A.P. SET CODE

B

MT - x

2017 ___ __ 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) $a = 3, d = 4$

Here, $t_1 = a = 3$

$t_2 = t_1 + d = 3 + 4 = 7$

$t_3 = t_2 + d = 7 + 4 = 11$

$t_4 = t_3 + d = 11 + 4 = 15$

$t_5 = t_4 + d = 15 + 4 = 19$

y The first five terms of the A.P. are 3, 7, 11, 15 and 19. **1**

(ii) $x^2 - x - 3 = 0$

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

$a = 1, b = -1, c = -3$ **1**

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

Comparing with $ax^2 + bx + c = 0$ we have $a = 2, b = 1, c = 1$

$a = b^2 - 4ac$

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

$= 1 - 8$

$= -7$

y $a = -7$

(iv) $\begin{vmatrix} -3 & 8 \\ 6 & 0 \end{vmatrix}$

$= (-3 \times 0) - (8 \times 6)$

$= 0 - 48$

$= -48$ **1**

(v) From a set of 25 cards marked 1 to 25

one card is drawn at random

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 } **1**

(vi) For class 1-10, Class mark = $\frac{1+10}{2} = \frac{11}{2} = 5.5$ ½

For class 11-20, Class mark = $\frac{11+20}{2} = \frac{31}{2} = 15.5$ ½

A.2. Solve ANY FOUR of the following :

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

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

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

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

y $S_{10} = 5\ (12 + 27)$

y $S_{10} = 5\ (39)$

y $\boxed{S_{10} = 195}$ 1

(ii) $x^2 - 17x + 60 = 0$ 1

y $x^2 - 12x - 5x + 60 = 0$

y $x(x - 12) - 5(x - 12) = 0$

y $(x - 12)\ (x - 5) = 0$

y $x - 12 = 0$ or $x - 5 = 0$

∴ $\boxed{x = 12 \text{ or } x = 5}$ 1

(iii)

Items	Measure of central angle	Expenditure (in Rs.)
Cement	75°	$\frac{75}{360} \times 540000 = 112500$
Bricks	50°	$\frac{50}{360} \times 540000 = 75000$
Labour	100°	$\frac{100}{360} \times 540000 = 150000$
Timber	90°	$\frac{90}{360} \times 540000 = 135000$
Steel	45°	$\frac{45}{360} \times 540000 = 67500$
Total	**360°**	**540000**

1 (table entries), 1 (total)

