

Q.P. SET CODE

A

MT - W

2018 ___ 1100 - **MT - W** - MATHEMATICS (71) Algebra - SET - A (E)

Time : 2 Hours

Preliminary Model Answer Paper

Max. Marks : 40

A.1.(A)	Solve ANY FOUR of the following :	
(i)	$A = \{x \mid x = n^2, n \in N, n \leq 10\}$	1
(ii)	$\frac{127}{200}$ $= \frac{127}{2 \times 100}$ $= \frac{63.5}{100}$ $\therefore \boxed{\frac{127}{200} = 0.635}$	1
(iii)	$y + \frac{1}{y} = y + y^{-1}$ <p>Here, one of the power of y is -1, which is not a whole number.</p> $\therefore \boxed{\text{It is not a polynomial}}$	1
(iv)	Ratio of 52 to 78 = $\frac{52}{78}$ $= \frac{26 \times 2}{26 \times 3}$ $= \frac{2}{3}$ $\therefore \boxed{\text{Ratio of 52 to 78} = 2 : 3}$	1
(v)	$3x + 5y = 9$... (i) $5x + 3y + 7$... (ii) Adding equation (i) & (ii)	

(vi)	$3x + 5y = 9$ $\underline{5x + 3y = 7}$ $8x + 8y = 16$ <p>Dividing throughout by 8, we get</p> $\boxed{x + y = 2}$	1															
	<table border="1"> <thead> <tr> <th>Sr. No.</th> <th>Individuals</th> <th>Age</th> <th>Taxable income (₹)</th> <th>Will have to pay income tax or not</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Miss. Nikita</td> <td>27</td> <td>₹ 2,34,000</td> <td>NO</td> </tr> <tr> <td>2</td> <td>Mrs. Kulkarni</td> <td>36</td> <td>₹ 3,27,000</td> <td>YES</td> </tr> </tbody> </table>	Sr. No.	Individuals	Age	Taxable income (₹)	Will have to pay income tax or not	1	Miss. Nikita	27	₹ 2,34,000	NO	2	Mrs. Kulkarni	36	₹ 3,27,000	YES	<p>½</p> <p>½</p>
	Sr. No.	Individuals	Age	Taxable income (₹)	Will have to pay income tax or not												
	1	Miss. Nikita	27	₹ 2,34,000	NO												
2	Mrs. Kulkarni	36	₹ 3,27,000	YES													
A.1.(B) Solve ANY TWO of the following :																	
(i)	<p>A = Even prime numbers</p> $\therefore A = \{ 2 \}$ $B = 7x - 1 = 13$ $\therefore 7x = 13 + 1$ $\therefore 7x = 14$ $\therefore x = 2$ $\therefore B = \{ 2 \}$ <p>Here, elements of A and B are exactly same.</p> $\therefore \boxed{A = B}$	<p>½</p> <p>½</p> <p>1</p>															
(ii)	$2x + y = 5$... (i) $3x - y = 5$... (ii) <p>Adding (i) and (ii)</p> $\begin{array}{r} 2x + y = 5 \\ 3x - y = 5 \\ \hline 5x = 10 \\ \therefore x = \frac{10}{5} \\ \therefore x = 2 \end{array}$ <p>Substituting the value of x in (i),</p> $\begin{array}{r} 2x + y = 5 \\ \therefore 2(2) + y = 5 \\ \therefore 4 + y = 5 \\ \therefore y = 5 - 4 \\ \therefore y = 1 \end{array}$ $\therefore \boxed{x = 2 \text{ and } y = 1 \text{ is the solution of given equations.}}$	<p>½</p> <p>½</p> <p>1</p>															

