HOMEWORK 5 - MATH 140
DUE DATE: Wednesday, October 6
INSTRUCTOR: George Voutsadakis

Read each problem very carefully before starting to solve it. One part of each homework problem will be chosen at random and graded. Each question is worth 1 point. It is necessary to show your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Water is poured into a container in the shape of a right circular cone with radius 4 feet and height 16 feet. Express the volume V of the water in the cone as a function of the height h of the water. (Hint: The volume of a cone of radius r and height h is $V = \frac{1}{3}\pi r^2 h$.)

2. Roughly draw the graph of the function $f(x) = 4x(x^2 - 4)$ by hand using the sign table method. Then use your calculators to add to your graphs the coordinates of all maxima and minima (if any).

3. Roughly draw the graph of the function $f(x) = (x + 1)^3(x - 3)$ by hand using the sign table method. Then use your calculators to add to your graphs the coordinates of all maxima and minima (if any).

4. Inscribe a right circular cylinder of height h and radius r in a cone of fixed radius R and fixed height H. Express the volume V of the cylinder as a function of r. (Hint: $V = \pi r^2 h$.)

5. Find the domain, create the sign table, find the asymptotes and then roughly sketch the graph of the rational function $f(x) = \frac{3x+5}{x-6}$.

6. Find the domain, create the sign table, find the asymptotes and then roughly sketch the graph of the rational function $f(x) = \frac{x-1}{x^2-5x+6}$.

7. Find the domain, create the sign table, find the asymptotes and then roughly sketch the graph of the rational function $f(x) = \frac{x^2-x-12}{x+5}$.

8. You have been hired by a postal service to design a closed box with a square base that has volume 5000 cubic inches.

   (a) Find a function for the surface area of the box in terms of the length x of the side of the base.

   (b) Graph that function using your calculators. (Draw for me the graph cleanly.)

   (c) What are the dimensions of the box that minimize the surface area? What is the minimum surface area?