CBSE Class–10 Mathematics

NCERT solution

Chapter - 3

Pair of Linear Equations in Two Variables - Exercise 3.4

1. Solve the following pair of linear equations by the elimination method and the substitution method:

(i) x + y = 5, 2x – 3y = 4

(ii) 3x + 4y = 10, 2x – 2y = 2

(iii) 3*x* – 5*y* – 4 = 0, 9*x* = 2*y* + 7

(iv) $\frac{x}{2}+\frac{2y}{3}=-1, x-\frac{y}{3}=3$

Ans. (i) x + y = 5 ... (1)

2x – 3y = 4 ... (2)

Elimination method:

Multiplying equation (1) by 2, we get equation (3)

2*x* + 2*y* = 10 ... (3)

2*x* – 3*y* = 4 ... (2)

Subtracting equation (2) from (3), we get

$5y = 6 \Rightarrow y = \frac{6}{5}$

Putting value of y in (1), we get

$x + \frac{6}{5} = 5$

$\Rightarrow x = 5 - \frac{6}{5} = \frac{19}{5}$

Therefore, $x = \frac{19}{5}$ and $y = \frac{6}{5}$

Substitution method:

$x + y = 5$ ... (1)

$2x - 3y = 4$ ... (2)

From equation (1), we get,

$x = 5 - y$

Putting this in equation (2), we get

$2(5 - y) - 3y = 4$

$\Rightarrow 10 - 2y - 3y = 4$

$\Rightarrow 5y = 6 \Rightarrow y = \frac{6}{5}$

Putting value of y in (1), we get

$x = 5 - \frac{6}{5} = \frac{19}{5}$

Therefore, $x = \frac{19}{5}$ and $y = \frac{6}{5}$

(ii) $3x + 4y = 10$... (1)

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

Elimination method:

Multiplying equation (2) by 2, we get (3)

$4x - 4y = 4$ ... (3)

$3x + 4y = 10$ ... (1)

Adding (3) and (1), we get

$7x = 14 \Rightarrow x = 2$

Putting value of x in (1), we get

$3(2) + 4y = 10$

$\Rightarrow 4y = 10 - 6 = 4$

$\Rightarrow y = 1$

Therefore, $x = 2$ and $y = 1$

Substitution method:

$3x + 4y = 10$... (1)

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

From equation (2), we get

$2x = 2 + 2y$

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

Putting this in equation (1), we get

$3(1 + y) + 4y = 10$

$\Rightarrow 3 + 3y + 4y = 10$

$\Rightarrow 7y = 7 \Rightarrow y = 1$

Putting value of y in (3), we get $x = 1 + 1 = 2$

Therefore, $x = 2$ and $y = 1$

(iii) $3x - 5y - 4 = 0$ ... (1)

$9x = 2y + 7$... (2)

Elimination method:

Multiplying (1) by 3, we get (3)

$9x - 15y - 12 = 0$... (3)

$9x - 2y - 7 = 0$... (2)

Subtracting (2) from (3), we get

$-13y - 5 = 0$

$\Rightarrow -13y = 5$

$\Rightarrow y = \frac{-5}{13}$

Putting value of y in (1), we get

$3x - 5\left(\frac{-5}{13}\right) - 4 = 0$

$\Rightarrow 3x = 4 - \frac{25}{13} = \frac{52-25}{13} = \frac{27}{13}$

$\Rightarrow x = \frac{27}{13 \times 3} = \frac{9}{13}$

Therefore, $x = \frac{9}{13}$ and $y = \frac{-5}{13}$

Substitution Method:

$3x - 5y - 4 = 0$ ... (1)

$9x = 2y + 7$... (2)

From equation (1), we can say that

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

Putting this in equation (2), we get

$9\left(\frac{4+5y}{3}\right) - 2y = 7$

$\Rightarrow 12 + 15y - 2y = 7$

$\Rightarrow 13y = -5 \Rightarrow y = \frac{-5}{13}$

Putting value of y in (1), we get

$3x - 5\left(\frac{-5}{13}\right) = 4$

$\Rightarrow 3x = 4 - \frac{25}{13} = \frac{52-25}{13} = \frac{27}{13}$

$\Rightarrow x = \frac{27}{13\times 3} = \frac{9}{13}$

Therefore, $x = \frac{9}{13}$ and $y = \frac{-5}{13}$

(iv) $\frac{x}{2} + \frac{2y}{3} = -1 \ldots (1)$

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

Elimination method:

Multiplying equation (2) by 2, we get (3)

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

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

Adding (3) and (1), we get

$\frac{5}{2}x=5$ ⇒ x = 2

Putting value of x in (2), we get

2 – $\frac{y}{3}$ = 3

⇒ y = −3

Therefore, x = 2 and y = −3

Substitution method:

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

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

From equation (2), we can say that $x=3+\frac{y}{3}=\frac{9+y}{3}$

Putting this in equation (1), we get

$\frac{9+y}{6}+\frac{2}{3}y=-1$

⇒ $\frac{9+y+4y}{6}=-1$

⇒ 5y + 9 = −6

$\Rightarrow 5y = -15 \Rightarrow y = -3$

Putting value of y in (1), we get

$$\frac{x}{2}+\frac{2}{3}(-3)=-1 \Rightarrow x = 2$$

Therefore, $x = 2$ and $y = -3$

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2. Form the pair of linear equations in the following problems, and find their solutions (if they exist) by the elimination method:

(i) If we add 1 to the numerator and subtract 1 from the denominator, a fraction reduces to 1. It becomes ½ if we only add 1 to the denominator. What is the fraction?