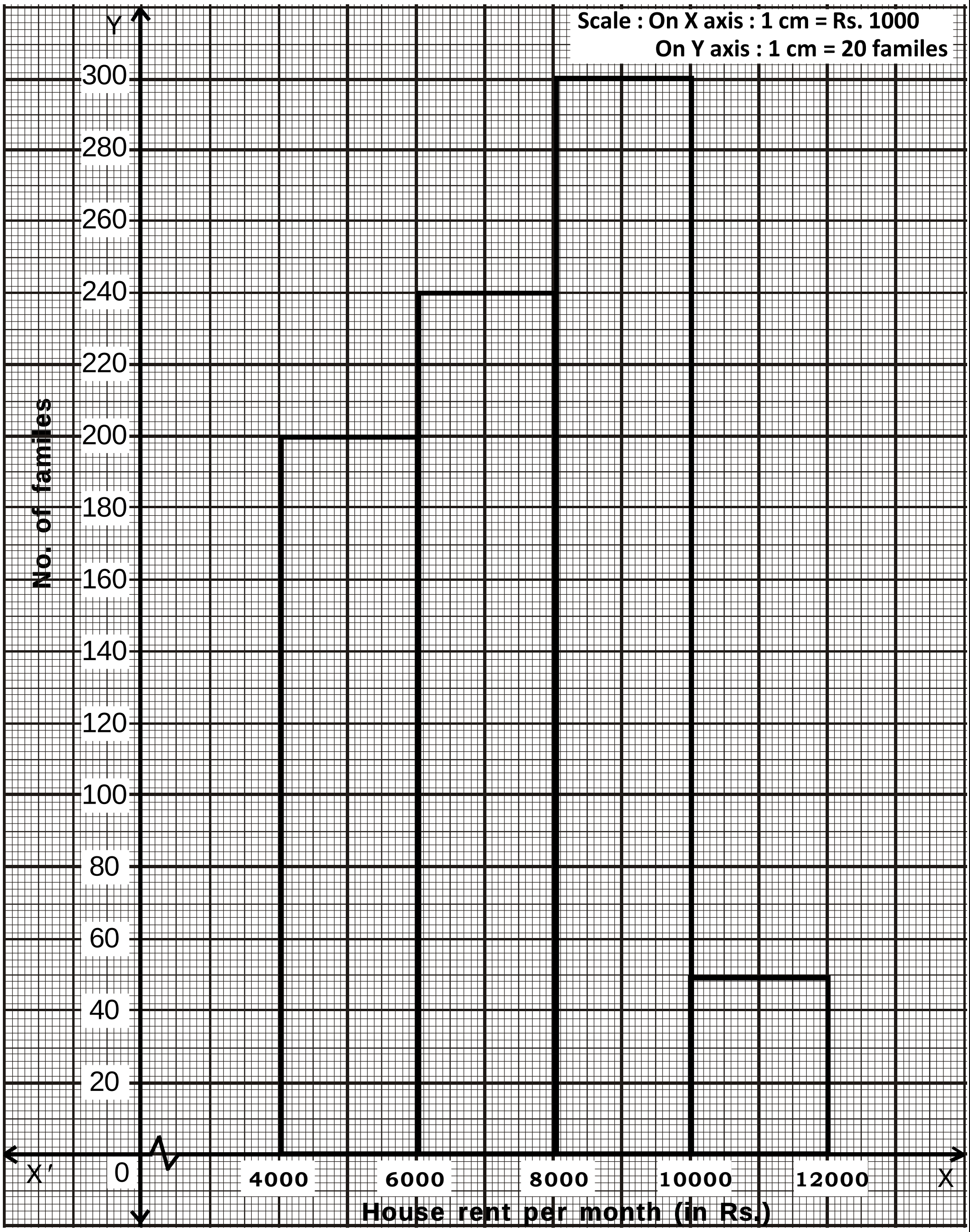
(iv) The equation of X-axis is y = 0 1

Let the point of intersection of graph x + y = 3 with X-axis be (h, 0)

∵ (h, 0) lies on the graph, it satisfies the equation

	y Substituting x = h and y = 0 in the equation we get,	
	h + 0 = 3	
	y h = 3	
	y The line x + y = 3 intersects the X-axis at (3, 0).	**1**
(v)	S = { 1, 2, 3, 4, 5, 6 }	
	n (S) = 6	**1**
	P is the event of getting a prime number	
	P = { 2, 3, 5 }	
	y n (P) = 3	**1**
(vi)	For the given A.P. 1, 7, 13, 19, ...	
	Here, $a = t_1 = 1$	
	$d = t_2 - t_1 = 7 - 1 = 6$	**½**
	We know,	
	$t_n = a + (n - 1) d$	**½**
	y $t_{18} = a + (18 - 1) d$	
	y $t_{18} = 1 + 17 (6)$	
	y $t_{18} = 1 + 102$	
	y $t_{18} = 103$	
	y Eighteenth term of A.P. is 103.	**1**
A.3.	**Solve ANY THREE of the following :**	
(i)	Since the taxi fare increases by Rs. 2 every kilometer after the first, the successive taxi fares form an A.P.	
	The taxi fare for first kilometer (a) = Rs. 14	**½**
	Increase in taxi fare in every kilometer after first kilometer (d) = 2	**½**
	No. of kilometers covered by taxi (n) = 10	
	Taxi fare for 10 kilometers = t_{10} = ?	
	$t_n = a + (n + 1) d$	**1**
	y $t_{10} = a + (10 - 1) d$	
	y $t_{10} = 14 + 9 (2)$	
	y $t_{10} = 14 + 18$	
	y $t_{10} = 32$	
	y Taxi fare for ten kilometers is Rs. 32.	**1**

