GRADE 10 MATH
LINEAR MODELS / COORDINATE GEOMETRY
WORKSHEET 4
LINE THROUGH TWO POINTS & PERPENDICULAR LINES

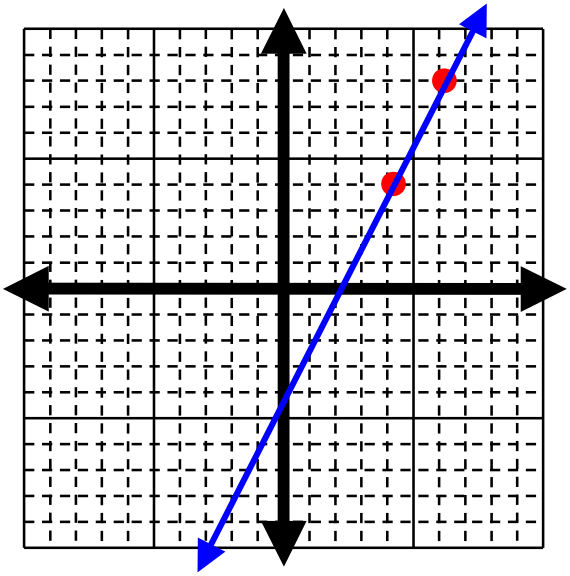
Name: _____
Date: _____

1. We have learned to graph lines
   a. given a slope and y-intercept (point slope form equation: y=mx+b)
   b. using an x and y intercept (standard form equation Ax+By=C)
   c. given a slope and ***any*** point that the line contains

2. We also know that a line can be made from just two points! Two points define a line! So how do we make a line given just two points $\mathbf{P_1(x_1,y_1)}$ and $\mathbf{P_2(x_2,y_2)}$

3. We know how to find the slope given two points: $m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$. And we know how to find an equation given one point and a slope. So know problem to find a line.

4. **Example**: Find the equation of the line that goes through the two points $\mathbf{P_1(4,4)}$ and $\mathbf{P_2(6,8)}$.

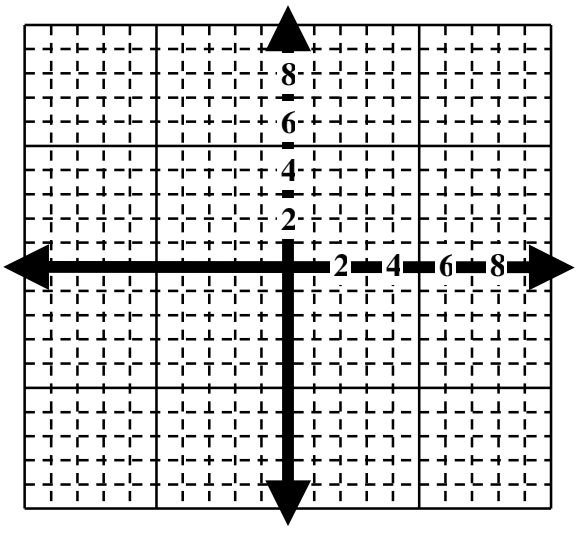


5. The slope is $m = \frac{8-4}{6-4} = 2$. We need the y-intercept now, ***b***.. so pick *one* point, say $\mathbf{P_2(6,8)}$. **8=2(6) + b**. So **b = -4**. So the equation of the line is **y = 2x - 4**

PRACTICE PROBLEMS

6. Given two points on a line calculate the equation of the line and plot it.

Line	P1	P2	Equation
A	(0, 0)	(8, 8)	
B	(2, 5)	(–4, –5)	
C	(5, 2)	(2, 7)	
D	(8,-8)	(-5,1)	



PERPENDICULAR LINES

7. We had learned that two lines that are parallel, ||, have the same slope. What about two lines that are perpendicular. ('*Perpendicular*' means intersect at a 90° angle).

8. It works out that two lines that are perpendicular have a special relationship between their slopes.

9. **Slopes of Perpendicular lines**. Say we have two lines:

   a. $\mathbf{L_1}$ with slope $\mathbf{m_1}$; and

   b. $\mathbf{L_2}$ with slope $\mathbf{m_2}$.

The relationship between the slopes of perpendicular lines is:

$$m_2 = -1 * \frac{1}{m_1} = -\frac{1}{m_1}$$

That is; the slopes of perpendicular lines are the ***negative reciprocals*** of each other. Another way to think about it is, if you multiply the two slopes together the product is –1.

