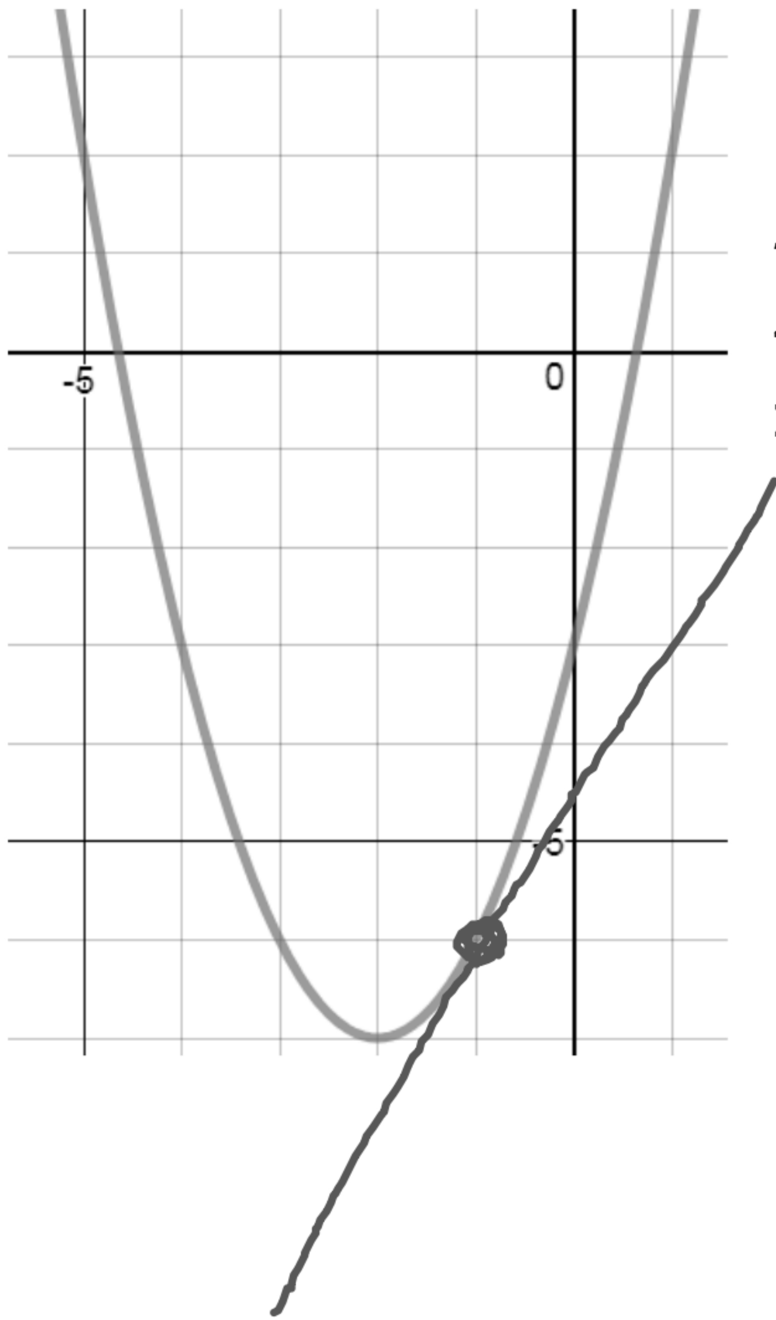
Do Now - 9/19/18

What is the slope of the line tangent to the function when x = -1?

