1. (20pts) Short answer. Box your answer. No justification required.

(a) True or False: Newton’s Method will always converge to the desired answer (i.e \( \lim_{n \to \infty} x_n = r \))? 

(b) For the function \( f(x) = x^3 + 1345 \) does the point at \((0, 1345)\) have any significance (in the curve sketching sense) other than being a y-intercept? 

(c) Suppose you know for some function \( f(x) \) that \( f(r) = 0 \), that is \( x = r \) is a root of the function \( f(x) \). If you are using Newton’s method applied to \( f(x) \) and let \( x_1 = r \) what is \( x_2 \)? 

(d) Find the most general antiderivative for \( f'(x) = \sin(x) + 2x \)

2. (20pts) Sketch the curve in parts.

\[
f(x) = \frac{1}{1 + x^2}
\]

(a) Domain, Asymptotes, Symmetry, Intercepts 

(b) Interval of Increasing or Decreasing, location and value of Maxima/Minima 

(c) Intervals of Concavity 

(d) Sketch (indicate with a label any intercepts, max/mins, asymptotes, inflection points).

3. (20pts) Show all work.

Maximize the product of two positive numbers that sum to 300.

4. (20pts) Show all work. Parts (a) and (b) are unrelated.

(a) Use Newton’s Method to find a solution to \( \sin(x) = x \). Find \( x_2 \) given \( x_1 = \pi/2 \). 

(b) Set up the formula for \( x_{n+1} \) if using Newton’s method to find a maxima/minima of a function \( g(x) \).

5. (20pts) Show all work.

Given the acceleration of a particle moving in a straight line is \( a(t) = 6t \), find the position function given \( v(0) = 1 \) and \( s(1) = 0 \).