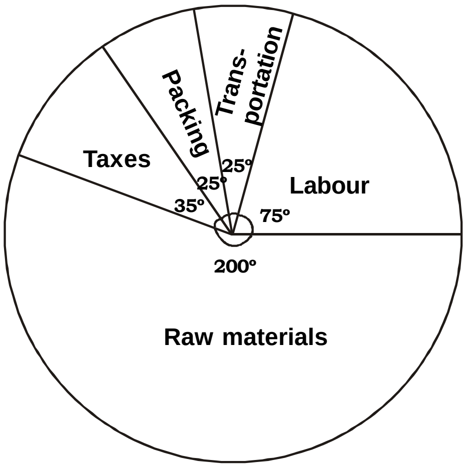
(ii)	$z^2 + 6z - 8 = 0$	
	y $z^2 + 6z = 8$ .... (i)	
	Third term $= \left(\frac{1}{2} \times \text{coefficient of } z\right)^2$	
	$= \left(\frac{1}{2} \times 6\right)^2$	
	$= (3)^2$	
	$= 9$	1
	Adding 9 to both sides of (i), we get,	
	$z^2 + 6z + 9 = 8 + 9$	
	y $(z + 3)^2 = 17$	1
	Taking square root on both the sides we get,	
	$z + 3 = \pm\sqrt{17}$	
	y $z = -3 \pm \sqrt{17}$	
	y $z = -3 + \sqrt{17}$ or $z = -3 - \sqrt{17}$	
	y **$-3 + \sqrt{17}$ and $-3 - \sqrt{17}$ are the roots of the given quadratic equations.**	1
(iii)	There are 52 cards in a pack	
	y $n(S) = 52$	
	(a) Let A be the event that card drawn is a king of red colour	
	∵ There are 2 kings of red colour	
	$n(A) = 2$	
	$P(A) = \frac{n(A)}{n(S)}$	
	y $P(A) = \frac{2}{52}$	
	y **$P(A) = \frac{1}{26}$**	1
	(b) Let B be the event that card drawn is a face card	
	∵ There are 3 face cards is each of the 4 types	
	y The total no. of face cards $n(B) = 4 \times 3 = 12$	
	y $P(B) = \frac{n(B)}{n(S)}$	
	y $P(B) = \frac{12}{52}$	
	y **$P(B) = \frac{3}{13}$**	1
	(c) Let C be the event that the card drawn is a red face card	
	∵ There are 3 face cards is each of the 2 red types	
	y The total no. of red face cards $n(C) = 2 \times 3 = 6$	

	$P(C) = \frac{n(C)}{n(S)}$	
	$\therefore P(C) = \frac{6}{52}$	
	$\therefore \boxed{P(C) = \frac{3}{26}}$	1
(iv)		3

(v)

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

1



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A.4. Solve ANY TWO of the following :

(i) 122, 116, 110, ...

$a = t_1 = 122$

$d = t_2 - t_1 = 116 - 122 = -6$ ½

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

$t_n = 122 + (n - 1)(-6)$

$t_n = 122 - 6n + 6$

$t_n = 128 - 6n$ **1**

when want smallest n such that

$t_n < 0$ ½

$128 - 6n < 0$

$128 < 6n$

Dividing both sides by 6

y $\frac{128}{6} < n$

	y 21.33... < n	½
	But 'n' is term number which is a natural number	
	The first natural number greater than 21.33... is '22'	½
	When n = 22	
	$t_n = 128 - 6n$	
	y $t_{22} = 128 - 6 \times 22$	
	y $t_{22} = 128 - 132$	½
	$t_{22} = -4$	
	y **First negative term of A.P. is – 4.**	½
(ii)	$\frac{27}{x-2} + \frac{31}{y+3} = 85$ ....(i)	
	$\frac{31}{x-2} + \frac{27}{y+3} = 89$ ....(ii)	
	Substituting $\frac{1}{x-2}$ = a and $\frac{1}{y+3}$ = b in (i) and (ii),	
	$27a + 31b = 85$ ....(iii)	
	$31a + 27b = 89$ ....(iv)	1
	Adding (iii) and (iv),	
	$58a + 58b = 174$	
	Dividing throughout by 58 we get,	
	$a + b = \frac{174}{58}$	
	y $a + b = 3$ ....(v)	
	Subtracting (iv) from (iii)	
	$-4a + 4b = -4$	
	Dividing throughout by – 4 we get,	
	$a - b = 1$ ......(vi)	1
	Adding (v) and (vi),	
	$a + b = 3$	
	$a - b = 1$	
	$2a = 4$	
	y $a = 2$	
	Subtracting a = 2 in (v),	
	$2 + b = 3$	
	y $b = 3 - 2$	
	y $b = 1$	1

Resubstituting the values of a and b

$a = \frac{1}{x-2}$

$2 = \frac{1}{x-2}$

y $2(x-2) = 1$

y $2x - 4 = 1$

y $2x = 5$

y $x = \frac{5}{2}$ ½

$b = \frac{1}{y+3}$

$1 = \frac{1}{y+3}$

$y + 3 = 1$

y $y = 1 - 3$

y $y = -2$ ½

y $x = \frac{5}{2}$ and $y = -2$ is the solution of given simultaneous equations.

(iii) When two dice are thrown

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) }

y n (S) = 36 ½

A is the event that sum of the numbers on their upper faces is atleast nine

A = { (3, 6), (4, 5), (4, 6), (5, 4), (5, 5), (5, 6), (6, 3), (6, 4), (6, 5), (6, 6) }

n (A) = 10 **1**

B is the event that sum of numbers on their upper faces is divisible by 8.