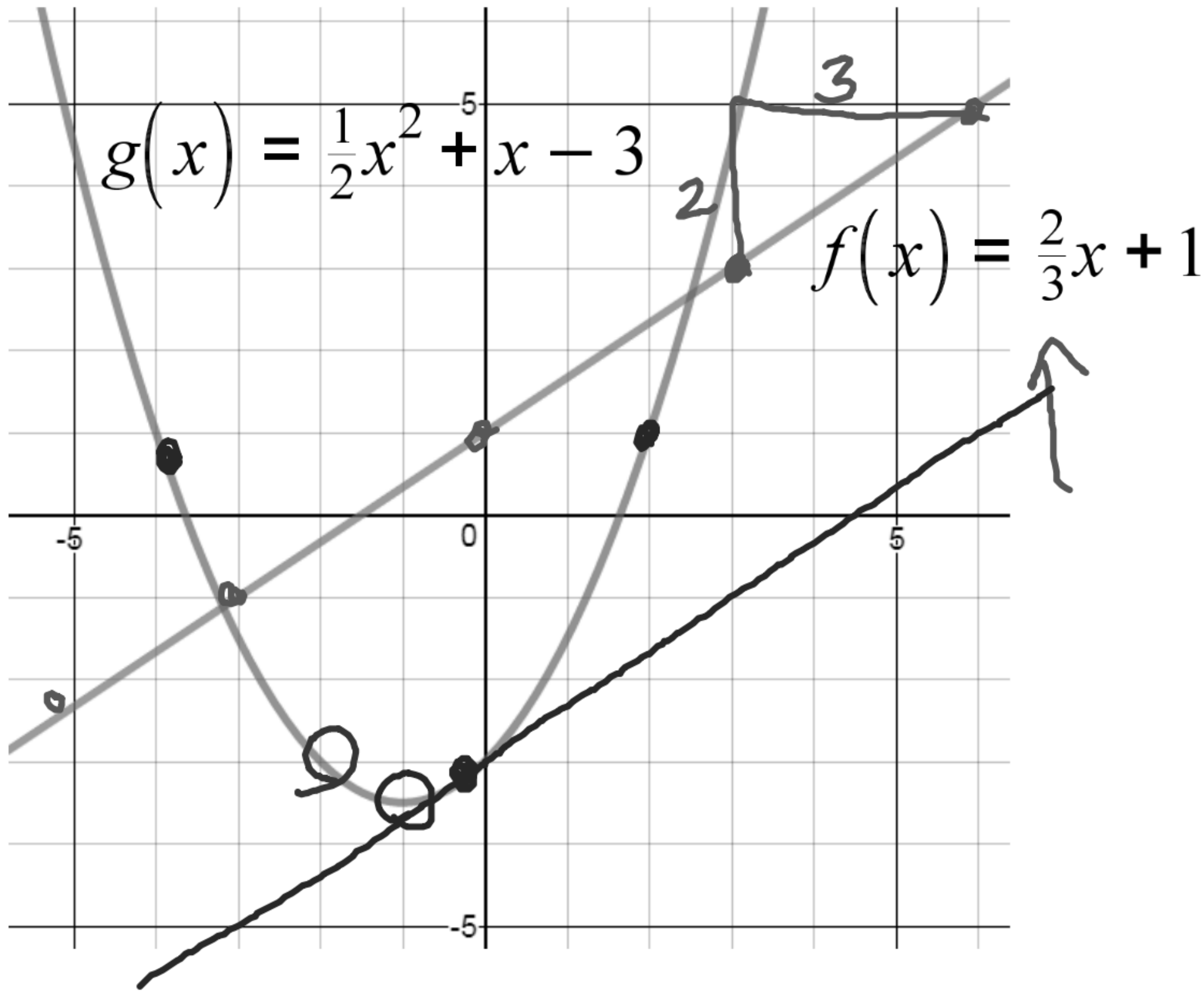


$y = x^2 + 4x - 3$

To guess the slope of the tangent line, find the slope of the secant line when $x_1 = -1$ and $x_2 = -1.001$

