Exercise 3A

Solve each of the following systems of equations graphically:
(Question 1 to Question 10)

Question 1:
2x + 3y = 2
x - 2y = 8

Solution:
2x + 3y = 2 ...........(1)
x - 2y = 8 ............(2)

Step 1: From Equation (1), isolate x
2x = 2 - 3y
Or x = (2 - 3y)/2

Choose any values for y and get corresponding values of x:

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>-2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>2</td>
<td>-2</td>
</tr>
</tbody>
</table>

Plot above points on the graph and join them.

Step 2: From equation (2)
x - 2y = 8
or x = 8 + 2y

Choose any values for y and get corresponding values of x:

<table>
<thead>
<tr>
<th>x</th>
<th>6</th>
<th>4</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>-1</td>
<td>-2</td>
<td>-3</td>
</tr>
</tbody>
</table>

Plot above points on the graph and join them.
Step 3:
Graph:

Step 4: Both the lines intersect each other at point (4, -2). 
So, x = 4, y = -2

Question 2:
3x + 2y = 4,  
2x – 3y = 7.

Solution:

3x + 2y = 4  ..(1)  
2x – 3y = 7  ..(2)

Isolate x from equation (1) and find the values of x and y.

3x + 2y = 4

or x = (4 - 2y)/ 3
Similarly, isolate $x$ from equation (2) and find the values of $x$ and $y$.

$2x - 3y = 7$

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

<table>
<thead>
<tr>
<th>x</th>
<th>5</th>
<th>2</th>
<th>-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>1</td>
<td>-1</td>
<td>-3</td>
</tr>
</tbody>
</table>

Graph:

Both the lines intersect each other at point $(2, -1)$.

So, $x = 2, \ y = -1$
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Question 3:
2x + 3y = 8,
x - 2y + 3 = 0.

Solution:

2x + 3y = 8 \quad \ldots(1)
x - 2y + 3 = 0 \quad \ldots(2)

Isolate x from equation (1) and find the values of x and y.

2x + 3y = 8
2x = 8 - 3y

x = \frac{(8 - 3y)}{2}

<table>
<thead>
<tr>
<th>x</th>
<th>4</th>
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<th>-2</th>
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</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Similarly, Isolate x from equation (2) and find the values of x and y.

x - 2y + 3 = 0

or x = 2y - 3

<table>
<thead>
<tr>
<th>x</th>
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<th>-1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the point (1, 2).

So, \( x = 1 \), \( y = 2 \)

**Question 4:**

2x – 5y + 4 = 0, 2x + y – 8 = 0.

**Solution:**

\[
2x – 5y + 4 = 0 \quad \ldots (1)
\]
\[
2x + y – 8 = 0 \quad \ldots (2)
\]

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

\[
2x – 5y + 4 = 0
\]

or \( 2x = 5y – 4 \)
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\[ x = \frac{(5y - 4)}{2} \]

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>3</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Similarly, isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

\[ 2x + y - 8 = 0 \]

or \( y = 8 - 2x \)

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Graph:
RS Aggarwal Solutions for Class 10 Maths Chapter 3 Linear Equations in Two Variables

Both the lines intersect each other at the point (3, 2).

So, \( x = 3, \ y = 2 \)

**Question 5:**

3\(x + 2y = 12,\)

5\(x - 2y = 4.\)

**Solution:**

3\(x + 2y = 12 \quad \text{.....(1)}\)

5\(x - 2y = 4 \quad \text{.....(2)}\)

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

3\(x + 2y = 12 \)

3\(x = 12 - 2y \)

Or \( x = (12 - 2y) / 2 \)

<table>
<thead>
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<th>4</th>
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<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>0</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Similarly, Isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

5\(x - 2y = 4 \)

5\(x = 4 + 2y \)

Or \( x = (4 + 2y) / 5 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>-2</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>
Both the lines intersect each other at the point (2, 3).
So, $x = 2$, $y = 3$

**Question 6:**
3x + y + 1 = 0
2x – 3y + 8 = 0

**Solution:**

3x + y + 1 = 0  ....(1)
2x – 3y + 8 = 0  ......(2)

Isolate x from equation (1) and find the values of x and y.
3x + y + 1 = 0

or y = -3x - 1

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>-1</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

Similarly, isolate x from equation (2) and find the values of x and y.

2x - 3y + 8 = 0

x = \(\frac{3y - 8}{2}\)

<table>
<thead>
<tr>
<th>x</th>
<th>-4</th>
<th>-1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the points (-1, 2).
So, x = -1, y = 2

Question 7:
2x + 3y + 5 = 0
3x – 2y – 12 = 0

Solution:

2x + 3y + 5 = 0  ...(1)
3x – 2y – 12 = 0  ...(2)
Isolate $x$ from equation (1) and find the values of $x$ and $y$.

\[2x + 3y + 5 = 0\]
\[2x = -3y - 5\]
\[x = \frac{-3y - 5}{2}\]

<table>
<thead>
<tr>
<th>$x$</th>
<th>-4</th>
<th>-1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>1</td>
<td>-1</td>
<td>-3</td>
</tr>
</tbody>
</table>

Similarly, Isolate $x$ from equation (2) and find the values of $x$ and $y$.

\[3x - 2y - 12 = 0\]
\[3x = 2y + 12\]
\[x = \frac{2y + 12}{3}\]

<table>
<thead>
<tr>
<th>$x$</th>
<th>4</th>
<th>0</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>0</td>
<td>-6</td>
<td>-3</td>
</tr>
</tbody>
</table>
Both the lines intersect each other at the point (2, -3).
So, $x = 2$, $y = -3$

**Question 8:**

$2x - 3y + 13 = 0$
$3x - 2y + 12 = 0$

**Solution:**

$2x - 3y + 13 = 0$ .................(1)
$3x - 2y + 12 = 0$ .................(2)
Isolate $x$ from equation (1) and find the values of $x$ and $y$.

\[2x - 3y + 13 = 0\]

or \[2x = 3y - 13\]

or \[x = (3y - 13) / 2\]

<table>
<thead>
<tr>
<th>$x$</th>
<th>-5</th>
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</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
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<td>5</td>
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</tbody>
</table>

Similarly, Isolate $x$ from equation (2) and find the values of $x$ and $y$.

\[3x - 2y + 12 = 0\]

or \[x = (2y - 12) / 3\]

<table>
<thead>
<tr>
<th>$x$</th>
<th>-4</th>
<th>-2</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>0</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the point \((-2, 3)\).
\(x = -2, y = 3\)

**Question 9:**
\[2x + 3y - 4 = 0\]
\[3x - y + 5 = 0\]

**Solution:**
2x + 3y - 4 = 0 \quad \text{……(1)}
3x - y + 5 = 0 \quad \text{……(2)}

Isolate x from equation (1) and find the values of x and y.

2x + 3y - 4 = 0 \\
\text{or } x = \frac{4 - 3y}{2}

<table>
<thead>
<tr>
<th>x</th>
<th>2</th>
<th>-1</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>2</td>
<td>-2</td>
</tr>
</tbody>
</table>

Similarly, Isolate x from equation (2) and find the values of x and y.

3x - y + 5 = 0 \\
\text{or } y = 5 + 3x

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>-1</th>
<th>-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>5</td>
<td>2</td>
<td>-1</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the point (-1, 2).
So, x = -1, y = 2

**Question 10:**

\[ x + 2y + 2 = 0 \]
\[ 3x + 2y - 2 = 0 \]
Solution:

\[ x + 2y + 2 = 0 \quad \text{ ..........(1)} \]
\[ 3x + 2y - 2 = 0 \quad \text{ ..........(2)} \]

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

\[ x + 2y + 2 = 0 \]
or \( x = -2y - 2 \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>(-2)</th>
<th>0</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
</tr>
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</table>

Similarly, Isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

\[ 3x + 2y - 2 = 0 \]
or \( x = \frac{2 - 2y}{3} \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>2</th>
<th>-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>1</td>
<td>-2</td>
<td>4</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the point (2, -2).
So, $x = 2, y = -2$

Solve each of the following given systems of equations graphically and find the vertices and area of the triangle formed by these lines and the x-axis:
(Question 11 to Question 15)

**Question 11:**
$x - y + 3 = 0, 2x + 3y - 4 = 0$. 
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Solution:
\[ x - y + 3 = 0 \]  \[ \cdots \cdots \cdots (1) \]

\[ 2x + 3y - 4 = 0 \]  \[ \cdots \cdots \cdots (2) \]

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

\[ x - y + 3 = 0 \]
\[ \text{or} \quad x = y - 3 \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>0</td>
</tr>
<tr>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Similarly, Isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

\[ 2x + 3y - 4 = 0 \]
\[ \text{or} \quad x = \frac{4 - 3y}{2} \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
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<tbody>
<tr>
<td>2</td>
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<tr>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>-2</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at (-1, 2) and x-axis at A (-3, 0) and D (2, 0). Which form a triangle, BAD.

Now, find the area of triangle BAD:

Area of ΔBAD = 1/2 (base x altitude)
= 1/2 x 5 x 2
= 5 sq.units. Answer!
Question 12:
2x - 3y + 4 = 0, x + 2y - 5 = 0.

Solution:

\[2x - 3y + 4 = 0 \quad \text{.........(1)}\]
\[x + 2y - 5 = 0 \quad \text{.........(2)}\]

Isolate x from equation (1) and find the values of x and y.

\[2x - 3y + 4 = 0\]
\[\text{or } x = \frac{3y - 4}{2}\]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>0</td>
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<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
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</tbody>
</table>

Similarly, isolate x from equation (2) and find the values of x and y.

\[x + 2y - 5 = 0\]
\[\text{or } x = 5 - 2y\]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Graph:
Now,
Find the area of triangle BAD:
Area of \( \triangle BAD = \frac{1}{2} \times \text{base} \times \text{altitude} \)
= \( \frac{1}{2} \times 7 \times 2 \)
= 7 sq. units

**Question 13:**
4\(x - 3y + 4 = 0\), 4\(x + 3y - 20 = 0\).

**Solution:**
4\(x - 3y + 4 = 0 \) \(\ldots\) (1)
4\(x + 3y - 20 = 0 \) \(\ldots\) (2)

Isolate \(x\) from equation (1) and find the values of \(x\) and \(y\).

4\(x - 3y + 4 = 0\)
or \(x = \frac{(3y - 4)}{4}\)

<table>
<thead>
<tr>
<th>(x)</th>
<th>(y)</th>
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</thead>
<tbody>
<tr>
<td>-1</td>
<td>0</td>
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<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>-4</td>
<td>-4</td>
</tr>
</tbody>
</table>

Similarly, Isolate \(x\) from equation (2) and find the values of \(x\) and \(y\).

4\(x + 3y - 20 = 0\)
or \(x = \frac{(20 - 3y)}{4}\)

<table>
<thead>
<tr>
<th>(x)</th>
<th>(y)</th>
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<tr>
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<td>2</td>
<td>4</td>
</tr>
<tr>
<td>-1</td>
<td>8</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the point $B \ (2, \ 4)$ and intersect $x$-axis at $A \ (-1, \ 0)$ and $D \ (5, \ 0)$.

