Section 3.1 Definition of the Derivative and
Section 3.2 Working with Derivatives

Section 3.1 Definition of the Derivative

1. For a given function f, what does f' represent.

2. Given a function f and a point a in its domain, what does $f'(a)$ represent?

3. Give three different notations for the derivative of f with respect to x.

4. Evaluate the derivative of $f(x)$ at $x = a$ for the given value of a, **using the definition of derivative**. Then write an equation for the tangent line to $f(x)$ at $x = a$.

a. $f(x) = (x + 1)^2$, $a = 2$

b. $f(x) = \sqrt{x + 1}$, $a=0$

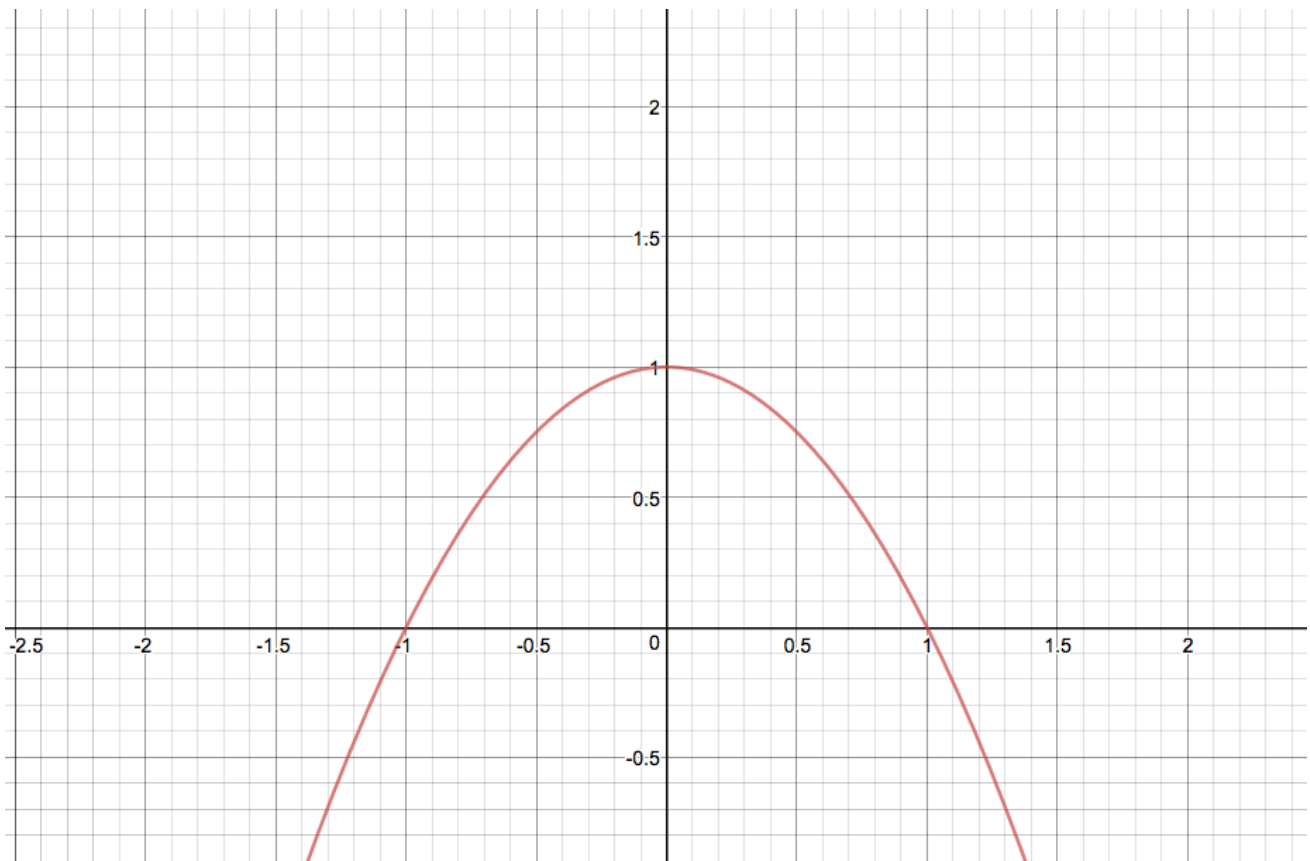c. $f(x) = \dfrac{1}{x + 1}$, $a=1$

5. The graph of the function $f(x) = 1 - x^2$ is given below. Find the equations of the tangent lines at:

    a. $x = -1$

    b. $x = 0$

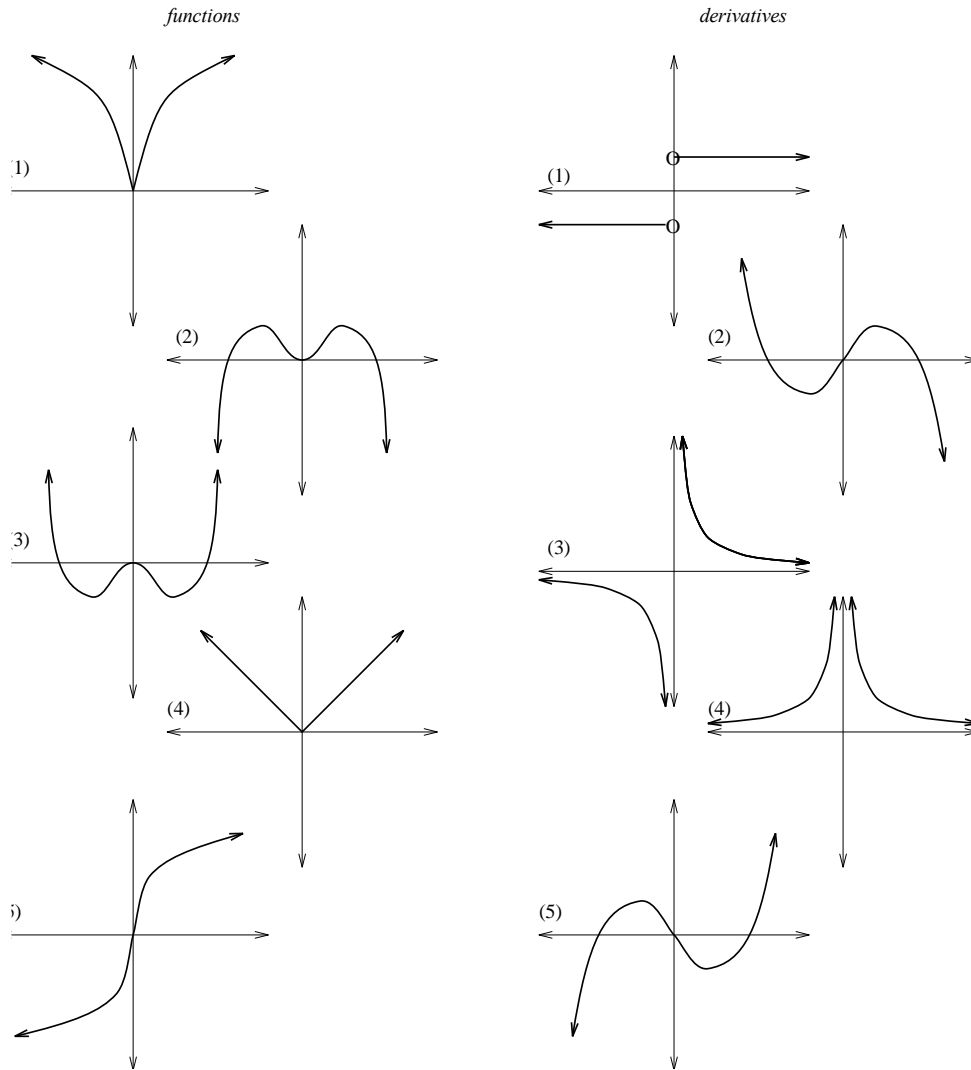   c. $x = 1$

Graph the tangent lines for $f(x)$ on the graph of $f(x)$. Explain what you notice about the tangent lines.

