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6),$ $(5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6),$ $(6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6) \}$ $\therefore n(S) = 36$ <p>(a) Let A be the event that sum of numbers on their upper faces is divisible by 9</p> $A = \{ (3, 6), (4, 5), (5, 4), (6, 3) \}$ $n(A) = 4$ $P(A) = \frac{n(A)}{n(S)}$ $\therefore P(A) = \frac{4}{36}$ $\therefore P(A) = \frac{1}{9}$ <p>(b) Let B be the event that sum of number on their upper faces is at the most 3.</p> $B = \{ (1, 1), (1, 2), (2, 1) \}$ $n(B) = 3$ $P(B) = \frac{n(B)}{n(S)}$ $\therefore P(B) = \frac{3}{36}$ $\therefore P(B) = \frac{1}{12}$ <p>(c) Let C be the event that number on the upper face of the first die is less than the number on the upper face of second die.</p> $C = \{ (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 3), (2, 4), (2, 5),$ $(2, 6), (3, 4), (3, 5), (3, 6), (4, 5), (4, 6), (5, 6) \}$ $n(C) = 15$ $P(C) = \frac{n(C)}{n(S)}$	<p>1</p> <p>1</p> <p>1</p>
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	$\therefore P(C) = \frac{15}{36}$ $\therefore P(C) = \frac{5}{12}$	1
(ii)	<p>For the A.P $\frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \dots$</p> $a = \frac{1}{6}$ $\therefore d = \frac{1}{4} - \frac{1}{6}$ $\therefore d = \frac{3}{12} - \frac{2}{12}$ $\therefore d = \frac{1}{12}$ $t_n = a + (n - 1)d$ $t_{20} = \frac{1}{6} + (20 - 1)\left(\frac{1}{12}\right)$ $= \frac{1}{6} + \frac{19}{12}$ $= \frac{2}{12} + \frac{19}{12}$ $= \frac{21}{12}$ $\therefore t_{20} = \frac{7}{4}$ <p>Now, $S_n = \frac{n}{2} [2a + (n - 1)d]$</p> $\therefore S_{10} = \frac{10}{2} [2a + (n - 1)d]$ $= 5 \left[2\left(\frac{1}{6}\right) + 9\left(\frac{1}{12}\right) \right]$ $= 5 \left[\frac{1}{3} + \frac{3}{4} \right]$ $= 5 \left[\frac{4 + 9}{12} \right]$	1
		1
		1

	$= 5 \left[\frac{13}{12} \right]$	
	$\therefore S_{10} = \frac{65}{12}$	1
(iii)	$(y^2 + 5y)(y^2 + 5y - 2) - 24 = 0$ <p>Substituting $y^2 + 5y = m$ we get,</p> $\therefore m(m - 2) - 24 = 0$ $\therefore m^2 - 2m - 24 = 0$ $\therefore m^2 - 6m + 4m - 24 = 0$ $\therefore m(m - 6) + 4(m - 6) = 0$ $\therefore (m - 6)(m + 4) = 0$ $\therefore m - 6 = 0 \quad \text{or} \quad m + 4 = 0$ $\therefore m = 6 \quad \text{or} \quad m = -4$ <p>Resubstituting $m = y^2 + 5y$ we get,</p> $y^2 + 5y = 6 \quad \dots\dots(i) \quad \text{or} \quad y^2 + 5y = -4 \quad \dots\dots(ii)$ <p>From (i),</p> $y^2 + 5y = 6$ $\therefore y^2 + 5y - 6 = 0$ $\therefore y^2 - y + 6y - 6 = 0$ $\therefore y(y - 1) + 6(y - 1) = 0$ $\therefore (y - 1)(y + 6) = 0$ $\therefore y - 1 = 0 \quad \text{or} \quad y + 6 = 0$ $\therefore y = 1 \quad \text{or} \quad y = -6$ <p>From (ii),</p> $y^2 + 5y = -4$ $\therefore y^2 + 5y + 4 = 0$ $\therefore y^2 + 4y + y + 4 = 0$ $\therefore y(y + 4) + 1(y + 4) = 0$ $\therefore (y + 4)(y + 1) = 0$ $\therefore y + 4 = 0 \quad \text{or} \quad y + 1 = 0$ $\therefore y = -4 \quad \text{or} \quad y = -1$ <p>$\therefore y = 1$ or $y = -6$ or $y = -4$ or $y = -1$.</p>	1
A.5.	Solve ANY TWO of the following :	
(i)	<p>Let the no. of Rs. 10 notes given to Durga be x and the no. of Rs.5 notes given to her be y.</p> <p>As per the first condition,</p> $10x + 5y = 190 \quad \dots\dots(i)$ <p>As per the second condition,</p> $5x + 10y = 185 \quad \dots\dots(ii)$ <p>Adding (i) and (ii),</p> $15x + 15y = 375$	1