(iii)	$7\sqrt{48} - \sqrt{27} - \sqrt{3}$ $= 7\sqrt{2 \times 2 \times 2 \times 2 \times 3} - \sqrt{3 \times 3 \times 3} - \sqrt{3}$ $= 7 \times 2 \times 2\sqrt{3} - 3\sqrt{3} - \sqrt{3}$ $= 28\sqrt{3} - 3\sqrt{3} - \sqrt{3}$ $\therefore \boxed{7\sqrt{48} - \sqrt{27} - \sqrt{3} = 24\sqrt{3}}$	1 1
A.2.(A) Choose the correct alternative answer and write.		
(i)	<p>(B) 22</p> <p>Working :</p> $t_n = a + (n - 1) d$ $\therefore t_{17} = a + (17 - 1) (11)$ $\therefore t_{17} = a + (16 \times 11)$ $\therefore t_{17} = a + 176 \quad \dots(i)$ $t_{15} = a + (15 - 1) (11)$ $\therefore t_{15} = a + (14 \times 11)$ $\therefore t_{15} = a + 154 \quad \dots(ii)$ <p>Now, $t_{17} - t_{15} = a + 176 - (a + 154)$ from (i) and (ii)</p> $= a + 176 - a - 154$ $\therefore \boxed{t_{17} - t_{15} = 22}$	1
(ii)	<p>(C) 0 or 4</p> <p>Working :</p> $x^2 + kx + k = 0$ <p>Comparing with $ax^2 + bx + c = 0$ we get,</p> $a = 1, b = k, c = k$ <p>\therefore Roots of $x^2 + kx + k = 0$ are real & equal</p> $\therefore b^2 - 4ac = 0$ $\therefore (k)^2 - 4(1)(k) = 0$ $\therefore k^2 - 4k = 0$ $\therefore k(k - 4) = 0$ $\therefore k = 0 \quad \text{or} \quad k - 4 = 0$ $\therefore \boxed{k = 0} \quad \text{or} \quad \boxed{k = 4}$	1

(iii)	<p>(C) $\frac{1}{2}$</p> <p>Working :</p> <p>$S = \{ 1, 2, 3, 4, 5, 6 \}$</p> <p>$\therefore n(S) = 6$</p> <p>Let A be the event that the number appearing on upperface is greater than 3.</p> <p>$A = \{ 4, 5, 6 \}$</p> <p>$\therefore n(A) = 3$</p> <p>$\therefore P(A) = \frac{n(A)}{n(S)} = \frac{3}{6} = \frac{1}{2}$</p>	1
(iv)	<p>(D) 144°</p> <p>Working :</p> $\text{Measure angle } (\theta) = \frac{\text{Data}}{\text{Total}} \times 360$ $\therefore \theta = \frac{40}{100} \times 360$ $\therefore \theta = 144^\circ$	1
A.2.(B) Solve ANY TWO of the following :		
(i)	$x + 7y = 10 \quad \dots(i)$ $3x - 2y = 7 \quad \dots(ii)$ <p>Multiplying equation (i) by 3 we get,</p> $3x + 21y = 30 \quad \dots(iii)$ <p>Subtracting (ii) from (iii) we get,</p> $3x + 21y = 30$ $3x - 2y = 7$ $\begin{array}{r} (-) \quad (+) \quad (-) \\ \hline 23y = 23 \end{array}$ <p>$\therefore \boxed{y = 1}$</p> <p>Substituting $y = 1$ in equation (ii) we get,</p> $3x - 2(1) = 7$ $3x - 2 = 7$ $\therefore 3x = 7 + 2$ $\therefore x = \frac{9}{3}$ <p>$\therefore \boxed{x = 3}$</p> <p>$\therefore \boxed{(x, y) = (3, 1)}$ is the solution of the given simultaneous equations.</p>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>

