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

   (a) Is this function continuous on the domain \((-\infty, \infty)\)? 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) $y = x^5 + 5x + e^5 + \frac{x}{5} + \frac{5}{x} + \ln(5x) + \arctan(5x) + \ln(5) + \sin 5$

(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. Consider the differential equation $y' = -3y$.

(a) For what value(s) of $C$ and $k$ is $y = Ce^{-kx}$ a solution to this differential equation?

(b) Find the solution that passes through $(1, 5)$. 
5. Given the graph of $f$, sketch a graph of $f'$ and a graph of $F$, an antiderivative of $f$ such that $F(0) = -1$. 

6. The graph shown is $f'$, NOT $f$. Answer the questions below.

At which labeled point(s) does $f$ have:
(a) a stationary point?
(b) a local max?
(c) a local min?
(d) $f''$ have a stationary point?
(e) $f''$ have a local max?
(f) $f''$ have a local min?
(g) a global max?
(h) a global min?
(i) $f''$ have a global max?
(j) $f''$ have a global min?
(k) $f'''$ have a global max?
(l) $f'''$ have a global min?

On what interval(s) is $f$:
(a) increasing?
(b) decreasing?
(c) $f'$ increasing?
(d) $f'$ decreasing?
(e) concave up?
(f) concave down?
(g) $f''$ concave up?
(h) $f''$ concave down?
7. Find all possible antiderivatives of the following.
   (a) \( g'(t) = e^5 + t^5 + e^{5t} \)

   (b) \( h'(r) = 3 \sin(2r) + \sqrt[3]{r} \)

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) \( \lim_{x \to 5} \frac{35 - 7x}{2x - 10} \)

   (e) \( \lim_{x \to 0^+} \frac{1}{x} \)

   (f) \( \lim_{x \to 0} \frac{1}{x} \)