1. A cylindrical can without top but with a bottom is made from $300\pi \text{in}^2$ of sheet metal. No sheet metal will be wasted. What is the greatest Volume of such a can? [Hint: Volume of a can = Area of circle * height of can]

2. A baseball team plays in a stadium that holds 55000 spectators. With ticket prizes at $10, the average attendance had been 27000. When ticket prizes were lowered to $8, the average attendance rise to 33000.

   (a) Find the demand function assuming that it is linear.
   (b) How should ticket prizes be set to maximize revenue?

3. A manufacturer has been selling 1000 television sets a week at $450 each. A market survey indicates that for each rebate of $10 offered to the buyer, the number of sets sold will increase by 100 per week.

   (a) Find the demand function.
   (b) How large a rebate should the company offer to maximize its revenue?
   (c) If the weekly cost function is $C(x) = 68,000 + 150x$, how should the manufacturer set the size of the rebate in order to maximize profit?

4. A supermarket manager estimates that a total of 800 cases of soup will be sold at a steady rate during the coming year and it costs $4 to store a case for a year. The average number of cases stored is $\frac{1}{2}x$ where $x$ is the number cases per order placed. The cost per order will be $100. What is the optimal reorder quantity that minimizes cost?
5. Differentiate the following functions:

(a) \( f(x) = (x^2 + 3x - 1)^3(x^3 - 1)^{\frac{1}{2}} \)

(b) \( g(x) = \frac{3x^2 - x^\frac{3}{2}}{3x^2 - 1} \)

(c) \( h(x) = \frac{\sqrt{x^4 - 3x^2}}{\sqrt{x - 1}} \)

6. Find two functions \( g(x) \) and \( h(x) \) such that the functions \( f(x) \) below are \( f(x) = g(h(x)) \) and differentiate \( f(x) \) using the chain rule:

(a) \( f(x) = \sqrt{\frac{z-1}{z+1}} \)

(b) \( f(x) = (x^2 + 3x - 4)^{\frac{3}{4}} \)

7. Differentiate \( f(x) = (1 + 4x)^5(3 + x - x^2)^8 \)

8. Use implicit differentiation to find the slope of the equation \( y^4 + x^2y^2 + x^4 = y + 1 \).

9. What is the slope of the equation \( x^2 + 2xy - y^2 + x = 2 \) at the point \((1, 2)\)?

10. A baseball diamond is a square with 90 ft sides. A batter hits the ball and runs toward first base with a speed of 24 ft/s. [Hint: Think of the baseball diamond as a square with corners A, B, C and D. After hitting the ball, the runner runs from point A to point B (first base)]

(a) At what rate is his distance from second base (point C) decreasing when he is halfway to first base? [Hint: Draw a picture and then use Pythagoras theorem and related rates for both parts of the problem.]

(b) At what rate is his distance from third base (point D) decreasing at the same moment?

11. A plane is flying horizontally at an altitude of 1 mile and at a speed of 500 mi/h. Find the rate at which the distance of the plane to the radar station is increasing when it is 2 miles away from the station.

12. Write each of the functions as \( e^{kx} \):
13. Differentiate the following functions:

(a) \((\sqrt[3]{e^{-x}e^{5x}})^3\)

(b) \(\frac{e^{-\frac{1}{2}}e^{4x}}{e^{2x}e^{-\frac{3}{4}}}\)

(c) \((1 + 2x^3)e^{3x}\)

(d) \(\sqrt{e^{-\frac{1}{2}x} + 3x^4}\)