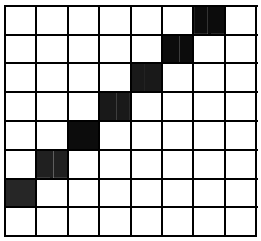
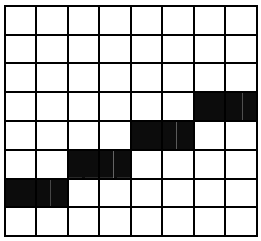
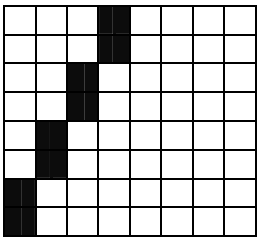
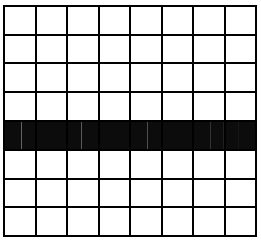
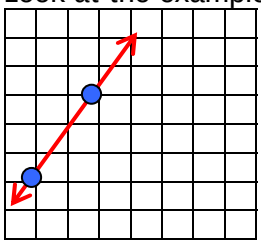
5-4-1 Slope

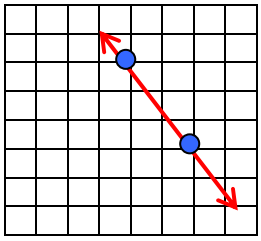
Imagine the above pictures to be stairs. In the first set, you go up one step for each one over. The second kind of steps might be found at a park. You go up one step for each two steps forward. The third set is like the steps in grandma's house. You climb up two for each one step over. The last is flat ground. You climb zero for each step forward.

Slope tells the steepness of things like roads or stairs. Slope is the ratio of rise to run. $^{rise}/_{run}$
Rise is the distance up from one point to the next. Rise might be negative if the line is actually going down. Run is the distance from left to right.

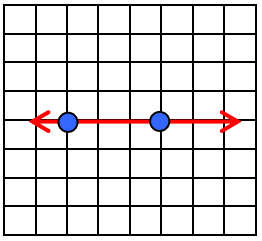
The numerical value of the slope of the above stairs in order from left to right are $^{1}/_{1}$=1, ½, $^{2}/_{1}$=2, $^{0}/_{1}$=0.
Look at the examples below. Count the rise and run of each



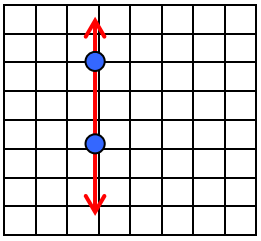
Positive
Up 3, Over 2
Slope 3/2



Negative
Down 3, Over 2
Slope -3/2



Zero
Up 0, Over 3
Slope 0/3=0



Undefined
Up 3, Over 0
Slope Undefined.

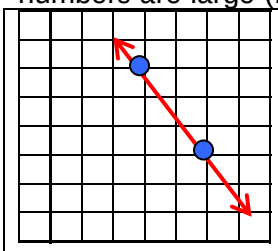
Any vertical line has an undefined slope because zero (the run) cannot go in a denominator. If you don't believe me try it on your calculator.

An uphill line left to right has positive slope.
A downhill line left to right has negative slope.
A horizontal line has slope of zero.
A vertical line has undefined slope.

NEVER DIVIDE BY ZERO!

Think about division.
12/3=4 because 3x4=12.
What could 12/0=?
?x0 would have to equal 12.
This can not happen.

To find the slope between two points, you could plot and count the rise and run. However, if the numbers are large (234, 5003) and (721, 834) counting isn't practical.



The points in the example are (3, 6) and (5, 3). Count the rise for the example. Find the difference (subtract) between 6 and 3. The y values and the rise both deal with the vertical. The rise is 3.
The run works the same way using the x coordinate. 3 - 5=-2
$\frac{\text{Rise}}{\text{Run}} = \frac{6 - 3}{3 - 5} = \frac{3}{-2}$ The slope is $-^{3}/_{2}$

The difference of the "y"s
Gives the numerator; rise
Then use the "x"s for the run.
Make the ratio. Slope is done.