-1.000001

$$m = \frac{f(-1) - f(-1.001)}{-1 - -1.001} = 1.999$$

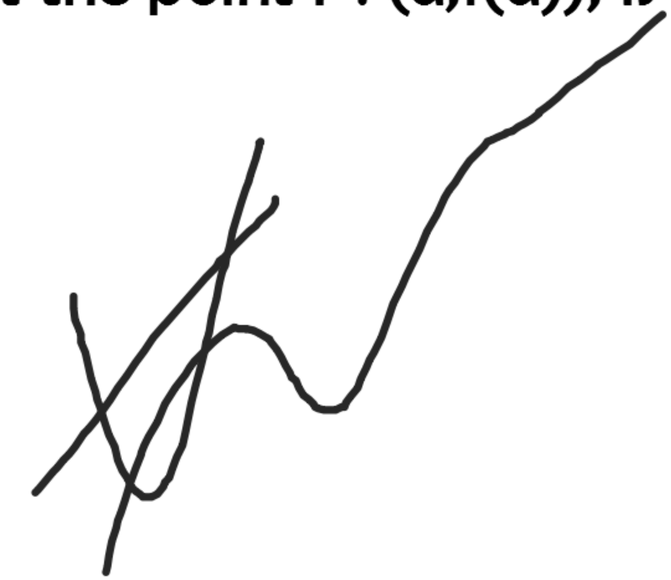


$g(x) = \frac{1}{2}x^2 + x - 3$
$f(x) = \frac{2}{3}x + 1$
5
-5
0
5
-5
3
2

Definition:

The **Tangent Line** to the curve y = f(x) at the point P: (a,f(a)), is the line through P with slope…

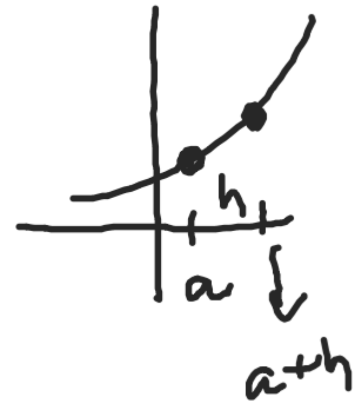
$$m = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$



provided that limit exists.

Note:
A second representation of m, instead of:

$$m = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$



is this:

$$m = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

...and this is a **derivative.** A **derivative** is the instantaneous slope, or the slope of the tangent line, of a function at a point *a*, and is denoted by $f'(a)$ provided the limit exists.

DERIVATIVE

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$ means the derivative at *a*.

Example: Use the definition of a derivative

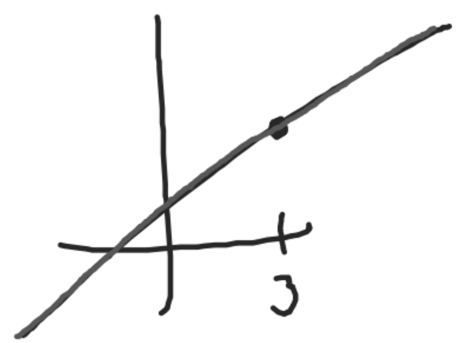
$$f'(a) = \lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$

to find the derivative of $f(x) = \frac{2}{3}x + 1$ when x = 3

$$f'(x) = \lim_{h\to 0}\frac{\frac{2}{3}(x+h)+1-\left(\frac{2}{3}x+1\right)}{h}$$

$$f'(x) = \lim_{h\to 0}\frac{\frac{2}{3}x+\frac{2}{3}h+1-\frac{2}{3}x-1}{h}$$

$$f'(x) = \lim_{h\to 0}\frac{\frac{2}{3}h}{h} = \boxed{\frac{2}{3}}$$



Example: Use the definition of a derivative

$$f'(a) = \lim_{h\to 0}\frac{f(a+h)-f(a)}{h}$$

to find the derivative of $f(x) = \frac{1}{2}x^2 + x - 3$ when x = -2

$$f'(a) = \lim_{h\to 0}\frac{\frac{1}{2}(a+h)^2+(a+h)-3-\left(\frac{1}{2}a^2+a-3\right)}{h}$$

$$= \lim_{h\to 0}\frac{\frac{1}{2}a^2+ah+\frac{1}{2}h^2+a+h-3-\frac{1}{2}a^2-a+3}{h}$$

