APPM 1350 - Fall 2021 - Week 7
October 5, 2021

1) Two people on bikes are at the same place. One of the bikers starts riding directly north at a rate of 8 m/sec. Simultaneously, the second starts to ride directly east at a rate of 5 m/sec. At what rate is the distance between the two riders increasing after 20 seconds?

2) Find the linearization $L(x)$ of the function at a:

$$f(x) = (x-3)^{\frac{1}{2}} \text{ at } a = 6.$$

3) Use a linear approximation (or differentials) to estimate

$$\sqrt{9.01}.$$

4) Calculate dy/dx for the ellipse given by

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

5) Calculate dy/dx for the equation

$$\cos(xy) = x + \sin(y).$$

6) A tank of water in the shape of a cone is leaking water at a constant rate of 2 ft^3/hour. The base radius of the tank is 7 ft and the height of the tank is 14 ft. At what rate is the depth of the water in the tank changing when the depth of the water is 6 ft?

7) Given a cylinder with the same height and diameter, the height of the cylinder was measured and found to be 6 centimeters with a possible error measurement of at most 0.01 centimeters. What is the maximum error in calculating the volume?

8) Find the critical numbers of the function.

   (a) $f(x) = x^3 - 3x + 5$

   (b) $g(t) = t + \sin(2t)$ on $[0, 2\pi]$.

9) A 10-ft ladder is leaning against a house on flat ground. The house is to the left of the ladder. The base of the ladder starts to slide away from the house. When the base has slid to 8 ft from the house, it is moving horizontally at the rate of 2 ft/sec. How fast is the ladder's top sliding down the wall when the base is 8 ft from the house?

10) Find the absolute maximum and absolute minimum values of f on the given interval.

   (a) $f(x) = x - \sin(2x)$ on $[0, \pi]$

   (b) $f(x) = x^{\frac{4}{3}}$ on $[-2, 9]$.