To find the area of Triangle BAD:

Area $\triangle BAD = \frac{1}{2} \times$ base $\times$ altitude

$= \frac{1}{2} \times 6 \times 4$

$= 12$ sq. units

**Question 14:**

$x - y + 1 = 0$, $3x + 2y - 12 = 0$

**Solution:**
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\[ x - y + 1 = 0 \] 
\[ ............(1) \]

\[ 3x + 2y - 12 = 0 \] 
\[ ............(2) \]

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

\[ x - y + 1 = 0 \]

or \( x = y - 1 \)

<table>
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<tr>
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<th>( y )</th>
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<tbody>
<tr>
<td>-1</td>
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</tr>
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<td>0</td>
<td>1</td>
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<tr>
<td>1</td>
<td>2</td>
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</table>

Similarly, Isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

\[ 3x + 2y - 12 = 0 \]

or \( x = \frac{12 - 2y}{3} \)

<table>
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<tr>
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<th>( y )</th>
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<tbody>
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<td>2</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the point E (2, 3) and intersect x-axis at A (-1, 0) and D (4, 0).

To find the area of Triangle EAD:

Area of $\triangle EAD = \frac{1}{2} \times \text{base} \times \text{altitude}$

1. $= \frac{1}{2} \times 5 \times 3
2. = 7.5 \text{ sq. units}$

**Question 15:**

$x - 2y + 2 = 0, 2x + y - 6 = 0.$

**Solution:**
Isolate $x$ from equation (1) and find the values of $x$ and $y$.

$x - 2y + 2 = 0 \quad \text{………(1)}$

$x = 2y - 2$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
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</thead>
<tbody>
<tr>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
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</tbody>
</table>

Similarly, isolate $y$ from equation (2) and find the values of $x$ and $y$.

$2x + y - 6 = 0 \quad \text{………(2)}$

$y = 6 - 2x$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>2</td>
<td>2</td>
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<tr>
<td>3</td>
<td>0</td>
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</table>

Graph:
Both the lines intersect each other at the point C (2, 2) and intersect the x-axis at A (-2, 0) and F (3, 0).

Now, To find the area of Triangle CAF:
Area of \( \triangle CAF = \frac{1}{2} \times \text{base} \times \text{altitude} \)
\[ = \frac{1}{2} \times 5 \times 2 \]
\[ = 5 \text{ sq. units} \]

Solve each of the following given systems of equations graphically and find the vertices and area of the triangle formed by these lines and the \( y \)-axis:
(Question 16 to Question 21)

Question 16:
\[ 2x - 3y + 6 = 0, \quad 2x + 3y - 18 = 0 \]

Solution:
\[ 2x - 3y + 6 = 0 \quad \text{........(1)} \]
\[ 2x + 3y - 18 = 0 \quad \text{........(2)} \]
Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).
\[ 2x - 3y + 6 = 0 \]
\[ \text{or} \quad x = \frac{(3y - 6)}{2} \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
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<tbody>
<tr>
<td>-3</td>
<td>0</td>
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<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
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</tbody>
</table>

Similarly, Isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).
\[ 2x + 3y - 18 = 0 \]
\[ \text{or} \quad x = \frac{(18 - 3y)}{2} \]
Graph:

Both the lines intersect each other at C (3, 4) and intersect y-axis at B (0, 2) and D (0, 6).

Now, To find the area of Triangle CBD:

Area of $\triangle CBD = \frac{1}{2} \times \text{base} \times \text{altitude}$

= $\frac{1}{2} \times 4 \times 3$ sq. units

= 6 sq. units
Question 17:
4x − y − 4 = 0, 3x + 2y − 14 = 0.

Solution:

4x − y − 4 = 0 ............(1)
3x + 2y − 14 = 0 ............(2)

Isolate x from equation (1) and find the values of x and y.

4x − y − 4 = 0
or x = (y + 4) /2

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
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</tr>
<tr>
<td>0</td>
<td>-4</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Similarly, Isolate y from equation (2) and find the values of x and y.

3x + 2y − 14 = 0
or y = (14 - 3x) / 2

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at C (2, 4) and y-axis at B (0, -4) and D (0, 7).

To find the area of Triangle CBD:
Area of $\triangle CBD = \frac{1}{2} \times \text{base} \times \text{altitude}$
$= \frac{1}{2} \times 11 \times 2$
$= 11 \text{ sq. units}$

**Question 18:**
\[ x - y - 5 = 0, \quad 3x + 5y - 15 = 0 \]

**Solution:**

\[ x - y - 5 = 0 \quad \text{……..(1)} \]
\[ 3x + 5y - 15 = 0 \quad \text{…….(2)} \]

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

\[ x = y + 5 \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
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</tr>
<tr>
<td>0</td>
<td>-5</td>
</tr>
<tr>
<td>1</td>
<td>-4</td>
</tr>
</tbody>
</table>

Similarly, Isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

\[ 3x + 5y - 15 = 0 \]

or \[ x = \frac{15 - 5y}{3} \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>-5</td>
<td>6</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at A (5, 0) and y-axis at B (0, -5) and E (0, 3).

To find the area of Triangle ABE:

\[
\text{Area of } \triangle ABE = \frac{1}{2} \times \text{base} \times \text{altitude}
\]
\[
= \frac{1}{2} \times 8 \times 5
\]
\[
= 20 \text{ sq. units}
\]

**Question 19.**

\[2x - 5y + 4 = 0, \quad 2x + y - 8 = 0.\]
Solution:

2x – 5y + 4 = 0 .......(1)
2x + y – 8 = 0 .......(2)

Isolate x from equation (1) and find the values of x and y.

2x – 5y + 4 = 0

or x = (5y – 4) / 2

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>-7</td>
<td>-2</td>
</tr>
</tbody>
</table>

Similarly, Isolate x from equation (2) and find the values of x and y.

2x + y – 8 = 0

or x = (8 - y) / 2

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at B (3, 2) and y-axis at G (0, 1) and H (0, 8).

To find the area of Triangle EGH:
Now area of $\triangle EGH = \frac{1}{2} \times \text{base} \times \text{altitude}$
$= \frac{1}{2} \times 7 \times 3$
$= 10.5 \text{ sq. units}$
Question 20:
5x – y – 7 = 0, x – y + 1 = 0

Solution:

5x – y – 7 = 0  \( \ldots \ldots \ldots \ldots (1) \)
x – y + 1 = 0  \( \ldots \ldots \ldots \ldots (2) \)

Isolate y from equation (1) and find the values of x and y.

\[ 5x - y - 7 = 0 \]

or \[ y = 5x - 7 \]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-7</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Similarly, isolate x from equation (2) and find the values of x and y.

\[ x - y + 1 = 0 \]

or \[ x = y - 1 \]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at C (2, 3) and intersect y-axis at A (0, -7) and F (0, 1).

Now, To find the area of Triangle CAG.

Area of $\triangle CAG = \frac{1}{2} \times \text{base} \times \text{altitude} = \frac{1}{2} \times 8 \times 2 = 8 \text{ sq.units}$

**Question 21:**
$2x - 3y = 12, x + 3y = 6$

**Solution:**
$2x - 3y = 12 \quad \ldots (1)$
$x + 3y = 6 \quad \ldots (2)$
Isolate $x$ from equation (1) and find the values of $x$ and $y$.

$2x - 3y = 12$

or $x = \frac{12 + 3y}{2}$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-2</td>
</tr>
<tr>
<td>0</td>
<td>-4</td>
</tr>
</tbody>
</table>

Plot the points $(6, 0)$, $(3, -2)$ and $(0, -4)$ on the graph and join them to get a line.

Similarly, Isolate $x$ from equation (2) and find the values of $x$ and $y$.

$x + 3y = 6$

or $x = 6 - 3y$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
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</thead>
<tbody>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>-6</td>
<td>4</td>
</tr>
</tbody>
</table>

Graph:
Both the lines intersect each other at the points A (6, 0) and intersect the y-axis at C (0, -4) and E (0, 2).

To find the area of Triangle ACE:

Now area of \(\triangle ACE = \frac{1}{2} \times \text{base} \times \text{altitude} \)

\[= \frac{1}{2} \times CE \times AO \]

\[= \frac{1}{2} \times 6 \times 6 \]

\[= 18 \text{ sq.units} \]

Show graphically that each of the following given systems of equations has infinitely many solutions:

**Question 22:**
\[2x + 3y = 6, \quad 4x + 6y = 12\]

**Solution:**
2x + 3y = 6 ..........(1)
4x + 6y = 12 ..........(2)

Isolate x from equation (1) and find the values of x and y.

2x + 3y = 6
or x = (6 - 3y) / 2

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>-3</td>
<td>4</td>
</tr>
</tbody>
</table>

Isolate x from equation (2) and find the values of x and y.

4x + 6y = 12
or x = (12 - 6y) / 2

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3/2</td>
<td>1</td>
</tr>
<tr>
<td>-3/2</td>
<td>3</td>
</tr>
</tbody>
</table>

Graph:
From the graph, we can see that, all the points lie on the same straight line.

Which shows that, system has infinite many solutions.

**Question 23:**

3x - y = 5, 6x - 2y = 10.

**Solution:**

3x - y = 5 ..............(1)
6x - 2y = 10 ..............(2)

Isolate y from equation (1) and find the values of x and y.

3x - y = 5

or y = 3x - 5
Similarly, Isolate x from equation (2) and find the values of x and y.

\[ 6x - 2y = 10 \]

Or \[ x = \frac{10 + 2y}{6} \]

Graph:
Both the lines coincide each other. Which shows that system has infinite many solutions.

**Question 24:**

2x + y = 6, 6x + 3y = 18

**Solution:**

2x + y = 6 \ \ ..........(1)

6x + 3y = 18 \ \ ..........(2)
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Isolate y from equation (1) and find the values of x and y.
\[2x + y = 6\]
or \[y = 6 - 2x\]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>-2</td>
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</tbody>
</table>

Similarly, isolate x from equation (2) and find the values of x and y.
\[6x + 3y = 18\]
or \[x = \frac{(18 - 3y)}{2}\]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>-4</td>
</tr>
</tbody>
</table>

Graph:
Both the lines coincide each other.  
This system has infinitely many solutions

**Question 25:**

\[ x - 2y = 5, \ 3x - 6y = 15. \]

**Solution:**

\[ x - 2y = 5 \quad \ldots \ldots (1) \]
\[ 3x - 6y = 15 \quad \ldots \ldots (2) \]

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

\[ x - 2y = 5 \]
or \( x = 5 + 2y \)

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>-1</td>
</tr>
<tr>
<td>1</td>
<td>-2</td>
</tr>
</tbody>
</table>

Similarly, isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

\[ 3x - 6y = 15 \]

or \( x = \frac{15 + 6y}{3} \)

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>-1</td>
<td>-3</td>
</tr>
<tr>
<td>-3</td>
<td>-4</td>
</tr>
</tbody>
</table>

Graph:
All the points lie on the same line. Which shows that, lines coincide each other. Hence, the system has infinite many solutions.

Show graphically that each of the following given systems of equations is inconsistent, i.e., has no solution: (Question 26 to Question 29)

Question 26: 
\[ x - 2y = 6, \ 3x - 6y = 0. \]

Solution:

\[ x - 2y = 6 \quad \text{.........(1)} \]
\[ 3x - 6y = 0 \quad \text{......(2)} \]

Isolate \( x \) from equation (1) and find the values of \( x \) and \( y \).

\[ x - 2y = 6 \]
\[ \text{or } x = 6 + 2y \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>-1</td>
</tr>
<tr>
<td>0</td>
<td>-3</td>
</tr>
</tbody>
</table>

Similarly, isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).

\[ 3x - 6y = 0 \]
\[ \text{or } x = 2y \]

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
Graph:

From the graph, we can see that both the lines are parallel to each other. This system has no solution.

Question 27:
2x + 3y = 4, 4x + 6y = 12.

