Excel Coaching Classes

Test Name:	Linear Equations in Two Variables	**Subjects:**	Mathematics Part - I
Marks:	20	**Standard:**	X School English Maharashtra State Board
Duration:	60min		

Chapter Details

Mathematics Part - I :	Linear Equations in Two Variables

Q.1(A) Choose the correct alternative. **(4)**

i **If $x + y = 10$ and $x - y = 12$, then**

☐ (A) $x = 11, y = 1$ ☑ (B) $x = 11, y = -1$

☐ (C) $x = -11, y = 1$ ☐ (D) $x = -11, y = -1$

Ans: $x + y = 10$ …(i)

$x - y = 12$ …(ii)

Adding (i) and (ii), we get

$$\begin{array}{r} x+y=10 \\ +x-y=12 \\ \hline 2x \quad =22 \end{array}$$

$\therefore x = 11$

$\therefore$ (i) $\Rightarrow y = -1$

ii **For simultaneous equations in variables x and y, $D_x = 49$, $D_y = -63$, $D = 7$ then what is x?**

☑ (A) 7 ☐ (B) –7

☐ (C) $\frac{1}{7}$ ☐ (D) $\frac{-1}{7}$

Ans: As $x = \frac{D_x}{D}$, we get

$x = \frac{49}{7} = 7$

iii **The value of m for which the value of the determinant $\begin{vmatrix} -3 & m \\ -5 & -4 \end{vmatrix}$ is –18 is**

☐ (A) 3 ☐ (B) –3

☐ (C) 6 ☑ (D) –6

Ans: Given $\begin{vmatrix} -3 & m \\ -5 & -4 \end{vmatrix} = -18$

$\therefore 12 + 5m = -18$

$\therefore 5m = -30$

$\therefore$ m = –6

iv **If the point (m, 11) lies on the graph of the equation $11x - 5y = 11$, then the value of m is**

☐ (A) 8 ☐ (B) 7

☐ (C) 9 ☑ (D) 6

Ans: Substitute x = m and y = 11 in the given equation, we get

$11m - 5(11) = 11$

$\Rightarrow m - 5 = 1$ …[Divide both sides by 11]

$\Rightarrow m = 6$

Q.1(B) Solve the following questions. (2)

i **Find the value of each of the following determinant.**

$\begin{vmatrix} 4 & 3 \\ 2 & 7 \end{vmatrix}$

$\begin{vmatrix} 4 & 3 \\ 2 & 7 \end{vmatrix} = (4 \times 7) - (3 \times 2) = 28 - 6$

$\therefore \begin{vmatrix} \mathbf{4} & \mathbf{3} \\ \mathbf{2} & \mathbf{7} \end{vmatrix} = \mathbf{22}$

ii **If $15x + 17y = 21$ and $17x + 15y = 11$, then find the value of $x + y$.**

$$\begin{array}{r} 15x + 17y = 21 \\ + \quad 17x + 15y = 11 \\ \hline 32x + 32y = 32 \end{array}$$

$\therefore$ $32(x + y) = 32$

$\therefore$ $x + y = \frac{32}{32} = 1$

Q.2 Solve the following questions.(Any two) (4)

i **Solve the following simultaneous equations.**

$x + 7y = 10$; $3x - 2y = 7$

$x + 7y = 10$

$\therefore$ $x = 10 - 7y$ …(i)

$3x - 2y = 7$ …(ii)

Substituting $x = 10 - 7y$ in equation (ii), we get

$3(10 - 7y) - 2y = 7$

$\therefore$ $30 - 21y - 2y = 7$

$\therefore$ $-23y = 7 - 30$

$\therefore$ $-23y = -23$

$\therefore$ $y = \frac{-23}{-23} = 1$

Substituting $y = 1$ in equation (i), we get

$x = 10 - 7y$

$= 10 - 7(1)$

$= 10 - 7 = 3$

$\therefore$ **$(x, y) = (3, 1)$ is the solution of the given simultaneous equations.**

ii **Two numbers differ by 3. The sum of twice the smaller number and thrice the greater number is 19. Then the Smaller number is.**

☐ (A) – 5 ☐ (B) –2

☑ (C) 2 ☐ (D) 5

Ans: Let the greater number be x and the smaller number be y.
According to the first condition, we get
$\therefore x - y = 3$ …(i)
According to the second condition, we get
$\therefore 3x + 2y = 19$ …(ii)
Solving equations (i) and (ii), we get
$x = 5$ and $y = 2$
$\therefore$ The smaller number is 2.

