Mathematics 1710 Exercise Set Number 7

1. Differentiate each of the following functions. For which values of x is the function defined. Being fluent with using the chain rule is good, and nothing beats practice. Remember - *to differentiate stuff inside a bracket raised to a power - multiply the bracket with the stuff inside by the power and reduce the power on the bracket by 1. Then multiply what you've go by the derivative of the stuff inside the bracket.*

   - $f(x) = 5x^{\frac{2}{7}} + 4x^{\frac{11}{9}}$
   - $f(x) = \sqrt{1 - x^2}$
   - $f(x) = (x^2 + \sqrt{x})^{\frac{3}{7}}$
   - $f(x) = \sqrt{\sqrt{x^2 + 3x - 1} + 1}$

2. Suppose a manufacturer has determined that the cost $C(q)$ of producing q units of their product is
$$C(q) = 0.0002q^3 - 0.02q^2 + 4q + 425.$$
   Approximate the additional cost of going from production of 40 items to 41 items.

3. A plane is flying horizontally at a constant altitude of 2 km and at a constant speed of 800 km/hr. The plane passes directly over a radar station at 2:00 P.M.. At what rate is the distance between the plane and the radar station increasing at 5:00 P.M.?

4. At 7:00 A.M. ship A is 100 km due west of ship B. Ship A is sailing due north at the rate of 30 km/hr and ship B is sailing due south at 20 km/hr. How fast is the distance between the two ships increasing 12:00 Noon?

5. A cylindrical tank 1 meter in diameter and 2 meters high is being filled with oil at the rate of 1 cubic meter per minute. At what rate is the depth of the oil rising.

6. For the function $f(x) = x^3 + 5x^2 + x + 2$ defined on the interval $[-2, 1]$, find

   - the zeros of the derivative

   - the values of points on the graph where the function takes on global maximum and global minimum values

   - the values of points on the graph where the function takes on any local maximum and local minimum values

7. For the function $f(x) = 3x^5 - 5x^3 - 1$ defined for x in the interval $[-1.5, 1.5]$, find the zeros of the derivative, and determine with the help of graphing software:

   - the values of the points on the graph where the function takes on global maximum and global minimum values

- the values of points on the graph where the function takes on any local minimum or maximum values