Solution:

\[2x + 3y = 4 \quad \text{.........(1)}\]
\[4x + 6y = 12 \quad \text{.........(2)}\]

Isolate x from equation (1) and find the values of x and y.
2x + 3y = 4

or \( x = \frac{4 - 3y}{2} \)

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>-1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>-2</td>
</tr>
</tbody>
</table>

Similarly, Isolate x from equation (2) and find the values of x and y.

4x + 6y = 12

or \( x = \frac{12 - 6y}{4} \)

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>-3</td>
<td>4</td>
</tr>
</tbody>
</table>

Graph:
From the graph, both the lines are parallel. 
Therefore given system has no solution.

Question 28.
2x + y = 6, 6x + 3y = 20.

Solution:
2x + y = 6  \hspace{1cm} \text{(1)}
Isolate \( y \) from equation (1) and find the values of \( x \) and \( y \).
\[
2x + y = 6
\]
or \( y = 6 - 2x \)

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Similarly, Isolate \( x \) from equation (2) and find the values of \( x \) and \( y \).
\[
6x + 3y = 20
\]
or \( x = \frac{1}{6}(20 - 3y) \)

<table>
<thead>
<tr>
<th>( x )</th>
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<tbody>
<tr>
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<tr>
<td>7/3</td>
<td>2</td>
</tr>
<tr>
<td>4/3</td>
<td>4</td>
</tr>
</tbody>
</table>

Graph:
From the graph, both the lines are parallel. Therefore this system has no solution.

Question 29: Draw the graphs of the following equations on the same graph paper: 
2x + y = 2, 2x + y = 6.
Find the coordinates of the vertices of the trapezium formed by these lines. Also, find the area of the trapezium so formed.
Solution:

2x + y = 2  \quad \ldots\ldots\ldots (1)

2x + y = 6  \quad \ldots\ldots\ldots (2)
Isolate $y$ from equation (1) and find the values of $x$ and $y$.

$$2x + y = 2$$

or $y = 2 - 2x$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>-2</td>
<td>6</td>
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</tbody>
</table>

Similarly, isolate $y$ from equation (2) and find the values of $x$ and $y$.

$$2x + y = 6$$

or $y = 6 - 2x$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Graph:
From above graph: ABFD is the trapezium formed by lines whose vertices are A (0, 2), B (1, 0), F (3, 0), D (0, 6).

Now, find the area of trapezium:

Area of trapezium ABFD = Area $\triangle DOF$ – Area $\triangle AOB$

= $\frac{1}{2}$ (DO x OF) – $\frac{1}{2}$ (AO x OB)

= $\frac{1}{2}$ (6 x 3) – $\frac{1}{2}$ (2 x 1)

= 8 sq.units. Answer!
Exercise 3B

Solve for x and y:

Question 1:
\[ x + y = 3, \]
\[ 4x - 3y = 26. \]

Solution:
\[ x + y = 3 \quad \ldots (1) \]
\[ 4x - 3y = 26 \quad \ldots (2) \]

Isolate x from equation (1), we get

\[ x = 3 - y \]

Substituting the value of x in equation (2),
\[ 4(3 - y) - 3y = 26 \]
\[ 12 - 4y - 3y = 26 \]
\[ 12 - 7y = 14 \]
\[ -7y = 14 \]
\[ y = -2 \]

Solve for x:
\[ x = 3 - y = 3 - (-2) = 5 \]

Answer: \( x = 5 \) and \( y = -2 \)

Question 2:
\[ x - y = 3, \]
\[ x/3 + y/2 = 6 \]

Solution:
\[ x - y = 3 \quad \ldots (1) \]
\[ x/3 + y/2 = 6 \quad \ldots (2) \]

Find the value of x from equation and substitute in equation (2).
\[ x = 3 + y \]
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Now,
\[
\begin{align*}
\frac{3+y}{3} + \frac{y}{2} &= 6 \\
6+2y+3y &= 6 \\
\Rightarrow \frac{6+5y}{6} &= 6 \\
\Rightarrow 6 + 5y &= 36 \\
5y &= 36 - 6 = 30 \\
y &= \frac{30}{5} = 6 \\
\text{and } x &= 3 + y = 3 + 6 = 9
\end{align*}
\]

The value of x is 9 and the value of y is 6.

**Question 3:**
2x + 3y = 0,
3x + 4y = 5.

**Solution:**
\[
\begin{align*}
2x + 3y &= 0 \quad \text{(1)} \\
3x + 4y &= 5 \quad \text{(2)}
\end{align*}
\]

Let us use elimination method to solve the given system of equations.

Multiply (1) by 4 and (2) by 3. And subtract both the equations.

\[
\begin{align*}
8x + 12y &= 0 \\
9x + 12y &= 15
\end{align*}
\]

Subtracting, \(-x = -15 \Rightarrow x = 15\)

From (1), \(y = -10\)

Hence: \(x = 15\) and \(y = -10\)

**Question 4:**
2x – 3y = 13,
7x – 2y = 20.

**Solution:**
\[
\begin{align*}
2x - 3y &= 13 \quad \text{(1)} \\
7x - 2y &= 20 \quad \text{(2)}
\end{align*}
\]
Let us use elimination method to solve the given system of equations.

Multiply (1) by 2 and (2) by 3. And subtract both the equations.

\[
\begin{align*}
4x - 6y &= 26 \\
21x - 6y &= 60
\end{align*}
\]

Subtracting, \(-17x = -34\)

\[x = \frac{-34}{-17} = 2\]

Substitute the value of \(x\) in equation (1), we have

\[y = -3\]

Hence: \(x = 2\) and \(y = -3\)

**Question 5.**

3\(x - 5y - 19 = 0\),

-7\(x + 3y + 1 = 0\).

**Solution:**

\[
\begin{align*}
3x - 5y - 19 &= 0 \quad \text{...............(1)} \\
-7x + 3y + 1 &= 0 \quad \text{...............(2)}
\end{align*}
\]

Let us use elimination method to solve the given system of equations.

Multiply (1) by 3 and (2) by 5. And add both the equations.

\[
\begin{align*}
9x - 15y &= 57 \\
-35x + 15y &= -5
\end{align*}
\]

Adding, \(-26x = 52\)

\[x = \frac{52}{-26} = -2\]

Substitute the value of \(x\) in equation (1), we have

\[3 \times (-2) - 5y = 19 \Rightarrow -6 - 5y = 19\]

\[y = -5\]
Hence: $x = -2$ and $y = -5$

$=> x = -2, y = -5$

**Question 6:**

\[2x - y + 3 = 0,\]
\[3x - 7y + 10 = 0.\]

**Solution:**

\[\begin{align*}
2x - y + 3 &= 0 \quad \text{………..(1)} \\
3x - 7y + 10 &= 0 \quad \text{………..(2)}
\end{align*}\]

Let us use substitution method to solve the given system of equations.
Find the value of $y$ form equation (1) and substitute the value in (2).

From (1)
\[-y = -3 - 2x \Rightarrow y = 2x + 3\]
And,
\[3x - 7(2x + 3) = 30 \Rightarrow 3x - 14x - 21 = -10\]
\[-11x = -10 + 21 = 11 \Rightarrow x = \frac{11}{-11} = -1\]

And $y = 2x + 3$
\[= 2(-1) + 3 = -2 + 3 = 1\]
$y = 1$

Again, $y = 2x + 3$
\[1 = 2x + 3\]
\[x = -1\]

Answer: $x = -1$ and $y = 1$

**Question 7:**

\[\frac{x}{2} - \frac{y}{9} = 6,\]
\[\frac{x}{7} + \frac{y}{3} = 5.\]

**Solution:**

\[\frac{x}{2} - \frac{y}{9} = 6\]
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\( \frac{x}{7} + \frac{y}{3} = 5 \)

Simplify both the equations:

\[
\begin{align*}
\frac{x}{2} - \frac{y}{9} &= 6 \\
\Rightarrow \quad \frac{9x - 2y}{18} &= 18 \\
\frac{x}{7} + \frac{y}{3} &= 5 \\
\Rightarrow \quad \frac{3x + 7y}{21} &= 105
\end{align*}
\]

\[9x - 2y = 108 \quad \text{.............(1)}\]

\[3x + 7y = 105 \quad \text{.............(2)}\]

Let us use elimination method to solve the given system of equations.

Multiply (2) by 3. And subtract both the equations.

\[
\begin{align*}
9x - 2y &= 108 \\
9x + 21y &= 315 \\
-23y &= -207
\end{align*}
\]

Subtracting,
\[y = \frac{-207}{-23} = +9\]

From (1); \[9x - 2(9) = 108\]
\[x = 14\]

Answer: \(x = 14\) and \(y = 9\)

**Question 8:**
\[
\begin{align*}
\frac{x}{3} + \frac{y}{4} &= 11, \\
\frac{5x}{6} - \frac{y}{3} &= -7.
\end{align*}
\]

**Solution:**
\[
\begin{align*}
\frac{x}{3} + \frac{y}{4} &= 11 \\
\frac{5x}{6} - \frac{y}{3} &= -7 \\
\text{Simplify both the equations:}
\end{align*}
\]
We have,

\[4x + 3y = 132 \quad \ldots \ldots (1)\]
\[5x - 2y = -42 \quad \ldots \ldots (2)\]

Let us use elimination method to solve the given system of equations.

Multiply (1) by 2 and (2) by 3. And add both the equations.

From (1):

\[4(6) + 3y = 132\]
\[y = \frac{108}{3} = 36\]

Answer: \(x = 6\) and \(y = 36\)

Question 9:

\[4x - 3y = 8,\]
\[6x - y = \frac{29}{3}\]

Solution:

\[4x - 3y = 8 \quad \ldots \ldots (1)\]
\[6x - y = \frac{29}{3} \quad \ldots \ldots (2)\]

Let us use elimination method to solve the given system of equations.

Multiply (2) by 3. And subtract both the equations.
\[
\begin{align*}
4x - 3y &= 8 \\
18x - 3y &= 29 \\
\hline
\end{align*}
\]
Subtracting, \(-14x = -21\)

Or \(x = 3/2\)

From (1);
\[4(3/2) - 3y = 8\]

Or \(y = -2/3\)

Answer: \(x = 3/2\) and \(y = -2/3\)

**Question 10:**
\[
\begin{align*}
2x - \frac{3y}{4} &= 3, \\
5x &= 2y + 7.
\end{align*}
\]

**Solution:**
\[
\begin{align*}
2x - \frac{3y}{4} &= 3 \text{ or } 8x - 3y = 12 \\
5x &= 2y + 7
\end{align*}
\]

Given set of equations can be written as:

\[
\begin{align*}
8x - 3y &= 12 \quad \text{………(1)} \\
5x - 2y &= 7 \quad \text{………(2)}
\end{align*}
\]

Let us use elimination method to solve the given system of equations.

Multiply (1) by 2 and (2) by 3. And subtract both the equations.

\[
\begin{align*}
16x - 6y &= 24 \\
15x - 6y &= 21 \\
\hline
\end{align*}
\]

Subtracting, \(x = 3\)

From (1); \(8(3) - 3y = 12\)

\(y = 4\)

Answer: \(x = 3\) and \(y = 4\)
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Question 11:
\[ 2x + 5y = \frac{8}{3} \]
\[ 3x - 2y = \frac{5}{6} \]

Solution:
\[ 2x + 5y = \frac{8}{3} \quad \ldots (1) \]
\[ 3x - 2y = \frac{5}{6} \quad \ldots (2) \]

Let us use elimination method to solve the given system of equations.

