

Linear Equations in Two Variables

Practice set 5.1

Q. 1. By using variables x and y form any five linear equations in two variables.

Answer : a) $x + y = 5$

b) $x + 2y = 6$

c) $2x + y = 4$

d) $3x + 4y = 8$

e) $5x + 9y = 1$

Q. 2. Write five solutions of the equation $x + y = 7$.

Answer : (a)

Let $x = 1$,

As, $x + y = 7$

$\Rightarrow 1 + y = 7$

$\Rightarrow y = 6$

Hence, solution is $x = 1$ and $y = 6$.

(b)

Let $x = 2$,

As, $x + y = 7$

$\Rightarrow 2 + y = 7$

$\Rightarrow y = 5$

Hence, solution is $x = 2$ and $y = 5$.

(c)

Let $x = 3$,

As, $x + y = 7$

$$\Rightarrow 3 + y = 7$$

$$\Rightarrow y = 4$$

Hence, solution is $x = 3$ and $y = 4$.

(d)

Let $x = 4$,

As, $x + y = 7$

$$\Rightarrow 4 + y = 7$$

$$\Rightarrow y = 3$$

Hence, solution is $x = 4$ and $y = 3$.

(e)

Let $x = 5$,

As, $x + y = 7$

$$\Rightarrow 5 + y = 7$$

$$\Rightarrow y = 2$$

Hence, solution is $x = 5$ and $y = 2$.

Q. 3. Solve the following sets of simultaneous equations.

i. $x + y = 4$; $2x - 5y = 1$

ii. $2x + y = 5$; $3x - y = 5$

iii. $3x - 5y = 16$; $x - 3y = 8$

iv. $2y - x = 0$; $10x + 15y = 105$

v. $2x + 3y + 4 = 0$; $x - 5y = 11$

vi. $2x - 7y = 7$; $3x + y = 22$

Answer : (i)

$$x + y = 4 \text{ eq.[1]}$$

$$2x - 5y = 1 \text{ eq.[2]}$$

We can write eq.[1] as,

$$x = 4 - y \text{ eq.[3]}$$

Substituting eq.[3] in eq.[2],

$$\Rightarrow 2(4 - y) - 5y = 1$$

$$\Rightarrow 8 - 2y - 5y = 1$$

$$\Rightarrow -7y = -7$$

$$\Rightarrow y = 1$$

Substituting 'y' in eq.[3]

$$\Rightarrow x = 4 - 1$$

$$\Rightarrow x = 3$$

Hence, solution is $x = 3$ and $y = 1$.

(ii)

$$2x + y = 5 \text{ eq.[1]}$$

$$3x - y = 5 \text{ eq.[2]}$$

We can write eq.[1] as,

$$y = 5 - 2x \text{ eq.[3]}$$

Substituting eq.[3] in eq.[2],

$$\Rightarrow 3x - (5 - 2x) = 5$$

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

$$\Rightarrow 5x = 10$$

$$\Rightarrow x = 2$$

Substituting 'x' in eq.[3]

$$\Rightarrow y = 5 - 2(2)$$

$$\Rightarrow y = 1$$

Hence, solution is $x = 2$ and $y = 1$.

(iii)

$$3x - 5y = 16 \text{ eq.[1]}$$

$$x - 3y = 8 \text{ eq.[2]}$$

We can write eq.[2] as,

$$x = 8 + 3y \text{ eq.[3]}$$

Substituting eq.[3] in eq.[1],

$$\Rightarrow 3(8 + 3y) - 5y = 16$$

$$\Rightarrow 24 + 9y - 5y = 16$$

$$\Rightarrow 4y = -8$$

$$\Rightarrow y = -2$$

Substituting 'y' in eq.[3]

$$\Rightarrow x = 8 + 3(-2)$$

$$\Rightarrow x = 8 - 6 = 2$$

Hence, solution is $x = 2$ and $y = -2$

(iv)

$$2y - x = 0 \text{ eq.[1]}$$

$$10x + 15y = 105 \text{ eq.[2]}$$

We can write eq.[1] as,

$$x = 2y \text{ eq.[3]}$$

Substituting eq.[3] in eq.[2],

$$\Rightarrow 10(2y) + 15y = 105$$

$$\Rightarrow 20y + 15y = 105$$

$$\Rightarrow 35y = 105$$

$$\Rightarrow y = 3$$

Substituting 'y' in eq.[3]

$$\Rightarrow x = 2(3)$$

$$\Rightarrow x = 6$$

Hence, solution is $x = 6$ and $y = 3$.

