Mathematics
(www.tiwariacademy.in)
(Chapter 3) (Pair of Linear Equations in two variables)
(Class 10)
Exercise 3.2

**Question 1:**
Form the pair of linear equations in the following problems, and find their solutions graphically.

(i) 10 students of Class X took part in a Mathematics quiz. If the number of girls is 4 more than the number of boys, find the number of boys and girls who took part in the quiz.

(ii) 5 pencils and 7 pens together cost ₹ 50, whereas 7 pencils and 5 pens together cost ₹ 46. Find the cost of one pencil and that of one pen.

**Answer 1:**

(i) Let the number of girls = \(x\) and let the number of boys = \(y\)

Total number of students = 10

Therefore, \(x + y = 10\) ... (1)

According to question, number of girls is 4 more than the number of boys, so

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

To represent graphically, three solutions of each equation is needed.

From the equation (1), we get

<table>
<thead>
<tr>
<th>(x)</th>
<th>5</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>(y)</td>
<td>5</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

From the equation (2), we get

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

(ii) Let the cost of one pencil = ₹ \(x\) and let the cost of one pen = ₹ \(y\)

According to first condition,

\(5x + 7y = 50\) ... (1)

According to second condition,

\(7x + 5y = 46\) ... (2)

To represent graphically three solutions of each equation is given below,

From the equation (1), we get

\(x = \frac{50 - 7y}{5}\)

<table>
<thead>
<tr>
<th>(x)</th>
<th>3</th>
<th>10</th>
<th>-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(y)</td>
<td>5</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

From the equation (2), we get

\(x = \frac{46 - 5y}{7}\)

<table>
<thead>
<tr>
<th>(x)</th>
<th>8</th>
<th>3</th>
<th>-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(y)</td>
<td>-2</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

**Question 2:**

On comparing the ratios \(\frac{a_1}{a_2}, \frac{b_1}{b_2}\) and \(\frac{c_1}{c_2}\), find out whether the lines representing the following pairs of linear equations intersect at a point, are parallel or coincident:

(i) \(5x - 4y + 8 = 0\) \(7x + 6y - 9 = 0\)

(ii) \(9x + 3y + 12 = 0\) \(18x + 6y + 24 = 0\)

(iii) \(6x - 3y + 10 = 0\) \(2x - y + 9 = 0\)
**Mathematics**

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(Chapter 3) (Pair of Linear Equations in two variables)

(Class 10)

**Answer 2:**

(i) \(5x - 4y + 8 = 0\)
\(7x + 6y - 9 = 0\)

Here, \(\frac{a_1}{a_2} = \frac{5}{7}\) and \(\frac{b_1}{b_2} = \frac{-4}{6} = \frac{-2}{3}\)

\(\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}\), so, the given pairs of linear equations intersect at a point.

(ii) \(9x + 3y + 12 = 0\)
\(18x + 6y + 24 = 0\)

Here, \(\frac{a_1}{a_2} = \frac{9}{18} = \frac{1}{2}\), \(\frac{b_1}{b_2} = \frac{3}{6} = \frac{1}{2}\) and \(\frac{c_1}{c_2} = \frac{12}{24} = \frac{1}{2}\)

\(\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}\), so, the following pairs of linear equations are coincident.

(iii) \(6x - 3y + 10 = 0\)
\(2x - y + 9 = 0\)

Here, \(\frac{a_1}{a_2} = \frac{6}{2} = 3\), \(\frac{b_1}{b_2} = \frac{-3}{-1} = 3\) and \(\frac{c_1}{c_2} = \frac{10}{9}\)

\(\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}\), so, the following pairs of linear equations are parallel.

**Question 3:**

On comparing the ratios \(\frac{a_1}{a_2}, \frac{b_1}{b_2}\) and \(\frac{c_1}{c_2}\), find out whether the following pair of linear equations are consistent, or inconsistent:

(i) \(3x + 2y = 5\); \(2x - 3y = 7\)

(ii) \(2x - 3y = 8\); \(4x - 6y = 9\)

(iii) \(\frac{3}{4}x + \frac{5}{3}y = 7\); \(9x - 10y = 14\)

(iv) \(5x - 3y = 11\); \(-10x + 6y = -22\)

**Answer 3:**

(i) \(3x + 2y = 5\)
\(2x - 3y = 7\)

Here, \(\frac{a_1}{a_2} = \frac{3}{2}\) and \(\frac{b_1}{b_2} = \frac{2}{-3}\)

\(\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}\), so, pair of linear equations are consistent.

(ii) \(2x - 3y = 8\)
\(4x - 6y = 9\)

Here, \(\frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}\), \(\frac{b_1}{b_2} = \frac{-3}{-6} = \frac{1}{2}\) and \(\frac{c_1}{c_2} = \frac{8}{9}\)

\(\Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}\), so, pair of linear equations are inconsistent.

(iii) \(\frac{3}{2}x + \frac{5}{3}y = 7\)
\(9x - 10y = 14\)

Here, \(\frac{a_1}{a_2} = \frac{3/2}{9} = \frac{1}{6}\) and \(\frac{b_1}{b_2} = \frac{5/3}{-10} = -\frac{1}{6}\)

\(\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}\), so, pair of linear equations are consistent.