Multiply (1) by 4 and (2) by 5. And add both the equations.

\[
\begin{align*}
24x + 60y &= 32 \\
90x - 60y &= 25
\end{align*}
\]

Adding, we get
\[ 114x = 57 \]

\[ x = \frac{1}{2} \]

Substitute the value of \( x \) in equation (1), we have
\[ 2\left(\frac{1}{2}\right) + 5y = \frac{8}{3} \]
\[ y = \frac{1}{3} \]

Answer: \( x = \frac{1}{2} \) and \( y = \frac{1}{3} \)

Question 12:
\[ 2x + 3y + 1 = 0, \]
\[ \frac{7 - 4x}{3} = y \]

Solution:
\[ 2x + 3y + 1 = 0 \quad \ldots (1) \]
\[ \frac{7 - 4x}{3} = y \quad \ldots (2) \]

Put value of \( y \) in (1), we get
\[ 2x + 3\left(\frac{7 - 4x}{3}\right) + 1 = 0 \]
\[ 2x + 7 - 4x + 1 = 0 \]
\[ x = 4 \]

from (2):
\[ \frac{7 - 4(4)}{3} = y \]
\[ y = -3 \]
Answer: $x = 4$ and $y = -3$

**Question 13:**

0.4$x$ + 0.3$y$ = 1.7,  
0.7$x$ – 0.2$y$ = 0.8.

**Solution:**

\[
0.4x + 0.3y = 1.7 \\
0.7x - 0.2y = 0.8 
\]

Multiply both the equations by 10, we get

\[
4x + 3y = 17 \quad \ldots (1) \\
7x - 2y = 8 \quad \ldots (2) 
\]

Multiply (1) by 2 and (2) by 3, 
8$x$ + 6$y$ = 34  
21$x$ – 6$y$ = 24  
Adding both the equations
29$x$ = 58
\[ x = 2 \]
From (1); \[ 4 \times 2 + 3y = 17 \]
\[ => 8 + 3y = 17 \]
\[ => 3y = 17 - 8 = 9 \]
\[ y = 3 \]

Answer: $x = 2$, $y = 3$

**Question 14:**

0.3$x$ + 0.5$y$ = 0.5,  
0.5$x$ + 0.7$y$ = 0.74.

**Solution:**

\[
0.3x + 0.5y = 0.5, \\
0.5x + 0.7y = 0.74. 
\]

Multiply both the equations by 10, we get

\[
3x + 5y = 5 \quad \ldots (1) \\
5x + 7y = 7.4 \quad \ldots (2) 
\]

Multiply (1) by 7 and (2) by 5. And subtract both the equations.
Substitute the value of \( x \) in equation (1), we have

\[ 3(0.5) + 5y = 5 \]

\[ y = 0.7 \]

Answer: \( x = 0.5 \) and \( y = 0.7 \)

**Question 15:**

\[
7(y + 3) - 2(x + 2) = 14, \quad 4(y - 2) + 3(x - 3) = 2.
\]

**Solution:**

Simplify given equations

\[ 7(y + 3) - 2(x + 2) = 14 \]

or \( 7y - 2x = -3 \)

and \( 4(y - 2) + 3(x - 3) = 2 \)

or \( 4y + 3x = 19 \)

new set of equations is:

\[ 7y - 2x = -3 \quad \text{……(1)} \]
\[ 4y + 3x = 19 \quad \text{……(2)} \]

Let us use elimination method to solve the given system of equations.

Multiply (1) by 3 and (2) by 2. And add both the equations.
21y – 6x = -9
8y + 6x = 38

Adding, 29y = 29 \Rightarrow y = \frac{29}{29} = 1

Substitute the value of x in equation (1), we have
7(1) – 2x = -3
x = 5
Answer: x = 5 and y = 1

Question 16:
6x + 5y = 7x + 3y + 1 = 2(x + 6y + 1)

Solution:
6x + 5y = 7x + 3y + 1 = 2(x + 6y + 1)
6x + 5y = 7x + 3y + 1
=> 6x + 5y – 7x – 3y = 1
=> -x + 2y = 1
=> 2y – x = 1

Again, 7x + 3y + 1 = 2(x + 6y + 1)
7x + 3y + 1 = 2x + 12y – 2
=> 7x + 3y – 2x – 12y = -2 – 1
=> 5x – 9y = -3
New set of equations is:
2y – x = 1 \hspace{1cm} (1)
5x – 9y = -3 \hspace{1cm} (2)

Using substitution method;

From (1), x = 2y – 1
Substituting the value of x in (2),
5(2y – 1) – 9y = -3
=> 10y – 5 – 9y = -3
=> y = -3 + 5
=> y = 2
And, x = 2y – 1 = 2(2) – 1 = 3
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Answer: \( x = 3, \ y = 2 \)

Question 17:

\[
\frac{x + y - 8}{2} = \frac{x + 2y - 14}{3} = \frac{3x + y - 12}{11}
\]

Solution:

Simply equations:

\[
\frac{x + y - 8}{2} = \frac{x + 2y - 14}{3}
\]

\[
3x + 3y - 24 = 2x + 4y - 28
\]

\[
x - y = -4
\]

And

\[
\frac{x + 2y - 14}{3} = \frac{3x + y - 12}{11}
\]

\[
11x + 22y - 154 = 9x + 3y - 36
\]

\[
11x + 22y - 9x - 3y = -36 + 154
\]

\[
2x + 19y = 118
\]

New set of equations is:

\( x - y = -4 \) \quad (1)
\( 2x + 19y = 118 \) \quad (2)

Using substitution method:

From (1): \( x = y - 4 \)

Put \( x \) in (2)
\[ 2(y - 4) + 19y = 118 \]
\[ 2y - 8 + 19y = 118 \]
\[ 214 = 118 + 8 = 126 \]

\[ y = \frac{126}{21} = 6 \]

Again, \( x = y - 4 = 6 - 4 = 2 \)

Answer: \( x = 2, y = 6 \)

**Question 18:**

\[ \frac{5}{x} + 6y = 13, \]
\[ \frac{3}{x} + 4y = 7 \ (x \neq 0) \]

**Solution:**

\[ \frac{5}{x} + 6y = 13 \quad \ldots \ldots (1) \]
\[ \frac{3}{x} + 4y = 7 \quad \ldots \ldots (2) \]

Let us use elimination method to solve the given system of equations.

Multiply (1) by 2 and (2) by 3. And subtract both the equations.

\[ \frac{10}{x} + 12y = 26 \]
\[ \frac{9}{x} + 12y = 21 \]

Subtracting, \( \frac{1}{x} = 5 \Rightarrow x = \frac{1}{5} \)

Substitute the value of \( x \) in equation (1), we have

\[ \frac{5}{1/5} + 6y = 13 \]
\[ y = -2 \]

Answer: \( x = \frac{1}{5} \) and \( y = -2 \)
Question 19:
\[ x + \frac{6}{y} = 6, \]
\[ 3x - \frac{8}{y} = 5 \quad (y \neq 0) \]

Solution:
\[ x + \frac{6}{y} = 6 \quad \ldots \ldots (1) \]
\[ 3x - \frac{8}{y} = 5 \quad \ldots \ldots (2) \]

Using elimination method to solve the given system of equations.

Multiply (1) by 3. And subtract both the equations.

\[
\begin{align*}
3x + \frac{18}{y} &= 18 \\
3x - \frac{8}{y} &= 5 \\
\hline
\end{align*}
\]

Subtracting,
\[ \frac{26}{y} = 13 \Rightarrow y = \frac{26}{13} = 2 \]

Substitute the value of \( y \) in equation (1), we have
\[ x + \frac{6}{2} = 6 \]
\[ x = 3 \]

Answer: \( x = 3 \) and \( y = 2 \)

Question 20:
\[ 2x - \frac{3}{y} = 9, \]
\[ 3x + \frac{7}{y} = 2 \quad (y \neq 0) \]

Solution:
\[ 2x - \frac{3}{y} = 9 \quad \ldots \ldots (1) \]
\[ 3x + \frac{7}{y} = 2 \quad \ldots \ldots \ldots (2) \]

Using elimination method to solve the given system of equations.
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Multiply (1) by 3 and (2) by 2. And subtract both the equations.

\[ 6x - \frac{9}{y} = 27 \]
\[ 6x + \frac{14}{y} = 4 \]

Subtracting, \[ \frac{-23}{y} = 23 \]

\[ y = -1 \]

Substitute the value of \( y \) in equation (1), we have

\[ 2x - \frac{3}{y} = 9 \]
\[ x = 3 \]

Answer: \( x = 3, y = -1 \)
Solve each of the following systems of equations by using the method of cross multiplication:

Question 1:
\[ x + 2y + 1 = 0, \]
\[ 2x - 3y - 12 = 0. \]

Solution:
\[ x + 2y + 1 = 0 \quad \ldots (1) \]
\[ 2x - 3y - 12 = 0 \quad \ldots (2) \]

From equation (1): \( a_1 = 1, b_1 = 2 \) and \( c_1 = 1 \)

And from equation (2): \( a_2 = 2, b_2 = -3 \) and \( c_2 = -12 \)

Using cross multiplication method:

\[
\frac{x}{-24 + 3} = \frac{y}{2 + 12} = \frac{1}{-3 - 4}
\]

\[
\frac{x}{-21} = \frac{y}{14} = \frac{1}{-7}
\]

\[
\frac{x}{-21} = \frac{1}{-7} \Rightarrow x = \frac{-21}{-7} = 3
\]

\[
\frac{y}{14} = \frac{1}{-7} \Rightarrow y = \frac{14}{-7} = -2
\]
Answer: $x = 3$ and $y = -2$

Question 2:
$3x - 2y + 3 = 0,$
$4x + 3y - 47 = 0.$

Solution:

$3x - 2y + 3 = 0 \quad \ldots (1)$

$4x + 3y - 47 = 0 \quad \ldots (2)$

From equation (1): $a_1 = 3, \ b_1 = -2$ and $c_1 = 3$

From equation (2): $a_2 = 4, \ b_2 = 3$ and $c_2 = -47$

Using cross multiplication method:

$$\frac{x}{9x-9} = \frac{y}{12+41} = \frac{1}{9+8}$$

$$\frac{x}{85} = \frac{y}{153} = \frac{1}{17}$$

$$\frac{x}{85} = \frac{1}{17} \Rightarrow x = \frac{85}{17} = 5$$

And

$$\frac{y}{153} = \frac{1}{17} \Rightarrow y = \frac{153}{17} = 9$$

Answer: $x = 5$ and $y = 9$

Thus, $x = 5, \ y = 9$
Question 3:

6x – 5y – 16 = 0, 
7x – 13y + 10 = 0.

Solution:

6x – 5y – 16 = 0 …(1)
7x – 13y + 10 = 0 …(2)

From equation (1): a_1 = 6, b_1 = -5 and c_1 = -16

From equation (2): a_2 = 7, b_2 = -13 and c_2 = 10

Using cross multiplication method:

\[
\begin{align*}
\frac{x}{-50 - 208} &= \frac{y}{-112 - 60} = \frac{1}{-78 + 35} \\
\frac{x}{-258} &= \frac{y}{-172} = \frac{1}{-43} \\
\frac{x}{-258} &= \frac{1}{-43} \Rightarrow x = \frac{-258}{-43} = 6 \\
\text{And} \\
\frac{y}{-172} &= \frac{1}{-43} \Rightarrow y = \frac{-172}{-43} = 4
\end{align*}
\]

Answer: x = 6, y = 4

Question 4:

3x + 2y + 25 = 0, 
2x + y + 10 = 0.
Solution:
3x + 2y + 25 = 0 ...(1)
2x + y + 10 = 0 ...(2)

From equation (1): \( a_1 = 3 \), \( b_1 = 2 \) and \( c_1 = 25 \)

From equation (2): \( a_2 = 2 \), \( b_2 = 1 \) and \( c_2 = 10 \)

Using cross multiplication method:

\[
\begin{align*}
\frac{x}{20 - 25} &= \frac{y}{50 - 30} = \frac{1}{3 - 4} \\
\frac{x}{-5} &= \frac{y}{20} = \frac{1}{-1} = -1 \\
\frac{x}{-5} &= -1 = x = 5 \\
\frac{y}{20} &= -1 = y = -20
\end{align*}
\]

Thus, \( x = 5 \), \( y = -20 \)

Question 5:
2x + 5y = 1,
2x + 3y = 3.

