7.2

Note Title 2/25/2008

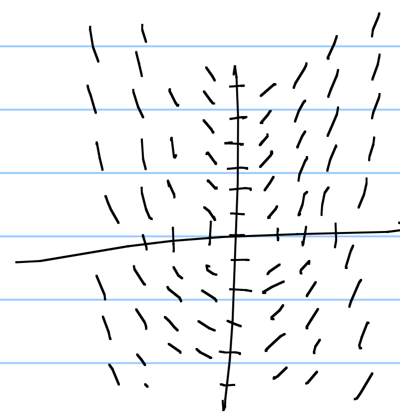
We cannot solve many dif. eq. but we can get a general idea of their solutions using direction fields

ex. Let $\frac{dy}{dx} = 2x$

This says at x the slope of the curve is $2x$.

So if $x=0$ $\frac{dy}{dx}=0 \Rightarrow$ slope $=0$ horizontal

if $x=1$, slope $=2$



if $x=3$, slope $=6$

if $x=-1$, slope $=-2$

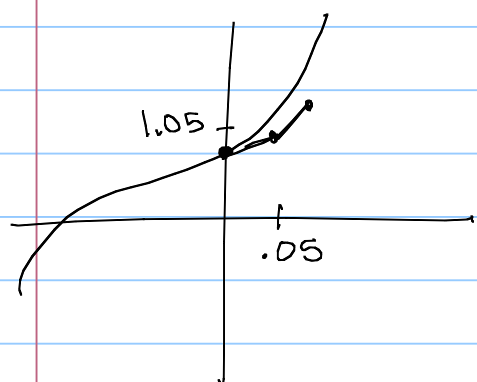
if $x=-2$, slope $=-6$

So it looks like graph is something like

Euler's Method

ex. Use Euler's Method to approximate $y(.1)$ when $\frac{dy}{dx} = y$ with $y(0)=1$ & step size $.05$

↑ increase x by .05 each time



At $(0,1)$ slope is $\frac{dy}{dx} = 1$

$\frac{\Delta y}{\Delta x} = 1 \Rightarrow \Delta y = 1\Delta x$

$\Rightarrow \Delta y = 1(.05) = .05$

So $y_1 = 1 + .05 = 1.05$

$(.05, 1.05)$

At $(.05, 1.05)$ $\frac{dy}{dx} = 1.05$

$\frac{\Delta y}{\Delta x} = 1.05 \Rightarrow \Delta y = 1.05(.05)$

$= .0525$

$x_2 = .05 + .05 = .1$

$y_2 = 1.05 + .0525 = 1.1025$

$(.1, 1.1025)$

So $y(.1) \approx 1.1025$

In general,

$y_1 = y_0 + hF(x_0, y_0)$

$y_2 = y_1 + hF(x_1, y_1)$

$\vdots$

$y_n = y_{n-1} + hF(x_{n-1}, y_{n-1})$

where h = step size

$F(x,y) = \frac{dy}{dx}$