

Name:

Math 115 Exam 3

December 5th, 2013

1) The square of the distance from the center of an elliptical racing track to a car driving on the track is given in feet by $h(t) = 20 + 10 \cos^2(\pi t)$ where $t \geq 0$ is in minutes.

a) (12 points) Determine where h is increasing or decreasing on the interval $[1/4, 3/4]$.

b) (6 points) Find the absolute maximum and minimum for h on the interval $[1/4, 3/4]$.

2) Sasquatch's favorite drinking cup has the shape of a cylinder with no top. Sasquatch is planning to go into business by mass-marketing such cups with his partner, Bigfoot. He wants the cups to contain a fixed volume of 9000π cm^3 . The insulated material for the sides costs more, at .03 cents per cm^2 , than the base, which costs .01 cents per cm^2 . The formula for the surface area of a cylinder with no top of radius r and height h is $\pi r^2 + 2\pi r h$.

a) (6 points) Establish an equation in one variable for the cost of Sasquatch's cup.

b) (12 points) Find the height and radius of a cup that minimizes the cost for Sasquatch to produce. Be sure to show your answer is actually a minimum.

3) a) (10 points) Show that there is exactly one cube whose volume is equal to 3 minus its height.

b) (6 points) Starting with $x_1 = 1$, apply Newton's method to find x_3 , thus approximating the sidelength of the cube. You may record your answer as a decimal to four places.

4) Consider the curves $f(x) = \sqrt{x^2 + 1}$ and $g(x) = \sqrt{x + 1}$.

a) (6 points) Find the intersection points of the curves.

b) (8 points) Set up an integral for the volume obtained by revolving the region bounded by the two curves about the y -axis BUT DO NOT EVALUATE THE INTEGRAL.

5) Evaluate the following integrals.

a) (6 points) $\int (8x - 13x^7 + 1) dx$

b) (8 points) $\int_{-2}^3 \frac{x}{(x^2 + 1)^2} dx$

c) (10 points) $\int_0^{\pi/6} \frac{1}{\sin(x) + 1} dx$