

## Chapter Test

Solve the following simultaneous linear equations (1 to 4):

$$1.(i) \begin{cases} 2x - \frac{3}{4}y = 3, \\ 5x - 2y = 7 \end{cases}$$

**Solution:**

$$2x - \frac{3}{4}y = 3$$

$$\frac{8x - 3y}{4} = 3$$

$$8x - 3y = 12 \quad \dots(i)$$

$$5x - 2y = 7 \quad \dots(ii)$$

Multiply (i) by 5 and (ii) by 8, we get

$$40x - 15y = 60 \quad (iii)$$

$$40x - 16y = 56 \quad (iv)$$

Subtract (iv) from (iii), we get

$$y = 4$$

Substitute y in (i)

$$8x - 3 \times 4 = 12$$

$$\therefore 8x = 12 + 12$$

$$\therefore 8x = 24$$

$$\therefore x = 24/8$$

$$\therefore x = 3$$

Hence  $x = 3$  and  $y = 4$ .

$$(ii) \begin{cases} 2(x-4) = 9y+2 \\ x - 6y = 2 \end{cases}$$

**Solution:**

$$2(x-4) = 9y+2$$

$$2x-8 = 9y+2$$

$$2x-9y = 2+8$$

$$2x-9y = 10 \quad \dots(i)$$

$$x-6y = 2 \quad \dots(ii)$$

Multiply (ii) by 2, we get

$$2x - 12y = 4 \quad \dots(iii)$$

Subtract (iii) from (i), we get

$$2x-9y = 10$$

$$-2x + 12y = -4$$

$$\text{-----}$$
$$0+3y = 6$$

$$\therefore 3y = 6$$

$$\therefore y = 6/3$$

$$\therefore y = 2$$

Substitute the value of y in (i)

$$\Rightarrow 2x - 9 \times 2 = 10$$

$$2x - 18 = 10$$

$$2x = 10 + 18$$

$$2x = 28$$

$$\therefore x = 28/2$$

$$\therefore x = 14$$

Hence  $x = 14$  and  $y = 2$ .

**2. (i)  $97x + 53y = 177$**

**$53x + 97y = 573$**

**Solution:**

Given equations are as follows.

$$97x + 53y = 177 \quad \dots(i)$$

$$53x + 97y = 573 \quad \dots(ii)$$

Multiply (i) by 53 and (ii) by 97

$$53(97x + 53y) = 53 \times 177$$

$$5141x + 2809y = 9381 \quad \dots(iii)$$

$$97(53x + 97y) = 97 \times 573$$

$$5141x + 9409y = 55581 \quad \dots(iv)$$

Subtract (iv) from (iii)

$$5141x + 2809y = 9381 \quad \dots(iii)$$

$$5141x + 9409y = 55581 \quad \dots(iv)$$

$$\hline 0x - 6600y = -46200$$

$$\Rightarrow -6600y = -46200$$

$$\Rightarrow y = -46200 / -6600$$

$$\Rightarrow y = 7$$

Substitute the value of y in (i)

$$\Rightarrow 97x + 53 \times 7 = 177$$

$$\Rightarrow 97x + 371 = 177$$

$$\Rightarrow 97x = 177 - 371$$

$$\Rightarrow 97x = -194$$

$$\Rightarrow x = -194/97$$

$$\Rightarrow x = -2$$

Hence  $x = -2$  and  $y = 7$ .

**(ii)  $x + y = 5.5$**

**$x - y = 0.9$**

**Solution:**

$$x + y = 5.5 \quad \dots(i)$$

$$x - y = 0.9 \quad \dots(ii)$$

Adding (i) and (ii), we get

$$2x = 5.5 + 0.9$$

$$2x = 6.4$$

$$\Rightarrow x = 6.4/2$$

$$\Rightarrow x = 3.2$$

Substitute value of x in (i)

$$3.2 + y = 5.5$$

$$\Rightarrow y = 5.5 - 3.2$$

$$\Rightarrow y = 2.3$$

Hence  $x = 3.2$  and  $y = 2.3$ .