(ii)	<p>The A.P. 12, 16, 20, 24.....</p> <p>Here $a=12, d = 16 - 12 = 4, t_{24} = ?$</p> $t_n = a + (n-1)d$ $\therefore t_{24} = 12 + (24-1)4 \quad (\because n = 24)$ $= 12 + 23 \times 4$ $= 12 + 92$ $\therefore t_{24} = 104$ <p style="border: 1px solid black; padding: 2px; display: inline-block;">Thus 24th term of the A.P. is 104.</p>	<p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>
(iii)	<p>MV of share = ₹ 120</p> <p>Total investment = ₹ 60,000</p> $\therefore \text{Number of shares} = \frac{\text{Total Investment}}{\text{MV}}$ $= \frac{60000}{120}$ $= 500$ <p style="border: 1px solid black; padding: 2px; display: inline-block;">\therefore The number of shares purchased is ₹ 500</p>	<p>1</p> <p>1</p>
A.3.(A) Solve ANY TWO of the following :		
(i)	<p>There are some instructions given below. Frame the equations from the information and write them in the blank boxes shown by arrows.</p> <div style="text-align: center; margin: 10px 0;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;">$x = 2y - 8$</div> </div> <p style="text-align: center;">↑</p> <p style="text-align: center;">Sarthak's age is less by 8 than double the age of Sakshi</p> <div style="display: flex; justify-content: space-around; align-items: center; margin: 10px 0;"> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;">$(y - 4) = (x - 4) - 3$</div> <p style="margin-top: 5px;">↑</p> <p>4 years ago Sakshi's age was 3 years less than Sarthak's age at that time.</p> </div> <div style="border: 1px solid black; padding: 10px; display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">I am Sarthak</div> <div style="margin-bottom: 5px;">→ My present age is x years.</div> <div style="margin-bottom: 5px;">← My present age is y years.</div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">I am Sakshi</div> </div> <div style="text-align: center;"> <div style="border: 1px solid black; padding: 5px; display: inline-block;">$x + y = 25$</div> <p style="margin-top: 5px;">↑</p> <p>The sum of present ages of Sarthak and Sakshi is 25.</p> </div> </div>	<p>2</p>

- (ii) Smita has invested ₹ 12,000 and purchased shares of FV ₹ 10 at a premium at ₹ 2. Find the number of shares she purchased. Complete the given activity to get the answer.

Solution:

Face value = ₹ 10, Premium = ₹ 2

$$\begin{aligned} \therefore \text{Market value} &= \text{Face value} + \text{Premium} \\ &= \boxed{10} + \boxed{2} \\ &= \boxed{12} \end{aligned}$$

$$\begin{aligned} \therefore \text{No. of Shares} &= \frac{\text{Total Investment}}{\text{Market value}} \\ &= \frac{12000}{12} \\ &= \boxed{1000} \end{aligned}$$

\therefore **Smita has purchased 1000 shares.**

- (iii)

Different Items	% of Expenditure	Measure of Central angle
Food	40	$\frac{40}{100} \times 360 = \boxed{144^\circ}$
Clothing	20	$\frac{\boxed{20}}{100} \times \boxed{360} = \boxed{72^\circ}$
House rent	15	$\frac{\boxed{15}}{100} \times \boxed{360} = \boxed{54^\circ}$
Education	20	$\frac{\boxed{20}}{100} \times \boxed{360} = \boxed{72^\circ}$
Expenditure	05	$\frac{\boxed{05}}{100} \times \boxed{360} = \boxed{18^\circ}$
Total	100	360°

<p>A.3.(B) Solve ANY TWO of the following :</p> <p>(i)</p> <p>(ii)</p> <p>(iii)</p>	<p>$2x^2 - 2x + \frac{1}{2} = 0$</p> <p>Multiplying throughout by 2, we get</p> $4x^2 - 4x + 1 = 0$ <p>$\therefore 4x^2 - 2x - 2x + 1 = 0$</p> <p>$\therefore 2x(2x - 1) - 1(2x - 1) = 0$</p> <p>$\therefore (2x - 1)(2x - 1) = 0$</p> <p>$\therefore 2x - 1 = 0$ or $2x - 1 = 0$</p> <p>$\therefore 2x = 1$ or $2x = 1$</p> <p>$\therefore x = \frac{1}{2}$ or $x = \frac{1}{2}$.</p> <p>\therefore</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>The root of given quadratic equation are $\frac{1}{2}$ and $\frac{1}{2}$.</p> </div> <p>MV = ₹ 1000</p> <p>Brokerage = 0.1%</p> <p>Brokerage per share = 0.1% of ₹ 1000</p> $= \frac{0.1}{100} \times 1000$ $= ₹ 1$ <p>\therefore Selling price per share = MV - Brokerage</p> $= 1000 - 1$ $= ₹ 999$ <p>\therefore</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>The amount obtained on selling the share is ₹ 999.</p> </div> <p>The sample space for box containing 15 tickets numbered from 1 to 15 is</p> $n(S) = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$ <p>$\therefore n(S) = 15$</p> <p>(i) Let A be the event that the ticket drawn shows an even number.</p> $A = \{2, 4, 6, 8, 10, 12, 14\}$ <p>$\therefore n(A) = 7$</p> $P(A) = \frac{n(A)}{n(S)} = \frac{7}{15}$ <p>$\therefore P(A) = \frac{7}{15}$</p> <p>(ii) Let B be the event that the ticket drawn shows a number which is a multiple of 5.</p> $B = \{5, 10, 15\}$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1</p> <p>1</p>
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$$\therefore n(B) = 3$$