(v)

$$2x + 3y + 4 = 0 \text{ eq.[1]}$$

$$x - 5y = 11 \text{ eq.[2]}$$

We can write eq.[2] as,

$$x = 11 + 5y \text{ eq.[3]}$$

Substituting eq.[3] in eq.[1],

$$\Rightarrow 2(11 + 5y) + 3y + 4 = 0$$

$$\Rightarrow 22 + 10y + 3y + 4 = 0$$

$$\Rightarrow 13y + 26 = 0$$

$$\Rightarrow 13y = -26$$

$$\Rightarrow y = -2$$

Substituting 'y' in eq.[3]

$$\Rightarrow x = 11 + 5(-2)$$

$$\Rightarrow x = 11 - 10 = 1$$

Hence, solution is $x = 1$ and $y = -2$.

(vi)

$$2x - 7y = 7 \text{ eq.[1]}$$

$$3x + y = 22 \text{ eq.[2]}$$

We can write eq.[2] as,

$$y = 22 - 3x \text{ eq.[3]}$$

Substituting eq.[3] in eq.[1],

$$\Rightarrow 2x - 7(22 - 3x) = 7$$

$$\Rightarrow 2x - 154 + 21x = 7$$

$$\Rightarrow 23x = 161$$

$$\Rightarrow x = 7$$

Substituting 'x' in eq.[3]

$$\Rightarrow y = 22 - 3(7)$$

$$\Rightarrow y = 22 - 21 = 1$$

Hence, solution is $x = 7$ and $y = 1$.

Practice set 5.2

Q. 1. In an envelope there are some 5 rupee notes and some 10 rupee notes. Total amount of these notes together is 350 rupees. Number of 5 rupee notes are less by 10 than number of 10 rupee notes. Then find the number of 5 rupee and 10 rupee notes.

Answer : Let the number of 5 rupees notes = x

Let the number of 10 rupees notes = y

Given, Total amount is 350 Rupees

$$\Rightarrow 5x + 10y = 350 \text{ eq.[1]}$$

Also,

Number of 5 rupees notes are less by 10 than number of 10 rupees note,

$$y = x - 10$$

$$\Rightarrow x = y + 10 \text{ eq.[2]}$$

Putting [2] in [1]

$$\Rightarrow 5(y + 10) + 10y = 350$$

$$\Rightarrow 5y + 50 + 10y = 350$$

$$\Rightarrow 15y = 300$$

$$\Rightarrow y = 20$$

$$\text{Then, } x = y + 10$$

$$\Rightarrow x = 20 + 10$$

$$\Rightarrow x = 30.$$

Answer: 30 notes of Rs 5 and 20 notes of Rs. 10.

Q. 2. The denominator of a fraction is 1 more than twice its numerator. If 1 is added to numerator and denominator respectively, the ratio of numerator to denominator is 1 : 2. Find the fraction.

Answer : Let the numerator be 'x' and denominator be 'y'

Given,

The denominator of a fraction is 1 more than twice its numerator

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

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

If 1 is added to numerator and denominator, the ratio of the numerator to denominator becomes 1:2.

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

$$\Rightarrow 2(x+1) = y+1$$

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

$$\Rightarrow y-2x = 1 \dots\dots\dots (2)$$

As (1) and (2) are the same, there can be infinitely many solutions for x and y. One such solution is: $x = 4$ and $y = 9$ Now, $y - 2x = 9 - 2(4) = 9 - 8 = 1$

Q. 3. The sum of ages of Priyanka and Deepika is 34 years. Priyanka is elder to Deepika by 6 years. Then find their today's ages.

Answer : Let the ages of Priyanka and Deepika be 'x' and 'y' respectively.

Given,

Sum of ages is 34

$$\Rightarrow x + y = 34$$

$$\Rightarrow y = 34 - x \text{ eq.[1]}$$

Also, Priyanka is elder to Deepika by 6 years

$$\Rightarrow x = y + 6$$

Using eq.[1] we have

$$\Rightarrow x = 34 - x + 6$$

$$\Rightarrow 2x = 40$$

$$\Rightarrow x = 20$$

Putting this value in eq.[1]

$$\Rightarrow y = 34 - 20 = 14 \text{ years.}$$

Hence, Age of Priyanka = $x = 20$ Years

Age of Deepika = $y = 14$ years.

Q. 4. The total number of lions and peacocks in a certain zoo is 50. The total number of their legs is 140. Then find the number of lions and peacocks in the zoo.

