Chapter 9 summary

For the third midterm, you should be able to do the following things:

- Given some geometric description of a curve in the plane, write down an equation so that the locus is the curve.
- Given a quadratic equation in two variables, you should be able to identify what conic section it is, determine **all** geometric data associated to it, and sketch it. The table on page 681 may be helpful.
- Given sufficient data to specify a conic section, find the equation defining it.
- Pass back and fourth between polar and rectangular coordinates.
- Sketch locus of a polar equation (i.e. a polar curve).
- Find the area bounded by a polar curve, or find the area between two polar curves.
- Find a parameterization for a geometrically or physically defined curve.
- Compute the speed, tangent vector and tangent line to a parameterized curve—understand the derivations of these (i.e. remember where they came from).
- Understand polar curves as parameterize curves and compute information about tangents in this setting.
- Compute arc length of a parameterized curve. This includes as a special case arc length from §6.4.
- Compute surface area for a surface obtained by revolving a parametrized curve around an axis (either axis!). This also includes surface area from §6.4 as a special case.
- Compute the area between a parameterized curve and the x–axis (recall that this takes some care to understand, i.e. left to right versus right to left). Similarly, compute volumes bounded by surfaces of revolution (again, care is needed). As an application, for a *simple closed* parametrized curve, be able to compute the area of the region bounded by that curve (see below).

Recall that a parameterized curve

$$x = f(t) \quad y = g(t) \qquad \text{for } t \in [a, b]$$

is **closed** if it starts and ends at the same point:

$$f(a) = f(b) \text{ and } g(a) = g(b)$$

and it is **simple** if there are no other points of self intersection. If the simple closed curve is traversed in a clockwise direction then the area of the region it bounds is

$$\int_a^b g(t)f'(t)dt$$

Review Problems:

- Miscellaneous problems, page 681–682: 1–18 (find all geometric data and sketch), 31–81.
- There are many more computational practice problems you can find on your own throughout the chapter. Here is a list of some additional problems that require more than mere computation. §9.1: 21–35; §9.2: 33–38, 59–64; §9.3: 37–42; §9.4: 30–42; §9.5: 23–42; §9.6: 65–67, 75, 76, 82–89.

A general word of warning for Midterm 3: Make sure that you are careful in choosing the limits of integration when computing with integrals. This means that you will need to understand why the limits of integration are what they are. This is really the point of these problems since the integrals themselves can be computed with "old" techniques.