$$P(B) = \frac{n(B)}{n(S)} = \frac{3}{15} = \frac{1}{5}$$

$$\therefore \boxed{P(B) = \frac{1}{5}}$$

1

A.4. Solve ANY THREE of the following :

(i)

$$x^2 + x + 20 = 0$$

$$x^2 + x + k = (x + a)^2$$

$$x^2 + x + k = x^2 + 2ax + a^2$$

Comparing the coefficients we get,

$$1 = 2a \quad k = a^2$$

$$\frac{1}{2} = a \quad k = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

$$\therefore x^2 + x + \frac{1}{4} - \frac{1}{4} - 20 = 0$$

$$\therefore \left(x + \frac{1}{2}\right)^2 = \frac{1}{4} + 20$$

$$\therefore \left(x + \frac{1}{2}\right)^2 = \frac{81}{4}$$

Taking square root on both sides,

$$\therefore x + \frac{1}{2} = \pm \frac{9}{2}$$

$$\therefore x = \frac{-1}{2} \pm \frac{9}{2}$$

$$\therefore x = \frac{-1}{2} + \frac{9}{2} \quad \text{or} \quad x = \frac{-1}{2} - \frac{9}{2}$$

$$\therefore x = \frac{8}{2} \quad \text{or} \quad x = \frac{-10}{2}$$

$$\therefore x = 4 \quad \text{or} \quad x = -5$$

\therefore 4 and -5 are the roots of the given quadratic equation.

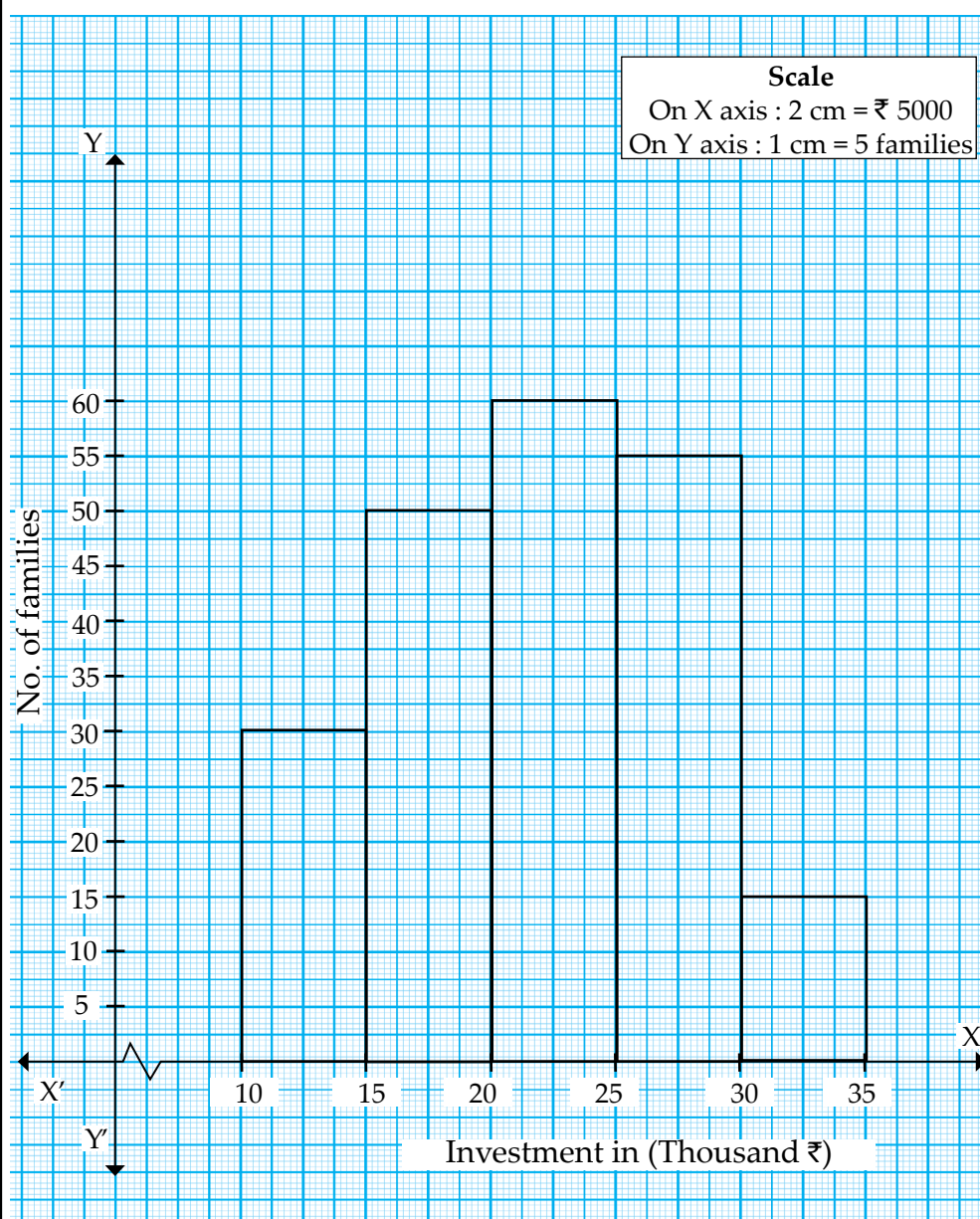
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(ii)

