**Equation of a Line**

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

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

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x2 – x1

The equation of a line in **functional form**:

b= y-intercept or initial value

a = slope

y = ax + b

To determine the equation of a line from a graph:

***Example # 1***

A (0 ,5)

B (10, 15)

**Step 1 – Pick and label two points as (x1, y1) and (x2, y2)**

(0,5) is (x1, y1) & (10,15) is (x2,y2)

**Step 2 – Determine the slope of the line**

Slope = $\frac{Δy}{Δx}$ = $\frac{y2-y1}{x2-x1}$ = $\frac{15-5}{10-0}$ = $\frac{10}{10}$ = 1

**Step 3 – Plug in a point into the BASE equation to replace the x and the y with actual numbers (also plug in the slope that you just found for the “a”) to solve.**

Y = ax + b

15 = 1(10) + b

15 = 10 + b

15 – 10 = b

5 = b

**Step 4 – Re-write the equation with the “a” and “b” filled in (leave the x and y)**

Y = 1x + 5

***Example # 2***

A (0, 6)

B (8, 0)

**Step 1 – Pick and label two points as (x1, y1) and (x2, y2)**

(0,6) is (x1, y1) & (8,0) is (x2,y2)

**Step 2 – Determine the slope of the line**

Slope = $\frac{Δy}{Δx}$ = $\frac{y2-y1}{x2-x1}$ = $\frac{0-6}{8-0}$ = $\frac{-6}{8}$ = $\frac{-3}{4}$

**Step 3 – Plug in a point into the BASE equation to replace the x and the y with actual numbers (also plug in the slope that you just found for the “a”) AND SOLVE**

Y = ax + b

0 = $\frac{-3}{4}$(8) + b

0 = -6 + b

0 + 6 = b

6 = b

**Step 5 – Re-write the equation with the “a” and “b” filled in (leave the x and y)**

y = $\frac{-3 }{4}$x+ 6

***Example #3***

**Step 1 – Pick and label two points as (x1, y1) and (x2, y2)**

(9,2) is (x1, y1) & (-9,-10) is (x2,y2)

**Step 2 – Determine the slope of the line**

Slope = $\frac{Δy}{Δx}$ = $\frac{y2-y1}{x2-x1}$ = $\frac{-10-2}{-9-9}$ = $\frac{-12}{-18}$ = $\frac{2}{3}$

**Step 3 – Plug in a point into the BASE equation to replace the x and the y with actual numbers (also plug in the slope that you just found for the “a”)**

Y = ax + b

-6 = $\frac{2}{3}$ (-3) + b

**Step 4 – Simplify the equation and isolate the “b” to solve for the variable**

-6 = $\frac{2}{3}$ (-3) + b

-6 = -2 + b

-6 + 2 = b

-4 = b

**Step 5 – Re-write the equation with the “a” and “b” filled in (leave the x and y)**

y = $\frac{2}{3}$ x – 4

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 equation for a horizontal line is y = b ; where b is the y-intercept

y = 6

( 0, 6 )

**Practice – Determine the equations of the lines**



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**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 = $\frac{-1}{2}$x + 1.5

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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 = $\frac{-1}{5}$x + 3

Example #4

0 = 5y – x -5y = -x y = $\frac{1}{5}$x

**Practice – Determine the Slopes and y-intercepts**

3*x* + 4*y* -12 = 0

-4*x* + 3*y* = 24

2*x* - *y* = 10

3*x* + 4*y* – 36 = 0

-3*x* - 2*y* = 48