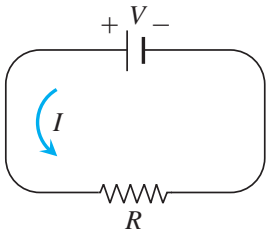
ACMAT161 Summer 2024
Professor Manguba-Glover
Homework 13 Name: _____

Show all work, simplify, and box your answers. If you do the problem incorrectly, or don't show sufficient work, you will be asked to rewrite the problem for full credit.

Due next class. This assignment is extra credit.

1. The voltage V (volts), current I (amperes), and resistance R (ohms) of an electric circuit like the one shown here are related by the equation $V = IR$. Suppose that V is increasing at a rate of 1 volt/sec while I is decreasing at the rate of 1/3 amp/sec. Let t denote time in seconds.

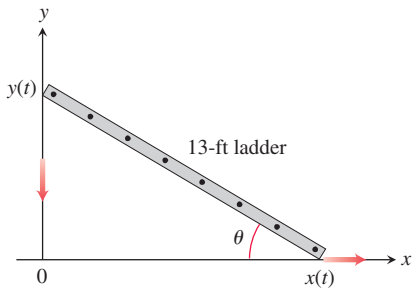


   (a) What is the value of dV/dt?
   (b) What is the value of dI/dt?
   (c) What equation relates dR/dt to dV/dt and dI/dt?
   (d) Find the rate at which R is changing when $V = 12$ voltes and $I = 2$ amp. Is R increasing, or decreasing?

2. Suppose that the edge lengths x, y, and z of a closed rectangular box are changing at the following rates:
$$\frac{dx}{dt} = 1 \text{ m/sec}, \quad \frac{dy}{dt} = -2 \text{ m/sec}, \quad \frac{dz}{dt} = 1 \text{ m/sec}.$$
   Find the rates at which the box's (a) volume, (b) surface area, and (c) diagonal length $s = \sqrt{x^2 + y^2 + z^2}$ are changing at the instant when $x = 4$, $y = 3$, and $z = 2$.

3. Sand falls from a conveyor belt at the rate of 10 m^3/min onto the top of a conical pile. The height of the pile is always three-eighths of the base diameter. How fast are the (a) height and (b) radius changing when the pile is 4 m high? Answer in centimeters per minute.

4. A 13-ft ladder is leaning against a house when its base starts to slide away (see figure). By the time the base is 12 ft from the house, the base is moving at the rate of 5 ft/sec.



   (a) How fast is the top of the ladder sliding down the wall then?

   (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 θ between the ladder and the ground changing then?

5. A balloon is rising vertically above a level, straight road at a constant rate of 1 ft/sec. Just when the balloon is 65 ft above the ground, a bicycle moving at a constant rate of 17 ft/sec passes under it. How fast is the distance $s(t)$ between the bicycle and balloon increasing 3 sec later?