Name: ___________
Date: ____________

GRADE 11 ESSENTIAL
UNIT F - RELATIONS AND PATTERNS
WORKSHEET 2
CALCULATING SLOPE, HORIZONTAL LINES, VERTICAL LINES

1. The **slope** of a line is the same as the slope (or *direction*) between any two points on the line.

2. The **slope** of the line has been defined as how much a line **rises divided** by how much it ***runs to the right***. $slope \equiv m \equiv \frac{\Delta y}{\Delta x} = \frac{rise}{run}$

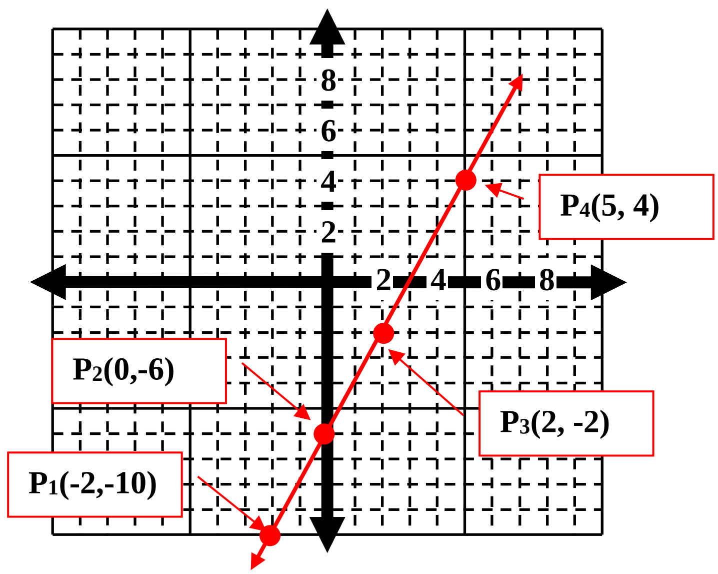
3. In other words the slope of a line is the **change** in the ***y*** divided by the change in the ***x*** between any two points on the line. It is a ratio comparison.

$$slope \equiv m \equiv \frac{increase\ in\ y}{increase\ in\ x}$$

4. Slope can now be *defined* as: $m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$; as shown below.

5. **Example**: line ***y* = 2*x* - 6**

Point	x	y
P_1	-2	-10
P_2	0	-6
P_3	2	-2
P_4	5	4



Lets pick any two points; say P_1 and P_2

The change in *y* to go from P_1 to P_2 is +4

The change in *x* to go from P_1 to P_2 is +2

So the slope is **4/2** or **m = 2**

6. You don't actually have to count lines on a graph!. You can just find the difference between the ***x*** coordinates and then the ***y*** coordinates of two points. (remember how ***difference*** means ***subtract***!). Let's do it for P_1 and P_2 above.

$$slope = m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-6 - (-10)}{0 - (-2)} = \frac{+4}{+2} = 2$$

7. **You** try finding the slope between P_3 and P_4 now. It should be exactly the same as above since a line has a constant slope. Use the slope formula to calculate the slope.

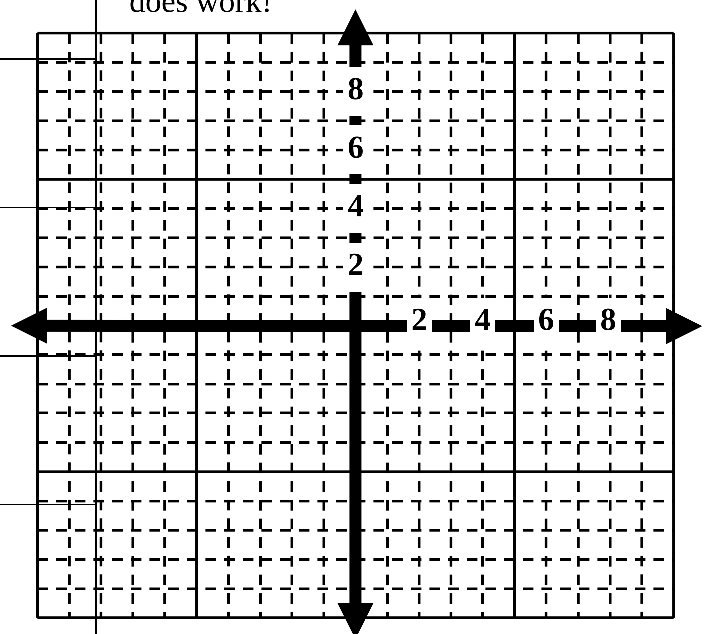
$$slope = m = \frac{y_4 - y_3}{x_4 - x_3} =$$

8. Find the slope for different lines that have the following points on them:

Caution!! Watch those 'minus minuses'. Subtracting a negative is the <u>same as adding</u>!

