Calculus 1   Assignment 4   Fall 2013

1. Using what you know about the derivatives of $\sin x$ and $\cos x$, prove that the derivative of $\sec x$ is $\sec x \tan x$ and that the derivative of $\cot x$ is $- \csc^2 x$.

2. Find the derivative of $y = \sin(\csc(e^x))$.

3. Voldemort has just narrowly escaped death at the hands of Dumbledore and is flying away from the scene in humiliation. The dark wizard is flying directly east 100 ft above the ground at a speed of 80 ft/s. Meanwhile, Dumbledore is laying on the ground, pointing his wand at the dark wizard, pondering whether or not to finish him off. At what rate is the angle between Dumbledore's wand and the ground decreasing when Dumbledore is 200 ft away from Voldemort?

4. A witch, who lives in a house made of gingerbread and candy, likes to entice children to her home in order to fatten them up and eat them. Recently no children have been stopping by, so she decides on a new tactic. The witch puts a spell on a flock of doves to drop candy corn into a pile until it's large enough that children are drawn to it. The pile of candy corn is shaped like an upside-down cone whose base diameter and height are always equal, and the doves drop the corn onto the tip of the cone at a rate of 30 cubic ft per minute. When the pile is 10 ft high, Hansel and Gretel see the candy and start to run frantically toward it. At this time, how fast is the height of the pile increasing? (Hint: You may need to look up a formula for the volume of a cone.)

5. At noon, Edward is 100 miles west of Jacob. Edward is running south at 35 miles per hour and Jacob is running north at 25 miles per hour. How fast is the distance between Edward and Jacob changing at 2:00 PM? (And "no," this is "not" a reference to a certain recent series involving vampires and werewolves.)