Investment(Thousand ₹)	No. of families
10 - 15	30
15 - 20	50
20 - 25	60
25 - 30	55
30 - 35	15

1

2



(iii)	<p>The number of trees in each row upto the 25th row are as follows: 1, 2, 3, 4, ... The no. of trees planted in each row form an A.P. with no. of trees in first row (a) = 1 Difference between no. of trees planted in two successive rows (d) = 1 No. of rows (n) = 25 Total no. of trees planted (S_{25}) = ?</p> $S_n = \frac{n}{2} [2a + (n-1)d]$ $\therefore S_{25} = \frac{25}{2} [2 \times (1) + (25-1)1]$ $\therefore S_{25} = \frac{25}{2} [2 + 24]$ $\therefore S_{25} = \frac{25}{2} \times 26$ $\therefore S_{25} = 25 \times 13$ $\therefore S_{25} = 325$ <p>325 trees were planted in 25 rows.</p>	<p>1</p> <p>1</p> <p>1</p>
(iv)	<p>FV of share = ₹ 100 Dividend on one share = 7% of ₹ 100 = $\frac{7}{100} \times 100$ = ₹ 7</p> <p>\therefore Dividend on 150 shares = 150×7 = ₹ 1050</p> <p>MV of share = ₹ 120 \therefore Total investment = 150×120 = ₹ 18,000</p> <p>\therefore Rate of return = $\frac{\text{Total dividend received}}{\text{Total investment}} \times 100$ = $\frac{1050}{18000} \times 100$</p> <p>Rate of return = 5.83%</p>	<p>1</p> <p>1</p> <p>1</p>

A.5. Solve ANY ONE of the following :

(i) $x + y = 5$ i.e. $y = 5 - x$

x	0	1	2
y	5	4	3
(x, y)	(0, 5)	(1, 4)	(2, 3)