Answer : Let the number of lions be 'x' and peacocks be 'y'

Given, Total no of lions and peacocks is 50

$$\Rightarrow x + y = 50$$

$$\Rightarrow x = 50 - y \text{ eq.[1]}$$

Also, Total no of their legs is 140, as lion has four legs and peacocks has 2 legs

$$\Rightarrow 4x + 2y = 140$$

$$\Rightarrow 4(50 - y) + 2y = 140$$

$$\Rightarrow 200 - 4y + 2y = 140$$

$$\Rightarrow 2y = 60$$

$$\Rightarrow y = 30$$

Using this in eq.[1]

$$\Rightarrow x = 50 - 30 = 20$$

Therefore,

No of lions, $x = 20$

No of peacocks, $y = 30$

Q. 5. Sanjay gets fixed monthly income. Every year there is a certain increment in his salary. After 4 years, his monthly salary was Rs. 4500 and after 10 years his monthly salary became 5400 rupees, then find his original salary and yearly increment.

Answer : Let the original salary be 'x' and yearly increment be 'y'

After 4 years, his salary was Rs. 4500

$$\Rightarrow x + 4y = 4500$$

$$\Rightarrow x = 4500 - 4y \text{ eq.[1]}$$

After 10 years, his salary becomes 5400

$$\Rightarrow x + 10y = 5400$$

$$\Rightarrow 4500 - 4y + 10y = 5400$$

$$\Rightarrow 6y = 900$$

$$\Rightarrow y = 150$$

Putting this in eq.[1],

$$\Rightarrow x = 4500 - 4(150)$$

$$\Rightarrow x = 4500 - 600 = 3900$$

Hence, his original salary was Rs. 3900 and increment per year was 150 Rs.

Q. 6. The price of 3 chairs and 2 tables is 4500 rupees and price of 5 chairs and 3 tables is 7000 rupees, then find the price of 2 chairs and 2 tables.

Answer : Let the price of one chair be 'x' and one table be 'y'.

Given,

Price of 3 chairs and 2 tables = 4500 Rs

$$\Rightarrow 3x + 2y = 4500$$

Multiplying by 3 both side,

$$\Rightarrow 9x + 6y = 13500$$

$$\Rightarrow 6y = 13500 - 9x \text{ eq.[1]}$$

Price of 5 chairs and 3 tables = 7000 Rs

$$\Rightarrow 5x + 3y = 7000$$

Multiplying by eq.[2] both side,

$$\Rightarrow 10x + 6y = 14000$$

$$\Rightarrow 10x + 13500 - 9x = 14000 \text{ eq.[From 1]}$$

$$\Rightarrow x = 500$$

Putting this in eq.[1]

$$\Rightarrow 6y = 13500 - 9(500)$$

$$\Rightarrow 6y = 13500 - 4500$$

$$\Rightarrow 6y = 9000$$

$$\Rightarrow y = 1500$$

Also, Price of 2 chairs and 2 tables = $2x + 2y$

$$= 2(500) + 2(1500)$$

$$= 1000 + 3000 = 4000 \text{ Rs.}$$

Q. 7. The sum of the digits in a two-digits number is 9. The number obtained by interchanging the digits exceeds the original number by 27. Find the two-digit number.

Answer : Let the unit digit be 'x'

Let the digit at ten's place be 'y'

The original number will be $10y + x$

Given,

$$\text{Sum of digits} = 9$$

$$\Rightarrow x + y = 9$$

$$\Rightarrow x = 9 - y \text{ eq.[1]}$$

Also,

If the digits are interchanged,

$$\text{Reversed number will be} = 10x + y$$

As, reversed number exceeds the original number by 27,

$$\Rightarrow (10x + y) - (10y + x) = 27$$

$$\Rightarrow 10x + y - 10y - x = 27$$

$$\Rightarrow 9x - 9y = 27$$

$$\Rightarrow x - y = 3$$

$$\Rightarrow 9 - y - y = 3 \text{ eq. [using 1]}$$

$$\Rightarrow -2y = -6$$

$$\Rightarrow y = 3$$

Using this in eq.[1]

$$\Rightarrow x = 9 - 3 = 6$$

Hence the original number is $10y + x = 10(3) + 6 = 30 + 6 = 36$.

Q. 8. In $\triangle ABC$, the measure of angle A is equal to the sum of the measures of $\angle B$ and $\angle C$. Also the ratio of measures of $\angle B$ and $\angle C$ is 4 : 5. Then find the measures of angles of the triangle.

