Problem 1. Find the domain of \( f(x) = \sqrt{\frac{x^2 - 8x + 14}{x^2 - 1}} \).

Problem 2. Evaluate each of the following limits, or state explicitly why it does not exist.

i. \( \lim_{x \to 2} \frac{x^4 - 2x^3 + 3x^2 - 15x + 18}{x^3 - 8} \)

ii. \( \lim_{x \to 3} \frac{\sqrt{7 - x} - 2}{\sqrt{4 - x} - 1} \)

iii. \( \lim_{t \to \infty} \frac{\sin(t^2 + 1)}{1 - t} \)

iv. \( \lim_{x \to \infty} \left( \frac{x^2}{x + 2} - \frac{x^3}{x^2 + 3} \right) \)

Problem 3. Let \( p(t) = t^2 - c^2 \) for \( t < 3 \) and \( p(t) = 2ct + 2 \) for \( t \geq 3 \). Find all values of \( c \) that make \( p(t) \) continuous on \(( -\infty, \infty )\).

Problem 4. Find all horizontal asymptotes of the graph of \( r(t) = \frac{6t^3 + 5t - 7}{\sqrt{625t^2 + 2t^5} - 10} \).

Problem 5. Use the definition of the derivative to find \( g'(3) \) if \( g(x) = \frac{x}{\sqrt{x + 1}} \).

Problem 6. Find all points on the graph of \( f(x) = 2x^3 + 3x^2 - 12x + 1 \) where the tangent line is horizontal.
Problem 7. In each of the following, compute the appropriate value.

i. Find $h'(0)$ if $h(q) = \frac{(e^{q^2+q} - 2)^8}{\sin^2(q) + 3}$.

ii. Find $f'(0)$ if $f(x) = (x^2 + 4x + 1)^2(x^3 - 1)^{10}e^{2x}$.

iii. Find $y'$ if $y(t) = \cos^3(\sec(t - \frac{1}{t}))$.

Problem 8. Find the second derivative of $f(x) = \frac{1}{\sqrt{\tan(x)}}$.

Problem 9. Find an equation of the line tangent to the graph of $x(t) = \sqrt{t^2 + 3t + 6}$ at the point $(2, 2)$.

Problem 10. Find an equation of the line tangent to the curve $y = \left(\frac{x^2 + 1}{x^2 - 1}\right)^2$ at the point $(2, \frac{25}{9})$.

Problem 11. A ball is thrown vertically upward at time $t = 0$ with an initial velocity of 80 ft/sec at an initial height of 96 feet. This gives the ball a height function of

$$h(t) = -16t^2 + 80t + 96.$$

i. Find the maximum height of the ball.

ii. Find the velocity of the ball when it hits the ground.