

Calculus I

Name: \_\_\_\_\_

Study Guide 17

Class: \_\_\_\_\_

Due Date: \_\_\_\_\_

Score: \_\_\_\_\_

No Work  $\Leftrightarrow$  No Points

Use Pencil Only  $\Leftrightarrow$  Be Neat & Organized

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1. (4 points) Given  $x^2 + y^2 = 2x + 4y$ ,  $\frac{dx}{dt} = -5$ , find  $\frac{dy}{dt}$  when  $x = 3$  and  $y = 1$ .

1. \_\_\_\_\_

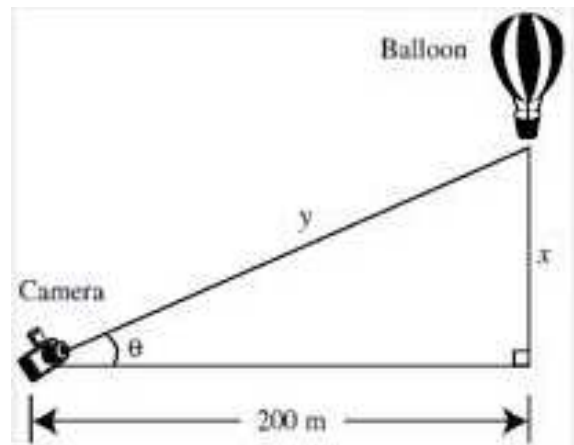
2. (4 points) A spherical balloon is inflated so its volume is increasing at the rate of  $10 \text{ ft}^3/\text{min}$ . How fast is the radius of the balloon increasing when the diameter is 4 ft?

2. \_\_\_\_\_

3. (4 points) An object is moving along the curve  $\frac{xy^3}{y^2 + 4} = 1$ . At what rate is the  $y$ -coordinate of the point  $(1, 2)$  changing if its  $x$ -coordinate decreases at 6 units/sec.

3. \_\_\_\_\_

4. (4 points) Use the accompany figure. The balloon is rising vertically at the rate of 25 m/min. Find the rate of change for the distance between the camera and the balloon after 8 minutes the balloon took off.



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4. \_\_\_\_\_

5. (4 points) Wheat is poured through a chute at the rate of  $10 \text{ ft}^3/\text{min}$  and falls in a conical pile whose bottom radius is always half the altitude. How fast is the circumference of the base be increasing when the pile is 8 ft high?

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5. \_\_\_\_\_

6. (3 points) Find a linear approximation function for  $\frac{1}{(1+2x)^5}$  for  $x_0 = 0$ .

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6. \_\_\_\_\_

7. (4 points) Let  $\theta$  be an acute angle in a right triangle, and let  $x$  and  $y$ , respectively, be the lengths of the sides adjacent to and opposite  $\theta$ . Suppose that  $x$  and  $y$  vary with time. At a certain instant,  $x = 2$  and is increasing at 1 unit / s, while  $y = 2$  and is decreasing at  $\frac{1}{4}$  unit / s. how fast is  $\theta$  changing at that moment?

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7. \_\_\_\_\_

8. (4 points) A rocket, rising vertically, is tracked by a radar station that is on the ground 5 miles from the launchpad. How fast is the rocket rising when it is 4 miles high and its distance from the radar station is increasing at a rate of 2000 mi/h?

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8. \_\_\_\_\_

9. (4 points) Find the slope of the tangent line to the curve  $\sqrt[3]{x^2} + \sqrt[3]{y^2} = 4$  at the point  $(-1, 3\sqrt{3})$ .

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9. \_\_\_\_\_

10. (5 points) A particle is moving along the curve  $16x^2 + 9y^2 = 144$ . Find all points  $(x, y)$  at which  $\frac{dx}{dt} = \frac{dy}{dt}$ , assume that they are never both zero at the same point.

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10. \_\_\_\_\_

11. (10 points) Consider  $f(x) = 4\sqrt[3]{x} - x\sqrt[3]{x}$ , find all the points where the first and second derivatives are zero or undefined. Make sure to be organized and box all your answers.