1. Consider the function \( f(x) = \frac{3}{5 - 2x} \).

   (a) Is this function continuous on the interval \((-\infty, \infty)\)? Explain.

   (b) Compute the average rate of change of \( f \) on \([2, 2.01]\).

   (c) Using the limit definition of the derivative, compute \( f'(x) \).

   (d) Find the equation of the tangent line to \( f \) at \( x = 2 \).

2. Given that \( f(0) = 2, g(0) = 3, f'(0) = 5, g'(0) = 7, \) and \( f'(3) = \pi \) compute the following.

   (a) \( h'(0) \) if \( h(x) = f(x)g(x) \)

   (b) \( j'(0) \) if \( j(x) = \frac{f(x)}{g(x)} \)

   (c) \( k'(0) \) if \( k(x) = f(g(x)) \)
3. Compute $dy/dx$ for each of the following.

(a) $y = x^5 + 5^x + e^5 + \frac{x}{5} + \frac{5}{\sqrt[5]{x}} + \ln(5x) + \arctan(5x) + \ln(5) + \sin 5$

(b) $y = \sqrt[3]{x} \cos(7x^3)$

(c) $y = \frac{e^x + e^\pi}{\tan 4 - 7x}$

(d) $y = \tan(e^{x^2 \arcsin(5x)})$

(e) $y^3 + yx^2 + x^2 = 3y^2$
4. Given the graph of \( f \), sketch a graph of \( f' \) and a graph of \( F \), an antiderivative of \( f \) such that \( F(0) = -1 \).

5. Shown below is a graph of \( f' \) on its entire domain. The graph is NOT \( f \).

   At which \( x \)-value(s)
   
   (a) does \( f \) have a stationary point?
   (b) \( f \) decreasing?
   (c) \( f' \) increasing?
   (d) \( f' \) decreasing?
   (e) \( f \) concave up?
   (f) \( f \) concave down?

   (g) is \( f \) greatest?
   (h) is \( f \) least?
   (i) is \( f' \) greatest?
   (j) is \( f' \) least?
   (k) is \( f'' \) greatest?
   (l) is \( f'' \) least?

   On what interval(s) is
   
   (a) \( f \) increasing?
   (b) \( f \) decreasing?
6. Is \( y = 7e^{3x} \) a solution to the differential equation \( y'' + 2y' - 15y = 0 \)? Explain.

7. Rewrite \( \sin(\arctan(5x)) \) as an algebraic expression.

8. Evaluate the following limits.

   (a) \( \lim_{x \to \infty} \frac{x^2}{\ln x} \)

   (b) \( \lim_{x \to 0} \frac{\sin (12x) - 12x}{x^3} \)

   (c) \( \lim_{x \to 0} \frac{e^x - 1}{\cos x} \)

   (d) \( \lim_{x \to 2} \frac{x^3 - 8}{x - 2} \)