

Math 21A
Kouba
Challenge Discussion Sheet 8

1.) A woman on a dock is pulling in a rope attached to a small boat. If the woman's hands are 12 feet higher than the boat and she is pulling in the rope at 2 ft./sec., at what rate is the boat approaching the dock when

- a.) 25 ft. of rope are out ?
- b.) 13 ft. of rope are out ?

2.) You are standing 100 feet from a small rocket as it is launched vertically into the air at the constant rate of 50 ft./sec. At what rate is the angle formed by you, the ground, and the rocket changing when the rocket is

- a.) 100 ft. above the ground ?
- b.) 1000 ft. above the ground ?

3.) An inverted conical tank with base radius 5 ft. and height 10 feet is being filled with water at the rate of 5π ft.³/min. At what rate is

- a.) the depth of the water changing
- b.) the circular surface area of the water changing

when the depth of the water is 8 feet ?

4.) Use Newton's Method to estimate the solution to $x^5 - 4x + 5 = 0$ to four decimal places.

5.) Use Newton's Method to estimate the positive solution to $\sin x = x^3$ to four decimal places.

6.) Use Newton's Method to estimate the square root of 20 to four decimal places.

7.) Use a differential to estimate the square root of 20.

8.) Use a differential to show that $\sin h \approx h$ for small h .

9.) A cube measuring 2 feet on each edge is dipped in warm chocolate until the candy coating on the cube is exactly 1 inch thick.

- a.) Use a differential to estimate the volume of chocolate surrounding the cube.
- b.) Compute the exact volume of chocolate surrounding the cube
- c.) What is the percentage error (relative to the exact volume) in using the differential's estimate ?