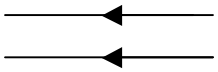
Date:

Parallel and Perpendicular Lines

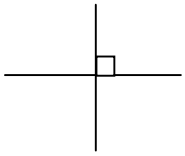
IMPORTANT DEFINITIONS

Parallel Lines:
Lines that run in the same direction and never cross. *Parallel lines have slopes that are equal*.



Note:
Matching arrow symbols indicate that lines are parallel.

Perpendicular Lines:
Lines that intersect at a right (90 degree) angle. *Perpendicular lines have slopes that are negative reciprocals*.



Notes:
A small box at the intersection indicates a 90 degree angle.

Ex. of a negative reciprocal:

$$\frac{2}{5} \rightarrow -\frac{5}{2}$$

Example 1:

Using the points given below, determine the slope of the line passing through the points, and determine which pairs of lines are parallel and which pairs are perpendicular.

Notation: If AB is parallel to CD, we write AB || CD.

If AB is perpendicular to CD, we write AB $\perp$ CD.

Recall: Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$

(x_1, y_1)	(x_2, y_2)	Slope (Steps)	Slope
A $(-4,7)$	B $(5,8)$	$m_{AB} = \frac{8-7}{5-(-4)} = \frac{1}{5+4}$	$\frac{1}{9}$
C $(-4,4)$	D $(-1,5)$		
E $(1,10)$	F $(2,7)$		
G $(7,-4)$	H $(10,2)$		
I $(6,12)$	J $(9,9)$		
K $(2,1)$	L $(6,2)$		
M $(-3,-3)$	N $(-2,-1)$		
O $(-1,-4)$	P $(4,-6)$		
Q $(-8,6)$	R $(-4,10)$		
S $(-5,2)$	T $(0,0)$		

From the table above, list any lines that are parallel or perpendicular.

Parallel lines: _____

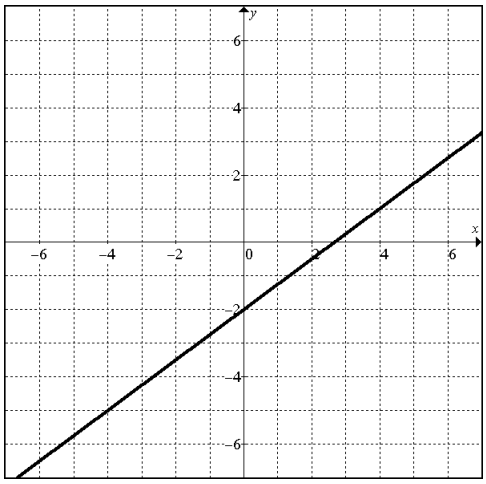
Perpendicular lines: _____

LEARNING GOALS:

- ☐ I can identify lines that are parallel and lines that are perpendicular.
- ☐ I can write equations of lines that are either parallel or perpendicular to each other.

Try it Yourself:

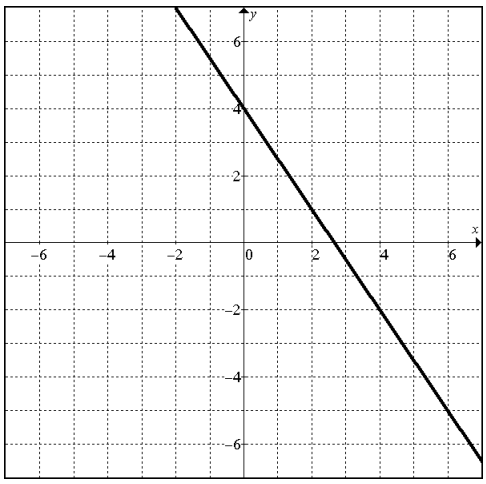
1. State the equation of the line shown on the Cartesian Plane given: _____



   a) Draw 3 lines that are parallel to the given line having y-intercepts of $-6,\ 0$ and 4.

   b) Label each of the lines you have drawn with their respective equations.

2. State the equation of the line shown on the Cartesian Plane given: _____



   a) Draw 3 lines that are perpendicular to the given line having y-intercepts of $-5,\ 0$ and 2.

   b) Label each of the lines you have drawn with their respective equations.

3. Beside each of the lines below, give its slope. Hint: "*x*-int" in the questions below is short for "*x*-intercept". *Work for these questions may be done on scrap paper.*

   a) The line $y = -2x - 1$ _____

   b) The line through (2,4) and (4,5) _____

   c) The line with *x*-int 5 and *y*-int 3 _____

   d) The line parallel to $y = 7 - \frac{3}{5}x$ _____

   e) The line with rise of 5 and run of 2 _____

   f) The line $y = x + 1$ _____

   g) The line through $(-3,1)$ and $(1,5)$ _____

   h) The line $y = \frac{2}{3}x + 5$ _____

   i) The line with rise of –2 and run 3 _____

   j) The line $\perp$ to $y = -\frac{3}{4}x - 1$ _____

   k) The line through $(4,-4)$ and $(2,-7)$ _____

   l) The line with *x*-int –2 and *y*-int –1 _____

In the space provided, list all pairs of lines from #3 above which are either parallel or perpendicular.

Parallel lines: _____ Perpendicular lines: _____

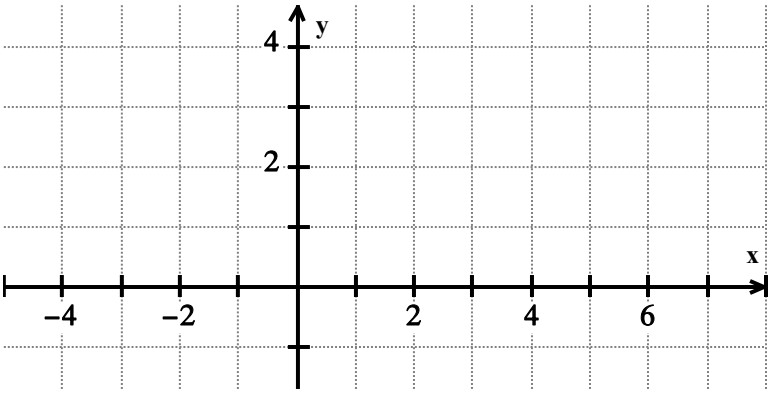
Answers:

$-2\ ;\ \frac{1}{2}\ ;\ -\frac{3}{5}\ ;\ -\frac{3}{5}\ ;\ \frac{5}{2}\ ;\ 1\ ;\ 1\ ;\ \frac{2}{3}\ ;\ -\frac{2}{3}\ ;\ \frac{4}{3}\ ;\ \frac{3}{2}\ ;\ -\frac{1}{2}$

c || d ; f || g ; a $\perp$ b ; i $\perp$ k

4. Determine whether or not the following set of points form a right triangle.
   Justify your answers with mathematical reasoning. A graph can be used as an aid.

   Vertices: A(3,-4) B(-1,-2) C(6,2)



5. Are the lines y=9 and x=-9 parallel or perpendicular? Explain.