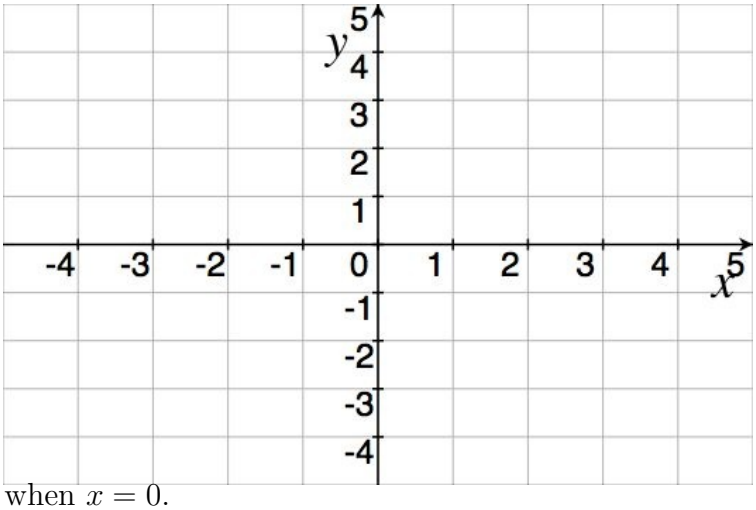
Functions

1. Let C be the piecewise defined function:

$$C(x) = \begin{cases} 3 + 2x & \text{if } -3 \leq x < 0 \\ x^2 - 2x & \text{if } 0 \leq 3 \end{cases}$$



   (a) Find $C(-2)$ and $C(2)$.

   (b) Find the output of the function C when $x = 0$.

   (c) Is C a function? Why or why not.

   (d) Given that C is a function, what is the domain of C?

   (e) Plot four points that are on the graph of C

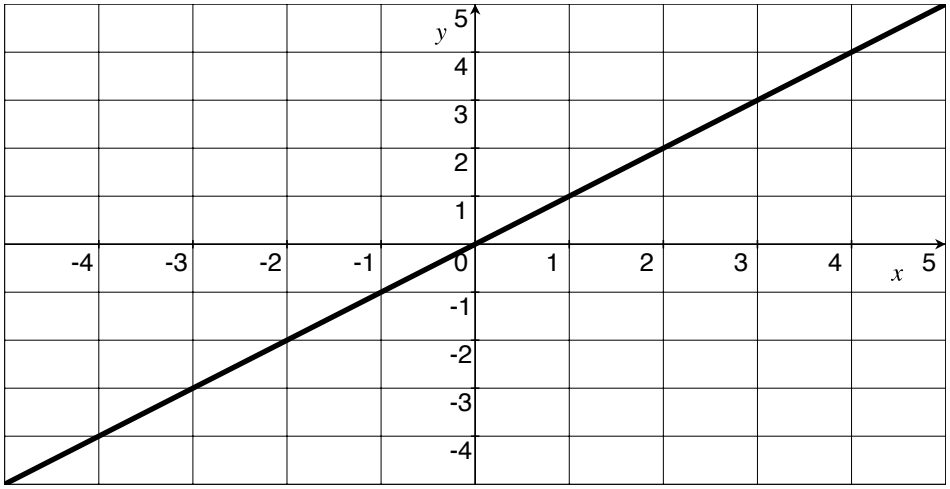
Slopes and Lines

Get into groups of two to three and work on the following. Elect one person to write up your answers neatly and turn the worksheet in by 10/13. You may need to arrange a meeting outside of class, so consider exchanging contact information.

1. Shape: Let $g(x) = 1 \cdot x$. The graph of g is plotted on the axis below and is an example of a line. All the functions on this worksheet will have graphs that are lines.

   (a) Let the function h have the rule $h(x) = -2 \cdot x$. We often suppress the multiplication sign and would instead write $h(x) = -2x$. Plot the graph of h on the set of axes below.

   (b) Plot the graphs of the functions $\alpha(x) = \frac{-1}{2}x$, $\beta(x) = 0x$, and $\gamma(x) = 3x$. You should have four different graphs drawn below by the end of this question.



   (c) For each graph above, determine if the graph defines a function or not.

   (d) For each graph above, find the x and y intercepts.

   (e) For each graph above, determine if the graph is increasing and decreasing.
   For example, the graph of g is increasing everywhere and decreasing no where.