iii **Solve the following equations by Cramer's method.**
$7x + 3y = 15$; $12y - 5x = 39$
The given simultaneous equations are
$7x + 3y = 15$ ...(i)
$12y - 5x = 39$
i.e. $-5x + 12y = 39$ ...(ii)
Equations (i) and (ii) are in $ax + by = c$ form.
Comparing the given equations with $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$, we get
$a_1 = 7, b_1 = 3, c_1 = 15$ and
$a_2 = -5, b_2 = 12, c_2 = 39$

$\therefore D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} = \begin{vmatrix} 7 & 3 \\ -5 & 12 \end{vmatrix}$
$= (7 \times 12) - (3 \times -5)$
$= 84 - (-15)$
$= 84 + 15 = 99 \neq 0$

$D_x = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix} = \begin{vmatrix} 15 & 3 \\ 39 & 12 \end{vmatrix}$
$= (15 \times 12) - (3 \times 39)$
$= 180 - 117 = 63$

$D_y = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix} = \begin{vmatrix} 7 & 15 \\ -5 & 39 \end{vmatrix}$
$= (7 \times 39) - (15 \times -5)$
$= 273 - (-75)$
$= 273 + 75 = 348$

$\therefore$ By Cramer's rule, we get
$x = \frac{D_x}{D}$ and $y = \frac{D_y}{D}$
$\therefore x = \frac{63}{99}$ and $y = \frac{348}{99}$
$\therefore x = \frac{7}{11}$ and $y = \frac{116}{33}$
$\therefore$ **$(x, y) = \left(\frac{7}{11}, \frac{116}{33}\right)$ is the solution of the given simultaneous equations.**

Q.3 Complete the following activity. **(3)**

i **The ages of Durga and Hari are in the ratio 5:7. After eight years, the ratio of their ages will be 3:4. Find their present ages.**
Let the present ages of Durga and Hari be x years and y years respectively.
$\therefore$ According to the first condition, the ages of Durga and Hari are in the ratio 5 : 7.
$\therefore \square = \frac{5}{7}$

∴ [ ] …(i)

After eight years,

Age of Durga = (*x* + 8) years

Age of Hari = (*y* + 8) years

According to the second condition, after 8 years, the ratio of their ages will be 3 : 4.

∴ $\frac{x+8}{y+8} = \square$

∴ [ ] …(ii)

Multiplying equation (i) by 3 and equation (ii) by 5, we get

21*x* – 15*y* = 0 …(iii)

20*x* – 15*y* = –40 …(iv)

Subtracting equation (iv) from equation (iii) Present age of Durga is [ ] years and that of Hari is [ ] years.

Let the present ages of Durga and Hari be *x* years and *y* years respectively.

∴ According to the first condition, the ages of Durga and Hari are in the ratio 5 : 7.

∴ $\boxed{\frac{x}{y}} = \frac{5}{7}$

∴ $\boxed{7x - 5y = 0}$ …(i)

After eight years,

Age of Durga = (*x* + 8) years

Age of Hari = (*y* + 8) years

According to the second condition, after 8 years, the ratio of their ages will be 3 : 4.

∴ $\frac{x+8}{y+8} = \boxed{\frac{3}{4}}$

∴ $\boxed{4x - 3y = -8}$ …(ii)

Multiplying equation (i) by 3 and equation (ii) by 5, we get

21*x* – 15*y* = 0 …(iii)

20*x* – 15*y* = –40 …(iv)

Subtracting equation (iv) from equation (iii) Present age of Durga is **40** years and that of Hari is **56** years.

Q.4 Solve the following questions.(Any one) (3)

i **Sum of the present ages of Manish and Savita is 31. Manish's age 3 years ago was 4 times the age of Savita. Find their present ages.**

Let the present ages of Manish and Savita be *x* years and *y* years respectively.

According to the first condition, sum of the present ages of Manish and Savita is 31.

∴ *x* + *y* = 31 …(i)

3 years ago,

Manish's age = (*x* – 3) years

Savita's age = (*y* – 3) years

According to the second condition, 3 years ago Manish's age was 4 times the age of Savita.

