

Practice Problems for 2nd Exam

1. Find the derivatives for functions given below.

a) $y = x^5 - 3x^2 + 10$

b) $y = \frac{1}{3x} + \frac{5}{x^3}$

c) $y = \frac{x+1}{x-1}$

d) $y = \left(\frac{x+1}{x-1}\right)^5$

e) $y = x^2 \cdot \sin x$

f) $y = \sqrt[5]{(x^3+1)^2}$

g) $y = x^{1/3}(x-5)^{2/3}$

2. Find all points on the graph of $y = 2x^3 - 3x^2 - 12x + 15$ where the tangent line is either horizontal or vertical.

3. Find all points on the graph $y = x(2-x)^{1/3}$ where the tangent line is either horizontal or vertical.

4. Find the maximum and the minimum of the function $f(x) = x^2 + \frac{16}{x}$ on the interval $[1, 4]$. Sketch the graph.

5. A ball is dropped from a building 400 ft high. How long does it take it to reach the ground. With what velocity will it hit the ground?

6. Air is escaping from a spherical balloon at a constant rate of 100π in³/s. What is the volume of the balloon when its radius is decreasing at the rate of 5 in/s?

7. A rancher wants to enclose a rectangular area and then divide it into 5 pens with fencing parallel to one side of the rectangle. He has 600 feet of fencing available to complete the job. What is the largest possible total area of the five pens?

8. A box without top is to be made out of a 8 by 5 piece of cardboard by cutting out squares of equal size from each corner, then folding the resulting sides up and gluing edges together. What are the dimensions of the box of maximal possible volume?

9. Suppose that you are to make a rectangular box with a square base from two different materials. The material for the base costs $\$2/\text{ft}^2$ and the material for the top and the four sides of the box costs $\$1/\text{ft}^2$. Find the dimensions of the box of the greatest possible volume if you are allowed to spend $\$144$ for the material to make it.

10. A manager of a rental complex has noticed that 80 units will be occupied if the rent is 420 dollars per month. Market research shows that one additional unit will stay vacant for each 6 dollar increase in rent, while each 6 dollar decrease in rent will result in one more unit being occupied. What rent should be charged to maximize revenue?