

## Collected Assignment on Sections 14.5 and 14.6

Math 232 Section 1

Due: April 7, 2006 10:10AM

Name (Print): \_\_\_\_\_

**Remember that you are not to discuss this homework with anyone other than Prof. King. Be sure to justify your answers. Use full sentences.**

1. Sand is leaking from a hole in a container at a rate of  $6\text{in}^3/\text{min}$ . As it leaks out, it forms a pile in the shape of a right circular cone whose base radius is increasing at a rate of  $\frac{1}{4}\text{in.}/\text{min}$ . If, at the instant that  $40\text{in}^3$  has leaked out, the radius is  $5\text{in.}$ , find the rate at which the height of the pile is increasing. Be sure to explain each step.

2. Section 14.6, Exercise 18, page 951. Hint: Think about the directional derivative as a dot product.

3. Let  $f(x, y, z) = \frac{x}{y} - \frac{y}{z}$  and consider the points  $P(0, -1, 2)$  and  $Q(3, 1, -4)$ .

(a) Find the directional derivative of  $f$  at  $P$  in the direction from  $P$  to  $Q$ .

(b) Find the maximum rate of change of  $f$  at  $P$  and the direction in which it occurs.

(c) Find the minimum rate of change of  $f$  at  $P$  and the direction in which it occurs.

4. The surface of a lake is represented by a region  $D$  in the  $xy$ -plane such that the depth (in feet) under the point  $(x, y)$  is  $f(x, y) = 600 - 3x^2 - 4y^2$ .

(a) In what direction should a boat at  $P(5,1)$  sail in order for the depth of the water to decrease most rapidly?

(b) In what direction from  $P$  does the depth remain the same?