MAT 1500 (Dr. Fuentes) **Worksheet 8 - Sections 3.9 & 4.1**

Section 3.9: Related Rates

Problem 1. A ladder 10 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 4 feet per second, how fast is the angle between the ladder and the ground changing when the bottom of the ladder is 6 feet from the wall?

Problem 2. Air is being pumped into a spherical balloon so that its volume increases at a rate of 100 cm^3/s. How fast is the radius of the baloon increasing when the diameter is 50 cm?

Problem 3. A paper cup has the shape of a cone with height 10 cm and radius 3 cm (at the top). If water is poured into the cup at a rate of 2 cm^3/s, how fast is the water level rising when the water is 5 cm deep?

Problem 4. Each side of a square is increasing at a rate of 6 cm/s. At what rate is the area of the square increasing when the area of the square is 16 cm^2 ?

Problem 5. A street light is mounted at the top of a 15-feet-tall pole. A man 6 feet tall walks away from the pole with a speed of 5 feet per second along a straight path. How fast is the tip of his shadow moving when he is 40 feet from the pole?

Section 4.1: Maximum & Minimum Values

Problem 6.
(a) Sketch the graph of a function that has a local maximum at 2 and is continuous, but not differentiable at 2.
(b) Sketch the graph of a function that has a local maximum at 2 and is not continuous at 2.
(c) Sketch the graph of a function on $[0, 4]$ that has an absolute maximum, no local maximum, and no absolute minimum.

Problem 7. Find the critical numbers of the function.

(a) $f(x) = \dfrac{x^2+2}{2x-1}$ (b) $F(x) = x^{4/5}(x-4)^2$ (c) $g(x) = xe^x$

Problem 8. Find the absolute maximum and the absolute minimum value(s) of the function

$$f(\theta) = 1 + \cos^2(\theta)$$

in the interval $[\pi/4, \pi]$.