$h\left(a+\frac{1}{2}h+1\right)$

$$= \lim_{h\to 0}\frac{ah+\frac{1}{2}h^2+h}{h}$$

$$= \lim_{h\to 0} a+\frac{1}{2}h+1 = a+1 = f'(a)$$

$$-2+1 = f'(-2)$$

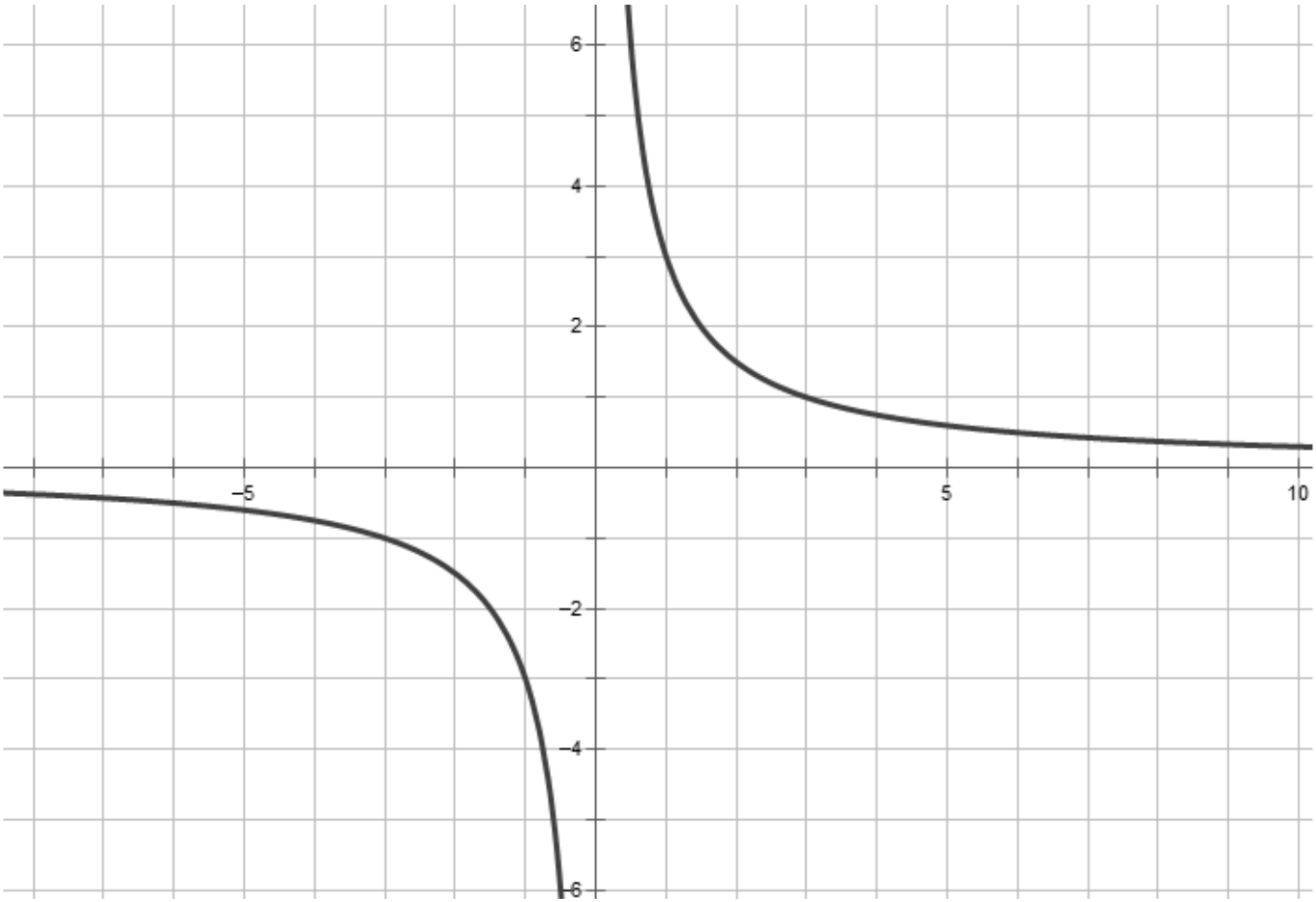
$$-1 = f'(-2)$$

Do Now - Sept 20, 2018

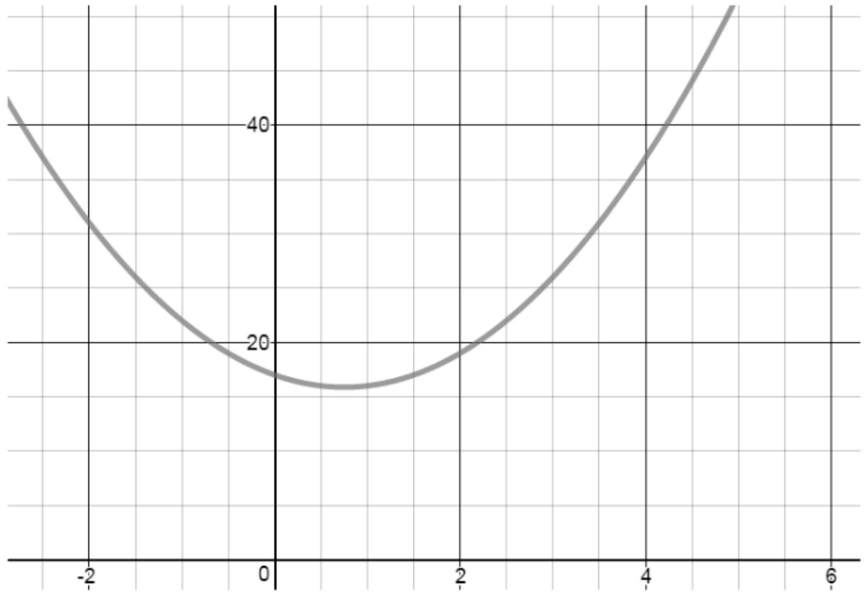
