Class Notes	
Class : 10th	Subject : Mathematics
Topic : Linear equations in two variables, exercise 3.3 solutions.	Prepared by : Y.Thakkar

Question 1:

Solve the following pair of linear equations by the substitution method:

(i) $x + y = 14;\ x - y = 4$ **(ii)** $s - t = 3;\ \frac{s}{3} + \frac{t}{2} = 6$

(iii) $3x - y = 3;\ 9x - 3y = 9$ **(iv)** $0.2x + 0.3y = 1.3;\ 0.4x + 0.5y = 2.3$

(v) $\sqrt{2}x + \sqrt{3}y = 0; \sqrt{3}x - \sqrt{2}y = 0$ **(vi)** $\frac{3x}{2} - \frac{5y}{3} = -2;\ \frac{x}{3} + \frac{y}{2} = \frac{13}{6}$

Answer 1:

(i) $x + y = 14$ ... (1)

$x - y = 4$ ... (2)

From the equation (1), we get

$y = 14 - x$ ... (3)

Putting the value of y in equation (2), we get

$x - (14 - x) = 4 \quad \Rightarrow 2x = 18 \quad \Rightarrow x = 9$

Putting the value of x in equation (3), we get

$y = 14 - 9 = 5$

Hence, $x = 9$ and $y = 5$.

(ii) $s - t = 3$ ... (1)

$\frac{s}{3} + \frac{t}{2} = 6$ ... (2)

From the equation (1), we get

$s = 3 + t$ ... (3)

Putting the value of s in equation (2), we get

$\frac{3+t}{3} + \frac{t}{2} = 6 \quad \Rightarrow \frac{6 + 2t + 3t}{6} = 6 \quad \Rightarrow 5t + 6 = 36 \quad \Rightarrow t = 6$

Putting the value of t in equation (3), we get

$s = 3 + 6 = 9$

Hence, $s = 9$ and $t = 6$.

(iii) $3x - y = 3$ ... (1)

$9x - 3y = 9$ ... (2)

From the equation (1), we get

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

Putting the value of y in equation (2), we get

$9x - 3(3x - 3) = 9 \quad \Rightarrow 9 = 9$, which is true.

Hence, pair of linear equations have infinite many solution.

(iv) $0.2x + 0.3y = 1.3$ ... (1)

$0.4x + 0.5y = 2.3$ ... (2)

From the equation (1), we get

$y = \frac{1.3 - 0.2x}{0.3}$ ... (3)

Putting the value of y in equation (2), we get

$0.4x + 0.5\left(\frac{1.3 - 0.2x}{0.3}\right) = 2.3$

$\Rightarrow 0.12x + 0.65 - 0.10x = 0.69 \quad \Rightarrow 0.02x = 0.04 \quad \Rightarrow x = 2$

Putting the value of x in equation (3), we get

$y = \frac{1.3 - 0.2(2)}{0.3} = \frac{0.9}{0.3} = 3$

Hence, $x = 2$ and $y = 3$.

(v) $\sqrt{2}x + \sqrt{3}y = 0$ ... (1)

$\sqrt{3}x - \sqrt{2}y = 0$ ... (2)

From the equation (1), we get

$y = -\frac{\sqrt{2}x}{\sqrt{3}}$ ... (3)

Putting the value of y in equation (2), we get

$\sqrt{3}x - \sqrt{2}\left(-\frac{\sqrt{2}x}{\sqrt{3}}\right) = 0 \quad \Rightarrow 3x - 2x = 0 \quad \Rightarrow x = 0$

Putting the value of x in equation (3), we get

$y = 0$

Hence, $x = 0$ and $y = 0$.

(vi) $\frac{3x}{2} - \frac{5y}{3} = -2$ ... (1)

$\frac{x}{3} + \frac{y}{2} = \frac{13}{6}$ ... (2)

From the equation (1), we get

$\frac{5}{3}y = \frac{3x}{2} + 2 = \frac{3x+4}{2}$

$y = \frac{3}{5}\left(\frac{3x+4}{2}\right) = \frac{9x+12}{10}$ ... (3)

Putting the value of y in equation (2), we get

$\frac{x}{3} + \frac{1}{2}\left(\frac{9x+12}{10}\right) = \frac{13}{6} \quad \Rightarrow \frac{20x + 27x + 36}{60} = \frac{13}{6}$

$\Rightarrow 282x + 216 = 780 \quad \Rightarrow 282x = 564 \quad \Rightarrow x = 2$

Putting the value of x in equation (3), we get

$y = \frac{9(2) + 12}{10} = 3$

Hence, $x = 2$ and $y = 3$.

Question 2:

Solve $2x + 3y = 11$ and $2x - 4y = -24$ and hence find the value of 'm' for which $y = mx + 3$.