(ii) Five years ago, Nuri was thrice as old as sonu. Ten years later, Nuri will be twice as old as sonu. How old are Nuri and Sonu?

(iii) The sum of the digits of a two–digit number is 9. Also, nine times this number is twice the number obtained by reversing the order of the digits. Find the number.

(iv) Meena went to a bank to withdraw Rs 2000. She asked the cashier to give her Rs 50 and Rs 100 notes only. Meena got 25 notes in all. Find how many notes of Rs 50 and Rs 100 she received.

(v) A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid Rs 27 for a book kept for seven days, while Susy paid Rs 21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

Ans. (i) Let numerator =x and let denominator =y

According to given condition, we have

$$\frac{x+1}{y-1}=1 \; and \; \frac{x}{y+1}=\frac{1}{2}$$

$\Rightarrow x + 1 = y - 1$ and $2x = y + 1$

$\Rightarrow x - y = -2$ ... **(1)** and $2x - y = 1$... **(2)**

So, we have equations **(1)** and **(2)**, multiplying equation **(1)** by 2 we get **(3)**

$2x - 2y = -4$... **(3)**

$2x - y = 1$... **(2)**

Subtracting equation **(2)** from **(3)**, we get

$-y = -5 \Rightarrow y = 5$

Putting value of y in **(1)**, we get

$x - 5 = -2 \Rightarrow x = -2 + 5 = 3$

Therefore, fraction = $\frac{x}{y} = \frac{3}{5}$

(ii) Let present age of Nuri = x years and let present age of Sonu = y years

5 years ago, age of Nuri = (x – 5) years

5 years ago, age of Sonu = (y – 5) years

According to given condition, we have

$(x - 5) = 3(y - 5)$

$\Rightarrow x - 5 = 3y - 15$

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

10 years later from present, age of Nuri = $(x + 10)$ years

10 years later from present, age of Sonu = $(y + 10)$ years

According to given condition, we have

$(x + 10) = 2(y + 10)$

$\Rightarrow x + 10 = 2y + 20$

$\Rightarrow x - 2y = 10$ ... **(2)**

Subtracting equation **(1)** from **(2)**, we get

$y = 10 - (-10) = 20$ years

Putting value of **y** in **(1)**, we get

$x - 3(20) = -10$

$\Rightarrow x - 60 = -10$

$\Rightarrow x = 50$ years

Therefore, present age of Nuri = 50 years and present age of Sonu = 20 years

(iii) Let digit at ten's place = x and Let digit at one's place = y

According to given condition, we have

$x + y = 9$ ... **(1)**

And $9(10x + y) = 2(10y + x)$

$\Rightarrow 90x + 9y = 20y + 2x$

$\Rightarrow 88x = 11y$

$\Rightarrow 8x = y$

$\Rightarrow 8x - y = 0$ ... **(2)**

Adding **(1)** and **(2)**, we get

$9x = 9 \Rightarrow x = 1$

Putting value of **x** in **(1)**, we get

$1 + y = 9$

$\Rightarrow y = 9 - 1 = 8$

Therefore, number = $10x + y = 10\ (1) + 8 = 10 + 8 = 18$

(iv) Let number of Rs 100 notes = x and let number of Rs 50 notes = y

According to given conditions, we have

$x + y = 25$ ... **(1)**

and $100x + 50y = 2000$

$\Rightarrow 2x + y = 40$ ... **(2)**

Subtracting **(2)** from **(1)**, we get

$-x = -15 \Rightarrow x = 15$

Putting value of **x** in **(1)**, we get

$15 + y = 25$

$\Rightarrow y = 25 - 15 = 10$

Therefore, number of Rs 100 notes = 15 and number of Rs 50 notes = 10

(v) Let fixed charge for 3 days = Rs x
Let additional charge for each day thereafter = Rs y
According to given condition, we have
$x + 4y = 27$ ... **(1)**
$x + 2y = 21$ ... **(2)**
Subtracting **(2)** from **(1)**, we get
$2y = 6 \Rightarrow y = 3$
Putting value of **y** in **(1)**, we get
$x + 4\ (3) = 27$
$\Rightarrow x = 27 - 12 = 15$
Therefore, fixed charge for 3 days = Rs 15 and additional charge for each day after 3 days = Rs 3