1. Find the following limits. You must show all your work.
   a) \( \lim_{{x \to 3}} \frac{x^2 - 8x + 15}{x^2 + x - 12} \)
   b) \( \lim_{{x \to 0}} \frac{\tan 3x}{x} \)
   c) \( \lim_{{x \to \infty}} \left( x - \sqrt{x^2 - 2x + 5} \right) \)

2. USING THE DEFINITION of derivative find the derivative of \( f(x) = \sqrt{x} - 2 \).

3. Find \( f'(x) \) for the following functions. You do not need to simplify your answers.
   a) \( f(x) = e^x - \sqrt{x} + \cot x \)
   b) \( f(x) = (x^2 + 5x + 2) \cosh x \)
   c) \( f(x) = \frac{1 + \ln x}{x + \sin x} \)
   d) \( f(x) = (x^2 + 4x - 1)^{2/3} \)
   e) \( f(x) = x^{\sin x} \)
   f) \( f(x) = \int_1^x \frac{dt}{\sin^2 t + 1} \)

4. Let \( y(x) \) be defined implicitly by \( x^3 + \ln(x + y) = y \). Find \( y'(x) \).

5. Determine an equation of the tangent line to the curve \( f(x) = \ln(x - 1) \) at the point where the graph crosses the \( x \)-axis.

6. The combined electrical resistance \( R \) of \( R_1 \) and \( R_2 \), connected in parallel, is given by
   \[ \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \]
   where \( R, R_1 \) and \( R_2 \) are measured in ohms. \( R_1 \) and \( R_2 \) are increasing at rates of 1 and 1.5 ohms per second, respectively. At what rate is \( R \) changing when \( R_1 = 50 \) ohms and \( R_2 = 75 \) ohms?

7. Calculate the absolute maximum of \( f(x) = \frac{x^2}{x^2 + 2} \) on \([-1, 1]\).
10. Evaluate the following indefinite integrals.
   a) \( \int (\sqrt{x} + \sqrt{\tan^2 x} + \sech^2 x) \, dx \)
   b) \( \int (x^3 - 2)^2 \, dx \)
   c) \( \int xe^{x^2 + 4} \, dx \)
   d) \( \int x^{3x + 1} \, dx \)
   e) \( \int (2 + \sin x)^3 \cos x \, dx \)

11. Evaluate the following definite integrals.
   a) \( \int_{0}^{\sqrt{\pi/4}} x \sec x^2 \tan x^2 \, dx \)
   b) \( \int_{0}^{3} f(x) \, dx \) where \( f(x) = \begin{cases} x, & x \leq 1 \\ x^2, & x > 1 \end{cases} \)

12. Find the area of the region bounded by the curves \( f = x^5 \) and \( g(x) = 4x^3 \).

13. Let \( R \) be the region bounded by the curves \( y = x^2 + 1, \ y = 0, \ x = 0, \) and \( x = 2 \).
   a) Set up, but DO NOT EVALUATE, the integral for the volume of the solid obtained by revolving this region around the \( y \)-axis.
   b) Set up, but DO NOT EVALUATE, the integral for the volume of the solid obtained by revolving this region around the line \( y = -1 \).

14. The velocity function (in meters per second) for a particle moving along a line is \( v(t) = -2t + 5 \). Find the TOTAL DISTANCE traveled on the time interval \([0,3]\).