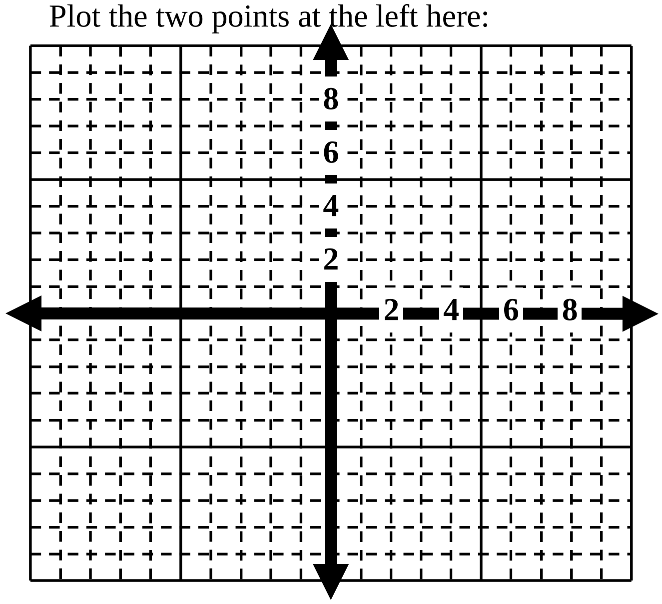
P_1	P_2	Slope
(0, 0)	**(2, 8)**	
(0, 4)	**(2, 6)**	
(-3,-3)	**(7, 2)**	
(-5, 2)	**(-3,-3)**	
(3, 2)	**(5, -2)**	

Plot the points on the graph paper below also to see that the slope formula does work!



HORIZONTAL LINES

Plot the two points at the left here:



9. Calculate the **slope** of the line between the points **P_1(-2, 4)** and **P_2(5, 4).** Write it below showing formula!:

10. Try these points too:
P_1(-5, 7) and **P_2(2, 7)**

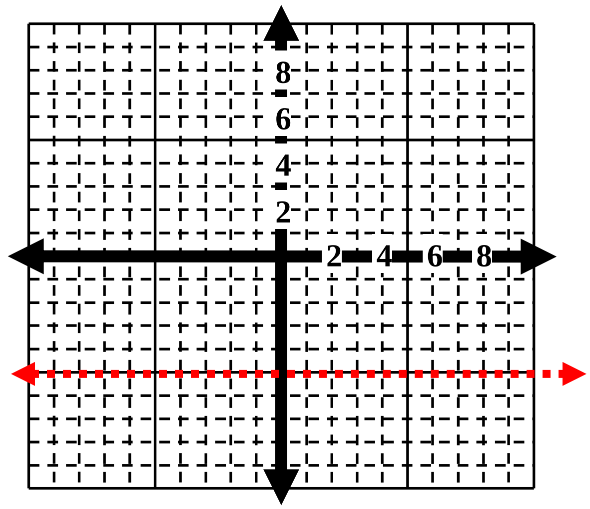
11. Notice the points on the lines above have the same y value. All points on the lines will have the same y-value. The lines are **Horizontal**. Both have a **slope of zero**. So their formula given ***y*=m*x* + b** is just ***y* = b**. In other words, ***y*** is a constant no matter what the ***x*** is! That is a **Horizontal line**!

think of horizon! The horizon is horizontal!

