

MA 2550: Calculus I

Supplementary Notes for Section 3.8

Guidelines for Solving Related-Rate Problems

- 1. If possible, draw a picture. If a quantity changes over time, label with a variable. If a quantity is fixed over time, label with the appropriate constant. **Warning:** Only label quantities with constants if they are actually constant over time!
- 2. Most problems refer to some specific moment in time. Identify all given quantities and all quantities to be determined (including rates) for this moment in time. Remember that rates are derivatives and you can recognize them when they are in *units of blah* per *units of time*.
- 3. Write an equation involving the variables whose rates of change are given or are to be determined. Common things to deal with are area, volume, trig, Pythagorean Theorem, similar triangles, etc.
- 4. Take d/dt of both sides.
- 5. Substitute in known values (including rates), then solve for desired quantity or rate.

Example 1: Suppose x and y are differentiable functions of t and are related by $y = x^2 - 1$. Find dy/dt when x = 2 given that dx/dt = 3.

Example 2: A nugget is dropped into a calm pond, causing concentric circles. The radius of the outer ripple is increasing at a rate of 2 ft/sec. When the radius is 3 feet, at what rate is the total area of the outer ripple changing?

