

Name _____ Period _____ Date _____

You may use a calculator on this test. However, calculators may be used for **computation only**. You **must** show all of your work and must use calculus techniques to obtain full credit for each question.

Vocabulary: **Directions** – Define each word *and* give an example.

1. Related Rate

Short Answer

2. Write the steps to solving an optimization (max/min) problem.

Review

3. What is the x -coordinate of the point of inflection of the graph of $y = \frac{1}{3}x^3 + 5x^2 + 24$?
4. Write an equation of the line tangent to the graph of $y = x + \cos x$ at the point $(0, 1)$.

Unit Five Problems

Directions: Show all work completed to obtain your final answers. Partial credit may be given for incorrect answers. No credit may be given for problems without work if it is required to obtain the answer. Circle or box in your final answers.

5. In an apple orchard there are 30 trees per acre and the average yield is 400 apples per tree. For each additional tree planted per acre, the average yield per tree is reduced by 10 apples. How many trees per acre will maximize the crop?

6. Find the area of the largest rectangle with lower base on the x -axis and upper vertices on the parabola $y = 12 - x^2$.
7. A balloon rises at the rate of 8 feet per second from a point on the ground 60 feet from an observer. Find the rate of change of the angle of elevation when the balloon is 25 feet above the ground.
8. A farmer has 160 feet of fencing to enclose two adjacent rectangular pig pens. What dimensions should be used so that the enclosed area will be a maximum?

9. The base of a pyramid-shaped tank is a square with sides of length 9 feet, and the vertex of the pyramid is 12 feet below the base. The tank is filled to a depth of 4 feet, and water is flowing into the tank at the rate of 3 cubic feet per second. Find the rate of change of the depth of water in the tank.

CHALLENGE: Re-do this problem, this time with the vertex of the pyramid 12 feet *above* the base.

Multiple Choice Question: Circle the best answer.

10. If the base b of a triangle is increasing at a rate of 3 inches per minute while its height h is decreasing at a rate of 3 inches per minute, which of the following must be true about the area A of the triangle?
- (A) A is always increasing.
 - (B) A is always decreasing.
 - (C) A is decreasing only when $b < h$.
 - (D) A is decreasing only when $b > h$.
 - (E) A remains constant.