Section 3.2 Working with Derivatives

6. Match each graph of a function $f(x)$ with one of the graphs of a functions that is a derivative, $f'(x)$. Justify each matching.

functions

derivatives

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7. Sketch the graph of the derivatives of the following functions. Determine if the derivatives are continuous functions. Explain your answers.
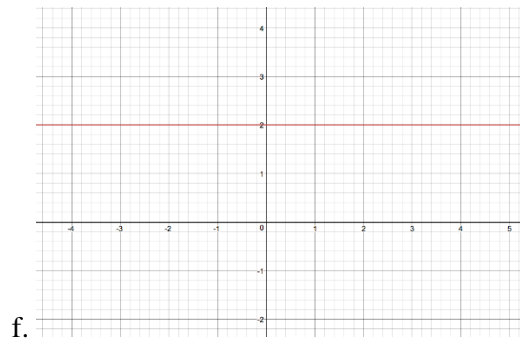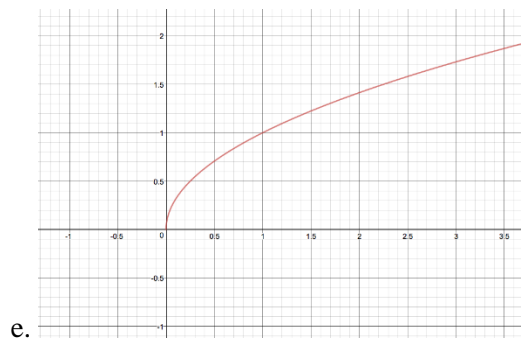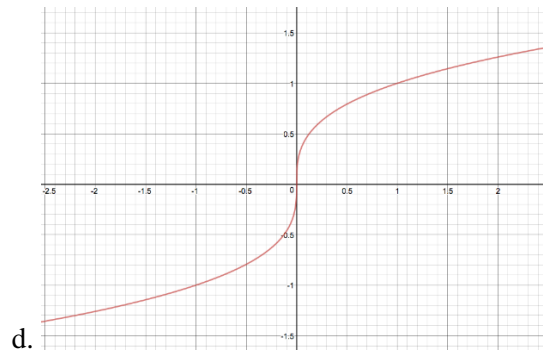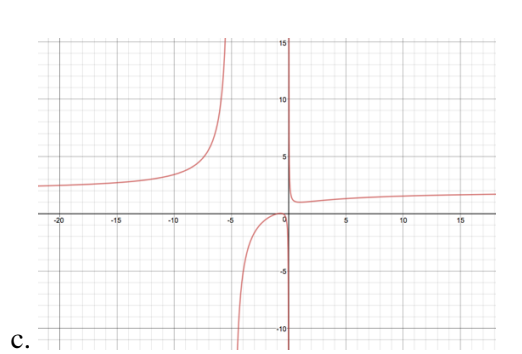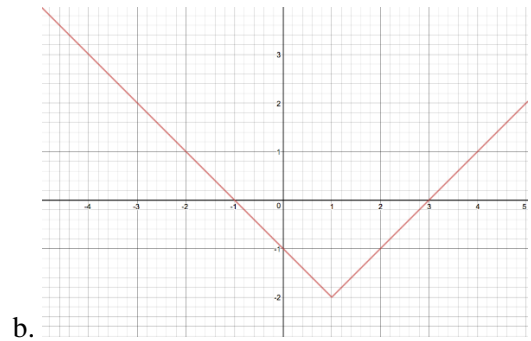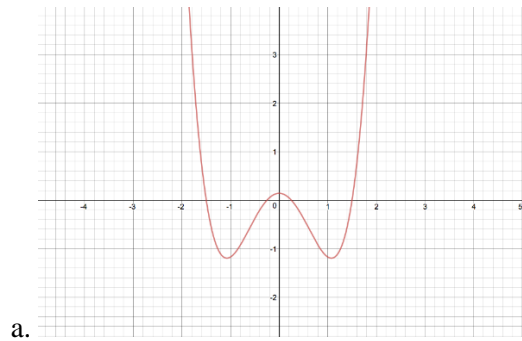
a.

b.

c.

d.

e.

f.

8. Determine if the following are possible or not possible. Explain your answer and provide a graph to back up your explanation.

    a. A function $f(x)$ is differentiable at a point x, but not continuous at that point.

    b. A function $f(x)$ is not differentiable at a point x, but is continuous at that point.

9. Graph the function $f(x) = \begin{cases} x & \text{if } x \leq 0 \\ x+1 & \text{if } x > 0 \end{cases}$

    a. For $x < 0$, what is $f'(x)$?

    b. For $x > 0$, what is $f'(x)$?

    c. Graph f' on its domain.

    d. Is f differentiable at 0? Explain.