Solution:

2x + 5y - 1 = 0 ...(1)

2x + 3y - 3 = 0 ...(2)

From equation (1): \( a_1 = 2 \), \( b_1 = 5 \) and \( c_1 = -1 \)

From equation (2): \( a_2 = 2 \), \( b_2 = 3 \) and \( c_2 = -3 \)
Using cross multiplication method:

\[
\frac{x}{-15+3} = \frac{y}{-2+6} = \frac{1}{6-10}
\]

\[
\frac{x}{-12} = \frac{y}{4} = \frac{1}{-4}
\]

\[
\frac{x}{-12} = \frac{1}{-4} \Rightarrow x = \frac{-12}{-4} = 3
\]

\[
\frac{y}{4} = \frac{1}{-4} \Rightarrow y = \frac{4}{-4} = -1
\]

Answer: \(x = 3\) and \(y = -1\)

**Question 6:**

\[2x + y = 35, \quad 3x + 4y = 65.\]

**Solution:**

\[2x + y - 35 = 0 \quad (1)\]

\[3x + 4y - 65 = 0 \quad (2)\]

From equation (1): \(a_1 = 2, \quad b_1 = 1\) and \(c_1 = -35\)

From equation (2): \(a_2 = 3, \quad b_2 = 4\) and \(c_2 = -65\)

Using cross multiplication method:
Question 7:
7x – 2y = 3,
22x – 3y = 16.

Solution:
7x – 2y – 3 = 0 ...(1)
22x – 3y – 16 = 0 ...(2)

From equation (1): a₁ = 7, b₁ = -2 and c₁ = -3
From equation (2): a₂ = 22, b₂ = -3 and c₂ = -16

Using cross multiplication method:

Answer: x = 15, y = 5
Question 8.
\[ \frac{x}{6} + \frac{y}{15} = 4 \]
\[ \frac{x}{3} - \frac{y}{12} = \frac{19}{4} \]

Solution:

Simplify given equations:
\[ \frac{x}{6} + \frac{y}{15} = 4 \]
\[ \frac{(5x + 2y)}{30} = 4 \]
\[ 5x + 2y - 120 = 0 \]

And
\[ \frac{x}{3} - \frac{y}{12} = \frac{19}{4} \]
\[ \frac{(4x - y)}{12} = \frac{19}{4} \]
\[ 4x - y - 57 = 0 \]

New set of equations is:
\[ 5x + 2y - 120 = 0 \quad ... (1) \]
\[ 4x - y - 57 = 0 \quad ... (2) \]

From equation (1):
\[ a_1 = 5, \quad b_1 = 2 \quad \text{and} \quad c_1 = -120 \]

From equation (2):
\[ a_2 = 4, \quad b_2 = -1 \quad \text{and} \quad c_2 = -57 \]
Using cross multiplication,

\[ \frac{x}{-114 - 120} = \frac{y}{-480 + 285} = \frac{1}{-5 - 8} \]

\[ \frac{x}{-234} = \frac{y}{-195} = \frac{1}{-13} \]

\[ \frac{x}{-234} = \frac{1}{-13} \Rightarrow x = \frac{-234}{-13} \]

\[ \Rightarrow x = 18 \]

And

\[ \frac{y}{-195} = \frac{1}{-13} \]

Or \( y = 15 \)

Answer: \( x = 18 \) and \( y = 15 \)

**Question 9:**

1/\( x \) + 1/\( y \) = 7
2/\( x \) + 3/\( y \) = 17 (\( x \neq 0 \) and \( y \neq 0 \))

**Solution:**

Simplify given equations:

Let 1/\( x \) = \( u \) and 1/\( y \) = \( v \)

1/\( x \) + 1/\( y \) = 7 implies

\[ u + v = 7 \]

2/\( x \) + 3/\( y \) = 17 implies:

\[ 2u + 3v = 17 \]
New set of equations is:

\[ u + v = 7 \quad \ldots \ldots (1) \]

\[ 2u + 3v = 17 \quad \ldots \ldots (2) \]

From equation (1):

\[ a_1 = 1, \quad b_1 = 1 \quad \text{and} \quad c_1 = -7 \]

From equation (2):

\[ a_2 = 2, \quad b_2 = 3 \quad \text{and} \quad c_2 = -17 \]

Using cross multiplication method:

\[
\begin{array}{ccc}
& b_1 & c_1 \\
& b_2 & c_2 \\
& a_1 & a_2 \\
& 1 & b_1 & c_1 \\
& 1 & b_2 & c_2 \\
\end{array}
\]

\[
\frac{u}{-17 + 21} = \frac{v}{-14 + 17} = \frac{1}{3 - 2}
\]

\[
\frac{u}{4} = 1 \quad \text{and} \quad \frac{v}{3} = 1
\]

\[ u = 4 \quad \text{and} \quad v = 3 \]

\[ x = \frac{1}{4} \quad \text{and} \quad y = \frac{1}{3} \quad [\text{Since we consider} \quad p = \frac{1}{x} \quad \text{and} \quad q = \frac{1}{y}] \]

Answer: \( x = \frac{1}{4}, \quad y = \frac{1}{3} \)

**Question 10:**

\[
\frac{5}{(x + y)} - \frac{2}{(x - y)} + 1 = 0,
\]

\[
\frac{15}{(x + y)} + \frac{7}{(x - y)} - 10 = 0 \quad (x \neq y, \quad x \neq -y).
\]

**Solution:**

Consider \( \frac{1}{(x + y)} = a \) and \( \frac{1}{(x - y)} = b \)

Given equations turn as:

\[ 5a - 2b + 1 = 0 \quad \ldots (1) \]

\[ 15a + 7b - 10 = 0 \quad \ldots (2) \]
From equation (1): \( a_1 = 5, b_1 = -2 \) and \( c_1 = 1 \)

From equation (2): \( a_2 = 15, b_2 = 7 \) and \( c_2 = -10 \)

Using cross multiplication method:

\[
\frac{a}{b_2 - c_2} = \frac{b}{c_1 - a_2} = \frac{1}{a_1 - b_2}
\]

\[
\frac{a}{20 - 7} = \frac{b}{15 + 50} = \frac{1}{35 + 30}
\]

So \( a = \frac{13}{65} = \frac{1}{5} \) and \( b = \frac{65}{65} = 1 \)

Putting back values and write equations in the form of \( x \) and \( y \), we get

\( x + y = 5 \) and \( x - y = 1 \)

Again we get a set of two linear equations with two variables. Solve again to find the value of \( x \) and \( y \).

Rearranging them again,

\( x + y - 5 = 0 \) ...(3)

\( x - y - 1 = 0 \) ...(4)

From equation (3): \( a_1 = 1, b_1 = 1 \) and \( c_1 = -5 \)

From equation (4): \( a_2 = 1, b_2 = -1 \) and \( c_2 = -1 \)

Using cross multiplication method,
Answer: x = 3 and y = 2

Question 11:

\[ \frac{ax}{b} - \frac{by}{a} = a + b, \]

\[ ax - by = 2ab. \]

Solution:

Simplify

\[ \frac{ax}{b} - \frac{by}{a} = a + b, \]

\[ \frac{ax}{b} - \frac{by}{a} - (a + b) = 0 \]

\[ \text{....(1)} \]

\[ ax - by - 2ab = 0 \text{ .......(2)} \]

From equation (1): \(a_1 = a/b, \ b_1 = -b/a\) and \(c_1 = -(a + b)\)

From equation (2): \(a_2 = a, \ b_2 = -b\) and \(c_2 = -2ab\)

Using cross multiplication method, we get

\[ \frac{x}{2b^2 - ab - b^2} = \frac{y}{-a^2 - ab + 2a^2} = \frac{1}{-a + b} \]
Answer: \( x = b \) and \( y = -a \)

**Question 12.**

\( 2ax + 3by = (a + 2b), \)
\( 3ax + 2by = (2a + b). \)

**Solution:**

\[
2ax + 3by - (a + 2b) = 0 \\
3ax + 2by - (2a + b) = 0
\]

Using cross multiplication method, we have

\[
x = \frac{b(b-a)}{(b-a)} \quad \text{and} \quad y = \frac{a(a-b)}{b-a}
\]

Answer: \( x = b \) and \( y = -a \)

**Question 13:**

Where \( x \neq 0 \) and \( y \neq 0. \)
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Solution:

\[ \frac{a}{x} - \frac{b}{y} = 0, \]

\[ \frac{ab^2}{x} + \frac{a^2b}{y} - (a^2 + b^2) = 0 \]

Using cross multiplication method, we have

\[ \frac{1}{x} = \frac{1}{y} = \frac{1}{a^3b + ab^3} \]

\[ \frac{1}{x} = \frac{b(a^2 + b^2)}{ab(a^2 + b^2)} = \frac{1}{a} \Rightarrow x = a \]

\[ \frac{1}{y} = \frac{a(a^2 + b^2)}{ab(a^2 + b^2)} = \frac{1}{b} \Rightarrow y = b \]

Answer: \(x = a\) and \(y = b\)
Question 1:
3x + 5y = 12, 5x + 3y = 4

Solution:

From (1): \( x = \frac{12 - 5y}{3} \)

From (2):
\[
5x + 3y - 4 = 0
\]
\[
5\left(\frac{12 - 5y}{3}\right) + 3y - 4 = 0
\]
\[
60 - 25y + 9y = 12
\]
\[
60 - 16y = 12
\]
\[
16y = 48
\]
\[
y = 3
\]
Now, substitute \( y \) in (1)

\[
3x + 5(3) = 12
\]

\[
3x + 15 = 12
\]

\[
3x = 12 - 15
\]

\[
x = -1
\]

Answer: \( x = -1 \) and \( y = 3 \)

**Question 2.**

\[2x - 3y = 17, \ 4x + y = 13.\]

**Solution:**

\[2x - 3y = 17 \quad \ldots \ldots \text{(1)}\]

\[4x + y = 13 \quad \ldots \ldots \text{(2)}\]

Here

\[a_1 = 2, \ b_1 = -3, \ c_1 = 17\]

\[a_2 = 4, \ b_2 = 1, \ c_2 = 13\]

Which shows:

\[
\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \quad \frac{b_1}{b_2} = \frac{-3}{1} = -3
\]

System has unique solutions.

Solve the equations using substitution method:

From (1): \( x = \frac{17 + 3y}{2} \)

Putting value of \( x \) in (2)

\[
4\left(\frac{17 + 3y}{2}\right) + y = 13
\]

\[
68 + 12y + 2y = 26
\]

\[
68 + 14y = 26
\]

\[y = -3\]
Again, \( x = \frac{17 + 3(-3)}{2} \)

\[ 2x = 8 \]
\[ x = 4 \]

Answer: \( x = 4 \) and \( y = -3 \)

**Question 3:**

\[ \frac{x}{2} + \frac{y}{2} = 3, \ x - 2y = 2 \]

**Solution:**

\[ 2x + 3y = 18 \ldots (1) \]
\[ x - 2y = 2 \ldots (2) \]

\[ a_1 = 2, \ b_1 = 3, \ c_1 = 18 \]
\[ a_2 = 1, \ b_2 = -2, \ c_2 = 2 \]

\[ \frac{a_1}{a_2} = \frac{2}{1} = 2, \ \frac{b_1}{b_2} = \frac{3}{-2} \]

\[ \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \]

This system has a unique solution.