$\mathbf{m_1 * m_2 = -1}$

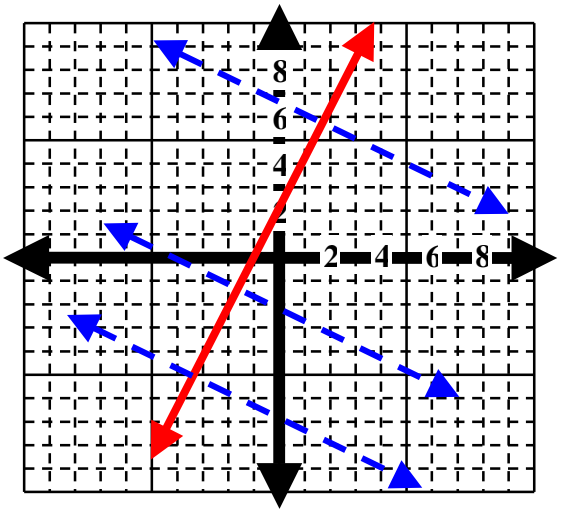
10. **Example**.

a. **Problem**. Find the equation of a line that is perpendicular to the line **y = 2x + 2**.

b. **Solution**. The slope, $\mathbf{m_2}$, of the perpendicular line will be $m_2 = -\frac{1}{m_1} = -\frac{1}{2}$

So any line that has a slope of –1/2 will be perpendicular to the line **y = 2x + 2.**

c. How many lines are there that are ⊥ to **y = 2x + 2?**



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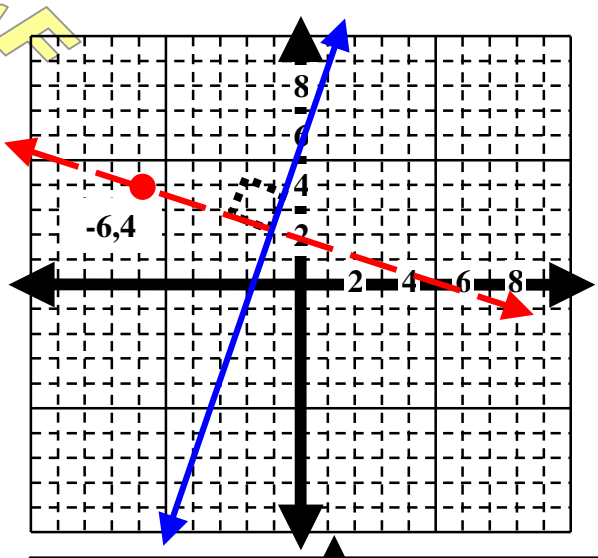
Find a Line that is ⊥ to another line and that runs through a given point.

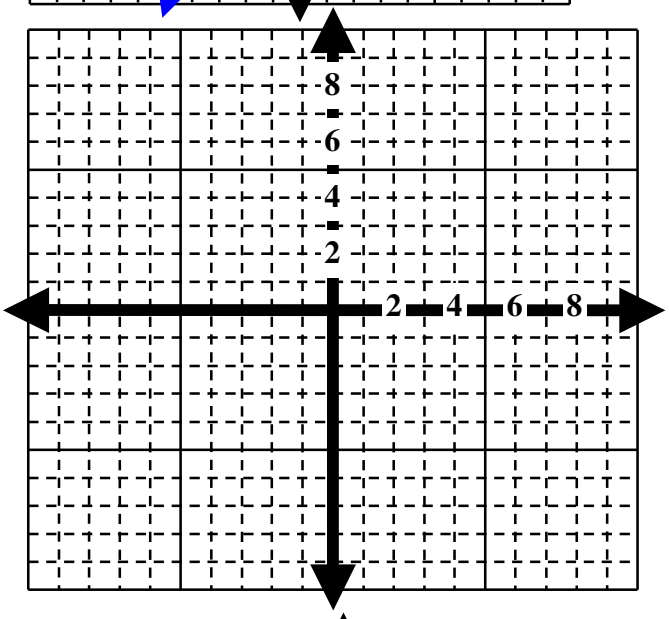
11. **Problem**: Find the equation of a line that is perpendicular to the line **y = 3x + 6** and that goes through the point **(-6, 4)**



12. **Solution**. The ⊥ line has a slope of **-1/3**. So it has the form **y = –x/3 + b**. but we know when **x = -6** that **y = 4**, so **4 = -(-6)/3 + b**. So **b = 2.** So **y = -x/3 + 2** is the ⊥ line**.**

13. **Practice Problems**. Calculate and graph the equations. Graph the given line and the perpendicular lines.