Dividing throughout by 15 we get,

$$\therefore x + y = 25 \quad \text{.....(iii)}$$

Subtracting (ii) from (i),

$$\begin{array}{r} 10x + 5y = 190 \\ 5x + 10y = 185 \\ \hline (-) \quad (-) \quad \quad (+) \\ 5x - 5y = 5 \end{array}$$

Dividing throughout by 5 we get,

$$x - y = 1 \quad \text{.....(iv)}$$

Adding (iii) and (iv),

$$\begin{array}{r} x + y = 25 \\ x - y = 1 \\ \hline 2x = 26 \end{array}$$

$$\therefore x = 13$$

Substituting $x = 13$ in (iii),

$$13 + y = 25$$

$$\therefore y = 25 - 13$$

$$\therefore y = 12$$

\therefore Durga had 13 notes of Rs. 10 rupee and 12 notes of Rs. 5.

(ii) Class width (h) = 4, Assumed mean (A) = 25

No. of trees	Class Mark (x_i)	$d_i = x_i - A$	$u_i = \frac{d_i}{h}$	No. of people (f_i)	$f_i u_i$
7 - 11	9	- 16	- 4	5	- 20
11 - 15	13	- 12	- 3	9	- 27
15 - 19	17	- 8	- 2	13	- 26
19 - 23	21	- 4	- 1	21	- 21
23 - 27	25 $\rightarrow A$	0	0	16	0
27 - 31	29	4	1	15	15
31 - 35	33	8	2	12	24
35 - 39	37	12	3	9	27
Total				100	- 28

$$\bar{u} = \frac{\sum f_i u_i}{\sum f_i}$$

$$\therefore \bar{u} = \frac{-28}{100}$$

$$\therefore \bar{u} = - 0.28$$

	$\begin{aligned} \text{Mean } (\bar{x}) &= A + h\bar{u} \\ &= 25 + 4(-0.28) \\ &= 25 - 1.12 \\ &= 23.88 \text{ years} \end{aligned}$	
	\therefore Mean of age is 23.88 years.	1
(iii)	<p>Let the number of days required by father alone to do a certain piece of work be 'x' days.</p> <p>\therefore No. of days required by tinu alone is (x + 9) days Also number of days required by both to complete the same work is 6 days.</p> <p>Work done by father in 1 day = $\frac{1}{x}$</p> <p>Work done by Tinu in 1 day = $\frac{1}{x + 9}$</p> <p>Work done by both in 1 day = $\frac{1}{6}$</p> <p>As per the given condition,</p> $\frac{1}{x} + \frac{1}{x + 9} = \frac{1}{6}$ $\frac{x + 9 + x}{x(x + 9)} = \frac{1}{6}$ $\frac{2x + 9}{x^2 + 9x} = \frac{1}{6}$ $6(2x + 9) = 1(x^2 + 9x)$ $12x + 54 = x^2 + 9x$ $0 = x^2 + 9x - 12x - 54$ $0 = x^2 - 3x - 54$ $x^2 - 3x - 54 = 0$ $x^2 - 9x + 6x - 54 = 0$ $x(x - 9) + 6(x - 9) = 0$ $(x - 9)(x + 6) = 0$ $x - 9 = 0 \quad \text{or} \quad x + 6 = 0$ $x = 9 \quad \text{or} \quad x = -6$ <p>\therefore The number of days cannot be negative</p> <p>$\therefore x \neq -6$ Hence $x = 9$</p> <p>$\therefore x + 9 = 9 + 9 = 18$</p> <p>$\therefore$ Tinu alone requires 18 days to complete the work.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
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