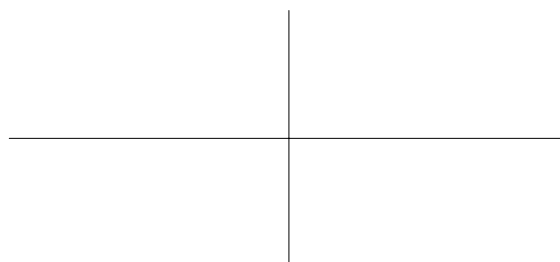
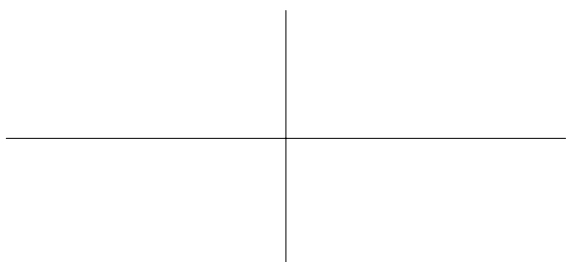


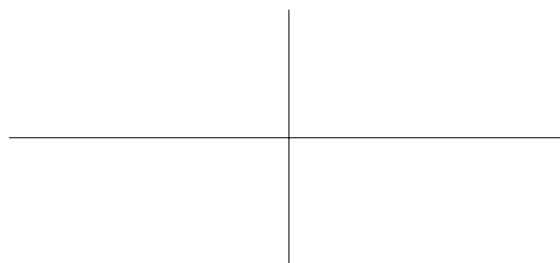
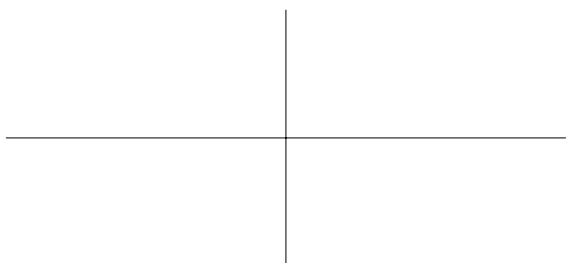
1. Determine if $f'(0)$ exists for $f(x) = (x + |x|)^2 + 3$. Support your answer.

2. In each case, use the graph of $f(x)$ to sketch a graph of $f'(x)$. Label all important features of each graph. Hint: Each function has some hidden features that you might not see on the standard window.

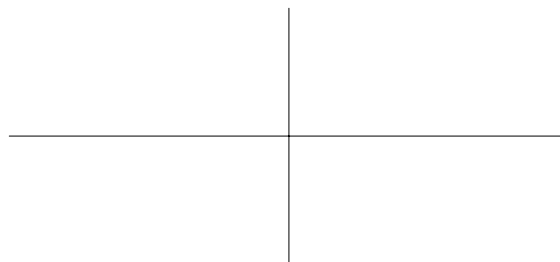
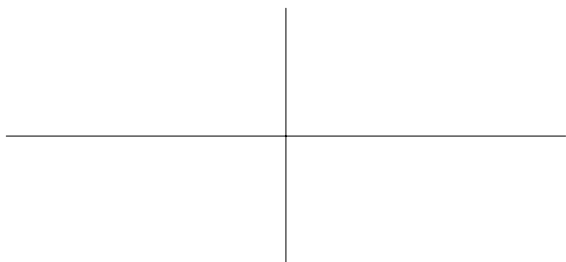
A. $f(x) = 3x^{2/3} - x$



B. $f(x) = 3x^{1/3}(2 + x)$



C. $f(x) = 28 + |13 - x| + |5 - x|$



3. The acceleration due to gravity, g , is a function of the distance from the center of the Earth, r . Let R be the radius of the Earth, M be the mass of the Earth, and G be the gravitational constant.

$$g(r) = \begin{cases} \frac{GMr}{R^3} & r < R \\ \frac{GM}{r^2} & r \geq R \end{cases}$$

A. Is g a continuous function of r ? Is g a differentiable function of r ?

B. Sketch a graph of $g(r)$. Label all important features.



4. Use the definition of the derivative to determine if $f'(0)$ exists in each case.

A. $f(x) = \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$

B. $f(x) = \begin{cases} x \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$