(iv) \(5x - 3y = 11\)
\(-10x + 6y = -22\)

Here, \(\frac{a_1}{a_2} = \frac{5}{-10} = -\frac{1}{2}\), \(\frac{b_1}{b_2} = \frac{-3}{6} = -\frac{1}{2}\) and \(\frac{c_1}{c_2} = \frac{11}{-22} = -\frac{1}{2}\)
\[ \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}, \text{ so, pair of linear equations are consistent.} \]

(v) \[ \frac{4}{3}x + 2y = 8 \]
\[ 2x + 3y = 12 \]
Here, \[ \frac{a_1}{a_2} = \frac{4}{3} = \frac{2}{3}, \quad \frac{b_1}{b_2} = \frac{2}{3} \quad \text{and} \quad \frac{c_1}{c_2} = \frac{8}{12} = \frac{2}{3} \]
\[ \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}, \text{ so, pair of linear equations are consistent.} \]

**Question 4:**
Which of the following pairs of linear equations are consistent/inconsistent? If consistent, obtain the solution graphically:

(i) \[ x + y = 5, \quad 2x + 2y = 10 \]
(ii) \[ x - y = 8, \quad 3x - 3y = 16 \]
(iii) \[ 2x + y - 6 = 0, \quad 4x - 2y - 4 = 0 \]
(iv) \[ 2x - 2y - 2 = 0, \quad 4x - 4y - 5 = 0 \]

**Answer 4:**

(i) \[ x + y = 5 \quad \text{... (1)} \]
\[ 2x + 2y = 10 \quad \text{... (2)} \]
Here, \[ \frac{a_1}{a_2} = \frac{1}{2}, \quad \frac{b_1}{b_2} = \frac{1}{2} \quad \text{and} \quad \frac{c_1}{c_2} = \frac{5}{10} = \frac{1}{2} \]
\[ \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}, \text{ so, pairs of linear equations are consistent.} \]

For three solutions of each equation,

Form equation (1), we get,

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

From equation (2), we get

\[ x = \frac{10 - 2y}{2} \]

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

(ii) \[ x - y = 8 \quad \text{... (1)} \]
\[ 3x - 3y = 16 \quad \text{... (2)} \]
Here, \[ \frac{a_1}{a_2} = \frac{1}{3}, \quad \frac{b_1}{b_2} = \frac{-1}{-3} = \frac{1}{3} \quad \text{and} \quad \frac{c_1}{c_2} = \frac{8}{16} = \frac{1}{2} \]
\[ \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}, \text{ so, pairs of linear equations are inconsistent.} \]

(iii) \[ 2x + y - 6 = 0 \quad \text{... (1)} \]
\[ 4x - 2y - 4 = 0 \quad \text{... (2)} \]
Here, \[ \frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2} \quad \text{and} \quad \frac{b_1}{b_2} = \frac{1}{-2} \]
\[ \Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2}, \text{ so, pairs of linear equations are consistent/inconsistent} \]

For three solutions of each equation,
From equation (1), we get
\[ x = \frac{6 - y}{2} \]

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

From equation (2), we get
\[ x = \frac{4 + 2y}{4} \]

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

(iv) \[ 2x - 2y - 2 = 0 \] \[ 4x - 4y - 5 = 0 \]

Here, \[ \frac{a_1}{a_2} = \frac{2}{4} = \frac{1}{2}, \quad \frac{b_1}{b_2} = \frac{-2}{-4} = \frac{1}{2}, \quad \text{and} \quad \frac{c_1}{c_2} = \frac{-2}{-5} = \frac{2}{5} \]

\[ \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}, \] so, pairs of linear equations are inconsistent.

**Question 5:**
Half the perimeter of a rectangular garden, whose length is 4 m more than its width, is 36 m. Find the dimensions of the garden.

**Answer 5:**
Let the breadth of garden = \( x \) m and
Let the length of the garden = \( y \) m
Half of the perimeter = 36 m
\[ \Rightarrow \frac{1}{2} [2(x + y)] = 36 \]
\[ \Rightarrow x + y = 36 \] \[ \text{... (1)} \]

According to question, length is 4 m more than its width, so
\[ y = x + 4 \] \[ \text{... (2)} \]

To get three solutions of each equation,

Form the equation (1), we get
\[ x = 36 - y \]

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>36</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>36</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

From the equation (2), we get
\[ y = x + 4 \]

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>8</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

Both the lines intersect at \((16, 20)\). So, the breadth of the garden is 16 m and the length is 20 m.
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Question 6:
Given the linear equation \(2x + 3y - 8 = 0\), write another linear equation in two variables such that the geometrical representation of the pair so formed is:

(i) intersecting lines  
(ii) parallel lines  
(iii) coincident lines

Answer 6:
(i) Given line \(2x + 3y - 8 = 0\) intersect the line \(x + 3y - 10 = 0\), as
\[
\frac{a_1}{a_2} \neq \frac{b_1}{b_2}
\]

(ii) Given line \(2x + 3y - 8 = 0\) is parallel to \(4x + 6y - 9 = 0\), as
\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}
\]

(iii) Given line \(2x + 3y - 8 = 0\) is coincident to \(4x + 6y - 16 = 0\), as
\[
\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}
\]

Question 7:
Draw the graphs of the equations \(x - y + 1 = 0\) and \(3x + 2y - 12 = 0\). Determine the coordinates of the vertices of the triangle formed by these lines and the \(x\)-axis, and shade the triangular region.

Answer 7:
From the equation (1), we get
\[
x = y - 1
\]

<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>3</td>
</tr>
</tbody>
</table>

From the equation (2), we get
\[
x = \frac{12 - 2y}{3}
\]

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

The coordinates of the vertices of the triangle formed by these lines and the \(x\)-axis are \((-1, 0), (4, 0)\) and \((2, 3)\).