12. The equation for a *horizontal* line is just ***y = [a constant]***

13. Plot the following *horizontal* lines on the graph to the right

a.	**y = 8**
b.	**y = -2**
c.	**y = 3**
d.	**y = -7.25**



14. What is the equation for the dotted line?

VERTICAL LINES

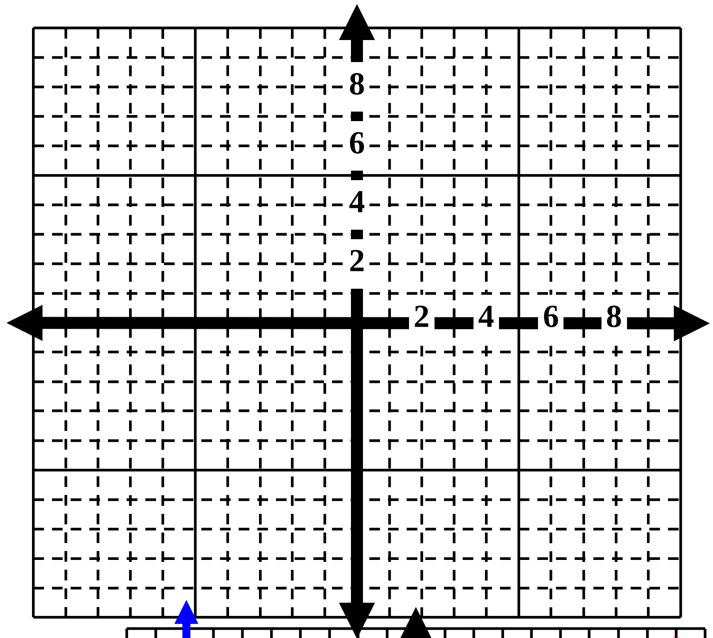
15. What is the slope of the line that contains the points **P_1(-5, -3)** and **P_2(-5, 7)?**

16. In mathematics, you can never get an answer by dividing by zero. (how can you ***divide*** something into zero bunches??). We say that the operation of dividing by **0** is ***undefined***. $\frac{3}{0}$ =? would mean that 0*? = 3. We have no way of having 0 bunches of something that makes 3 total

17. The equation for a **Vertical** line is just **x = [a constant].** All points on that vertical line have the same ***x*** value. The ***x*** value never changes for any specific vertical line.

18. Plot the following vertical lines:

a.	**x = -5**
b.	**x = 0**
c.	**x = 7**
d.	**x = -8.25**



SUMMARY

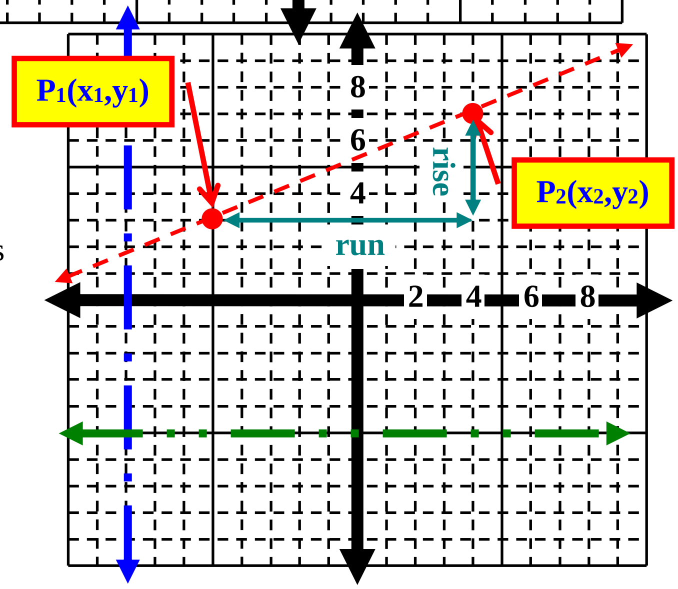
$$m = slope = \frac{rise}{run} = \frac{change in y}{change in x} = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

The slope of the dashed line to the right is

$$m = \frac{(7-3)}{(4-(-5))} = \frac{4}{9} or 0.44\bar{4}$$

Horizontal Line at right is: ***y* = -5**

Vertical Line at right is: ***x* = -8**



THINKING AHEAD – BRAIN TEASERS

Given a line: **y = 3x +2** , can you give an equation of a parallel line? (hint: a line that goes the same direction!)

How many different lines are there that are parallel to the one given above (**y = 3x + 2)** ?

What is another way to think about dividing by zero? (hint: can we divide by a number close to zero instead)