Solve the equations:

From (2), \( x = 2 + 2y \)

Substituting the value of \( x \) in (1),

\[ 2(2 + 2y) + 3y = 18 \]
\[ \Rightarrow 4 + 4y + 3y = 18 \]
\[ \Rightarrow 7y = 18 - 4 = 14 \]
\[ \Rightarrow y = 2 \]
and \( x = 2 + 2 \times 2 = 2 + 4 = 6 \)

Answer: \( x = 6 \) and \( y = 2 \)
Find the value of \( k \) for which each of the following systems of equations has a unique solution:

**Question 4:**
\[ 2x + 3y - 5 = 0, \quad kx - 6y - 8 = 0. \]

**Solution:**
\[
2x + 3y - 5 = 0 \quad \text{(1)} \\
kx - 6y - 8 = 0 \quad \text{(2)}
\]

\[
a_1 = 2, \quad b_1 = 3, \quad c_1 = -5 \\
a_2 = k, \quad b_2 = -6, \quad c_2 = -8
\]

\[
\frac{a_1}{a_2} = \frac{2}{k}, \quad \frac{b_1}{b_2} = \frac{3}{-6}
\]

Which shows:

\[
\frac{a_1}{a_2} \neq \frac{b_1}{b_2}
\]

System has a unique solution.

Now, find the value of \( k \):

\[
\frac{2}{k} \neq \frac{3}{-6}
\]

\[ k \neq -4 \]

**Question 5:**
\[ x - ky = 2, \quad 3x + 2y + 5 = 0. \]

**Solution:**
\[
x - ky = 2 \quad \text{(1)} \\
3x + 2y + 5 = 0 \quad \text{(2)}
\]

Here,
\[
a_1 = 1, \quad b_1 = -k, \quad c_1 = -2
\]
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\[ a_2 = 3, \quad b_2 = 2, \quad c_2 = 5 \]

\[ \frac{a_1}{a_2} = \frac{1}{3}, \quad \frac{b_1}{b_2} = \frac{-k}{2}, \quad \frac{c_1}{c_2} = \frac{2}{-5} \]

Systems has a unique solution.

Now,

\[ \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{1}{3} \neq \frac{-k}{2} \]

\[ k \neq \frac{2}{3} \]

**Question 6.**

5x – 7y – 5 = 0, 2x + ky – 1 = 0.

**Solution:**

\[ 5x – 7y – 5 = 0 \quad \text{...}(1) \]
\[ 2x + ky – 1 = 0 \quad \text{...}(2) \]

Here,

\[ a_1 = 5, \quad b_1 = -7, \quad c_1 = -5 \]
\[ a_2 = 2, \quad b_2 = k, \quad c_2 = -1 \]

\[ \frac{a_1}{a_2} = \frac{5}{2}, \quad \frac{b_1}{b_2} = \frac{-7}{k} = \frac{-7}{k} \]

Systems has a unique solution.

\[ \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{5}{2} \neq \frac{-7}{k} \]

\[ k \neq \frac{-14}{5} \]

**Question 7.**

4x + ky + 8 = 0, x + y + 1 = 0.

**Solution:**

\[ 4x + ky + 8 = 0 \quad \text{......}(1) \]
\[ x + y + 1 = 0 \quad \text{......}(2) \]
Here,
$a_1 = 4, b_1 = k, c_1 = 8$
$a_2 = 1, b_2 = 1, c_2 = 1$

\[
\frac{a_1}{a_2} = \frac{4}{1}, \quad \frac{b_1}{b_2} = \frac{k}{1}
\]

Systems has a unique solution.

\[
\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{4}{1} \neq \frac{k}{1}
\]

$k \neq 4$

**Question 8.**

$4x - 5y = k, 2x - 3y = 12.$

**Solution:**

$4x - 5y = k \quad \ldots \ldots (1)$

$2x - 3y = 12 \quad \ldots \ldots \ldots \ldots \ldots (2)$

Here,
$a_1 = 4, b_1 = -5, c_1 = -k$
$a_2 = 2, b_2 = -3, c_2 = -12$

\[
\frac{a_1}{a_2} = \frac{4}{2} = 2, \quad \frac{b_1}{b_2} = \frac{-5}{-3} = \frac{5}{7}
\]

Systems has a unique solution.

And

\[
\frac{c_1}{c_2} = \frac{-k}{-12}
\]

Which shows that,
Therefore, \( k \) is any real number.

**Question 9.**
\[ kx + 3y = (k - 3), \quad 12x + ky = k. \]

**Solution:**

\[ kx + 3y = (k - 3), \quad 12x + ky = k \]

Here,
\[ a_1 = k, \quad b_1 = 3, \quad c_1 = k - 3 \]
\[ a_2 = 12, \quad b_2 = k, \quad c_2 = k \]

\[ \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow k \neq \frac{3}{12} \Rightarrow k \neq \frac{1}{4} \]

Systems has a unique solution.

\[ k^2 \neq 36 \Rightarrow k \neq \pm 6 \]

\( k \) is not equal to 6 or -6.

**Question 10:**
Show that the system of equations \( 2x - 3y = 5, \quad 6x - 9y = 15 \) has an infinite number of solutions.

**Solution:**

\[ 2x - 3y = 5, \quad 6x - 9y = 15 \]

Here,
\[ a_1 = 2, \quad b_1 = -3, \quad c_1 = 5 \]
\[ a_2 = 6, \quad b_2 = -9, \quad c_2 = 15 \]
Question 11.
Show that the system of equations $6x + 5y = 11, 9x + \frac{15}{2}y = 21$ has no solution.

Solution:

$6x + 5y = 11$
$9x + \frac{15}{2}y = 21$

Here,
$a_1 = 6, b_1 = 5, c_1 = -11$
$a_2 = 9, b_2 = \frac{15}{2}, c_2 = -21$

$\frac{a_1}{a_2} = \frac{6}{9} = \frac{2}{3}$

$\frac{b_1}{b_2} = \frac{2}{\frac{15}{2}} = \frac{2}{\frac{15}{2}} = \frac{4}{15}$

$\frac{c_1}{c_2} = \frac{-11}{-21} = \frac{11}{21}$

Therefore,
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

System of equations has no solution.
Question 12: For what value of k does the system of equations $kx + 2y = 5$, $3x - 4y = 10$ have
(i) a unique solution,
(ii) no solution?

Solution:

System of equations $kx + 2y = 5$ and $3x - 4y = 10$

Here,

- $a_1 = k$, $b_1 = 2$, $c_1 = 5$
- $a_2 = 3$, $b_2 = -4$, $c_2 = 10$

\[
\frac{a_1}{a_2} = \frac{k}{3}, \quad \frac{b_1}{b_2} = \frac{2}{-4} = \frac{-1}{2}
\]

\[
\frac{c_1}{c_2} = \frac{5}{10} = \frac{1}{2}
\]

(i) Systems has a unique solution.

\[
\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{k}{3} \neq \frac{-1}{2}
\]

$k \neq -\frac{3}{2}$

(ii) If systems has no solution

\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}
\]

\[
\frac{k}{3} = \frac{-1}{2} \neq \frac{1}{2}
\]

$k \neq -\frac{3}{2}$

Question 13: For what value of k does the system of equations $x + 2y = 5$, $3x + ky + 15 = 0$ have
(i) a unique solution,  
(ii) no solution?

Solution:

\[ x + 2y = 5, \quad 3x + ky + 15 = 0 \]

Here,
\[ a_1 = 1, \quad b_1 = 2, \quad c_1 = -5 \]
\[ a_2 = 3, \quad b_2 = k, \quad c_2 = 15 \]

\[ \frac{a_1}{a_2} = \frac{1}{3}, \quad \frac{b_1}{b_2} = \frac{2}{k}, \quad \frac{c_1}{c_2} = \frac{-5}{15} = \frac{-1}{3} \]

(i) a unique solution

\[ \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{1}{2} \neq \frac{2}{k} \]

\[ k \neq 4 \]

(ii) no solution

\[ \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \]

\[ \frac{1}{2} = \frac{2}{k} \neq \frac{-1}{3} \]

\[ k = 4 \]

Question 14.

For what value of \( k \) does the system of equations \( x + 2y = 3, \quad 5x + ky + 7 = 0 \) have
(i) a unique solution,
(ii) no solution? Also, show that there is no value of \( k \) for which the given system of equations has infinitely many solutions.

Solution:

\[ x + 2y = 3, \quad 5x + ky + 7 = 0 \]
Here
\(a_1 = 1, b_1 = 2, c_1 = -5\)
\(a_2 = 3, b_2 = k, c_2 = 15\)
\[
\frac{a_1}{a_2} = \frac{1}{5}, \quad \frac{b_1}{b_2} = \frac{2}{k}, \quad \frac{c_1}{c_2} = \frac{-3}{7}
\]

(i) a unique solution.

\[
\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \frac{1}{5} \neq \frac{2}{k}
\]

\(k \neq 10\)

(ii) no solution? Also, show that there is no value of \(k\) for which the given system of equations has infinitely many solutions.

System has no solution:

\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \frac{1}{5} = \frac{2}{k} \neq \frac{-3}{7}
\]

\(k = 10\)

System has infinitely many solutions:

\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}
\]

\[
\frac{1}{5} = \frac{2}{k} = \frac{-3}{7}
\]

Which is not at all possible.

\(1/5 \neq -3/7\)

\(K\) has no value.
Question 1:

5 chairs and 4 tables together cost ₹ 5600, while 4 chairs and 3 tables together cost ₹ 4340. Find the cost of a chair and that of a table.

Solution:
Let us consider,
Cost of one chair = ₹ x and
Cost of one table = ₹ y

As per the statement,

5x + 4y = ₹ 5600 \(\text{(1)}\)
4x + 3y = ₹ 4340 \(\text{(2)}\)

Using elimination method:

Multiply (1) by 3 and (2) by 4. And subtract both the equations.

\[
\begin{align*}
15x + 12y &= 16800 \\
16x + 12y &= 17360 \\
\hline
-x &= -560
\end{align*}
\]

So, \(x = 560\)

From (1):

\[
\begin{align*}
5 \times 560 + 4y &= 5600 \\
2800 + 4y &= 5600 \\
4y &= 5600 - 2800 \\
4y &= 2800 \\
y &= 700
\end{align*}
\]

Answer:
Cost of one chair = ₹ 560
and cost of one table = ₹ 700
Question 2:
23 spoons and 17 forks together cost ₹ 1770, while 17 spoons and 23 forks together cost ₹ 1830. Find the cost of a spoon and that of a fork.

Solution:

Let us consider,

Cost of one spoon = ₹ x and
Cost of one fork = ₹ y

As per the statement,
23x + 17y = 1770 ...(1)
17x + 23y = 1830 ...(2)

Adding both the equations, we get
40x + 40y = 3600
Dividing by 40,
x + y = 90 ...(3)

and subtracting (2) from (1)
6x – 6y = -60
Dividing by 6,
x – y = -10 ...(4)

Now, Adding (3) and (4)
2x = 80
or x = 40

From (3): x + y = 90
40 + y = 90
y = 50

Therefore, Cost of one spoon = ₹ 40
and cost of one fork = ₹ 50
Question 3:
A lady has only 25-paisa and 50-paisa coins in her purse. If she has 50 coins in all totalling ₹ 19.50, how many coins of each kind does she have?