**3. (i)  $x + y = 7xy$**

**$2x - 3y + xy = 0$**

**Solution:**

$$x + y = 7xy \quad \dots(i)$$

$$2x - 3y + xy = 0 \quad \dots(ii)$$

Divide (i) by  $xy$ , we get

$$\frac{x}{xy} + \frac{y}{xy} = \frac{7xy}{xy}$$

$$\frac{1}{y} + \frac{1}{x} = 7$$

$$\frac{1}{x} + \frac{1}{y} = 7 \dots\dots(iii)$$

Divide (ii) by  $xy$ , we get

$$\frac{2x}{xy} - \frac{3y}{xy} + \frac{xy}{xy} = 0$$

$$\frac{2}{y} - \frac{3}{x} + 1 = 0$$

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

Multiplying (iii) by 3, we get

$$\frac{3}{x} + \frac{3}{y} = 3 \times 7$$

$$\frac{3}{x} + \frac{3}{y} = 21 \dots\dots(v)$$

Adding (v) and (iv), we get

$$\frac{5}{y} = 20$$

$$y = \frac{5}{20}$$

$$y = \frac{1}{4}$$

Substitute value of y in (iv)

$$-\frac{3}{x} + 2 \times 4 = -1$$

$$-\frac{3}{x} + 8 = -1$$

$$-\frac{3}{x} = -1 - 8$$

$$-\frac{3}{x} = -9$$

$$x = \frac{3}{9}$$

$$x = \frac{1}{3}$$

Hence  $x = 1/3$  and  $y = 1/4$ .

(ii)

$$\frac{30}{x-y} + \frac{44}{x+y} = 10$$

$$\frac{40}{x-y} + \frac{55}{x+y} = 13$$

**Solution:**

$$\frac{30}{x-y} + \frac{44}{x+y} = 10 \dots (i)$$

$$\frac{40}{x-y} + \frac{55}{x+y} = 13 \dots (ii)$$

Multiply (i) by 4 and (ii) by 3, we get

$$\frac{120}{x-y} + \frac{176}{x+y} = 40 \dots (iii)$$

$$\frac{120}{x-y} + \frac{165}{x+y} = 39 \dots (iv)$$

Subtracting (iv) from (iii), we get

$$0 + \frac{11}{x+y} = 1$$

$$x + y = 11 \dots (v)$$

Substitute (v) in (i), we get

$$\frac{30}{x-y} + \frac{44}{11} = 10$$

$$\frac{30}{x-y} + 4 = 10$$

$$\frac{30}{x-y} = 10 - 4$$

$$\frac{30}{x-y} = 6$$

$$x - y = \frac{30}{6}$$

$$x - y = 5 \dots (vi)$$

Now solve for (v) and (vi)

$$x+y = 11$$

$$x-y = 5$$

Add (v) and (vi)

$$2x = 16$$

$$\therefore x = 16/2 = 8$$

Substitute x in (v)

$$8+y = 11$$

$$\therefore y = 11-8$$

$$\therefore y = 3$$

Hence  $x = 8$  and  $y = 3$ .

**4. (i)  $ax+by = a-b$**

**$bx-ay = a+b$**

**Solution:**

$$ax+by = a-b \dots (i)$$

$$bx-ay = a+b \dots (ii)$$

multiplying (i) by a and (ii) by b, we get

$$a(ax+by) = a(a-b)$$

$$a^2x + aby = a^2-ab \dots (iii)$$

$$b(bx-ay) = b(a+b)$$

$$b^2x - aby = ab+b^2 \dots (iv)$$

Adding (iii) and (iv)

$$a^2x + aby = a^2-ab$$

$$b^2x - aby = ab+b^2$$

$$\text{-----}$$

$$(a^2+b^2)x = (a^2+b^2)$$

$$\Rightarrow x = (a^2+b^2) / (a^2+b^2)$$

$$\Rightarrow x = 1$$

Substitute the value of x in (i), we get

$$a \times 1 + by = a - b$$

$$a + by = a - b$$

$$\Rightarrow by = -b$$

$$\Rightarrow y = -b/b$$

$$\Rightarrow y = -1$$

Hence  $x = 1$  and  $y = -1$ .

(ii)  $3x + 2y = 2xy$

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

**Solution:**

$$3x + 2y = 2xy \quad \dots(i)$$

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

$$\frac{1}{x} + \frac{2}{y} = \frac{7}{6} \quad \dots(ii)$$

Divide (i) by  $xy$

$$\frac{3x}{xy} + \frac{2y}{xy} = \frac{2xy}{xy}$$

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

Multiply (ii) by 2, we get

$$\frac{2}{x} + \frac{4}{y} = \frac{7}{3} \quad \dots(iv)$$

Subtract (iii) from (iv)

$$\frac{2}{x} + \frac{4}{y} = \frac{7}{3}$$

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

---


$$0 + \frac{1}{y} = \frac{7}{3} - 2$$

$$\frac{1}{y} = \frac{7-6}{3}$$

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

$$y = 3$$

Substitute y in (iii)

$$(3/3) + (2/x) = 2$$

$$1 + (2/x) = 2$$

$$(2/x) = 1$$

$$\therefore x = 2$$

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

5. Solve  $2x - (3/y) = 9$

$3x + (7/y) = 2$ .

