

Names \_\_\_\_\_

**Roles for your group members:** Recorder, Function Grapher, Derivative Grapher  
Your mission is to graph the given piecewise function on the grid on the left and to graph the derivative of the piecewise function on the grid on the right. You must also write a piecewise function for the derivative.

**Warm-up**

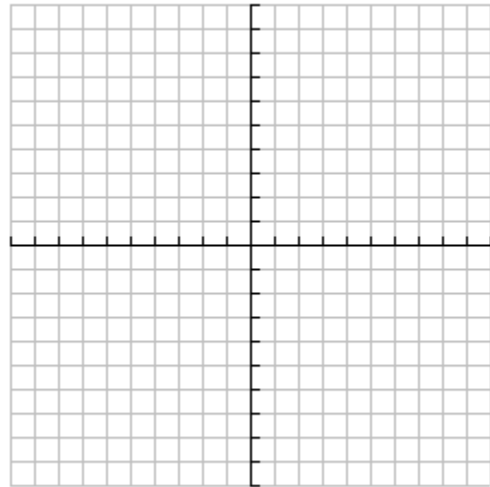
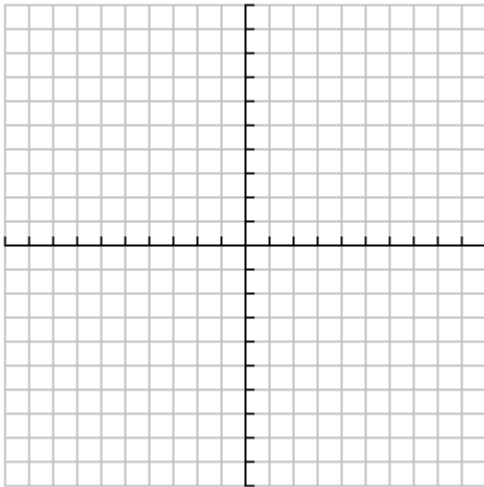
Graph  $y = x^2$  and zoom in several times on the point  $(0, 0)$

Graph  $y = |x|$  and zoom in several times on the point  $(0, 0)$

What do you notice?

Now graph on the axes below:  $f(x) = |x|$

Also graph:  $f'(x)$



Write a piece-wise function for  $f(x) = |x|$  and discuss the continuity of  $f(x)$

$f(x) = \left\{ \right.$

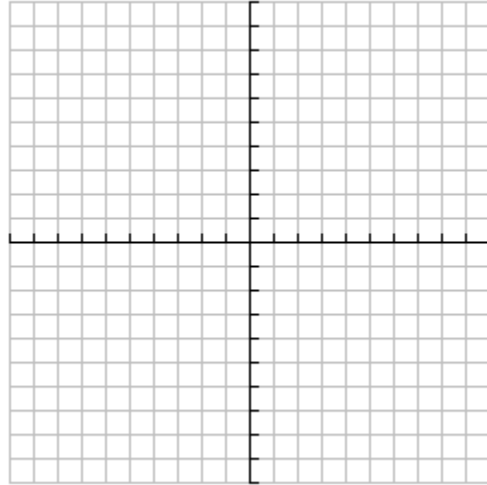
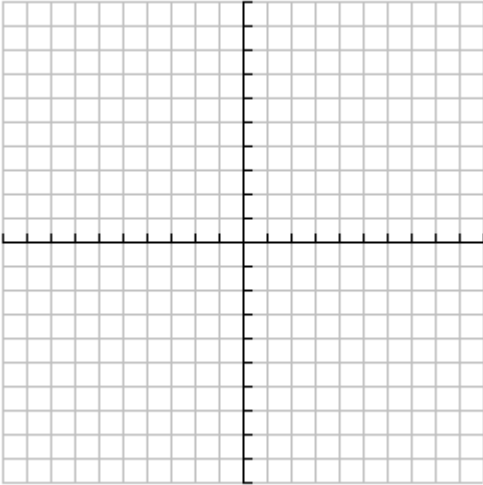
Now write a piece-wise function for  $f'(x)$  and discuss the continuity of  $f'(x)$

$f'(x) = \left\{ \right.$

1.

$$f(x) = \begin{cases} x^2 + 1, & x \leq 1 \\ 2x, & x > 1 \end{cases}$$

$$f'(x) = \begin{cases} \end{cases}$$

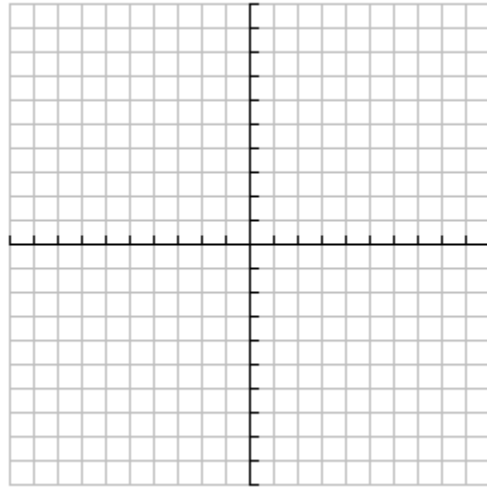
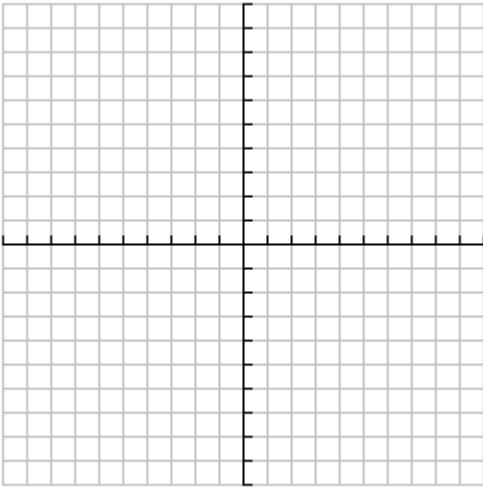