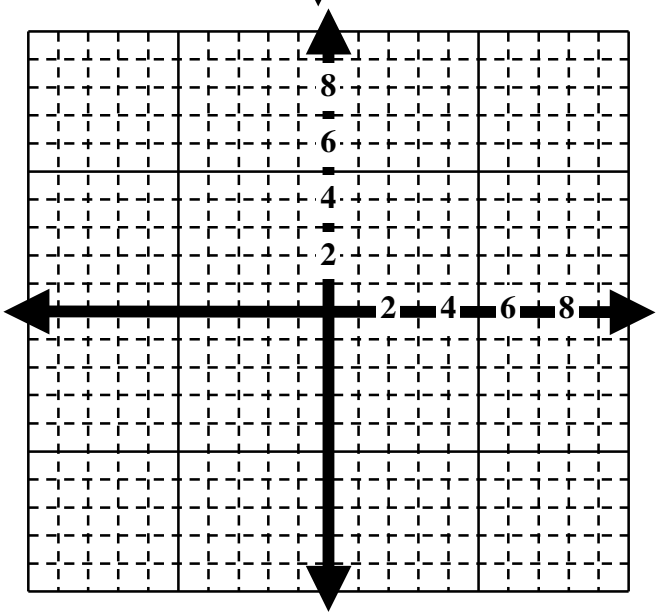
a. a line perpendicular to **y = 4x – 8** that runs through point **(–2, 2)**.



b. a line perpendicular to $y = -\frac{3}{8}x + 4$ and runs through **(0, –6)**

14. **More Practice Problems.** Calculate and graph the equations. Graph the given line and the perpendicular lines.

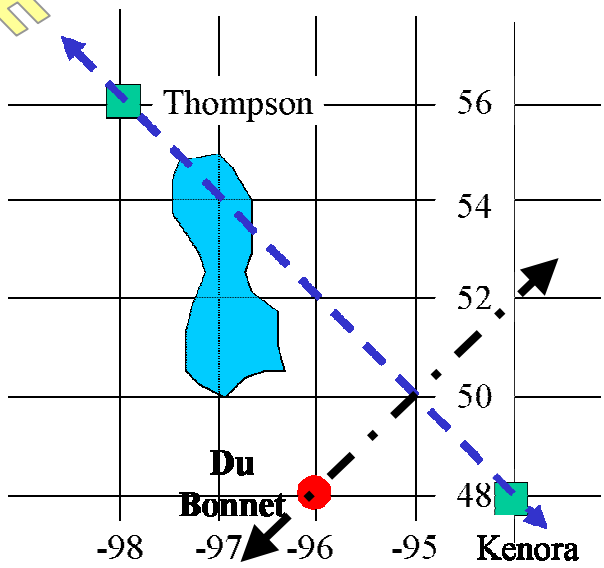
a. a line ⊥ to the line ***y = x*** that passes through point **(0, 0)**.



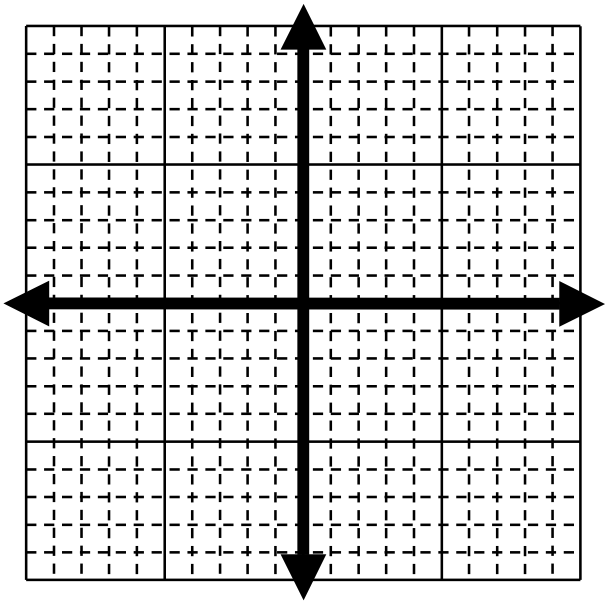
b. a line ⊥ to the line ***y*** = 0.6***x*** **+ 5** that passes through point **(0, 0)**.

15. **Practical Problem**

You are flying from Kenora to Thompson. Your flight track is given by the equation **y = –1x – 46** in your navigation computer. Air Traffic Control calls on the radio and says: "W*e can get you higher when you are abeam (**meaning** ⊥) to Lac Du Bonnet. Call when abeam*!". In other words, once your left wing tip seems to be pointing at Du Bonnet, you will make a radio call.



So what will your navigation computer calculate for the equation of the line that is perpendicular to your track but passes through Lac Du Bonnet? Lac Du Bonnet is at position **(–96, 48)**.



Answer: The line perpendicular to your flight track and that runs through Lac Du Bonnet is: **y = x + 144.** *(Use the graph paper at right if you really need to see the y-intercepts to believe it!). Try the graphing calculator too, since you can zoom into different parts of the graph that way.*