 $\frac{1}{2}$ when $x = 0$

$\therefore y = 5 - 0$

$\therefore y = 5$

when $x = 1$

$\therefore y = 5 - 1$

$\therefore y = 4$

when $x = 2$

$\therefore y = 5 - 2$

$\therefore y = 3$

$x - y = 3$ i.e. $y = x - 3$

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

 $\frac{1}{2}$ when $x = 0$

$\therefore y = 0 - 3$

$\therefore y = -3$

when $x = 1$

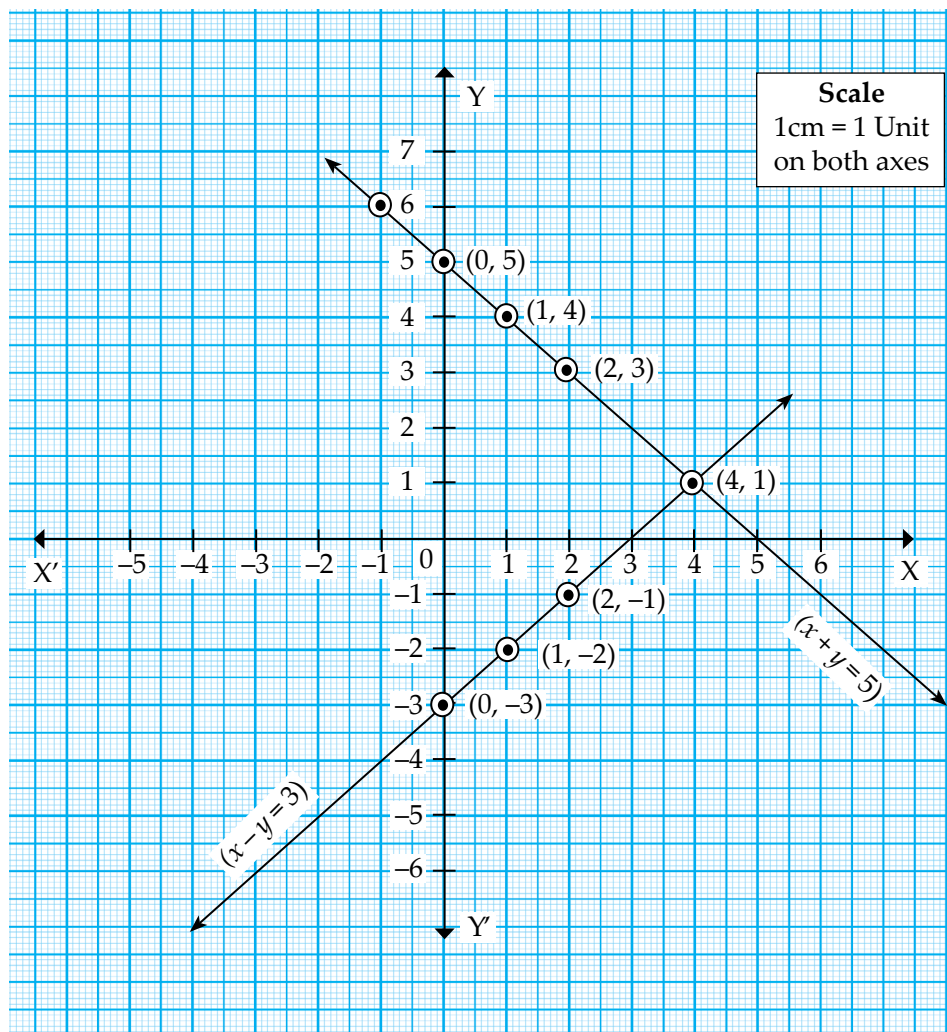
$\therefore y = 1 - 3$

$\therefore y = -2$

when $x = 2$

$\therefore y = 2 - 3$

$\therefore y = -1$



2

The lines of the two given simultaneous equations intersect each other at (4, 1)

∴ **The solution of the given simultaneous equations is (4, 1) i.e. $x = 4, y = 1$**

1

(ii)

While purchasing 200 shares

FV = ₹ 50, Premium = ₹ 100

MV = FV + Premium

= 50 + 100

∴ MV = ₹ 150

Total amount invested = No. of shares × MV + Brokerage
 = 200 × 150 + 20
 = 30000 + 20
 = 30020

1

$$\begin{aligned} \text{Dividend per share} &= \frac{50}{100} \times 50 \\ &= ₹ 25 \end{aligned}$$

$$\begin{aligned} \text{Dividend on 200 share} &= 200 \times 25 \\ &= ₹ 5000 \end{aligned}$$