Use the definition of a derivative to find the instantaneous slope of the function $f\left(x\right) = \frac{3}{x}$ at the point (3,1).

Then, find the equation of the line tangent to the function at that point. Use $y - y_1 = m(x - x_1)$

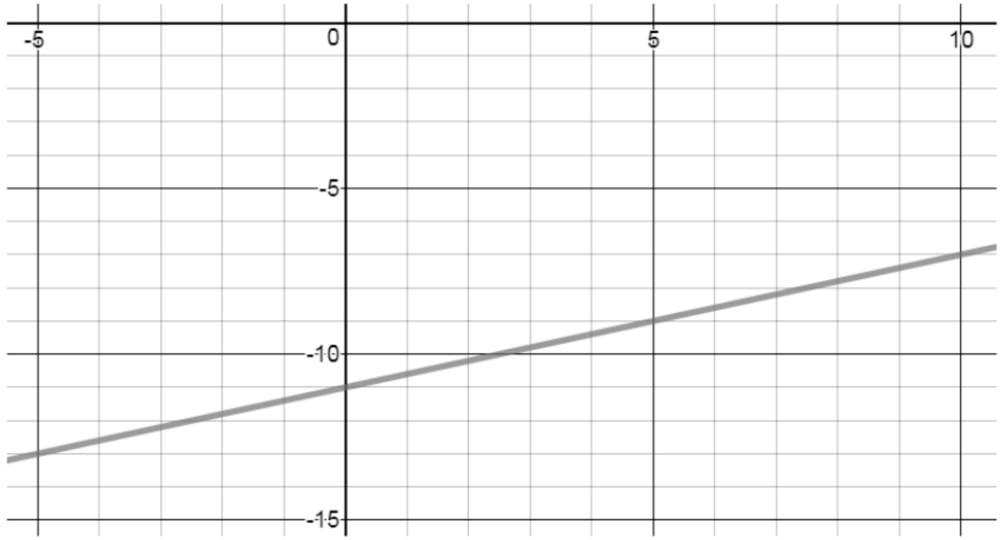
D.M.A.M.S?
Does My Answer Make Sense?



