1. If \( f(x) = \sin x \) and \( g(x) = x^2 \), compute \( (f \circ g)(x) \), and \( (g \circ f)(x) \). Are they equal?

2. Find the domain of \( f(x) = \frac{\sqrt{x - 5}}{x^4 - 16} \).

3. Compute each of the following limits.
   
   (a) \( \lim_{x \to 2} \frac{3x^2 - 4}{x + 2} \)
   
   (b) \( \lim_{x \to -2} \frac{x^2 - 4}{x^3 + 4x^2 + 4x} \)
   
   (c) \( \lim_{x \to 4} \frac{\sqrt{25 - x^2} - \sqrt{2x + 1}}{4 - x} \)
   
   (d) \( \lim_{x \to \infty} \sin(2x) \)
   
   (e) \( \lim_{x \to \infty} \frac{7 - 3x^2}{2x^2 + 1} \)
   
   (f) If \( e^{-2x} < f(x) < \frac{2}{x^4} \) for \( x > 0 \), what is \( \lim_{x \to \infty} f(x) \)?
   
   (g) Use the Squeeze Theorem to find \( \lim_{x \to 0^+} \sqrt{x} e^{\sin(3\pi x^4)} \).

4. Suppose that an object is dropped a 1000 foot cliff, and has position given by \( s(t) = 1000 - 10t^2 \) at any time \( t \) in seconds.

   (a) What is the object’s average velocity during the first 5 seconds?
   
   (b) Use the definition of the derivative to compute the velocity of the falling object.
   
   (c) How fast is the object travelling at \( t = 5 \) seconds?

5. Differentiate the following functions.

   (a) \( y = 45x^{10} + 7x^8 - 5x^3 + 2x - \pi \)
   
   (b) \( y = \frac{7x + 8}{\sqrt{x}} \)
   
   (c) \( y = x^7 e^x \)
   
   (d) \( y = \frac{2x + 1}{x^3 - 9} \)

6. Find the equation of the tangent line to \( y = \frac{2x + 1}{x^3 - 9} \) at \( x = 2 \).

7. Using the Intermediate Value Theorem, explain why \( f(x) = x^7 - 3x + 1 \) has at least one real root.
8. (a) Carefully define what it means for \( y = f(x) \) to be continuous at \( x = a \).

(b) How can a function fail to be continuous at a point?

(c) Suppose that \( f(x) = \frac{x^3 - 49x}{x - 7} \) for all \( x \neq 7 \).
   How should we define \( f(7) \) so that \( f \) is continuous at \( x = 7 \)?

9. Give an example of a continuous function that fails to be differentiable at a point.

10. Be able to read limits from the graph of a function!