Answer : Given that, In $\triangle ABC$

$$\angle A = \angle B + \angle C \text{ eq. [1]}$$

Let $\angle B = x$ and $\angle C = y$

Then,

$$\angle A = x + y$$

In $\triangle ABC$, By angle sum property of triangle

$$\angle A + \angle B + \angle C = 180^\circ$$

$$\Rightarrow x + y + x + y = 180$$

$$\Rightarrow 2x + 2y = 180$$

$$\Rightarrow x + y = 90$$

$$\Rightarrow x = 90 - y \text{ eq. [2]}$$

Also, Given that

$$\frac{\angle B}{\angle C} = \frac{4}{5}$$

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

$$\Rightarrow 5x = 4y$$

From eq.[2]

$$\Rightarrow 5(90 - y) = 4y$$

$$\Rightarrow 450 - 5y = 4y$$

$$\Rightarrow 9y = 450$$

$$\Rightarrow y = 50^\circ$$

Putting this in eq.[2]

$$\Rightarrow x = 90 - 50 = 40^\circ$$

Therefore, we have

$$\angle A = x + y = 40^\circ + 50^\circ = 90^\circ$$

$$\angle B = x = 40^\circ$$

$$\angle C = y = 50^\circ$$

Q. 9. Divide a rope of length 560 cm into 2 parts such that twice the length of the smaller part is equal to $\frac{1}{3}$ of the larger part. Then find the length of the larger part.

Answer : Let the length of smaller part be 'x' cm and larger part be 'y' cm.

Length of rope = 560 cm

$$\Rightarrow x + y = 560$$

$$\Rightarrow y = 560 - x \text{ eq.[1]}$$

Also,

Twice the length of smaller part is equal to $\frac{1}{3}$ of the larger part

$$\Rightarrow 2x = \frac{1}{3}y$$

$$\Rightarrow 6x = y$$

$$\Rightarrow 6x = 560 - x$$

$$\Rightarrow 7x = 560$$

$$\Rightarrow x = 80$$

Using this in eq.[1]

$$\Rightarrow y = 560 - 80 = 480$$

Therefore,

Length of smaller part = 'x' cm = 80 cm

Length of larger part = 'y' cm = 480 cm

Q. 10. In a competitive examination, there were 60 questions. The correct answer would carry 2 marks, and for incorrect answer 1 mark would be subtracted. Yashwant had attempted all the questions and he got total 90 marks. Then how many questions he got wrong?

Answer : Let the no of questions he got wrong be 'x'

And the no of questions he got right be 'y'

As, he attempted all the questions,

$$\Rightarrow x + y = 60$$

$$\Rightarrow y = 60 - x \text{ eq.[1]}$$

Also, he carries 2 for each corrects question and (-1) for each wrong question, also he got 90 marks

$$\Rightarrow y(2) + x(-1) = 90$$

$$\Rightarrow 2y - x = 90$$

$$\Rightarrow 2(60 - x) - x = 90 \text{ eq.[Using 1]}$$

$$\Rightarrow 120 - 2x - x = 90$$

$$\Rightarrow -3x = -30$$

$$\Rightarrow x = 10$$

\Rightarrow he got 10 wrong questions.

Problem set 5

Q. 1 A. Choose the correct alternative answers for the following questions.

If $3x + 5y = 9$ and $5x + 3y = 7$ then What is the value of $x + y$?

- A. 2**
- B. 16**
- C. 9**
- D. 7**

Answer : $3x + 5y = 9$ eq.[1]

$$5x + 3y = 7 \text{ eq.[2]}$$

Adding eq.[1] and eq.[2] we get

$$3x + 5y + 5x + 3y = 9 + 7$$

$$\Rightarrow 8x + 8y = 16$$

Dividing both side by 8, we get

$$\Rightarrow x + y = 2$$

Q. 1 B. 'When 5 is subtracted from length and breadth of the rectangle, the perimeter becomes 26.' What is the mathematical form of the statement?

- A. $x - y = 8$**
- B. $x + y = 8$**
- C. $x + y = 23$**
- D. $2x + y = 21$**

Answer : Let the length be 'x' and breadth be 'y' units.

$$\text{Perimeter of triangle} = 2(x + y) \text{ units}$$

If 5 is subtracted from length and breadth

$$\text{Perimeter} = 26 \text{ units eq.[Given]}$$

$$\Rightarrow 2(x - 5 + y - 5) = 26$$

$$\Rightarrow 2(x + y - 10) = 26$$

$$\Rightarrow x + y - 10 = 13$$

$$\Rightarrow x + y = 23$$

Q. 1 C. Ajay is younger than Vijay by 5 years. Sum of their ages is 25 years. What is Ajay's age?

A. 20

B. 15

C. 10

D. 5

Answer : Let Ajay's age be 'x' years and Vijay's age be 'y' years.

