Calculus Refresher for M408D – Day 2

1. Find the intervals on which the function f increases, and the intervals on which f decreases.

$f(x) = x \ln x$.

2. Find the absolute Maximum and Minimum of

$f(x) = x^4 - 2x^2 + 3$ on $[-2,3]$

3. A right circular cylinder (with a bottom and a top) is to be designed to hold 12 fluid ounces of a soft drink and to use a minimum of material in its construction. Find the required dimensions for the container. [1 fl.oz. $\approx$ 1.8 in^3]

4. A poster is to have a total area of 72 in^2 with 1-inch margins at the bottom and sides and a 3-inch margin at the top. What dimensions will give the largest printed area?

5. Determine all real numbers x that make the second derivative of $y = \frac{1}{2}\tan x + \sin x$ equal zero or undefined.

6. Find all the values of x at which the graph of $y = x^2 + 4\sin x$ changes concavity on $[0,\pi]$

7. Consider the function $y = x^3 - 6x^2 + 9x$.

   a. Determine the open intervals on which the function is increasing.
   b. Determine the relative extrema.
   c. Determine the intervals on which the function is concave up or down.
   d. Determine the x-value(s) of inflection point(s).

8. Use the following steps to graph $f(x) = \dfrac{x^2+1}{x^2-2}$:

   1. Locate x and y intercepts.
   2. Determine any horizontal or vertical asymptotes.
   3. Find intervals where $f(x)$ is increasing and where it is decreasing.
   4. Locate all critical points and identify them as a max, a min, or neither.
   5. Find intervals where $f(x)$ is concave up and where it is concave down.
   6. Locate all inflection points.
   7. Graph the function below: