1. Find the following limits:

   \[ a) \lim_{x \to 1} \frac{x^2 - 2x + 1}{x - 1} \quad \text{b) } \lim_{x \to \infty} \frac{2x + 1}{x^2 + 4} \]

2. (a) State the \( \epsilon-\delta \) definition of limit. (b) Use this definition to prove that \( \lim_{x \to -21}(3x - 1) = -64 \).

3. Use the definition of the derivative to find the derivative of \( f(x) = x^2 \).

4. Find the maximum and minimum values of \( f(x) = x^2 + 2x + 5 \) over the interval \([-2, 1]\).

5. Sketch the graph of \( f(x) = 2x^3 - 3x - 10 \). Find all the intervals where the function is increasing, decreasing, is concave up or concave down.

6. Find the following integrals:

   \[ a) \int \sin(2x - 4) \, dx \quad \text{b) } \int_0^1 x^2(x^3 + 5)^9 \, dx \]

7. (a) Estimate the area under the curve \( f(x) = 3x - 1 \) over the interval \((1, 3)\) by dividing the interval into 4 equal subintervals and computing the area of the corresponding circumscribed polygon. (b) Find the exact value of the area under the curve by dividing the interval into \( n \) equal segments and computing the limit of the area of the corresponding polygon as \( n \to \infty \).
8. Find the area trapped between \( y = x + 4 \) and \( y = x^2 - 2 \).

9. Let \( R \) be the region trapped by \( y = x^3 \), \( x = 3 \), and \( y = 0 \). Find the volume of the solid generated by revolving \( R \) about the \( x \)-axis.

10. Find all the work done in pumping all the oil (density \( \delta = 2 \) pounds per cubic foot) over the edge of a cylindrical tank that stands on one of its bases. Assume that the radius of the base is 4 feet, the height is 10 feet, and the tank is full of oil.

    Each problem is worth 10 points.