Given, Ajay is younger than Vijay by 5 years

$$\Rightarrow x = y - 5 \text{ eq.[1]}$$

Also, Sum of their ages is 25 years,

$$\Rightarrow x + y = 25$$

From eq.[1]

$$\Rightarrow y - 5 + y = 25$$

$$\Rightarrow 2y = 30$$

$$\Rightarrow y = 15$$

Putting this in eq.[1]

$$\Rightarrow x = 15 - 5 = 10$$

Age of Ajay = $x = 10$ Years

Age of Vijay = $y = 15$ Years

Q. 2. Solve the following simultaneous equations.

i. $2x + y = 5$; $3x - y = 5$

ii. $x - 2y = -1$; $2x - y = 7$

iii. $x + y = 11$; $2x - 3y = 7$

iv. $2x + y = -2$; $3x - y = 7$

v. $2x - y = 5$; $3x + 2y = 11$

vi. $x - 2y = -2$; $x + 2y = 10$

Answer : (i)

$$2x + y = 5$$

$$\Rightarrow y = 5 - 2x \text{ eq.[1]}$$

$$3x - y = 5$$

Using eq.[1] we have

$$\Rightarrow 3x - (5 - 2x) = 5$$

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

$$\Rightarrow 5x = 10$$

$$\Rightarrow x = 2$$

Using 'x' in eq.[1]

$$\Rightarrow y = 5 - 2(2)$$

$$\Rightarrow y = 5 - 4 = 1 \text{ cm}$$

(ii)

$$x - 2y = -1$$

$$\Rightarrow x = 2y - 1 \text{ eq.[1]}$$

$$2x - y = 7$$

Using eq.[1], we have

$$\Rightarrow 2(2y - 1) - y = 7$$

$$\Rightarrow 4y - 2 - y = 7$$

$$\Rightarrow 3y = 9$$

$$\Rightarrow y = 3$$

Using this value in eq.[1]

$$\Rightarrow x = 2(3) - 1$$

$$\Rightarrow x = 5$$

(iii)

$$x + y = 11$$

$$\Rightarrow y = 11 - x \text{ eq.[1]}$$

$$2x - 3y = 7$$

Using eq.[1], we have

$$\Rightarrow 2x - 3(11 - x) = 7$$

$$\Rightarrow 2x - 33 + 3x = 7$$

$$\Rightarrow 5x = 40$$

$$\Rightarrow x = 8$$

Using this in eq.[1]

$$\Rightarrow y = 11 - 8$$

$$\Rightarrow y = 3$$

(iv)

$$2x + y = -2$$

$$\Rightarrow y = -2x - 2 \text{ eq.[1]}$$

$$3x - y = 7$$

Using eq.[1]

$$3x - (-2x - 2) = 7$$

$$\Rightarrow 3x + 2x + 2 = 7$$

$$\Rightarrow 5x = 5$$

$$\Rightarrow x = 1$$

Using this in eq.[1]

$$\Rightarrow y = -2(1) - 2$$

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

(v)

$$2x - y = 5$$

$$\Rightarrow y = 2x - 5 \text{ eq.[1]}$$

$$3x + 2y = 11$$

Using eq.[1]

$$\Rightarrow 3x + 2(2x - 5) = 11$$

$$\Rightarrow 3x + 4x - 10 = 11$$

$$\Rightarrow 7x = 21$$

$$\Rightarrow x = 3$$

Using this in eq.[1]

$$\Rightarrow y = 2(3) - 5$$

$$\Rightarrow y = 1$$

(vi)

$$x - 2y = -2$$

$$x = 2y - 2 \text{ eq.[1]}$$

$$x + 2y = 10$$

using eq.[1], we have

$$\Rightarrow 2y - 2 + 2y = 10$$

$$\Rightarrow 4y = 12$$

$$\Rightarrow y = 3$$

Using this in eq.[1]

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

$$\Rightarrow x = 4$$

Q. 3. By equating coefficients of variables, solve the following equations.

i. $3x - 4y = 7$; $5x + 2y = 3$

ii. $5x + 7y = 17$; $3x - 2y = 4$

iii. $x - 2y = -10$; $3x - 5y = -12$

iv. $4x + y = 34$; $x + 4y = 16$

Answer : (i)

$$3x - 4y = 7 \text{ eq.[1]}$$

$$5x + 2y = 3 \text{ eq.[2]}$$

Multiplying eq.[2] by 2 both side, we get

$$10x + 4y = 6 \text{ eq.[3]}$$

Adding eq.[1] and eq.[3], we get

$$3x - 4y + 10x + 4y = 7 + 6$$

$$\Rightarrow 13x = 13$$

$$\Rightarrow x = 1$$

Putting this in eq.[1], we get

$$3(1) - 4y = 7$$

$$\Rightarrow -4y = 7 - 3$$

$$\Rightarrow -4y = 4$$

$$\Rightarrow y = -1$$

(ii)

