## Calculus Review Unit 7

Use calculus to solve each of the following problems. Show all of your work, including an appropriate diagram, and your answer neatly organized.

1. A 30-foot ladder stands upright against a vertical wall. If the lower end of the ladder is pulled away from the wall (on level ground) at the rate of 3 feet per second (fps), then how fast is the angle between the ladder and the wall changing the instant the top of the ladder is 24 feet above the ground?

2. A ship with a constant speed of 12 mph sails for one hour on a heading of  $0^{\circ}$  (due north) and then turns to a new heading of  $60^{\circ}$  ( $60^{\circ}$  east of north). How fast is the distance between the ship and its starting point changing at the end of the second hour?

3. A conical reservoir with its axis vertical is 30 feet deep and 20 feet across the top. If water is being added at the rate of 1.5 cubic feet per second ( $ft^3/s$ ), then how fast is the water rising the instant it is 10 feet deep? (Express your final answer in inches per second.)

4. A ship is anchored 1.5 miles off a straight shore, and its searchlight is following a car that is traveling along the shore at 30 mph. How fast is the searchlight turning when the car is 2 miles from the ship? (Express your final answer in degrees per second rounded to 2 significant digits.)

5. A cone has a circular base with a radius of 5 inches and a height of 3 inches. If the radius of the base is increasing at 1.5 inches per second, while the height remains constant, then how fast is the volume increasing after 4 seconds?

6. A kite 100 feet high is being blown horizontally at 8 fps. How fast is the string running out when there are 300 feet of string out? (Express your answer rounded to 2 significant digits.)

7. A bridge crosses over a canal at right angles, 60 feet above the surface of the water. A man walking across the bridge at 5 fps passes directly over a boat going through the canal at 12 fps. How fast are the man and the boat separating one minute later?

8. Sand is being poured onto a conical pile at the rate of 2 cubic feet per second. If the pile is such that its height is always equal to the radius of its base, then how fast is the height of the pile increasing the instant the pile is 5 feet tall? How fast is the area of the base of the pile increasing at the same instant?