**Math 120: Precalculus** **Autumn 2016**

## A List of Topics for the First Midterm

Here's a list of things you should be comfortable doing for the exam.

1. Unit conversion and rates of change.
2. Coordinate systems.
   (a) Plotting things in a coordinate system.
   (b) Using the distance formula.
3. Equations for lines and circles.
   (a) Finding intersections of curves.
   (b) Writing equations for circles and semicircles.
4. Linear modeling.
   (a) Finding an equation for a line given various pieces of information. Finding the shortest distance from a line to a point not on that line.
   (b) Using linear equations for real-world problems with constant rates of change.
   (c) Finding parametric equations for linear motion.
5. Functions and graphing.
   (a) Graphing a function, and analyzing a function based on its graph.
   (b) Evaluating functions, and solving equations like $f(2x+3) = x$.
6. Graphical analysis.
   (a) Determining the domain and range of a function, visually or algebraically, and using the vertical line test.
   (b) Graphing, constructing, and solving multipart functions.
7. Quadratic functions.
   (a) Graphing quadratic functions and converting to vertex form.
   (b) Finding a formula for a quadratic based on some points it passes through and/or information about its vertex.
   (c) (Not optimization—that will be on the second midterm.)

### Some Useful Equations

- The distance $d$ between points $(x_1, y_1)$ and $(x_2, y_2)$: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- A line through points $(x_1, y_1)$ and $(x_2, y_2)$: $y = \left(\dfrac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1) + y_1$
- A line through the point $(x_1, y_1)$ with slope $m$: $y = m(x - x_1) + y_1$
- A line with $y$-intercept $b$ and slope $m$: $y = mx + b$

- A circle with center $(x_0, y_0)$ and radius $r$: $(x - x_0)^2 + (y - y_0)^2 = r^2$
- The parametric equations for uniform linear motion from $(x_0, y_0)$ to $(x_1, y_1)$ in $\Delta t$ units of time, where $\Delta x = x_1 - x_0$, and $\Delta y = y_1 - y_0$:

$$x = x_0 + \frac{\Delta x}{\Delta t}t \qquad y = y_0 + \frac{\Delta y}{\Delta t}t$$

- An upper semicircle with center $(x_0, y_0)$ and radius $r$: $y = y_0 + \sqrt{r^2 - (x - x_0)^2}$
- A lower semicircle with center $(x_0, y_0)$ and radius $r$: $y = y_0 - \sqrt{r^2 - (x - x_0)^2}$
- A quadratic, with vertex $(h, k)$ and scaling factor $a$: $y = a(x - h)^2 + k$
- Converting to vertex form from $y = ax^2 + bx + c$: $h = \dfrac{-b}{2a} \qquad k = c - \dfrac{b^2}{4a}$