$$5x + 7y = 17 \text{ eq.[1]}$$

$$3x - 2y = 4 \text{ eq.[2]}$$

Multiplying eq.[1] by 3 both side and Multiplying eq.[2] by 5 both side we get,

$$15x + 21y = 51 \text{ eq.[3]}$$

$$15x - 10y = 20 \text{ eq.[4]}$$

Subtracting eq.[4] from eq.[3], we get

$$15x + 21y - 15x + 10y = 51 - 20$$

$$\Rightarrow 31y = 31$$

$$\Rightarrow y = 1$$

Putting this in eq.[1], we get

$$5x + 7(1) = 17$$

$$\Rightarrow 5x = 10$$

$$\Rightarrow x = 2$$

(iii)

$$x - 2y = -10 \text{ eq.[1]}$$

$$3x - 5y = -12 \text{ eq.[2]}$$

Multiplying eq.[1] by 3

$$3x - 6y = -30 \text{ eq.[3]}$$

Subtracting eq.[2] from eq.[3], we get

$$3x - 6y - 3x + 5y = -30 + 12$$

$$\Rightarrow -y = -18$$

$$\Rightarrow y = 18$$

Putting this in eq.[1], we get

$$x - 2(18) = -10$$

$$\Rightarrow x - 36 = -10$$

$$\Rightarrow x = 26$$

(iv)

$$4x + y = 34 \text{ eq.[1]}$$

$$x + 4y = 16 \text{ eq.[2]}$$

Multiplying eq.[2] by 4 both side, we get

$$4x + 16y = 64 \text{ eq.[3]}$$

Subtracting eq.[3] from eq.[1], we get

$$4x + 16y - 4x - y = 64 - 34$$

$$\Rightarrow 15y = 30$$

$$\Rightarrow y = 2$$

Putting this in eq.[2], we get

$$x + 4(2) = 16$$

$$\Rightarrow x + 8 = 16$$

$$\Rightarrow x = 8$$

Q. 4. Solve the following simultaneous equations.

$$\text{i. } \frac{x}{3} + \frac{y}{4} = 4; \frac{x}{2} - \frac{y}{2} - \frac{y}{4} = 1$$

$$\text{ii. } \frac{x}{3} + 5y = 13; 2x + \frac{y}{2} = 19$$

$$\text{iii. } \frac{2}{x} + \frac{3}{y} = 13; \frac{5}{x} - \frac{4}{y} = -2$$

Answer : (i)

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

$$\Rightarrow \frac{4x + 3y}{12} = 4$$

$$\Rightarrow 4x + 3y = 48 \text{ eq.[1]}$$

$$\frac{x}{2} - \frac{y}{2} - \frac{y}{4} = 1$$

$$\frac{2x - 2y - y}{4} = 1$$

$$\Rightarrow 2x - 3y = 4 \text{ eq.[2]}$$

Adding eq.[1] and eq.[2], we get

$$\Rightarrow 4x + 3y + 2x - 3y = 48 + 4$$

$$\Rightarrow 6x = 52$$

$$\Rightarrow x = \frac{52}{6} = \frac{26}{3}$$

Using this in eq.[1], we have

$$4\left(\frac{26}{3}\right) + 3y = 48$$

$$\Rightarrow \frac{104 + 9y}{3} = 48$$

$$\Rightarrow 104 + 9y = 144$$

$$\Rightarrow 9y = 40$$

$$\Rightarrow y = \frac{40}{9}$$

(ii)

$$\frac{x}{3} + 5y = 13$$

$$\Rightarrow \frac{x + 15y}{3} = 13$$

$$\Rightarrow x + 15y = 39$$

$$\Rightarrow x = 39 - 15y \text{ eq.[1]}$$

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

$$\Rightarrow \frac{4x + y}{2} = 19$$

$$\Rightarrow 4x + y = 38$$

Using eq.[1], we have

$$\Rightarrow 4(39 - 15y) + y = 38$$

$$\Rightarrow 156 - 60y + y = 38$$

$$\Rightarrow 59y = 118$$

$$\Rightarrow y = 2$$

Putting this value in eq.[2]

$$\Rightarrow x = 39 - 15(2)$$

$$\Rightarrow x = 39 - 30$$

$$\Rightarrow x = 9$$

(iii)

$$\frac{2}{x} + \frac{3}{y} = 13$$

$$\Rightarrow \frac{(2y + 3x)}{xy} = 13$$

$$\Rightarrow 2y + 3x = 13xy \text{ eq.[1]}$$

$$\frac{5}{x} - \frac{4}{y} = -2$$

$$\Rightarrow \frac{5y - 4x}{xy} = -2$$

$$\Rightarrow 5y - 4x = -2xy \text{ eq.[2]}$$

Multiplying eq.[1] by 4 both side, and Multiplying eq.[2] by 3 both side, we get

$$8y + 12x = 52xy \text{ eq.[3]}$$

$$15y - 12x = -6xy \text{ eq.[4]}$$

Adding eq.[3] and eq.[4]