Solution:
Let us consider,
Number of 25-paisa coins = x and
Number 50-paisa coins = y
Total number of coins = 50
and total amount = ₹ 19.50 or 1950 paisa
x + y = 50 ...(1)
25x + 50y = 1950
x + 2y = 78 ...(2)
Subtracting (1) from (2),
y = 28
And, x = 50 – y = 50 – 28 = 22
Number of 25-paisa coins = 22
and 50-paisa coins = 28

Question 4:
The sum of two numbers is 137 and their difference is 43. Find the numbers.

Solution:
Given: Sum of two numbers is 137 and difference is 43
Let us consider, first number = x and
Second number = y
x + y = 137 .....(1)
x – y = 43 .....(2)
Adding both the equations, we get

\[2x = 180\]

or \[x = 90\]

On subtracting (2) from (1),
\[2y = 94\]
\[y = 47\]

So,

First number = 90 and
Second number = 47

**Question 5:**
Find two numbers such that the sum of twice the first and thrice the second is 92, and four times the first exceeds seven times the second by 2.

**Solution:**

Let us consider, first number = \(x\) and
Second number = \(y\)

As per the statement,
\[2x + 3y = 92 \ldots(1)\]
\[4x - 7y = 2 \ldots(2)\]

Using elimination method:

Multiply (1) by 2 and (2) by 1, we get
\[4x + 6y = 184 \ldots(3)\]
\[4x - 7y = 2 \ldots(4)\]

Subtracting (3) from (4),
\[13y = 182\]
\[y = 14\]

From (1), \(2x + 3y = 92\)
\[2x + 3 \times 14 = 92\]
\[2x + 42 = 92\]
\[2x = 92 - 42 = 50\]
\[x = 25\]
Question 6:

Find two numbers such that the sum of thrice the first and the second is 142, and four times the first exceeds the second by 138.

Solution:

Let us consider,

First number = $x$ and
Second number = $y$

As per the statement,

$3x + y = 142$ ...(1)
$4x - y = 138$ ...(2)

Using elimination method:

Add (1) and (2), we get

$7x = 280$

$x = 40$

From (1):

$3 \times 40 + y = 142$
$120 + y = 142$
$y = 142 - 120 = 22$

Answer:

First number = 40,
Second number = 22

Question 7:

If 45 is subtracted from twice the greater of two numbers, it results in the other number.
If 21 is subtracted from twice the smaller number, it results in the greater number. Find the numbers.

Solution:

Let us consider,

First greater number = $x$ and

Second smaller number = $y$
As per the statement,

2x – 45 = y …(1)

2y – 21 = x …(2)

Using Substitution method:

Substituting the value of y in (2),

2 (2x – 45) – 21 = x

4x – 90 – 21 = x

4x – x = 111

3x = 111

x = 37

From (1): y = 2 x 37 – 45 = 29

Answer:
The numbers are 37 and 29.

**Question 8:**
If three times the larger of two numbers is divided by the smaller, we get 4 as the quotient and 8 as the remainder. If five times the smaller is divided by the larger, we get 3 as the quotient and 5 as the remainder. Find the numbers.

**Solution:**

Let us consider,

larger number = x and

Smaller number = y

As per the statement,

3x = 4y + 8 ……(1)

5y = 3x + 5 …(2)

Using Substitution method:

Substitute the value of 3x in (2), we get

5y = 4y + 8 + 5

5y – 4y = 13
or \( y = 13 \)

From (1): \( 3x = 4 \times 13 + 8 = 60 \)
\[ x = 20 \]

Answer:
Larger number = 20
Smaller number = 13

Question 9:
If 2 is added to each of two given numbers, their ratio becomes 1 : 2. However, if 4 is subtracted from each of the given numbers, the ratio becomes 5 : 11. Find the numbers.

Solution:
Let us consider,
First number = \( x \) and
Second number = \( y \)
As per the statement,

\[ \frac{x+2}{y+2} = \frac{1}{2} \]
or \( y + 2 = 2x + 4 \)
or \( y = 2x + 2 \) \((1)\)
And

\[ \frac{x-4}{y-4} = \frac{5}{11} \]
or \( 11(x-4) = 5(y - 4) \)
\[ 11x - 44 = 5(2x + 2) - 20 \]
\[ (using \ result \ of \ equation \ (1) ) \]
\[ 11x - 44 = 10x + 10 - 20 \]
\[ 11x - 10x = 10 - 20 + 44 \]
or \( x = 34 \)

From (1):
\[ y = 2 \times 34 + 2 = 68 + 2 = 70 \]

Answer:
Numbers are 34 and 70
Question 10:
The difference between two numbers is 14 and the difference between their squares is 448. Find the numbers.

Solution:
Let us consider,
First number = x and
Second number = y

(Assume y is smaller)

As per the statement,
\[ x - y = 14 \]  
\[ x^2 - y^2 = 448 \]

\[ (x + y) (x - y) = 448 \]

\[ (x + y) \times 14 = 448 \]

\[ x + y = 32 \]

Adding (1) and (2),
\[ 2x = 46 \] or \[ x = 23 \]

Subtracting (1) from (2)
\[ 2y = 18 \] or \[ y = 9 \]

Answer:
Numbers are 23 and 9

Question 11:
The sum of the digits of a two-digit number is 12. The number obtained by interchanging its digits exceeds the given number by 18. Find the number.

Solution:
Let us consider,

One's digit of a two digit number = x and
Ten's digit = y
So, the number is \( x + 10y \)
By interchanging the digits,
One’s digit = y and
Ten’s digit = x

Number is $y + 10x$

As per the statement,
$x + y = 12 \quad \text{(1)}$

$y + 10x = x + 10y + 18$

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

$x - y = 2 \quad \text{(2)}$

Adding (1) and (2), we have

$2x = 14$ or $x = 7$

On subtracting (1) from (2),

$2y = 10$ or $y = 5$

Answer:
Number = $7 + 10 \times 5 = 57$

**Question 12:**
A number consisting of two digits is seven times the sum of its digits. When 27 is subtracted from the number, the digits are reversed. Find the number.

**Solution:**

Let us consider, one’s digit of a two digit number = $x$ and
ten’s digit = $y$

The number is $x + 10y$

After reversing the digits,
One’s digit = $y$
and ten’s digit = $x$

The number is $y + 10x$
As per the statement,

\[ x + 10y - 27 = y + 10x \]
\[ y + 10x - x - 10y = -27 \]
\[ 9x - 9y = -27 \]

\[ x - y = -3 \quad \text{(1)} \]

Again,

\[ 7(x + y) = x + 10y \]
\[ 7x + 7y = x + 10y \]
\[ 7x - x = 10y - 7y \]
\[ 6x = 3y \]
\[ 2x = y \quad \text{(2)} \]

Using Substitution method:

Substituting the value of \( y \) in (1)
\[ x - 2x = -3 \]
\[-x = -3 \]
or \( x = 3 \)

From (2): \( y = 2(3) = 6 \)

Answer:
Number = \( x + 10y = 3 + 10(6) = 63 \)

**Question 13:**

The sum of the digits of a two-digit number is 15. The number obtained by interchanging the digits exceeds the given number by 9. Find the number.

**Solution:**

Let us consider,

one's digit of a two digit number = \( x \) and

ten's digit = \( y \)

The number is \( x + 10y \)

After interchanging the digits,

One’s digit = \( y \) and
ten’s digit = \( x \)

The number is \( y + 10x \)
As per the statement,
\[ x + y = 15 \] \hspace{1cm} (1)

And,
\[ y + 10x = x + 10y + 9 \]
\[ y + 10x - x - 10y = 9 \]
\[ 9x - 9y = 9 \]
\[ x - y = 1 \] \hspace{1cm} (2)

On adding, we get
\[ 2x = 16 \]
Or \[ x = 8 \]

On subtracting (2) from (1)
\[ 2y = 14 \]
\[ y = 7 \]

Answer:
Number = \[ x + 10y = 8 + 10(7) = 78 \]

**Question 14:**
A two-digit number is 3 more than 4 times the sum of its digits. If 18 is added to the number, the digits are reversed. Find the number.

**Solution:**
Let us consider, one's digit of the two digit number = \( x \) and

Ten's digit = \( y \)
The number is \( x + 10y \)

By reversing the digits,
One's digit = \( y \) and
ten's digit = \( x \)
The number is \( y + 10x \)
Now, As per the statement,

\[ 4(x + y) + 3 = x + 10y \]
\[ 4x + 4y + 3 = x + 10y \]
\[ 3x - 6y = -3 \]
\[ x - 2y = -1 \quad \ldots \ldots \text{(1)} \]

And,

\[ x + 10y + 18 = y + 10x \]
\[ 18 = y + 10x - x - 10y \]
\[ 9x - 9y = 18 \]
\[ x - y = 2 \quad \text{(2)} \]

On subtracting (1) form (2)

\[ y = 3 \]

Form (1): \[ x = 2y - 1 = 2(3) - 1 = 5 \]

Answer:

Number = \[ x + 10y = 5 + 10(3) = 35 \]

**Question 15:**

A number consists of two digits. When it is divided by the sum of its digits, the quotient is 6 with no remainder. When the number is diminished by 9, the digits are reversed. Find the number.

**Solution:**

Let us consider, ones digit of a two digit number = \( x \) and

Tens digit = \( y \)

The number is \( x + 10y \)

By reversing the digits,
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One's digit = y and ten's digit = x

The number is $y + 10x$

As per the statement,

$$\frac{x + 10y}{x+y} = 6$$

$x + 10y = 6(x + y)$

$5x = 4y$

or $x = \frac{4}{5}y \quad \ldots \ldots (1)$

And,

$x + 10y - 9 = y + 10x$
$x + 10y - y - 10x = 9$

$-9x + 9y = 9$

$x - y = -1$

using equation (1)

$\frac{4}{5}y - y = -1$

$y = 5$

From (1): $x = \frac{4}{5}(5) = 4$

Answer:

The number is: $x + 10y = 4 + 10(5) = 54$

**Question 16:**

A two-digit number is such that the product of its digits is 35. If 18 is added to the number, the digits interchange their places. Find the number.

**Solution:**

Let us consider,
One's digit of a two digit number = x and
Ten's digit = y

...
The number is \( x + 10y \)

By interchanging the digits,

One’s digit = \( y \) and ten’s digit = \( x \)

The number is \( y + 10x \)

As per the statement,

\[ xy = 35 \quad \ldots \ldots (1) \]

And, \( x + 10y + 18 = y + 10x \)

\[ 18 = y + 10x - x - 10y \]

\[ x - y = 2 \quad \ldots \ldots (2) \]

using algebraic identity: \( (x + y)^2 = (x - y)^2 + 4xy \)

\[ (x + y)^2 = (2)^2 + 4(35) \]

\[ = 144 \]

\[ = (12)^2 \]

or \( x + y = 12 \quad \ldots \ldots (3) \)

Subtracting (2) from (3), we get

\[ 2x = 14 \]

or \( x = 7 \)

Form (1): \( xy = 35 \)

\[ 7(y) = 35 \]

\[ y = 5 \]

Answer: The number is \( x + 10y = 7 + 10(5) = 57 \)

**Question 17:**

A two-digit number is such that the product of its digits is 18. When 63 is subtracted from the number, the digits interchange their places. Find the number.
Solution:

Let us consider, one's digit of a two digit number = x and
Ten's digit = y

The number is \( x + 10y \)

After interchanging the digits One's digit = y
Ten's digit = x
The number is \( y + 10x \)

As per the statement,
\[ xy = 18 \] ........(1)

And, \( x + 10y - 63 = y + 10x \)
\[ 9y - 9x - y - 10x = 63 \]
\[ 8y - 19x = 63 \]
\[ y - x = 7 \] .....(2)

using algebraic identity: \( (x + y)^2 = (x - y)^2 + 4xy \)
\[ (x + y)^2 = (-7)^2 + 4(18) = 49 + 72 = 121 \] (Using (1))
\[ (x + y)^2 = 11^2 \]
or \( x + y = 11 \) .....(3)

Add (1) and (2)
\[ 2y = 18 \]
or \( y = 9 \)

From (1): \( xy = 18 \)
\[ 9x = 18 \]
\[ x = 2 \]

Answer:
The number is: \( x + 10y = 2 + 10(9) = 92 \)
Question 18:

The sum of a two-digit number and the number obtained by reversing the order of its digits is 121, and the two digits differ by 3. Find the number.

