In Section 6.1, we saw that the equation \( x + 2y = 9 \) had more than one solution.

In fact, this equation has _______________________ solutions. We can choose a value for one of the variables and solve for the other variable.

Since there are infinitely many solutions, we cannot list them all. Instead, we represent the set of solutions using the **rectangular (Cartesian) coordinate system**.

For the equation \( x + 2y = 9 \), we can plot some of the solutions as ordered pairs.

Notice that the solutions all appear to…..

The graph of this equation is a _______________ and all points (ordered pairs) on the line satisfy the equation. Note there are infinitely many solutions!

*Note:* It takes ________ points to draw a line.

Since the graph of all its solutions takes the form of a straight line, \( x + 2y = 9 \) is called a ____________________________________.

A **linear equation in two variables** (in **standard form**) appears as: \( Ax + By = C \)

where A, B, C are real numbers but both A and B cannot equal 0 at the same time

*Note:* The exponent on \( x \) and \( y \) is implied to be ________.
Example 1: Determine if the following are linear equations in two variables. If it is, write in standard form.

a) \( x^2 + y = 4 \)

b) \( y = \frac{1}{2} x + 4 \)

c) \( x = -8 \)

Example 2: Graph each of the following linear equations.

a) \( y = 2x \)

b) \( y = -2x \)
c) \( y = -\frac{1}{2}x \)

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

Review the graph of \( x + 2y = 9 \) from earlier.

We can see that the graph crosses the \( y \) axis at \( \underline{__________,} \), and if we extended the \( x \) axis, the graph crosses the \( x \) axis at \( \underline{______________}. \)

The points at which the graph crosses the axes are called intercepts.

- An \textit{x intercept} is where a graph crosses (or touches) the \( x \) axis.

- A \textit{y intercept} is where a graph crosses (or touches) the \( y \) axis.
**Example 3:** Consider the following graphs. Determine the \(x\) and/or \(y\) intercept(s) for each.

a) ![Graph a]

b) ![Graph b]

c) ![Graph c]

d) ![Graph d]

Consider all the intercepts we found. For the \(x\) intercepts, the \(y\) value is always _______ and for the \(y\) intercepts, the \(x\) value is always ______.

So…
- To find an \(x\) intercept, set \(y = 0\) and solve for \(x\). It will be an ordered pair \((a, 0)\).
- To find a \(y\) intercept, set \(x = 0\) and solve for \(y\). It will be an ordered pair \((0, b)\).

Since we only need 2 points to graph a line (and use a 3\textsuperscript{rd} point to check), we can use try finding the \(x\) and \(y\) intercepts to graph a linear equation in 2 variables!

**Example 4:** Graph \(2x + y = 4\) by finding the intercepts.
Application

*Example 5:* The revenue $y$ (in billions of dollars) for Home Depot during the years 1998-2001 is given by the equation $y = 8x + 30$ where $x$ is the number of years after 1998. Use this equation to estimate the revenue for Home Depot in 2000.