(*x* – 3) = 4 (*y* – 3)

∴ *x* – 3 = 4*y* – 12

∴ *x* – 4*y* = –12 + 3

∴ *x* – 4*y* = –9 …(ii)

Subtracting equation (ii) from (i), we get

$$\begin{array}{rcl} x + y &=& 31 \\ x - 4y &=& -9 \\ - \quad + \quad + & & \\ \hline 5y &=& 40 \end{array}$$

$\therefore\ y = \frac{40}{5} = 8$

Substituting $y = 8$ in equation (i), we get

$x + y = 31$

$x + 8 = 31$

$\therefore\ x = 31 - 8$

$\therefore\ x = 23$

$\therefore$ The present ages of Manish and Savita are 23 years and 8 years respectively.

ii **Solve the following simultaneous equations.**

$99x + 101y = 499$; $101x + 99y = 501$

$99x + 101y = 499$ …(i)

$101x + 99y = 501$ …(ii)

Adding equations (i) and (ii), we get

$$\begin{array}{r} 99x + 101y = 499 \\ +101x + 99y = 501 \\ \hline 200x + 200y = 1000 \end{array}$$

$\therefore\ x + y = \frac{1000}{200}$ …[Dividing both sides by 200]

$\therefore\ x + y = 5$ …(iii)

Subtracting equation (ii) from (i), we get

$$\begin{array}{rcl} 99x &+& 101y = 499 \\ 101x &+& 99y = 501 \\ - \quad & - \quad & - \\ \hline -2x + 2y &=& -2 \end{array}$$

$\therefore\ x - y = \frac{-2}{-2}$ …[Dividing both sides by –2]

$\therefore\ x - y = 1$ …(iv)

Adding equations (iii) and (iv), we get

$$\begin{array}{r} x + y = 5 \\ +x - y = 1 \\ \hline 2x \quad = 6 \end{array}$$

$\therefore\ x = \frac{6}{2} = 3$

Substituting $x = 3$ in equation (iii), we get

$x + y = 5$

$3 + y = 5$

$\therefore\ y = 5 - 3 = 2$

$\therefore$ $(x, y) = (3, 2)$ is the solution of the given simultaneous equations.

Q.5 Solve the following questions.(Any one) (4)

i **Kantabai bought $1\frac{1}{2}$ kg tea and 5 kg sugar from a shop. She paid ₹ 50 as return fare for rickshaw. Total expense was ₹ 700. Then she realised that by ordering online the goods can be bought with free home delivery at the same price. So,**

next month she placed the order online for 2 kg tea and 7 kg sugar. She paid ₹ 880 for that. Find the rate of sugar and tea per kg.

Let the rate of tea be ₹ x per kg and that of sugar be ₹ y per kg.

According to the first condition, cost of

$1\frac{1}{2}$ kg tea + cost of 5 kg sugar + fare for rickshaw = total expense

$\therefore \quad 1\frac{1}{2}x + 5y + 50 = 700$

$\therefore \quad \frac{3}{2}x + 5y = 700 - 50$

$\therefore \quad \frac{3}{2}x + 5y = 650$

$\therefore \quad 3x + 10y = 1300 \quad \ldots$(i)[Multiplying both sides by 2]

According to the second condition, cost of 2 kg tea and 7 kg sugar is 880.

$2x + 7y = 880 \quad \ldots$(ii)

Multiplying equation (i) by 2, we get

$6x + 20y = 2600 \quad \ldots$(iii)

Multiplying equation (ii) by 3, we get

$6x + 21y = 2640 \quad \ldots$(iv)

Subtracting equation (iii) from (iv), we get

$$\begin{array}{rcrcr} 6x & + & 21y & = & 2640 \\ 6x & + & 20y & = & 2600 \\ - & & - & & - \\ \hline & & y & = & 40 \end{array}$$

Substituting $y = 40$ in equation (i), we get

$3x + 10y = 1300$

$3x + 10(40) = 1300$

$\therefore \quad 3x + 400 = 1300$

$\therefore \quad 3x = 1300 - 400$

$\therefore \quad 3x = 900$

$\therefore \quad x = \frac{900}{3} = 300$

$\therefore$ The rate of tea is ₹300 per kg and that of sugar is ₹40 per kg.

ii **Convert the following equations into simultaneous equations and solve:**

$\sqrt{\frac{x}{y}} = 4, \frac{1}{x} + \frac{1}{y} = \frac{1}{xy}$

$\sqrt{\frac{x}{y}} = 4$

Squaring on both sides, we get

$\frac{x}{y} = 16$

$\therefore \quad x = 16y \quad \ldots$(i)

$\frac{1}{x} + \frac{1}{y} = \frac{1}{xy}$

Multiplying both sides by xy, we get

$y + x = 1$

i.e., $x + y = 1 \quad \ldots$(ii)

Substituting $x = 16y$ in equation (ii), we get

$16y + y = 1$

$\therefore \quad 17y = 1$

$\therefore \quad y = \frac{1}{17}$

Substituting $y = \frac{1}{17}$ in equation (i), we get

$x = \frac{16}{17}$

$\therefore$ **$(x, y) = \left(\frac{16}{17}, \frac{1}{17}\right)$ is the solution of the given equations.**