$$\Rightarrow 8y + 12x + 15y - 12x = 52xy - 6xy$$

$$\Rightarrow 23y = 46xy$$

$$\Rightarrow 1 = 2x$$

$$\Rightarrow x = \frac{1}{2}$$

Putting this in eq.[1]

$$\Rightarrow 2y + 3\left(\frac{1}{2}\right) = 13\left(\frac{1}{2}\right)y$$

$$\Rightarrow 2y + \frac{3}{2} = \frac{13}{2}y$$

$$\Rightarrow \frac{13}{2}y - 2y = \frac{3}{2}$$

$$\Rightarrow \frac{9y}{2} = \frac{3}{2}$$

$$\Rightarrow y = \frac{3}{9} = \frac{1}{3}$$

Q. 5. A two-digit number is 3 more than 4 times the sum of its digits. If 18 is added to this number, the sum is equal to the number obtained by interchanging the digits. Find the number.

Answer : Let the unit digit be 'x'

Let the digit at ten's place be 'y'

The original number will be $10y + x$

Given, number is 3 more than 4 times the sum of its digits

$$\Rightarrow 10y + x = 4(x + y) + 3$$

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

$$\Rightarrow 6y - 3x = 3$$

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

$$\Rightarrow x = 2y - 1 \text{ eq.[1]}$$

Also,

If the digits are interchanged,

Reversed number will be $= 10x + y$

As, reversed number exceeds the original number by 18,

$$\Rightarrow (10x + y) - (10y + x) = 18$$

$$\Rightarrow 10x + y - 10y - x = 18$$

$$\Rightarrow 9x - 9y = 18$$

$$\Rightarrow x - y = 2$$

$$\Rightarrow 2y - 1 - y = 2 \text{ eq.[using 1]}$$

$$\Rightarrow y = 3$$

Using this in eq.[1]

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

Hence the original number is $10y + x = 10(3) + 5 = 30 + 5 = 35$.

Q. 6. The total cost of 6 books and 7 pens is 79 rupees and the total cost of 7 books and 5 pens is 77 ruppees. Find the cost of 1 book and 2 pens.

Answer : Let the cost of one book be 'x' rupees and cost of one pen be 'y' rupees.

Cost of 6 books and 7 pens = 79 Rs

$$\Rightarrow 6x + 7y = 79 \text{ eq.[1]}$$

Cost of 7 books and 5 pens = 77 Rs

$$\Rightarrow 7x + 5y = 77 \text{ eq.[2]}$$

Multiplying eq.[1] by 5 both side, and Multiplying eq.[2] by 7 both side, we get

$$\Rightarrow 30x + 35y = 395 \text{ eq.[3]}$$

$$\Rightarrow 49x + 35y = 539 \text{ eq.[4]}$$

Subtracting eq.[3] from eq.[4], we get

$$\Rightarrow 49x + 35y - 30x - 35y = 539 - 395$$

$$\Rightarrow 19x = 144$$

$$\Rightarrow x = \frac{144}{19}$$

Using this in eq.[1]

$$\Rightarrow 6\left(\frac{144}{19}\right) + 7y = 79$$

$$\Rightarrow \frac{864}{19} + 7y = 79$$

$$\Rightarrow 864 + 19 \times 7y = 79 \times 19$$

$$\Rightarrow 19 \times 7y = 79 \times 19 - 864$$

$$\Rightarrow y = \frac{1501 - 864}{19 \times 7}$$

$$\Rightarrow y = 5$$

$$\& 6x + 7y = 79$$

$$\Rightarrow 6x + 35 = 79$$

$$\Rightarrow 6x = 44$$

$$\Rightarrow x = 7$$

Hence, the cost of 1 pen & 2 books = Rs $1(y) + 2x$

$$= 5 + 14 = \text{Rs } 19.$$

Q. 7. The ratio of incomes of two persons is 9 : 7. The ratio of their expenses is 4 : 3. Every person saves rupees 200, find the income of each.

