1. (10 points) Suppose that \( f(x) = \sqrt{x - 3} \) and \( g(x) = x^2 + 3 \).

   (a) Find a simplified formula for \((f \circ g)(x)\) and state its domain.

   (b) Find a simplified formula for \((g \circ f)(x)\) and state its domain.
2. (10 points) Solve for $x$ in each of the following equations.

(a) $5e^x - 2 = 3e^x + 6$

(b) $\ln(x^5) - \ln(x^3) = 15$
3. (12 points) Sketch a graph for each of the following functions, including the coordinates for all \(x\)-intercepts and \(y\)-intercepts, and all horizontal and vertical asymptotes.

(a) \(y = 2 + e^{-x}\)

(b) \(y = \frac{1}{x - 3}\)

(c) \(y = \ln(x - 2)\)
4. (24 points) Evaluate the following limits.

(a) \( \lim_{x \to 1} \left( 1 + \frac{1}{x} \right)^x \)

(b) \( \lim_{x \to +\infty} \left( 1 + \frac{1}{x} \right)^x \)

(c) \( \lim_{x \to +\infty} e^{1/x^2} \)

(d) \( \lim_{x \to +\infty} \frac{\sqrt{x}}{\ln x} \)

(e) \( \lim_{x \to 8^+} \frac{1}{x - 8} \)
(f) \( \lim_{x \to 1^-} \frac{\sqrt{x}}{\ln x} \)

(g) \( \lim_{x \to +\infty} \frac{1 - 4x^2}{1 - 2x^2} \)

(h) \( \lim_{x \to -2} \frac{x^2 - 4}{x^2 + 5x + 6} \)
5. (8 points) Let \( f(x) = 4x^2 - 5 \). Use the definition of a derivative as a limit to show that \( f'(x) = 8x \). Show each step in your calculation and be sure to use proper terminology.
6. (6 points) Find $\frac{dw}{dt}$ given that $w = \frac{6}{\sqrt{t}}$

7. (6 points) Find $f'(x)$ given that $f(x) = x^2 \sin x$
8. (6 points) Find $g'(x)$ given that $g(x) = \frac{x^2 + 1}{x^3}$

9. (6 points) Find $\frac{dy}{dx}$ given that $y = 4 + 5 \sec x$
10. (6 points) Evaluate $f''(1)$ given that $f(x) = x^3 + \frac{1}{x}$

11. (6 points) Find the equation of the line which is tangent to the graph of $f(x) = 2\cos x$ at $x = \frac{\pi}{2}$. Write your final answer in the simplified form $y = mx + b$. 