Hence find the value of  $k$  if  $x = ky + 5$ .

**Solution:**

$$2x - (3/y) = 9 \quad \dots(i)$$

$$3x + (7/y) = 2 \quad \dots(ii)$$

Multiply (i) by 3 and (ii) by 2, we get

$$6x - (9/y) = 27 \quad \dots(iii)$$

$$6x + (14/y) = 4 \quad \dots(iv)$$

Subtracting (iv) from (iii), we get

$$-23/y = 23$$

$$\Rightarrow y = 23/-23$$

$$\Rightarrow y = -1$$

Substitute  $y$  in (i)

$$2x - (3/-1) = 9$$

$$2x + 3 = 9$$

$$2x = 9 - 3$$

$$2x = 6$$

$$\Rightarrow x = 6/2$$

$$\Rightarrow x = 3$$

Hence  $x = 3$  and  $y = -1$ .

Given  $x = ky + 5$

Substitute  $x$  and  $y$  in above eqn

$$3 = k \times -1 + 5$$

$$3 = -k + 5$$

$$\Rightarrow k = 5 - 3$$

$$\Rightarrow k = 2$$

Hence the value of  $k$  is 2.

6.

$$\frac{1}{x+y} - \frac{1}{2x} = \frac{1}{30}$$

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

Hence find the value of  $2x^2 - y^2$ .

**Solution:**

$$\frac{1}{x+y} - \frac{1}{2x} = \frac{1}{30} \dots\dots (i)$$

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

Let  $(x+y) = a$

$$(1/a) - (1/2x)$$

$$\frac{1}{a} - \frac{1}{2x} = \frac{1}{30} \dots (iii)$$

$$\frac{5}{a} + \frac{1}{x} = \frac{4}{3}$$

Multiply (iii) by 5

$$\frac{5}{a} - \frac{5}{2x} = \frac{1}{6} \dots (iv)$$

$$\frac{5}{a} + \frac{1}{x} = \frac{4}{3}$$

Subtracting (ii) from (iv)

$$-\frac{5}{2x} - \frac{1}{x} = \frac{1}{6} - \frac{4}{3}$$

$$\frac{(-5-2)}{2x} = \frac{(1-8)}{6}$$

$$-\frac{7}{2x} = -\frac{7}{6}$$

$$2x = 6$$

$$x = 3$$

Substitute x in (iii)

$$(1/a) - 1/(2 \times 3) = 1/30$$

$$(1/a) - (1/6) = 1/30$$

$$1/a = (1/30) + (1/6)$$

$$1/a = (1+5)/30$$

$$1/a = 6/30$$

$$\Rightarrow a = 30/6$$

$$\Rightarrow a = 5$$

Substitute a in  $x+y = a$

$$3+y = 5$$

$$\therefore y = 5-3$$

$$\therefore y = 2$$

Hence  $x = 3, y = 2$ .

$$\therefore 2x^2 - y^2 = 2 \times 3^2 - 2^2$$

$$= 2 \times 9 - 4$$

$$= 18 - 4$$

$$= 14$$

Hence the value of  $2x^2 - y^2$  is 14.

7. Can x, y be found to satisfy the following equations simultaneously ?

$$\frac{2}{y} + \frac{5}{x} = 19$$

$$\frac{5}{y} - \frac{3}{x} = 1$$

$$3x + 8y = 5$$



If so the find.

**Solution:**

$$\frac{2}{y} + \frac{5}{x} = 19 \dots (i)$$

$$\frac{5}{y} - \frac{3}{x} = 1 \dots (ii)$$

$$3x + 8y = 5 \dots (iii)$$

Multiply (i) by 5 and (ii) by 2, we get

$$\frac{10}{y} + \frac{25}{x} = 95 \dots (iv)$$

$$\frac{10}{y} - \frac{6}{x} = 2 \dots (v)$$

Subtract (v) from (iv)

$$31/x = 95 - 2$$

$$31/x = 93$$

$$\therefore x = 31/93$$

$$\therefore x = 1/3$$

Substitute x in (i)

$$(2/y) + 5 \div (1/3) = 19$$

$$(2/y) + 5 \times 3 = 19$$

$$(2/y) = 19 - 15$$

$$(2/y) = 4$$

$$\therefore y = 2/4$$

$$\therefore y = 1/2$$

Substitute x and y in (iii)

$$3 \times (1/3) + 8 \times (1/2) = 5$$

$$1 + 4 = 5$$

The value of x and y satisfies (iii).

Hence the given equations are simultaneous.