Answer : As the ratio of incomes is 9 : 7,

Let income of first person = $9x$

Income of second person = $7x$

Also, ratio of incomes is 4 : 3,

Let expenses of first person = $4y$

Expenses of second person = $3y$

Each person saves 200 Rs,

$$\Rightarrow 9x - 4y = 200 \text{ eq.}[1]$$

$$\Rightarrow 7x - 3y = 200 \text{ eq.}[2]$$

Multiplying eq.[1] by 3 both side and Multiplying eq.[2] by 4 both side, we get

$$\Rightarrow 27x - 12y = 600 \text{ eq.}[3]$$

$$\Rightarrow 28x - 12y = 800 \text{ eq.}[4]$$

Subtracting eq.[3] from eq.[4], we get

$$\Rightarrow 28x - 12y - (27x - 12y) = 800 - 600$$

$$\Rightarrow 28x - 12y - 27x + 12y = 200$$

$$\Rightarrow x = 200$$

Income of first person = $9x = 9(200) = 1800 \text{ Rs}$

Income of second person = $7x = 7(200) = 1400 \text{ Rs}$

Q. 8. If the length of a rectangle is reduced by 5 units and its breadth is increased by 3 units, then the area of the rectangle is reduced by 8 square units. If length is reduced by 3 units and breadth is increased by 2 units, then the area of rectangle will increase by 67 square units. Then find the length and breadth of the rectangle.

Answer : Let the length be 'x' and breadth be 'y'

Area of rectangle = length \times breadth

Area of rectangle = xy

First case:

Length = $x - 5$

Breadth = $y + 3$

As, area is reduced by 8 sq. units

$$\Rightarrow xy - (x - 5)(y + 3) = 8$$

$$\Rightarrow xy - (xy + 3x - 5y - 15) = 8$$

$$\Rightarrow xy - xy - 3x + 5y + 15 = 8$$

$$\Rightarrow 3x - 5y = 7 \text{ eq.[1]}$$

Second case:

Length = $x - 3$

Breadth = $y + 2$

As, the area is increased by 67 units

$$\Rightarrow (x - 3)(y + 2) - xy = 67$$

$$\Rightarrow xy + 2x - 3y - 6 - xy = 67$$

$$\Rightarrow 2x - 3y = 73 \text{ eq.[2]}$$

Multiplying eq.[1] by 2 both side, and Multiplying eq.[2] by 3 both side, we get

$$\Rightarrow 6x - 10y = 14 \text{ eq.[3]}$$

$$\Rightarrow 6x - 9y = 219 \text{ eq.}[4]$$

Subtracting eq.[3] from eq.[4]

$$\Rightarrow 6x - 9y - 6x + 10y = 219 - 14$$

$$\Rightarrow y = 205$$

Using this in eq.[1]

$$\Rightarrow 3x - 5(205) = 7$$

$$\Rightarrow 3x - 1025 = 7$$

$$\Rightarrow 3x = 1032$$

$$\Rightarrow x = 344$$

Hence, length = $x = 344$ units

Breadth = $y = 219$ units.

Q. 9. The distance between two places A and B on road is 70 kilometers. A car starts from A and the other from B. If they travel in the same direction, they will meet after 7 hours. If they travel towards each other they will meet after 1 hour, then find their speeds.

Answer : Let the speed of car at place A is x km/h and that of car at place B is y km/h

If they travel in same direction, they will meet after 7 hours, i.e. the difference of distance covered by them in 7 hours will be equal to distance b/w A and B.

As, distance = speed \times time, and distance from A to B is 70 km

$$\Rightarrow 7x - 7y = 70$$

$$\Rightarrow x - y = 10$$

$$\Rightarrow x = y + 10 \text{ eq.}[1]$$

If they, travel in opposite direction, they will meet after 1 hour i.e. sum of distance travelled by both cars will be equal to the distance b/w A and B.

$$\Rightarrow x + y = 70$$

Using eq.[1], we have

$$\Rightarrow y + 10 + y = 70$$

$$\Rightarrow 2y = 60$$

$$\Rightarrow y = 30$$

Using this in eq.[1], we have

$$x = 30 + 10 = 40$$

Hence,

Speed of car at A = $x = 40$ km/h

Speed of car at B = $y = 30$ km/h

Q. 10. The sum of a two-digit number and the number obtained by interchanging its digits is 99. Find the number.

Answer : Let the unit digit be 'x' and digit at ten's place be 'y'

Original Number = $10y + x$

Number obtained by interchanging digits = $10x + y$

Given,

$$10y + x + 10x + y = 99$$

$$\Rightarrow 11x + 11y = 99$$

$$\Rightarrow x + y = 9$$

If $x = 1$, $y = 8$ and number is 18

If $x = 2$, $y = 7$ and number is 27

If $x = 3$, $y = 6$ and number is 36

If $x = 4$, $y = 5$ and number is 45

If $x = 5$, $y = 4$ and number is 54

If $x = 6$, $y = 3$ and number is 63

If $x = 7$, $y = 2$ and number is 72

If $x = 8$, $y = 1$ and number is 81