The Cartesian Coordinate System and Linear Equations in Two Variables

When graphing equations in two dimensions a rectangular coordinate system is used. This system is created when two number lines are placed perpendicular to each other, crossing at their zero values, (Graph A).

In Graph B we see that four regions or quadrants are formed when the axis cross each other.

This graph shows how they named. Points that are found in a quadrant share their sign values with all other points in the same quadrant: QI: (+, +) QII: (-, +) QIII: (-, -) QIV: (+, -)
Another convention used is that each axis is given a letter designation, \( x \) for the horizontal axis and \( y \) for the vertical. Points are a set of ordered pair in the form of \((x, y)\). These coordinate values are found by tracing their location first to the \( x \) axis and then to the \( y \).

**Example 1:** Plot each point on the same axes.

- \( A = (2, 2) \)
- \( B = (-1, 2) \)
- \( C = (3, 1) \)
- \( D = (-3, 0) \)
- \( E = (3, 0) \)
- \( F = (2, -1) \)
- \( G = (-2, -2) \)
- \( H = (0, 1) \)
- \( I = (0, -2) \)

**Solution**

![Graph showing points plotted on a coordinate plane.](image)

An equation such as \( y = 3x - 4 \) has two variables, \( x \) and \( y \). The equation defines the relationship between these variables. The \( x \) variable is in independent variable and \( y \) is the dependent variable. The variable \( y \) is called the dependent variable because its value depends on the value of \( x \).

From this equation we could produce ordered pairs \((x, y)\) that are solutions of the equation. The collection of the ordered pairs is referred to as a relation.

The equation can then be used to determine if a set of ordered pairs are solutions for the given equation.
Example 2. Determine if the ordered pairs satisfy the equation $2x = y + 3$.
(1, -1), (-3, -9), (0, 3)

Solution:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1, -1)</td>
<td>(-3, -9)</td>
<td>(0, 3)</td>
</tr>
<tr>
<td>$2x = y + 3$</td>
<td>$2x = y + 3$</td>
<td>$2x = y + 3$</td>
</tr>
<tr>
<td>$2(1) = -1 + 3$</td>
<td>$2(-3) = -9 + 3$</td>
<td>$2(0) = 3 + 3$</td>
</tr>
<tr>
<td>2 = 2</td>
<td>-6 = -6</td>
<td>0 = 6</td>
</tr>
<tr>
<td>true</td>
<td>true</td>
<td>false</td>
</tr>
</tbody>
</table>