
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) : $y = \left(\frac{y_2 - y_1}{x_2 - x_1} \right) (x - x_1) + y_1$
- 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 Δt units of time, where $\Delta x = x_1 - x_0$, and $\Delta y = y_1 - y_0$:

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

- 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 $y = ax^2 + bx + c$: $h = \frac{-b}{2a}$ $k = c - \frac{b^2}{4a}$