Section 3.9: Related Rates

(1) In this section, we see examples of using the rate of change of one quantity to find the rate of change of another related quantity. When we are doing a related rates problem, what variable are we taking the derivative with respect to? Why?

We take the derivative with respect to t because we want to know how the quantities are changing over time.

(2) What role does the chain rule play in a related rates problem? Explain with an example.

Since we are taking the derivative with respect to t, it's like we are doing implicit differentiation, which requires the chain rule. Let's day we have the volume of a sphere is

$$V = 4/3\pi r^3.$$

When we take the derivative with respect to t, we get the derivative of V is 1 times $\frac{dV}{dt}$ (chain rule) and then the derivative of $4/3\pi r^3$ is $4\pi r^2$ times $\frac{dr}{dt}$, another chain rule.

(3) When doing a related rates problem, we are often given values for various unknown quantities. Which values can you plug in before taking the derivative and which do you have to wait to plug in?

If a quantity is constant you can plug it in right away. If it is changing, you have to wait until after to take the derivative to plug it in.

(4) It is often useful to have a set of steps that you follow when doing these types of problems. What steps will you use when doing related rates problems?

Step 1: Draw a diagram and pick variables.
Step 2: Identify the quantities you know.
Step 3: Identify the quantities you want to know.
Step 4: Find an expression that relates the known and unknown quantities.
Step 5: Take the derivative with respect to t. Plug in known quantities and solve for unknowns.

(5) As you are working through the problems in this section, you will need to use various mathematical expressions/ideas to relate the variables in the problems. Make a list of the expressions/ideas you use here. Be sure to include details of the ones you are not completely comfortable with. (e.g. similar triangles, pythagorean theorem)

- Similar triangles
- Volumns of spheres, cones, (formulas given), cubes
- pythagorean theorem
- surface area

Extra Practice in Book: 3.9: (all exercises in this section are good practice, I especially recommend:)1,3,5,7,11,15,20