Math 1b Midterm 1 Review

§9.1 Modeling with Differential equations

Examples: Population → $P'(t) = kP(t)$

Spring → Hooke's law. force $= -kx = m\frac{d^2x}{dt^2}$

Definition: order of a differential equation is the maximum derivative taken

Definition: f is a solution if $y = f(x)$ satisfies the differential equation (note - it used to be that functions HAD solutions, but with DiffEQ's, they ARE solutions)

Definition: the initial condition is the point you know on the curve so that you can get rid of the constant.

Look at problems 3, 7, 11.

§9.2 Direction Fields and Euler's Method

Definition: A solution curve is a graph of points (x,y) satisfying the DiffEQ through a particular point. Given a DiffEQ, we don't necessarily know the original function, but in many cases we know a lot about the slope. For example, if it's a first order DiffEQ, we can plug in points (x,y) to compute y' at different spots in the plane. Drawing these in gives a direction field or slope field.

Just as you can find an approximate solution graph with an initial value and slope field, Euler's method is a lot more precise.

Choose a step value h. $x_{n+1} = x_n + h$.

$y_{n+1} = y_n + hF(x_n, y_n)$ where F is the first order diffEQ

Look at problems 13, 19, 27.