

Ex - 3.4

Q1. Solve the following pair of 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 $x - \frac{y}{3} = 3$

Sol. (i) Solution By Elimination Method:

$$x + y = 5 \quad \dots(i)$$

$$2x - 3y = 4 \quad \dots(ii)$$

Multiplying (i) by 3 and (ii) by 1 and adding we get $3(x + y) + 1(2x - 3y) = 3 \times 5 + 1 \times 4$

$$\Rightarrow 3x + 3y + 2x - 3y = 19$$

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

From (i), substituting $x = \frac{19}{5}$, we get

$$\frac{19}{5} + y = 5 \Rightarrow y = 5 - \frac{19}{5} \Rightarrow y = \frac{6}{5}$$

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

(i) Solution By Substitution Method :

$$x + y = 5 \quad \dots(i)$$

$$2x - 3y = 4 \quad \dots(ii)$$

$$\text{From (i), } y = 5 - x \quad \dots(iii)$$

Substituting y from (iii) in (ii), $2x - 3(5 - x) = 4$

$$\Rightarrow 2x - 15 + 3x = 4$$

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

$$\text{Then from (iii), } y = 5 - \frac{19}{5} \Rightarrow y = \frac{6}{5}$$

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

(ii) Solution by elimination method

$$3x + 4y = 10 \quad \dots(i)$$

$$2x - 2y = 2 \quad \dots(ii)$$

multiplying (ii) equation by 2, we get

$$4x - 4y = 4 \quad \dots(iii)$$

Add equation (i) and (iii), we get

$$7x = 14$$

$$\Rightarrow x = 2$$

Substituting, $x = 2$ in (i), we get

$$3 \times 2 + 4 \times y = 10$$

$$\Rightarrow 4y = 4$$

$$\Rightarrow y = 1$$

$$\text{Hence, } x = 2, y = 1$$

(ii) Solution by substitution method

$$3x + 4y = 10 \quad \dots(i)$$

$$2x - 2y = 2 \quad \dots(ii)$$

From (ii), $y = \frac{2x-2}{2} = x - 1 \quad \dots(\text{iii})$

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

$$3x + 4(x - 1) = 10$$

$$\Rightarrow 3x + 4x - 4 = 10$$

$$\Rightarrow 7x = 14$$

$$x = 2$$

Then from (iii)

$$y = 2 - 1 = 1$$

Hence, $x = 2, y = 1$

(iii) Solution by elimination method

$$3x - 5y = 4 \quad \dots(\text{i})$$

$$9x = 2y + 7 \quad \dots(\text{ii})$$

Multiplying (i) equation by 3, we get

$$9x - 15y = 12 \quad \dots(\text{iii})$$

Subtracting (iii) from (ii), we get

$$9x - 9x + 15y = 2y + 7 - 12$$

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

$$13y = -5$$

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

From (i) substituting value of $y = \frac{-5}{13}$

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

$$\Rightarrow 3x = \frac{-25}{13} + 7$$

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

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

$$x = \frac{9}{13}$$

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

(iii) Solution by substitution method

$$3x - 5y = 4 \quad \dots(i)$$

$$9x = 2y + 7 \quad \dots(ii)$$

From (i)

$$x = \frac{4+5y}{3} \quad \dots(iii)$$

Substuting $x = \frac{4+5y}{3}$ in (ii)

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

$$12 + 15y = 2y + 7$$

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

from (iii)

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

$$\text{Hence, } y = \frac{-5}{13}, x = \frac{9}{13}$$

(iv) Solution by elimination method

$$\frac{x}{2} + \frac{2y}{3} = -1 \quad \dots(i)$$

$$x - \frac{y}{3} = 3 \quad \dots(ii)$$

Multiplying (ii), we get

$$2x - \frac{2y}{3} = 6 \quad \dots(iii)$$

Adding (i) and (iii), we get

$$2x + \frac{x}{2} = -1 + 6$$

$$\Rightarrow \frac{5x}{2} = 5$$

$$\Rightarrow x = 2$$

From (ii) substituting $x = 2$, in equation (ii), we get

$$\Rightarrow 2 - \frac{y}{3} = 3$$

$$\Rightarrow -1 = \frac{y}{3}$$

$$\Rightarrow y = -3$$

$$\text{Hence, } x = 2, y = -3$$

(iv) Solution by substitution method

$$\frac{x}{2} + \frac{2y}{3} = -1 \quad \dots(i)$$

$$x - \frac{y}{3} = 3 \quad \dots(ii)$$

$$\text{from (ii), } x = 3 + \frac{y}{3} \quad \dots(iii)$$

Substituting x from (iii) in (i), we get

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

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

$$\Rightarrow \frac{y + 4y}{6} = -1 - \frac{3}{2}$$

$$\Rightarrow \frac{5y}{6} = \frac{-5}{2}$$

$$\Rightarrow y = -3$$

Substituting $y = -3$ in equation (ii), we get

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

$$\Rightarrow x + 1 = 3$$

$$\Rightarrow x = 2$$

Hence, $x = 2$, $y = -3$

Q2. 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.

(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.

Sol. (i) Let fraction = $\frac{x}{y}$

$$\frac{x+1}{y-1} = 1,$$

$$x + 1 = y - 1$$

$$x - y = -2 \quad \dots(i)$$

$$\frac{x}{y+1} = \frac{1}{2}$$

$$2x = y + 1$$

$$2x - y = 1 \quad \dots(ii)$$

Multiplying (i) by 2 and (ii) by 1 and subtracting we get

$$2x - 2y = -4$$

Subtracting,
$$\frac{2x - y = 1}{-y = -5}$$

$$y = 5$$

Substituting $y = 5$ in (ii), we get

$$2x - 5 = 1 \Rightarrow x = 3$$

$$\text{Fraction} = \frac{x}{y} = \frac{3}{5}$$

(ii) Let present age of Nuri = x years

Let present age of Sonu = y years

Five years ago,

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

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

$$x - 3y = -10 \quad \dots(i)$$

Ten years later,

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

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

$$x - 2y = 10 \quad \dots(ii)$$

Subtracting (ii) from (i)

$$x - 3y = -10$$

$$x - 2y = +10$$

$$-y = -20$$

$$\Rightarrow y = 20$$

Substituting $y = 20$ in (ii), we get

$$x - 2 \times 20 = 10$$

$$\Rightarrow x = 50$$

So, present age of Nuri is 50 years

present age of Sonu is 20 years

(iii) Let unit digit = x , ten's digit = y

So, original number = $10y + x$

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

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

$$88y = 11x$$

$$x = 8y \quad \dots(i)$$

Also given sum of digits = 9

$$x + y = 9 \quad \dots(ii)$$

from (i) and (ii)

$$9y = 9$$

$$y = 1 \Rightarrow x = 8$$

$$\text{So, number} = 10 \times 1 + 8 = 18$$

- (iv) Let number of Rs.50 notes = x
 and number of Rs.100 notes = y
 total notes = $x + y = 25$... (i)

Also value of notes = Rs. 2000

$$50x + 100y = 2000$$

$$x + 2y = 40 \quad \dots (ii)$$

From (i) and (ii)

Number of Rs.50 notes = 10

Number of Rs.100 notes = 15

- (v) Let fixed charge be Rs. x
 and charge for each extra day by Rs. y

Then $x + 4y = 27$... (i)

$$x + 2y = 21 \quad \dots (ii)$$

Subtracting (ii) from (i)

$$2y = 6$$

$$y = 3$$

Substituting $y = 3$ in (i)

$$\Rightarrow x = 15$$

So fixed charge = Rs. 15

and charge for each extra day = Rs.3