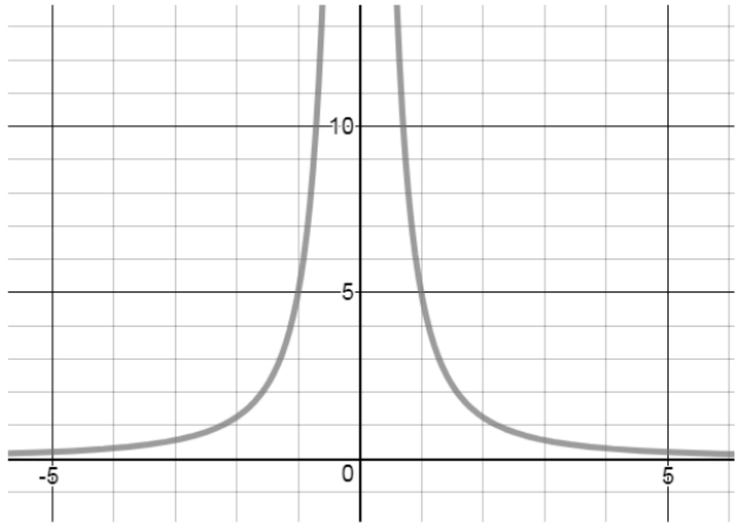
1. $y = 2x^2 - 3x + 17$ when x = -2, -1, 0, 2, 3, 4 and 5



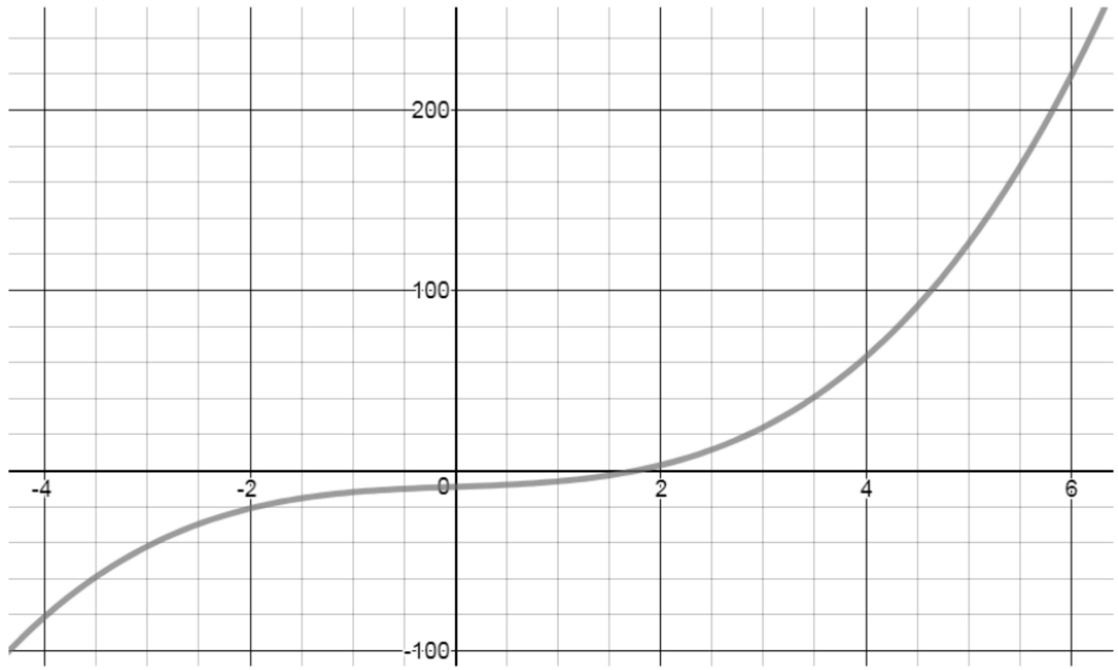
2. $y = \frac{2}{5}x - 11$ when x = -5, -4, -3, 5, 8, 9 and 10