Answer 2:

$2x + 3y = 11$ ... (1)

$2x - 4y = -24$ ... (2)

From the equation (1), we get

$y = \frac{11-2x}{3}$ ... (3)

Putting the value of y in equation (2), we get

$2x - 4\left(\frac{11 - 2x}{3}\right) = -24 \quad \Rightarrow 6x - 44 + 8x = -72 \quad \Rightarrow 14x = -28 \quad \Rightarrow x = -2$

Putting the value of x in equation (3), we get

$y = \frac{11 - 2(-2)}{3} = 5$

Hence, $x = -2$ and $y = 5$.

Putting the value of x and y in $y = mx + 3$, we get

$5 = -2m + 3$

$\Rightarrow m = -1$

Question 3:

Form the pair of linear equations for the following problems and find their solution by substitution method:

(i) The difference between two numbers is 26 and one number is three times the other. Find them.

(ii) The larger of two supplementary angles exceeds the smaller by 18 degrees. Find them.

(iii) The coach of a cricket team buys 7 bats and 6 balls for ₹3800. Later, she buys 3 bats and 5 balls for ₹1750. Find the cost of each bat and each ball.

(iv) The taxi charges in a city consist of a fixed charge together with the charge for the distance covered. For a distance of 10 km, the charge paid is ₹105 and for a journey of 15 km, the charge paid is ₹155. What are the fixed charges and the charge per km? How much does a person have to pay for travelling a distance of 25 km?

(v) A fraction becomes $\frac{9}{11}$, if 2 is added to both the numerator and the denominator. If, 3 is added to both the numerator and the denominator it becomes $\frac{5}{6}$. Find the fraction.

(vi) Five years hence, the age of Jacob will be three times that of his son. Five years ago, Jacob's age was seven times that of his son. What are their present ages?

Answer 3:

(i) Let the first number = x

Let the second number = y

According to question,

$x = 3y$ ... (1)

The difference between two number is 26, therefore

$x - y = 26$ ... (2)

Putting the value of x in equation (2), we get

$3y - y = 26 \Rightarrow 2y = 26 \quad \Rightarrow y = 13$

Putting the value of y in equation (1), we get

$x = 3(13) = 39$

Hence, one number is 13 and the other number is 39.

(ii) Let the larger angle = x

Let the smaller angle = y

According to question,

$x = y + 18$ ... (1)

Both angles are supplementary, therefore

$x + y = 180$ ... (2)

Putting the value of x in equation (2), we get

$y + 18 + y = 180 \Rightarrow 2y = 162 \quad \Rightarrow y = 81$

Putting the value of y in equation (1), we get

$x = 81 + 18 = 99$

Hence, one angle is 81° and the other one is 99°.

(iii) Let the cost of one bat = ₹ x

Let the cost of one ball = ₹ y

According to first condition, $7x + 6y = 3800$

$\Rightarrow x = \frac{3800 - 6y}{7}$ ... (1)

According to second condition,

$3x + 5y = 1750$ ... (2)

Putting the value of x in equation (2), we get

$3\left(\frac{3800-6y}{7}\right) + 5y = 1750$

$\Rightarrow 11400 - 18y + 35y = 12250$

$\Rightarrow 17y = 850$

$\Rightarrow y = 50$

Putting the value of y in equation (1), we get

$$x = \frac{3800 - 6(50)}{7} = 500$$

Hence, the cost of one bat is ₹500 and the cost of one ball is ₹50.

(iv) Let the numerator = x

Let the denominator = y

Therefore, the fraction = $\frac{x}{y}$

According to first condition,

$$\frac{x+2}{y+2} = \frac{9}{11}$$

$\Rightarrow 11x + 22 = 9y + 18$

$\Rightarrow x = \frac{9y-4}{11}$ ... (1)

According to second condition,

$\frac{x+3}{y+3} = \frac{5}{6}$ $\Rightarrow 6x + 18 = 5y + 15$

$\Rightarrow 6x - 5y = -3$ ... (2)

Putting the value of x in equation (2), we get

$6\left(\frac{9y-4}{11}\right) - 5y = -3$ $\Rightarrow 54y - 24 - 55y = -33$ $\Rightarrow -y = -9$ $\Rightarrow y = 9$

Putting the value of y in equation (1), we get

$$x = \frac{9(9) - 4}{11} = 7$$

Hence, the fraction = $\frac{x}{y} = \frac{7}{9}$.

(v) Let the age of Jacob = x years

Let the age of son = y years

After 5 years,

Jacob's = $x + 5$ years

Son's age = $y + 5$ years

According to question, $x + 5 = 3(y + 5)$ $\Rightarrow x + 5 = 3y + 15$

$\Rightarrow x = 3y + 10$ ... (1)

5 years ago,

Jacob's age = $x - 5$ years and son's age = $y - 5$ years

According to question, $x - 5 = 7(y - 5)$ $\Rightarrow x - 5 = 7y - 35$

$\Rightarrow x - 7y = -30$ ... (2)

Putting the value of x in equation (2), we get

$3y + 10 - 7y = -30$

$\Rightarrow -4y = -40$ $\Rightarrow y = 10$

Putting the value of y in equation (1), we get, $x = 3(10) + 10 = 40$

Hence, the age of Jacob is 40 years and the age of his son is 10 years.