1. Find an equation of the tangent line to \( y = \frac{2x}{x^2 + 1} \) at the point \((0, 0)\).

2. If \( f \) is a differentiable function, find the derivative of \( y = \frac{1 + xf(x)}{\sqrt{x}} \).

3. Find the first and second derivatives of the function:
   (a) \( F(t) = (1 - 7t)^6 \)  
   (b) \( y = (x^3 + 1)^{2/3} \)  
   (c) \( y = \frac{2x}{(x - 1)^2} \)

4. Find \( dy/dx \):
   (a) \( y = \sqrt{x + 5} \)  
   (b) \( y \sin(x^2) = x \sin(y^2) \)  
   (c) \( \sqrt{x+y} = 1 + x^2y \)  
   (d) \( y^5 + x^2y^3 = 1 + x^4y \)

5. A man starts walking north at 4 ft/s from a point P. Half a minute later, a woman starts walking south at 5 ft/s from a point 500 ft due east of point P. At what rate are the people moving apart 2 minutes after the woman starts walking?

6. Water is leaking out of an inverted conical tank at a rate of 10,000 cm\(^3\)/min at the same time that water is being pumped into the tank at a constant rate. The tank has height 600 cm and the diameter of the top is 400 cm. If the water level is rising at a rate of 20 cm/min when the height of the water is 200 cm, find the rate at which water is being pumped into the tank.

7. Find the linearizaton \( L(x) \) of \( f(x) = \sqrt[3]{1 + x} \) at \( x = 0 \) and use it to approximate \( \sqrt[3]{0.95} \).

8. Find the differential of
   (a) \( y = x^2 \sin(x) \)  
   (b) \( y = \sqrt{4 + 5x} \)

9. The edge of a cube was found to be 30 cm with a possible error in measurement of 0.1 cm. Use differentials to estimate the error, relative error, and percentage error in computing (a) the volume of the cube and (b) the surface area of the cube.

10. State Rolle’s Theorem. Now, let \( f(x) = 1 - x^{2/3} \), show that \( f(-1) = f(1) \) but there is no number \( c \) in \((-1, 1)\) which satisfies Rolle’s Theorem. Does this contradict Rolle’s Theorem? Why or why not?

11. Verify that \( f(x) = \sqrt{x} \) satisfies the hypothesis of the Mean Value Theorem on the interval \([0, 1]\). Find all values of \( c \) that satisfy the conclusion of the Mean Value Theorem.

12. At 2:00 p.m., a car’s speedometer reads 30 mi/h. At 2:10 p.m., it reads 50 mi/h. Assuming the car has been driven the whole time, show that at some time between 2:00 and 2:10, the acceleration is 120 mi/h\(^2\).

13. Show that the equation \( 2x - 1 - \sin(x) = 0 \) has exactly one real root.

14. Find the absolute maximum and minimum values of \( f \) on the given interval:
   (a) \( f(x) = x^3 - 6x^2 + 9x + 2 \), \([-1, 4]\)  
   (b) \( f(x) = \sin(x) + \cos(x), [-\pi/4, \pi/2] \)

15. For the functions given below:
   (a) Find the intervals on which \( f \) is increasing or decreasing
   (b) Find the local maximum and minimum values of \( f \)
   (c) Find the inflection points and state where the function is concave up/down.
   (i) \( f(x) = x^4 - 4x - 1 \)  
   (ii) \( f(x) = \frac{x^2}{x^2 + 3} \)  
   (iii) \( f(x) = x - 2\sin(x), 0 \leq x \leq 2\pi \)

16. For the functions given below, state the domain, find all horizontal and vertical asymptotes, find all local maxima, minima, and inflection points and then sketch the graph.
   (a) \( y = \frac{2x}{(x - 1)^2} \)  
   (b) \( y = \frac{\sqrt{1 - x^2}}{x} \)  
   (c) \( y = \frac{x}{x - 5} \)