

Math 27: Calculus I
Workshop 4: Related Rates
Due Monday, October 18

The solutions write-up is equal in course credit to one homework assignment. Each group should turn in one write-up, due at the start of class on Monday, October 18. Justify all answers using relevant terms and results from the course.

1. A revolving searchlight $1/2$ mile from shore makes 1 revolution per minute. How fast is the light travelling along the straight beach at the instant it passes over a shorepoint 1 mile away from the shorepoint nearest to the searchlight?

2. While innocently painting his house from the top of a 10 foot ladder one summer day, Prof. Davis feels a sudden jerk! Looking down he sees Killer, the neighbor's dog, pulling on the base of the ladder at a constant rate of $\frac{1}{2}$ ft/sec. Due to his impeccable balance Prof. Davis does not fall. The base of the ladder starts 2 feet from the wall and you may assume the top of the ladder never leaves the wall
 - (a) How far does he fall during the first four seconds of motion? The next four? The next four? The last four? (You may wish to use a calculator)
 - (b) From what you found in part a), what can you say about the rate at which he is falling?
 - (c) How fast is he approaching the ground when Killer has pulled the bottom of the ladder 6 feet from the wall?
 - (d) How fast is he moving when he hits the ground? Will he be okay?
 - (e) The ladder, the wall, and the ground form a triangle. How fast is the area of the triangle changing when Prof. Davis is 8 feet from the ground? Is the triangle getting larger, or smaller at this time?
 - (f) A bucket of paint is sitting halfway down the ladder. How fast is the distance between the wall and the paint changing when Killer has pulled the ladder 6 feet from the wall?

- (g) How fast is the distance between the bucket of paint and the base of the wall changing when Killer is 6 feet from the wall?
3. Coffee is draining from a conical filter, which is 6 inches tall and has diameter 6 inches at its top, into a cylindrical coffee pot, which has diameter 6 inches. The coffee is draining at a rate of 10 cubic inches per minute.
- (a) How quickly is the level of coffee rising in the coffee pot?
- (b) When the coffee in the cone is 5 inches deep, how quickly is the level in the cone dropping?