**Linear equations in two variables**

A linear equation is an equation of the form

\[ Ax + By = C \]

Notice that this equation has 2 variables: \( x \) and \( y \).

Consider the equation

\[ 2x + y = 5 \]

here the \( A \) term is 2
the \( B \) term is 1
the \( C \) term is 5

This equation has an infinite number of solutions and these solutions are expressed as **ordered pairs** written in the form \((x, y)\).

Order is very important, hence the name **ordered pairs**. The \( x \) is always first and the \( y \) is always second.
To find some solutions to the equation

\[2x + y = 5\]

we make a chart:

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

To fill out the "y" column, we substitute 2 for \( x \) and solve for \( y \).

If \( x = 2 \), we have

\[
2(2) + y = 5 \\
4 + y = 5 \\
y = __
\]

So we can fill out the chart:

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

As an ordered pair, we write this solution \((2, 1)\) indicating that when \( x = 2 \), \( y = 1 \).
Consider the equation

\[ x + y = 3 \]

To find ordered pairs that satisfy this equation we set up a chart:

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>fill in the corresponding y values</td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
</tr>
</tbody>
</table>

Note: We can choose any value for x and find its corresponding y-value, but it is helpful to choose small, whole numbers to make the calculations a bit easier.

Example 1: Find three solutions to the equation

\[ 2x - y = 4 \]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
</table>
Plotting Solutions:

Consider the equation

\[ x + 3 = 5 \]

The solution to this single variable equation is \( x = 2 \).

We can plot this solution on a number line:

\[ \begin{align*}
\text{-3} & \quad \text{-2} & \quad \text{-1} & \quad 0 & \quad 1 & \quad 2 & \quad 3 \\
\end{align*} \]

Since linear equations have two variables, we require two number lines to plot solution points.
This coordinate system is known as the **cartesian coordinate system**

- The point \((0, 0)\) is called the **origin** and denotes the solution \(x=0\) when \(y=0\).

- The cartesian coordinate system is made up of **4 quadrants** labeled above.
Example 2:

Plot the following points on the graph above:

A) (3, 2)
B) (-2, 1)
C) (6, -2)
D) (-4, -3)
E) (0, 0)
F) (0, 3)
G) (-3, 0)
H) (6, 0)
Linear equations in 2 variables - Practice Problems

1. Find at least 3 solutions to the linear equation
   \[ x + 2y = 7 \]

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

2. Does the point \((-3, 2)\) satisfy the equation
   \[ 2x + y = 1 \]

3. Does the point \((-8, 2)\) satisfy the equation
   \[ x = -4y \]
4. Plot the following points on the graph above:

A) \((-1, 1)\)

B) \((4, 3)\)

C) \((-7, -2)\)

D) \((-4, -2)\)

e) \((0, -2)\)

f) \((-3, 0)\)