(1) Find the break even quantity $q$ for product $Y$ if consumers will pay $p = (100 - q)$ and when the average cost is $c = \frac{20q + 1600}{q}$.

(2) For $f(x) = (x + 3)^3$ and $g(x) = 1 - x^2$ find $g \circ f(x)$.

(3) Consumers will buy 30 units of a product if the price is $10$, and they will buy 40 units if the price is $6$. Assuming that the demand is linear find the demand equation.
(4) Write the expression \[ \ln \left( \frac{x^5}{(x+1)^2(x+2)^3} \right) \] in terms of \( \ln(x) \), \( \ln(x + 1) \), \( \ln(x + 2) \).

(5) Find the limits, justify your answers. \[
\lim_{x \to 1^-} \frac{x^2 + 3}{x + 1} \quad \quad \lim_{x \to \infty} \frac{2x^3 + 10}{-x^4 + 5x^3 - 11}
\]

(6) Use the definition to find the derivative of \( f(x) = 6 - 2x + x^2 \).
(7) Find the derivatives do not simplify.
(a) \( \frac{d}{dx} \left( 10x^9 + \frac{5}{\sqrt{x}} + \ln(x) + e^{x^2} \right) \)

(b) \( \frac{d}{dq} \frac{2 - q^3}{q + 3} \)

(c) \( \frac{d}{dt} (t + 3)(t^2 + 1)^9 \)

(8) For its best product a company knows that \( m \) workers will produce the quantity \( q = 2m^2 + m \) per day. The demand function for the product is \( p = \frac{7}{q^2 + q} \). Find the marginal revenue product when \( m = 10 \).

(9) Elasticity of demand. The demand equation for a product is \( p = \sqrt{5000 - q^2} \). Find the elasticity of demand \( \eta \). Describe the elasticity of demand when \( q = 50 \).
(10) Find the intervals of increase, decrease, concave up, concave down, local extrema, and inflection points for $y = 3x^4 - 4x^3$.

(11) The marginal cost for a product is $0.4q + 28$ and the marginal revenue is $600 - 4q$. Find the profit maximizing output.

(12) Find the antiderivatives do not simplify.
   
   (a) $\int x^3 - 8x^2 + \frac{7}{\sqrt{x}} \, dx$

   (b) $\int e^x + \frac{2}{x} \, dx$

   (c) $\int (x^2 + 3)^4 x \, dx$