NCERT Solutions for Class 10th Maths Chapter 3 Pair of Linear Equations in Two Variables Ex 3.4

Question-20

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

(i) x + y = 5 and 2x - 3y = 4

(ii) 3x + 4y = 10 and 2x − 2y = 2

(iii) 3x − 5y − 4 = 0 and 9x = 2y + 7

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

Solution:

(i) x + y = 5 and 2x - 3y = 4

Elimination method:

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

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

(1) × 2 ⇒2x + 2y = 10..... (3)

(2)⇒ 2x - 3y = 4

(3)− (2) => 5y = 6

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

Substitute $y = \frac{6}{5}$ in (1)

x + y = 5

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

$= \frac{25 - 6}{5} = \frac{19}{5}$

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

Substitution method:

From (1) : x = 5 − y

Substituting in (2) : 2(5 − y) − 3y = 4

10 − 2y − 3y = 4

-5y = 4 − 10

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

x = 5 − y

$= 5 - (\frac{6}{5}) = \frac{25 - 6}{5} = \frac{19}{5}$

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

(ii) 3x + 4y = 10 and 2x − 2y = 2

Elimination method:

3x + 4y = 10 …….. (1)

2x − 2y = 2 ……(2)

Multiply (2) with 2 and adding with (1) we get,

3x + 4y = 10 …….. (1)

4x − 4y = 4 …… (3)

⇒7x = 14

$x = \frac{14}{7} = 2$

Substitute x = 2 in (2)

2x − 2y = 2

⇒2(2) −2y = 2

2y = 4 − 2 = 2

∴ y =1

Thus x = 2, y = 1.

Substitution method:

3x + 4y = 10 …….. (1)

2x − 2y = 2 ……(2)

from (2) x − y = 1

=> x = 1 + y

Substitute in (1) ⇒ 3(1+y) + 4y = 10

3 + 3y + 4y = 10

7y = 7 ⇒ y =1

Substitute in (1) ⇒3x + 4 = 10

3x = 6

⇒x = 2

Thus x = 2, y = 1.

(iii) 3x − 5y − 4 = 0 and 9x = 2y + 7

Elimination method:

3x - 5y = 4 ……..(1)

9x - 2y = 7 ……(2)

Multiply (1) with 3 and adding with (2) we get,

9x − 15y = 12……(1)

9x - 2y = 7 ……(2)

-13 y = 5

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

Substitute $y = \frac{-5}{13}$ in (1)

3x - 5y = 4

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

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

$3X = \frac{27}{13}$

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

$\therefore x = \frac{9}{13}, y = \frac{-5}{13}$.

Substitution method:

3x = 5y + 4 ……..(1)

9x = 2y + 7 ……(2)

from (1) $x = \frac{5y + 4}{3}$

sub in (2)

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

15y + 12 − 2y − 7 = 0

13y = -5

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

$x = \frac{5\left(\frac{-5}{13}\right) + 4}{3} = \frac{-25 + 52}{39} = \frac{-27}{39} = \frac{-9}{13}$.

$\therefore x = \frac{9}{13}, y = \frac{-5}{13}$.

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

Elimination method:

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

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

Multiply by 6 on both sides in equation (1)

Multiply by 3 in both sides in equation (2)

3x + 4y = -6 ..... (3)

3x - y = 9 ..... (4)

(3) – (4) => 5y = -15

y = -3

Substituting y = -3 in (3) we get,

3x + 4y = -6

3x + 4(-3) = -6

3x = -6 +12 = 6

x = 2

Thus x = 2, y = -3.

Substitution method:

Multiply by 6 on both sides in equation (1)

Multiply by 3 in both sides in equation (2)

3x + 4y = -6 ..... (3)

3x - y = 9 ..... (4)

=>y = 3x – 9 from (4)

Substitute in (3)

3(x) + 4(3x – 9) = -6

3x + 12x – 36 = -6

15x = 30

∴ x = 2

Since, y = 3x – 9

y = 3(2) – 9

y = 6 – 9 = -3.

Thus x = 2, y = -3.

Question-21

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 $\frac{1}{2}$ 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.

Solution:

(i) Let the fraction be $\frac{x}{y}$, x is the numerator and y is the denominator

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

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

becomes x + 1 = y - 1

(i.e.,) x - y = -2

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

(2) becomes,

2x = y + 1 ..... (4)

sub x in (4)

2(y - 2) = y + 1

2y - 4 = y + 1

2y - y = 4 + 1

y = 5

$\therefore$ x = y - 2 from (3)

= 3

$\therefore$ The fraction is $\frac{3}{5}$.

(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?

Nuri's age = x
Sonu's age = y
5 years ago, x - 5 = 3(y - 5) ..... (1)
10 years later, x + 10 = 2(y + 10) ..... (2)
x - 5 = 3y - 15
x = 3y - 10 ..... (3)
sub x in (2)
3y - 10 + 10 = 2y + 20
3y - 2y = 20
y = 20
∴ Nuri's age x = 3y - 10
= 3(20) - 10
= 60 - 10 = 50
Nuri's age x = 50 years
Sonu's age y = 20 years

(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.
Let x, y be the 2 digits of the number
x + y = 9 .....(1)
9(10x + y) = 2 (10y + x) .....(2)
(2) => 90x + 9y = 20y + 2x
88x - 11y = 0
⇒ 8x - y = 0 ..... (3)
Solving (1) and (3) we get,
x +y = 9 .....(4)
8x - y = 0 ..... (3)
=> 9x = 9
∴ x = 1
Substituting x = 1 in (1)
x + y = 9
1+ y = 9
y = 8.
The two-digit number is 18.

Question-22

Form the pair of linear equations in the following problems, and find their solutions (if they exist) by the elimination method:
(i) Meena went to a bank to withdraw `2000. She asked the cashier to give her `50 and `100 notes only. Meena got 25 notes in all. Find how many notes of `50 and `100 she received.
(ii) A lending library has a fixed charge for the first three days and an additional charge for each day thereafter. Saritha paid `27 for a book kept for seven days, while Susy paid `21 for the book she kept for five days. Find the fixed charge and the charge for each extra day.

Solution:

(i) 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.
Let the number of Rs. 50 notes be x and the number of Rs. 100 notes be y
$x + y = 25$ ..... (1)
$50x + 100y = 2000$ .....(2)
simplifying (2)
$x + 2y = 40$ .....(3)
$x + y = 25$
$\underline{x + 2y = 40}$
$y = 15$
sub for $y = 15$ in (1)
$x + 15 = 25$
$x = 10$
Number of Rs. 50 notes = 10
Number of Rs. 100 notes = 15

(ii) 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.
Let x be the fixed charge for first three days and y be the additional charge.
Saritha had the book for 7 days, so she pays additional charges for 4 days.
Susy had the book for 5 days so she pays additional charges for 2 days.
Saritha paid
$x + 4y = 27$ ..... (1)
Susy paid, $x + 2y = 21$ ..... (2)
Subtracting (1) and (2)
$2y = 6$
$\therefore y = 3$
Eqn. (1)$\Rightarrow x + 4(3) = 27$
$x + 12 = 27$
$x = 15$
Fixed charges = Rs. 15
Additional charges = Rs. 3 per day

********** END **********