Discuss the continuity of  $f(x)$

Discuss the continuity of  $f'(x)$

$$2. f(x) = \begin{cases} x^2 + 2, & x \leq 1 \\ x + 2, & x > 1 \end{cases}$$

$$f'(x) = \left\{ \right.$$

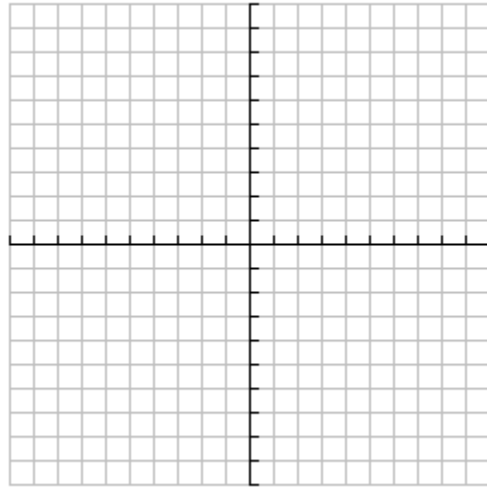
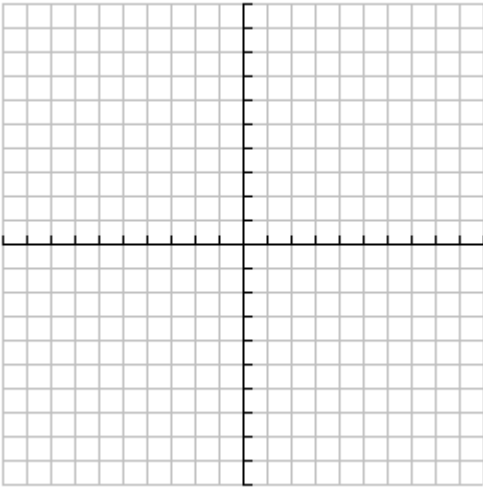


Discuss the continuity of  $f(x)$

Discuss the continuity of  $f'(x)$

3.  $f(x) = \begin{cases} 3x + 2, & x \leq 1 \\ x^3 + 4, & x > 1 \end{cases}$

$f'(x) = \begin{cases} \end{cases}$

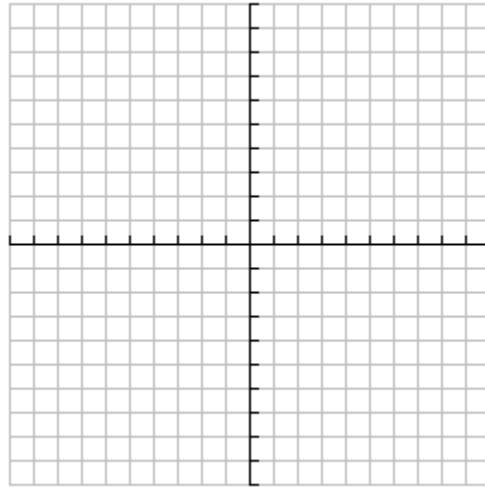
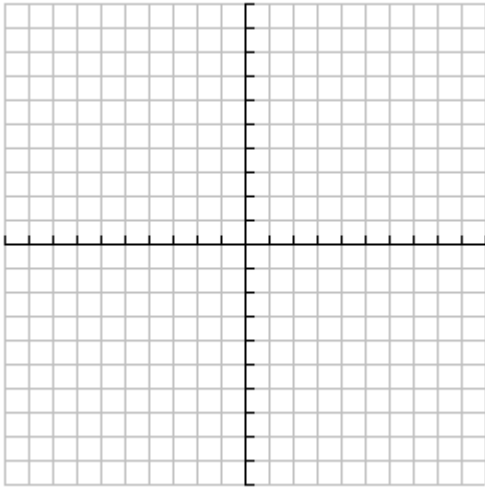


Discuss the continuity of  $f(x)$

Discuss the continuity of  $f'(x)$

4.  $f(x) = \begin{cases} 2x^2 + x - 1, & x \leq 1 \\ 5x - 3, & x > 1 \end{cases}$

$$f'(x) = \begin{cases} & \\ & \end{cases}$$



Discuss the continuity of  $f(x)$

Discuss the continuity of  $f'(x)$

***Making piecewise functions differentiable:***

- I. Find what you need to make the function continuous first
  - II. Find what you need to make the function differentiable
  - III. Use what you found to set up a system of equations which you will solve to find any missing values that will make your function, not only continuous, but differentiable
  - IV. You should check your solution(s)
5. Find the values for  $b$  and  $c$  that make the piecewise function differentiable for all real numbers

$$f(x) = \begin{cases} 3x^2 + 4x, & x \leq 1 \\ 2x^3 + bx + c, & x > 1 \end{cases}$$

6. Find the values for  $a$  and  $b$  that make the function continuous for all real numbers

$$g(x) = \begin{cases} ax^2 + 10, & x < 2 \\ x^2 - 6x + b, & x \geq 2 \end{cases}$$

**HOMEWORK:** page 118 #113 and #114 [you must show all steps, use limits, and as always, use proper mathematical notation]