1

While selling 1st 100 shares

$$\begin{aligned} \text{Discount} &= ₹ 10 \\ \text{MV} &= \text{FV} - \text{discount} \\ &= 50 - 10 \\ &= ₹ 40 \end{aligned}$$

$$\begin{aligned} \therefore \text{Amount received by selling 100 shares} &= \text{No. of shares} \times \text{MV} - \text{brokerage} \\ &= 100 \times 40 - 20 \\ &= 4000 - 20 \\ &= ₹ 3,980 \end{aligned}$$

While selling remaining shares

(i.e 200 – 100 = 100 shares)

$$\begin{aligned} \text{Premium} &= ₹ 75 \\ \text{MV} &= \text{FV} + \text{Premium} \\ &= 50 + 75 \\ &= ₹ 125 \end{aligned}$$

1

$$\begin{aligned} \therefore \text{Amount received by selling 100 shares} &= \text{No. of shares} \times \text{MV} - \text{brokerage} \\ &= 100 \times 125 - 20 \\ &= 12,500 - 20 \\ &= ₹ 12,480 \end{aligned}$$

$$\begin{aligned} \text{Net amount received} &= 5000 + 3980 + 12480 \\ &= ₹ 21,460 \end{aligned}$$

Net amount invested > Net amount received

$$\begin{aligned} \therefore \text{There is a loss in the transaction} \\ \text{Loss incurred} &= 30,020 - 21480 \\ &= ₹ 8560 \end{aligned}$$

1

\therefore Mr D'souza incurred a loss of ₹ 8560

<p>A.6.</p> <p>(i)</p>	<p>Solve ANY ONE of the following :</p> $\frac{2}{x} - \frac{3}{y} = 15 \quad \dots(i)$ $\frac{8}{x} + \frac{5}{y} = 77 \quad \dots(ii)$ <p>Substituting $\frac{1}{x} = m$ and $\frac{1}{y} = n$ in the above equations, we get</p> $2m - 3n = 15 \quad \dots(iii)$ $8m + 5n = 77 \quad \dots(iv)$ <p>Multiplying (iii) by 5 and (iv) by 3, we get,</p> $10m - 15n = 75 \quad \dots(v)$ $24m + 15n = 231 \quad \dots (vi)$ <p>Adding (v) and (vi), we get,</p> $10m - 15n = 75$ $24m + 15n = 231$ <hr style="width: 20%; margin-left: 0;"/> $34m = 306$ $\therefore m = \frac{306}{34}$ $\therefore m = 9$ <p>Substituting $m = 9$ in (iii) we get</p> $(2 \times 9) - 3n = 15$ $\therefore 18 - 3n = 15$ $\therefore -3n = 15 - 18$ $\therefore 3n = -3$ $\therefore n = \frac{-3}{-3}$ $\therefore n = 1$ <p>Resubstituting the value of m and n we get,</p> $\frac{1}{x} = 9 \text{ and } \frac{1}{y} = 1$ $\therefore x = \frac{1}{9} \text{ and } y = 1$ <div style="border: 1px solid black; padding: 5px; display: inline-block;"> $\therefore x = \frac{1}{9} \text{ and } y = 1 \text{ is the solution of given simultaneous equations.}$ </div>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p>
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(ii)	<p>Let α & β be the roots of the given quadratic equation, $x^2 - 4kx + k + 3 = 0$ Comparing with $ax^2 + bx + c = 0$ $a = 1$, $b = -4k$, $c = k + 3$ we know that,</p> $\alpha + \beta = \frac{-b}{a} = \frac{-(-4k)}{1} = 4k$ $\alpha\beta = \frac{c}{a} = \frac{k+3}{1} = k+3$ <p>According to given condition,</p> $\alpha + \beta = 2(\alpha\beta)$ $\therefore 4k = 2(k+3)$ $\therefore 4k = 2k + 6$ $\therefore 4k - 2k = 6$ $\therefore 2k = 6$ $\therefore k = \frac{6}{2}$ $\therefore \boxed{k = 3}$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>
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