B = { (2, 6), (3, 5), (4, 4), (5, 3), (6, 2) }

n (B) = 5 **1**

C is the event that same number appears an upper faces of both dice

C = { (1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6) }

n (C) = 6

A ą B = ¤

y A and B are mutually exclusive events. ½

A.5. **Solve ANY TWO of the following :**

(i) $2\left(x^2 + \frac{1}{x^2}\right) - 9\left(x + \frac{1}{x}\right) + 14 = 0$ ....(i)

Substituting $x + \frac{1}{x} = m$

Squaring both the sides we get,

$\left(x + \frac{1}{x}\right)^2 = m^2$

y $(x)^2 + 2 \times x \times \frac{1}{x} + \left(\frac{1}{x}\right)^2 = m^2$

y $x^2 + 2 + \frac{1}{x^2} = m^2$

y $x^2 + \frac{1}{x^2} = m^2 - 2$

Equation (i) becomes

y $2(m^2 - 2) - 9m + 14 = 0$

y $2m^2 - 4 - 9m + 14 = 0$ ½

$\therefore$ $2m^2 - 9m + 10 = 0$

y $2m^2 - 4m - 5m + 10 = 0$

y $2m(m - 2) - 5(m - 2) = 0$

y $(m - 2)(2m - 5) = 0$

y $m - 2 = 0$ or $2m - 5 = 0$

y $m = 2$ or $2m = 5$

y $m = 2$ or $m = \frac{5}{2}$

Resubstituting $m = x + \frac{1}{x}$ we get,

$x + \frac{1}{x} = 2$ ..... (ii) or $x + \frac{1}{x} = \frac{5}{2}$ ..... (iii) ½

From (ii), $x + \frac{1}{x} = 2$

Multiplying throughout by x we get,

$x^2 + 1 = 2x$

y $x^2 - 2x + 1 = 0$

y $(x - 1)^2 = 0$

Taking square root on both the sides we get,

$x - 1 = 0$

y $x = 1$ **1**

From (iii), $x + \frac{1}{x} = \frac{5}{2}$

Multiplying throughout by 2x, we get;

$2x^2 + 2 = 5x$

y $2x^2 - 5x + 2 = 0$

y $2x^2 - 4x - x + 2 = 0$

y $2x(x - 2) - 1(x - 2) = 0$

y $(x - 2)(2x - 1) = 0$

y $x - 2 = 0$ or $2x - 1 = 0$

y $x = 2$ or $2x = 1$

y $x = 2$ or $x = \frac{1}{2}$ **1**

y $\boxed{x = 1 \text{ or } x = 2 \text{ or } x = \frac{1}{2}}$ **½**

(ii) Let the speed of bus be x km/hr. and time taken be y hrs.

Distance = Speed × Time **½**

y Distance = xy km

According to the first condition,

$(x + 15)(y - 2) = xy$

y $x(y - 2) + 15(y - 2) = xy$

y $xy - 2x + 15y - 30 = xy$

y $-2x + 15y = 30$ ......(i) **1**

According to the second condition,

$(x - 5)(y + 1) = xy$

y $x(y + 1) - 5(y + 1) = xy$

y $xy + x - 5y - 5 = xy$

y $x - 5y = 5$ ......(ii) **1**

Multiplying (ii) by 3 we get,

$3x - 15y = 15$ ......(iii)

Adding (i) and (iii) we get,

$-2x + 15y = 30$

$3x - 15y = 15$

$x = 45$ **1**

Substituting x = 45 in (ii),

y $45 - 5y = 5$

y $-5y = 5 - 45$

y $-5y = -40$

y $y = \frac{-40}{-5}$

y $y = 8$ **1**

y Distance = xy
= 45 × 8
= 360

y Distance covered by bus is 360 km. ½

(iii)

Calories	Frequency (f_i) (No. of boys)	Cumulative frequency less than type
1000 - 1500	5	5
1500 - 2000	13	18
2000 - 2500	16	34 ì *c.f.*
2500 - 3000	18 ì *f*	52
3000 - 3500	27	79
3500 - 4000	10	89
4000 - 4500	4	93
Total	**93 ì N**	

1

Here total frequency = pf_i = N = 93

y $\frac{N}{2} = \frac{93}{2} = 46.5$ ½

Cumulative frequency (less than type) which is just greater than 46.5 is 52.

Therefore corresponding class 2500 - 3000 is median class. ½

L = 2500, N = 93, *c.f.* = 34, f = 18, h = 500 ½

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

$$= 2500 + \left(\frac{93}{2} - 34\right)\frac{500}{18}$$ 1

$$= 2500 + (46.5 - 34)\frac{500}{18}$$

$$= 2500 + (12.5)\frac{500}{18}$$

$$= 2500 + \frac{6250}{18}$$

$$= 2500 + 347.22$$

$$= 2847.22$$ 1

y Median of calories consumed by boys is 2847.22 calories. ½

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