1. Determine whether the following statements are True or False. If False, provide a description (or theorem or picture or counterexample ...) that explains your position.
   A) If \( y = f(x) \) is increasing and differentiable and \( \Delta x > 0 \), then \( \Delta y > dy \).
   B) The sum of two increasing functions is increasing.
   C) If \( f_1 \) is concave up and \( f_2 \) is concave down on an interval \( I \), then \( f_1 f_2 \) is neither concave up nor concave down on \( I \).

2. Let \( t(x) = \tan x \) and notice that \( t(0) = t(\pi) = 0 \). Does there exist a number \( w \) for which \( t'(w) = 0 \)? Why or why not?

3. Consider the function \( h(t) = t - 2 \sin t \) on the interval \([0, 2\pi]\). Find all critical numbers of \( h \), state the intervals of increase/decrease, and find all relative extrema.

4. Consider the function \( f(x) = \frac{x}{x^2 + 1} \). State the intervals where the graph is concave upward/downward and find all points of inflection, if applicable.

5. The side of a cube is found to be 10cm long. From this, you find the volume of the cube is \( 10^3 = 1000 \text{cm}^3 \). If your original measurement of the side is accurate to within 2%, approximately how accurate is your calculation of volume?

6. A box with a square base is constructed so the length of one side of the base plus the height is 10 inches. What is the largest possible volume of such a box?

7. Give a full analysis of the function \( y = x^3 + 3x^2 + 1 \). Include intercepts (approximate if necessary), asymptotes, intervals of increase/decrease, extrema, intervals of concavity, points of inflection, and a sketch. Note: some of this info may not apply to this function.