Solution:

Let us consider, one's digit of a two digit number = x and

Ten's digit = y

Number is $x + 10y$

By reversing the digits,

One's digit = y and

Ten's digit = x

Number is $y + 10x$

As per the statement,

$x + 10y + y + 10x = 121$

$11x + 11y = 121$

$x + y = 11 \ldots (1)$

And,

$x - y = 3 \ldots (2)$

On adding, we get

$2x = 14$ or $x = 7$

On subtracting (2) form (1),

$2y = 8$ or $y = 4$

Answer:

Number = $7 + 10(4) = 47$

or $4 + 10(7) = 4 + 70 = 74$
Question 19.
The sum of the numerator and denominator of a fraction is 8. If 3 is added to both of the numerator and the denominator, the fraction becomes 3/4. Find the fraction.

Solution:
Let us consider, a fraction \( \frac{x}{y} \), where \( x \) is numerator and \( y \) is denominator.

As per the statement,
\[ x + y = 8 \quad \text{(1)} \]

And,
\[ \frac{x+3}{y+3} = \frac{3}{4} \]

\[ 4(x+3) = 3(y+3) \]

\[ 4x - 3y = -3 \quad \text{(2)} \]

Using Substitution method:
Substitute the value of \( x \) from (1) in (2), we get

\[ 4(8 - y) - 3y = -3 \]

\[ 32 - 4y - 3y = -3 \]

\[ -7y = -35 \]

\[ y = 5 \]

From (1):
\[ x + 5 = 8 \]

\[ x = 3 \]

Answer: Fraction is \( \frac{3}{5} \)

Question 20:
If 2 is added to the numerator of a fraction, it reduces to \( \frac{1}{2} \) and if 1 is subtracted from the denominator, it reduces to \( \frac{1}{3} \). Find the fraction.

Solution:
Let us consider, a fraction \( \frac{x}{y} \), where \( x \) is numerator and \( y \) is denominator.
As per the statement,

\[(x + 2)/y = \frac{1}{2}\]

\[x/y - 1 = \frac{1}{3}\]

\[2x + 4 = y \ldots (1)\]

And, \[3x = y - 1 \ldots (2)\]

Using Substitution method:

Using (1) in (2)

\[3x = 2x + 4 - 1\]

\[3x = 2x + 3\]

\[x = 3\]

Form (1): \[y = 2(3) + 4 = 10\]

Answer: Required fraction is \[\frac{3}{10}\]
Exercise 3F

Question 1:
Write the number of solutions of the following pair of linear equations:

\[ x + 2y - 8 = 0, \ 2x + 4y = 16. \]

Solution:
\[ x + 2y = 8 \]
And, \[ 2x + 4y = 16 \]

These given equations are in the form:
\[ a_1 x + b_1 y + c_1 = 0 \text{ and } a_2 x + b_2 y + c_2 = 0 \]
where,
\[ a_1 = 1, \ b_1 = 2 \text{ and } c_1 = 8 \]
\[ a_2 = 2, \ b_2 = 4 \text{ and } c_2 = 16 \]

\[ \frac{a_1}{a_2} = \frac{1}{2}, \ \frac{b_1}{b_2} = \frac{2}{4} = \frac{1}{2} \]

System has infinitely many solutions.

Question 2:
Find the value of \( k \) for which the following pair of linear equations have infinitely many solutions:

\[ 2x + 3y = 7, \ (k - 1) x + (k + 2) y = 3k. \]

Solution:
\[ 2x + 3y = 7 \]
\[ (k - 1)x + (k + 2)y = 3k \]

These given equations are in the form:
\[ a_1 x + b_1 y + c_1 = 0 \text{ and } a_2 x + b_2 y + c_2 = 0 \]
where,
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\[ a_1 = 2, \ b_1 = 3 \text{ and } c_1 = 7 \]

\[ a_2 = (k - 1), \ b_2 = (k + 2) \text{ and } c_2 = 3k \]

\[
\frac{a_1}{a_2} = \frac{2}{k - 1}, \ \frac{b_1}{b_2} = \frac{3}{k + 2}, \ \frac{c_1}{c_2} = \frac{7}{3k}
\]

Which shows:

\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}
\]

System has infinitely many solutions.

Now, Find the value of \( k \):

\[
\frac{2}{k - 1} = \frac{3}{k + 2} = \frac{7}{3k}
\]

\[
\frac{2}{(k-1)} = \frac{3}{(k+2)}
\]

\[
3(k-1) = 2(k+2)
\]

which implies, \( k = 7 \)

The value of \( k \) is 7.

**Question 3:**
For what value of \( k \) does the following pair of linear equations have infinitely many solutions?

\[ 10x + 5y - (k - 5) = 0 \text{ and } 20x + 10y - k = 0. \]

**Solution:**

\[ 10x + 5y - (k - 5) = 0 \text{ and } 20x + 10y - k = 0. \]

These given equations are in the form:

\[ a_1x + b_1y + c_1 = 0 \text{ and } a_2x + b_2y + c_2 = 0 \]

where,
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Given:

\[a_1 = 10, \ b_1 = 5 \text{ and } c_1 = -(k - 5)\]

\[a_2 = 20, \ b_2 = 10 \text{ and } c_2 = -k\]

\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}
\]

System has infinitely many solutions.

\[
\frac{10}{20} = \frac{5}{10} = \frac{-(k - 5)}{-k} = \frac{k - 5}{k}
\]

5k = 10k - 50

or k = 10

The value of k is 10.

**Question 4:**
For what value of k will the following pair of linear equations have no solution?

\[2x + 3y = 9, \ 6x + (k - 2) y = (3k - 2)\]

**Solution:**

\[2x + 3y = 9, \ 6x + (k - 2) y = (3k - 2)\]

These given equations are in the form:

\[a_1x + b_1y + c_1 = 0 \text{ and } a_2x + b_2y + c_2 = 0\]

where,

\[a_1 = 2, \ b_1 = 3 \text{ and } c_1 = 9\]

\[a_2 = 6, \ b_2 = (k - 2) \text{ and } c_2 = (3k - 2)\]

\[
\frac{a_1}{a_2} = \frac{2}{6}, \ \frac{b_1}{b_2} = \frac{3}{k - 2}, \ \frac{c_1}{c_2} = \frac{9}{3k - 2}
\]

\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}
\]
Therefore, the system has no solution.

Now,
\[ \frac{2}{6} = \frac{3}{(k - 2)} \]
\[ 2k - 4 = 18 \]
or \[ k = 11 \]

Since
\[ \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \]
\[ \frac{3}{9} \neq \frac{9}{31} \]
Which is true. The value of \( k \) is 11.

**Question 5:**
Write the number of solutions of the following pair of linear equations:
\[ x + 3y - 4 = 0 \text{ and } 2x + 6y - 7 = 0. \]

**Solution:**
\[ x + 3y - 4 = 0 \text{ and } 2x + 6y - 7 = 0. \]
These given equations are in the form:
\[ a_1x + b_1y + c_1 = 0 \text{ and } a_2x + b_2y + c_2 = 0 \]
where,
\[ a_1 = 1, \ b_1 = 3 \text{ and } c_1 = -4 \]
\[ a_2 = 2, \ b_2 = 6 \text{ and } c_2 = -7 \]

\[ \frac{a_1}{a_2} = \frac{1}{2}, \ \frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}, \ \frac{c_1}{c_2} = \frac{-4}{-7} = \frac{4}{7} \]

\[ \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \]
System has no solution.
Question 6:
Write the value of k for which the system of equations $3x + ky = 0$, $2x - y = 0$ has a unique solution.

Solution:

$3x + ky = 0$, $2x - y = 0$

$a_1 = 3$, $b_1 = k$ and $c_1 = 0$

$a_2 = 2 + b_2 = -1$ and $c_2 = 0$

The system has a unique solution.

$k \neq -\frac{3}{2}$

Question 7:
The difference between two numbers is 5 and the difference between their squares is 65. Find the numbers.

Solution:

Let $x$ be the first number and $y$ be second number.

$x - y = 5$

$x^2 - y^2 = 65 \ldots (2)$

Now, by dividing (2) by (1) we get:

$x + y = 13 \ldots (3)$

On adding (1) and (2) we get

$2x = 18$
or \( x = 9 \)

From (3): \( 9 + y = 13 \)

or \( y = 4 \)

Two numbers are 4 and 9.

**Question 8:**
The cost of 5 pens and 8 pencils is ₹120, while the cost of 8 pens and 5 pencils is ₹153. Find the cost of 1 pen and that of 1 pencil.

**Solution:**
Let the cost of one pen is ₹ \( x \) and cost of one pencil is ₹ \( y \), then

As per statement,

\[
5x + 8y = 120 \quad \text{(1)}
\]

\[
8x + 5y = 153 \quad \text{(2)}
\]

Adding both the equations, we get

\[
13x + 13y = 273
\]

\[
x + y = 21 \quad \text{(3)}
\]

On subtracting (1) from (2),

\[
3x - 3y = 33
\]

\[
x - y = 11 \quad \text{(iv)}
\]

Again,

Adding (3) and (iv),

\[
2x = 32 \text{ or } x = 16
\]

On subtracting,

\[
2y = 10 \text{ or } y = 5
\]

Answer:
Cost of 1 pen = ₹ 16
and cost of 1 pencil = ₹ 5
Question 9:
The sum of two numbers is 80. The larger number exceeds four times the smaller one by 5. Find the numbers.

Solution:
Let \( x \) be the first number and \( y \) be the second number.

As per statement,
\[
x + y = 80 \quad \text{and} \quad x - 4y = 5
\]
on subtracting both the equations, we get
\[
y = 15
\]
From (1): \( x + 15 = 80 \)
\[
x = 80 - 15 = 65
\]
Answer:
Required numbers are 15 and 65.

Question 10:
A number consists of two digits whose sum is 10. If 18 is subtracted from the number, its digits are reversed. Find the number.

Solution:
Let one’s digit of a two digits number is \( x \) and ten’s digit is \( y \), then the number is \( x + 10y \)

By reversing its digits One’s digit = \( y \) and ten’s digit = \( x \)

Then the number is \( y + 10x \)

As per statement,
\[
x + y = 10 \quad \text{(1)}
\]

And,
\[
x + 10y - 18 = y + 10x
\]
\[
x + 10y - y - 10x = 18
\]
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-9x + 9y = 18

x – y = -2 (Dividing by -9) .....(2)

Adding (1) and (2), we have

2x = 8 or x = 4

From (1): 4 + y = 10

y = 6

Answer:
Number = x + 10y = 4 + 10(6) = 64