   (f) Let f be the function with the rule $f(x) = mx$ where m be some fixed number (like 2, $\frac{1}{3}$, -4, etc...). Use your above observations to determine if the graph of f is increasing, decreasing, or doing neither if:

   - $m > 0$:
   - $m = 0$:
   - $m < 0$:

2. Slope:

   (a) Given two points: (a, b) and (c, d) on a line, explicitly find a formula for the slope.

   (b) Let $h(x) = -2x$ be the function you graphed in (1a). Find two points that are on the graph of h and compute the slope of the line defined by h.

   (c) If $f(x) = mx$ where m be some fixed number (like 2, $\frac{1}{3}$, -4, etc...), what is the slope of the graph of f?

3. Let δ be a linear function defined by $\delta(x) = h(x) - 2.5$ where h was the function defined in #1. Since $h(x) = -2x$ we could also write $\delta(x) = -2x - 2.5$. Identify the y-intercept of δ.

4. Let ϵ be the linear function defined by $\epsilon(x) = h(x) + 1$ where $h(x) = -2x$ again.

   (a) Find another way to write the rule of ϵ much like we did for the function δ.

   (b) Identify the y-intercept of ϵ.

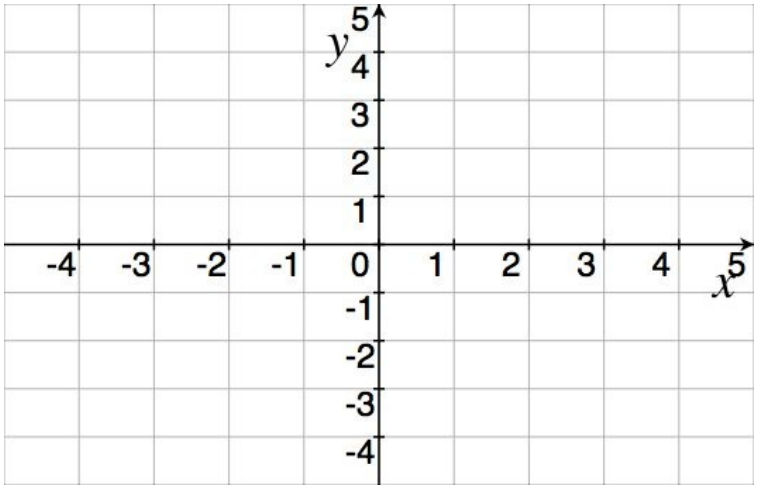
5. Let m and b be fixed numbers (like 2, $\frac{1}{3}$, -4, etc...) and define $f(x) = mx + b$.

   (a) Where is the y-intercept of f? (Consider looking at #3 & 4, if you need help.)

   (b) The rule of the function f is a special form called slope intercept form. Why does it have this name?

6. Use the the information from #5 to fill in the table below and then graph t, r, & s.

function	slope	y-intercept
$t(x) = -2x + 1$		
$r(x) = -2x - 2$		
$s(x) = \frac{-1}{2}x + 3$		



7. Let the graph of the function α be a line with slope $\frac{-1}{3}$ and assume the graph crosses the y-axis at $(0, 7)$. Find the rule of α without graphing it.

8. Let the graph of the function β be a line with slope $\frac{1}{2}$ and assume it passes through the point $(3, 4)$. Find the rule of β.

   Hint: Since you know what m is, write $\beta(x) = mx+b$, and try to solve for b by plugging in points. Otherwise, there is a "point-slope formula" that can be used that is on page 20. *Be warned, you will have no books or notes on the exam and quizzes so make sure whatever materials you use to answer this question can be memorized easily.*

9. Let the graph of the function γ be a line that passes through the points $(-1, 2)$ and $(2, -5)$, find the rule of γ.

10. Consider the graphs of two functions: $\delta(x) = m_1x+b_1$ and $\epsilon(x) = m_2x+b_2$ with slopes m_1 and m_2, respectively. If $|m_1| > |m_2|$, which graph is steeper?

11. Special Cases: What is the slope of a horizontal line? A vertical one? In each case, is the line the graph of a function?

12. Parallel Lines

    (a) Explain (in English) what parallel lines are.

    (b) If two lines are parallel, what is the relationship between their slopes?

    (c) Find the rule of a line that is parallel to $\frac{4}{7}x + \pi$ and passes through the point $(-1, 3)$.

13. Perpendicular Lines

    (a) Explain (in English) what it means for two lines to be perpendicular. Be specific.

    (b) If two lines are perpendicular, what is the relationship between their slopes?

    (c) Find the equation of a line perpendicular to the line that passes through $(-2, -1)$ and $(4, 3)$. Note: There are many right answers.