HW 17: Section 3.3 and 3.4

Due: Thursday, November 7th in SQRC by 9pm

Learning Goals:

- Find critical points of functions.
- Use critical points to identify local extrema
- Sketch graphs of curves using graphing tools and using information about derivatives.

Questions:

1. Problem 3.3.8 Find all critical numbers by hand. Either use a graph or the first derivative test to determine whether the critical number represents a local maximum, local minimum, or neither.
$$f(x) = x^4 + 6x^2 - 2$$

2. Problem 3.3.12 Find all critical numbers by hand. Either use a graph or the first derivative test to determine whether the critical number represents a local maximum, local minimum, or neither.
$$f(x) = \sqrt{3}\sin(x) + \cos(x)$$

3. Find the absolute extrema of the function $f(x) = x^4 - 8x^2 + 2$ on the interval (a) $[-3, 1]$ and also on (b) $[-2, 2]$

4. Problem 3.3.40 Sketch the graph of a continuous function f such that the absolute maximum of $f(x)$ on the open interval $(-2, 2)$ does not exist and the absolute minimum equals 2.

5. Explore the graphs of $e^{-x}, xe^{-x}, x^2e^{-x}$ and x^3e^{-x}. Find all local extrema and use l'Hopitals rule to determine the behavior as $x \to \infty$. You can think of the graph of x^ne^{-x} as showing the results of a tug of war: $x^n \to \infty$ as $x \to \infty$ but $e^{-x} \to 0$ as $x \to infty$. Describe the graph of x^ne^{-x} in terms of this tug-of-war.

6. Problem 3.3.52 Use a graphing tool to sketch the graph of $f(x) = e^{-x^2}$. Determine where the graph is steepest.

7. Problem 3.4.4 By hand, find the intervals where the function $y = x^3 - 3x^2 - 9x + 1$ is increasing and decreasing. Use this information to determine all local extrema and sketch a graph.