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

(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) does $f$ have a local max?
(c) does $f$ have a local min?
(d) does $f'$ have a stationary point?
(e) does $f'$ have a local max?
(f) does $f'$ have a local min?
(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?
(c) $f'$ increasing?
(d) $f'$ decreasing?
(e) $f$ concave up?
(f) $f$ concave down?
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) \( \lim_{{x \to 2}} \frac{x^3 - 8}{x - 2} \)