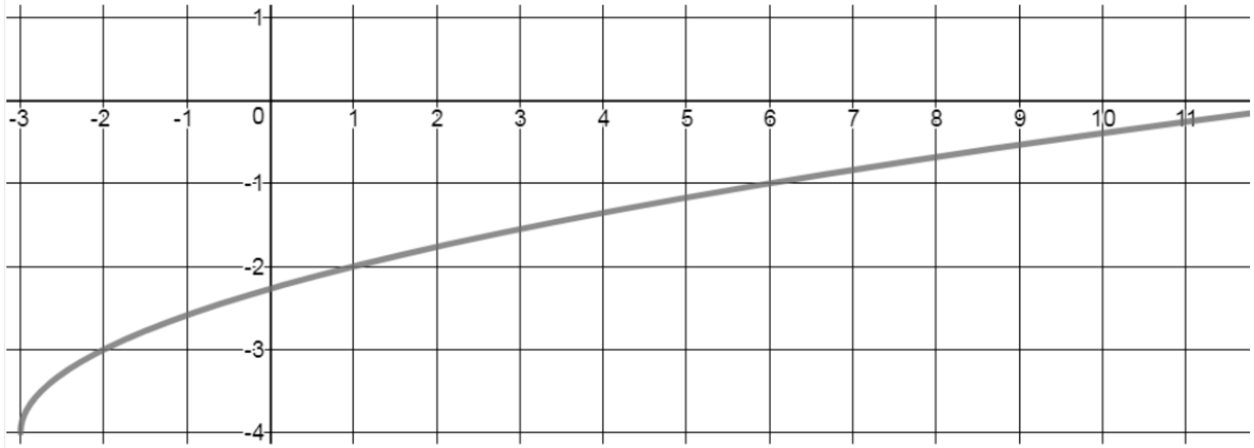
3. $y = \frac{5}{x^2}$ when x = -4, -3, -2, -1, 2, 3 and 5



4. $y = x^3 + 2x - 9$ when x = -4, -2, -1, 0, 2, 3 and 6



5. $y = \sqrt{x+3} - 4$ when x = -2.96, -2, 1, 6, 7, 9 and 13



Opener Sept. 20th, 2017

Find f'(a) where:

$$f'\left(a\right) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

for $f\left(x\right) = \sqrt{x+2} - 5$

Opener Oct. 5th, 2015

Write the equation of a line in point-slope form that contains the point with the slope provided.

Sketch a quick graph of each problem once you have the equation.

1. (3, 7)
   $m = \frac{1}{2}$

2. (-3, -6)
   m = 7

3. (0, 8)
   $m = -\frac{3}{8}$

4. (-91, 0)
   m = 0

$y = 3x^2 - 6x + 7$ FIND $y'(10)$

$$y'(a) = \lim_{h \to 0} \frac{\left(3(a+h)^2 - 6(a+h) + 7\right) - \left(3a^2 - 6a + 7\right)}{h}$$

$$= \lim_{h \to 0} \frac{3(a^2 + 2ah + h^2) - 6a - 6h + 7 - 3a^2 + 6a - 7}{h}$$

$$= \lim_{h \to 0} \frac{3a^2 + 6ah + 3h^2 - 6a - 6h + 7 - 3a^2 + 6a - 7}{h}$$

$$= \lim_{h \to 0} \frac{h(6a + 3h - 6)}{h} = 6a - 6 = f'(a)$$

$$f'(10) = 6(10) - 6$$
$$= 60 - 6$$
$$= 54$$