For two points (x_1,y_1) and (x_2,y_2)

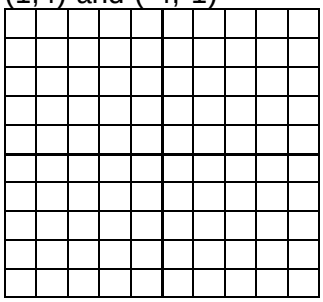
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{rise}{run}$$

When $x_1 \neq x_2$

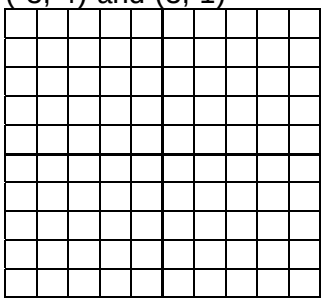
Memorize this formula.

Examples: Find the slope of the lines containing the given points. Use both counting and the formula.

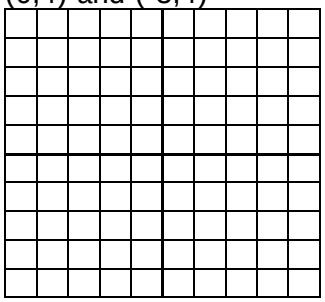
(1,4) and (-4,-1)



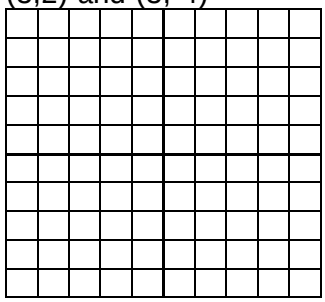
(-3, 4) and (3, 1)



(0,4) and (-3,4)



(3,2) and (3,-4)



First write the formula to follow. Then fill in the values in the correct positions. Simplify.

$$m = \frac{\_}{\_}$$

$$m = \frac{-1-4}{-4-1} = \frac{-5}{-5} = 1$$

Practice: Use the formula to find the slope of the line through the given points. Watch negatives and be careful with fractions.

a) (5, 6) and (7,12)	(3, 2) and (7,15)	(1,1) and (13, 5)	(5, 8) and (10, 12)
b) (2/3 , 1/2) and (3, 3/4)	(7/8, 6 2/3) and (8 1/2 , 7 3/4)	(1 5/8, 3 ¾) and (4 ½ , 5 2/3)	(2 ¼, 3 2/3) and (4 2/3, 6 ½)
c) (- 5, -6) and (7,12)	(- 3, -2) and (7,15)	(-1,-1) and (13, 5)	(-5, -8) and (10, 12)
d) (-2/3 , -1/2) and (3, 3/4)	(-7/8, -6 2/3) and (8 1/2 , 7 3/4)	(-1 5/8, -3 ¾) and (4 ½ , 5 2/3)	(-2 ¼, -3 2/3) and (4 2/3, 6 ½)
e) (5, -6) and (7,12)	(3, 2) and (7, -15)	(1, -1) and (13, -5)	(5, -8) and (10, -12)
f) (2/3 , -1/2) and (3, -3/4)	(7/8, -6 2/3) and (8 1/2 , -7 3/4)	(1 5/8, -3 ¾) and (4 ½ , -5 2/3)	(2 ¼, -3 2/3) and (4 2/3, -6 ½)
g) (-5, -6) and (-7,-12)	(-3, -2) and (-7,-15)	(-1,-1) and (-13,- 5)	(-5, -8) and (-10, -12)
h) (-2/3 , -1/2) and (-3, -3/4)	(-7/8, -6 2/3) and (-8 1/2 , - 7 3/4)	(-1 5/8, - 3 ¾) and (- 4 ½ , -5 2/3)	(-2 ¼, -3 2/3) and (-4 2/3, -6 ½)
i) (-5, 6) and (7,-12)	(-3, 2) and (7,-15)	(-1,1) and (13, -5)	(-5, 8) and (10, -12)
j) (-2/3 , 1/2) and (3,- 3/4)	(-7/8, 6 2/3) and (8 1/2 , -7 3/4)	(-1 5/8, 3 ¾) and (4 ½ , -5 2/3)	(-2 ¼, 3 2/3) and (4 2/3, -6 ½)

k) (9 , 5) and (12 , 5)	(½ ,1/3) and (2, 1/3)	(30, 235) and (10, 235)	(-8, 34) and (3, 34)
l) (3, 5) and (3, 6)	(½ , 5) and (½ , 20)	(542, 10) and (542, -5)	(-6, -8) and (-6, 34)

Find the slope for each line. Choose points that look like they are on the line. you will have estimate in some cases. Figure or count the rise and run.