Student: Cole Lamers **Date:** 09/12/19	**Instructor:** Viktoriya Shcherban **Course:** Calc 1 11:30 AM / Internet (81749&81750) Shcherban	**Assignment:** 3.8 Related Rates

1. Suppose that a dimension x and the area $A = 11x^2$ of a shape are differentiable functions of t. Write an equation that relates $\frac{dA}{dt}$ to $\frac{dx}{dt}$.

$\frac{dA}{dt} = ($ 22X $)\frac{dx}{dt}$

2. Assume that $y = 9x$ and $\frac{dx}{dt} = 3$. Find $\frac{dy}{dt}$.

$\frac{dy}{dt} =$ 27 (Simplify your answer.)

3. Assume that $x = x(t)$ and $y = y(t)$. Let $y = x^3 + 5$ and $\frac{dx}{dt} = 3$ when $x = 2$.

Find $\frac{dy}{dt}$ when $x = 2$.

$\frac{dy}{dt} =$ 36 (Simplify your answer.)

4. Assume that all variables are implicit functions of time t. Find the indicated rate.

$x^2 + 3y^2 + 2y = 5$; $\frac{dx}{dt} = 2$ when $x = 2$ and $y = -1$; find $\frac{dy}{dt}$

$\frac{dy}{dt} =$ 2 (Simplify your answer.)

5. The dimensions x and y of an object are related to its volume V by the formula $V = 5x^2y$.

a. How is $\frac{dV}{dt}$ related to $\frac{dy}{dt}$ if x is constant?

b. How is $\frac{dV}{dt}$ related to $\frac{dx}{dt}$ if y is constant?

c. How is $\frac{dV}{dt}$ related to $\frac{dx}{dt}$ and $\frac{dy}{dt}$ if neither x nor y is constant?

a. Complete the equation for when x is constant.

$\frac{dV}{dt} = (5x^2) \frac{dy}{dt}$

b. Complete the equation for when y is constant.

$\frac{dV}{dt} = (10xy) \frac{dx}{dt}$

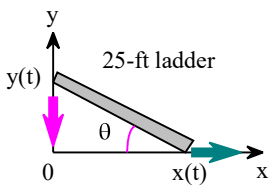
c. Complete the equation for when neither x nor y is constant.

$\frac{dV}{dt} = (10xy) \frac{dx}{dt} + (5x^2) \frac{dy}{dt}$

6. When a circular plate of metal is heated in an oven, its radius increases at a rate of 0.01 cm / min. At what rate is the plate's area increasing when the radius is 58 cm?

The rate of change of the area is 1.16π cm^2 / min.
(Type an exact answer in terms of π.)

7. A 25-ft ladder is leaning against a house when its base starts to slide away. By the time the base is 24 ft from the house, the base is moving away at the rate of 7 ft/sec.
a. What is the rate of change of the height of the top of the ladder?
b. At what rate is the area of the triangle formed by the ladder, wall, and ground changing then?



c. At what rate is the angle between the ladder and the ground changing then?

a. The rate of change of the height of the top of the ladder is -24 ft/sec.
(Simplify your answer.)

b. The area is changing at $-\frac{527}{2}$ ft^2/sec.
(Simplify your answer.)

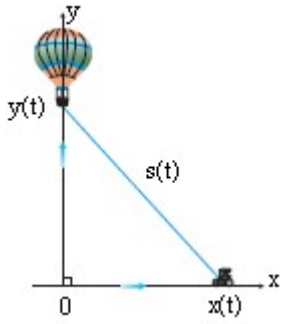
c. The angle is changing at -1 rad/sec.
(Simplify your answer.)

8. Water is flowing at the rate of 70 m^3 / min from a shallow concrete conical reservoir (vertex down) of base radius 50 m and height 8 m.
a. How fast (centimeters per minute) is the water level falling when the water is 7 m deep?
b. How fast is the radius of the water's surface changing then? Answer in centimeters per minute.

a. The water level is falling at 1.16 cm / min.
(Round to two decimal places as needed.)

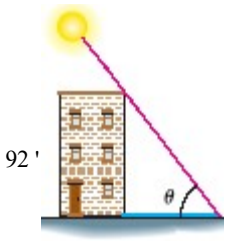
b. The radius of the water's surface is changing at −7.28 cm / min.
(Round to two decimal places as needed.)

9. A balloon is rising vertically above a level, straight road at a constant rate of 5 ft / sec. Just when the balloon is 66 ft above the ground, a bicycle moving at a constant rate of 12 ft / sec passes under it. How fast is the distance s(t) between the bicycle and balloon increasing 6 seconds later?



s(t) is increasing by $\frac{56}{5}$ ft / sec.
(Simplify your answer.)

10. On a morning of a day when the sun will pass directly overhead, the shadow of a 92-ft building on level ground is 69 ft long. At the moment in question, the angle θ the sun makes with the ground is increasing at the rate of 0.25°/min. At what rate is the shadow decreasing? Remember to use radians in your calculations. Express your answer in inches per minute.



The shadow is decreasing at 7.5 inches per minute.
(Round to one decimal place as needed.)