**Equation of a Line (Functional Form)**

*Recall :* How to calculate the slope of a line given two points

A (x1, y1) and B (x2, y2) Slope = y2 – y1

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x2 – x1

* Positive Slope – increase
* Negative Slope decrease

The equation of a line in functional form:

b= y-intercept or initial value

y = ax + b

a = slope

*Vocabulary:*

* The y-intercept is the value on the y-axis where the line crosses the y-axis
* The x-intercept is the value on the x-axis where the line crosses the x-axis

Slope is negative because it is going downwards

Slope = y2 – y1

 = 0 – 6

 = -6

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x2 – x1

\_\_\_\_\_
 8 – 0

\_\_ or-0.75
 8

A (0, 6)

B (8, 0)

**From a graph, how do we determine the equation of a line?**

1. Determine two points on the line that are given or easy to find (perfect points) and label them.

A (0 ,5)

B (10, 15)

(x1, y1)

(x2, y2)

a = y2 – y1

 = 15 – 5

 = 10 or 1

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x2 – x1

\_\_\_\_\_
 10 – 0

\_\_\_
 10

1. Calculate the slope
2. Calculate the value of the y-intercept b = y1 – a­(x1)

 = 5 – 1(0)

 = 5 – 0

 **b = 5**

Sometimes we encounter **vertical lines or horizontal lines**

The equation for a **vertical** line is x = c ; where c is the x-intercept

X = 9

( 9, 0 )

**\* the slope of this line is said to be “undefined” or infinite \***

The equation for a **horizontal** line is y = c ; where c is the y-intercept

y = 6

( 0, 6 )

**\* the slope of this line is equal to 0 \***

 **Graphing a Line**

Here are a few methods for graphing a line that is given in **functional form**. Choose the way that works for you!

1. **Table of Values** : enter the x-values into the equation to get the y-values. Plot the points and join in a straight line.

Equation: y = 2x + 1



|  |  |
| --- | --- |
| **X** | **Y** |
| -1 | -1 |
| 0 | 1 |
| 1 | 3 |
| 2 | 5 |

1. **Rise over Run (slope!)** Equation: y = 3x – 5
* Plot the y-intercept
* Starting from the y-intercept…

**3 = 3 (rise = up 3)**

 **1 (run = right 1)**

**move up/down (RISE)** by the number of squares on the grid

then **right/left (RUN)**

1. **Intercept Method** Equation: y = -x + 4
* Plot the y-intercept (y = 4)
* Determine the x-intercept: replace y with 0 and solve for x!

0 = -x + 4

x = 4

* Plot the x-intercept and join in a straight line to the y-intercept

**General Form Equation of a Line**

Looks like : ax + by + c = 0

a is NOT the slope

b is NOT the y-intercept

So, how do we find the slope and the y-intercept?

Example:

2x + 4y – 6 = 0

Step 1 – Change the equation to functional form by isolating the y variable.

 2x + 4y -6 = 0 4y = -2x + 6

Step 2 – Divide both sides of the equation by the coefficient in front of y to get the equation back into the form of y = ax + b

 4y = -2x + 6 y = -0.5x + 1.5

\_\_\_ \_\_\_\_\_
 4 4

Slope = -0.5 or -1/2

Y-Intercept = 1.5

Example #2

3x – 6y + 15 = 0 -6y = -3x – 15 Y = ½ x + 2.5

Example #3

-30 + 10y = -2x 10y = -2x + 30 y = -0.2x + 3

Example #4

0 = 5y – x -5y = -x y = 0.2x

**Drawing a Line Using the General Form Equation**

We use the intercept method, which requires us to find both the x and y intercepts.

If we remember, the x intercept is the point on the line at which y = 0 and the y intercept is the point on the line at which x = 0

Therefore we need to replace each variable with 0 and solve for the other.

Example:

2x + 6y – 18 = 0

Make x = 0

2(0) + 6y – 18 = 0

Isolate and solve for y

This is the y-intercept or point (0,3)

6y = 18 6y = 18 y = 3

\_\_ \_\_
 6 6

Make y = 0

2x + 6(0) – 18 = 0

Isolate and solve for x

This is the x-intercept or point (9,0)

\_\_ \_\_
 2 2

2x = 18 2x = 18 x = 9

With these two points, you can plot them on a Cartesian plane and connect the two points with a line.

Try these examples...

3x + 6y – 12 = 0

2x + y = 6

X – 3y + 9 = 0

5x – 5y +5 = 0

2y + 4x = 8

4y = 16