AB Calculus Rates of Change and Derivatives Review **Name:** _____

1. Find the average rate of change of the function $f(x) = 3 + \sin x$ over the interval $[-\pi, \pi]$.

2. Find the slope of the line tangent to the curve at the given value of x.
   a) $f(x) = -3x^2 + 6x$ at $x = 6$.
   b) $f(x) = \frac{-1}{x+6}$ at $x = -4$.
   c) $f(x) = 4 - 15x$ at $x = 3$.
   d) $f(x) = \begin{cases} 8 + x & x \le 4 \\ -x - 6 & x > 4 \end{cases}$ at $x = 5$.

3. Find the equation of the tangent line to the curve $f(x) = \frac{7}{x} - 2$ at $\left(3, \frac{1}{3}\right)$.

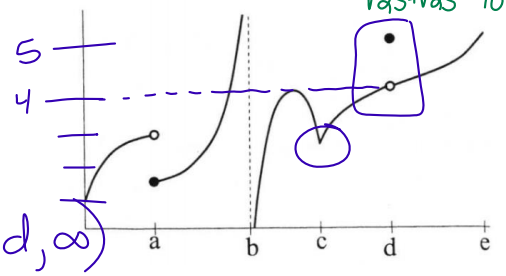
4. Find the equation of the normal line to the function $y = 4x^2$ at $(3, 36)$.

5. Find the x-value(s) where the graph of the function $f(x) = 6x^2 + 4x - 4$ has horizontal tangents.

6. Use the limit definition of derivative to find the derivative of the function $f(x) = x^3 + 7$.

7. Use the alternative definition of derivative to find the derivative of each function at the indicated point.
   a) $f(x) = \sqrt{x}$ at $x = 25$.
   b) $f(x) = -2x^2 + 10x$ at $x = 10$.

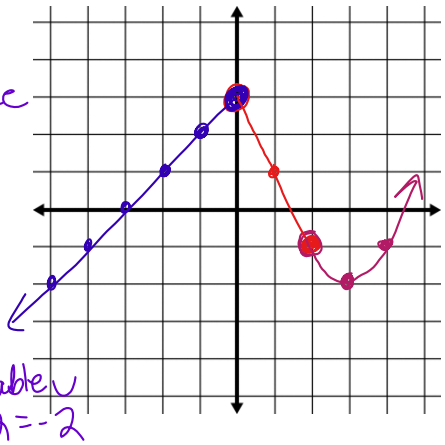
8. Consider the graph of f given to the right.
   a) On what interval is f continuous?
   b) On what interval is f differentiable?



9. Graph the given function, then answer the following questions.

$$f(x) = \begin{cases} 3 + x, & x \le 0 \\ -2x + 3, & 0 < x \le 2 \\ x^2 - 6x + 7, & x > 2 \end{cases}$$

   a) Compare the right-hand and left-hand derivatives at $x = 0$ to prove whether or not the function is differentiable at $x = 0$. Explain your answer.
   b) Compare the right-hand and left-hand derivatives at $x = 2$ to prove whether or not the function is differentiable at $x = 2$. Explain your answer.



10. For each of the following functions, find the interval for which the function is differentiable.

a) $f(x) = \dfrac{1}{x^2 - 81}$

b) $f(x) = -7x + 5$

c) $f(x) = \sqrt{16 - x^2}$

11. Graph the derivative of the function below on the grid to the right.