**Quiz 2, January 24, 2017, 11:40 class**

Consider the Initial Value Problem $y' = -y$, $y(0) = 2$. Use **Euler's Method** to approximate $y(\frac{1}{2})$. **Take the step size to be $h = \frac{1}{4}$.**

**ANSWER:** Let $f(x,y) = -y$, $(x_0,y_0) = (0,2)$, $x_1 = \frac{1}{4}$, and $x_2 = \frac{1}{2}$. Define $y_1$ so that the slope of the line joining $(x_0,y_0)$ to $(x_1,y_1)$ is $f(x_0,y_0)$. Define $y_2$ so that the slope of the line joining $(x_1,y_1)$ to $(x_2,y_2)$ is $f(x_1,y_1)$. Then $y_2$ is our approximation of $y(\frac{1}{2})$.

At any rate

$$\frac{y_1-2}{\frac{1}{4}} = \frac{y_1-y_0}{x_1-x_0} = f(x_0,y_0) = -2;$$

so,

$$y_1 = -\frac{1}{2} + 2 = \frac{3}{2};$$

and

$$\frac{y_2-\frac{3}{2}}{\frac{1}{4}} = \frac{y_2-y_1}{x_2-x_1} = f(x_1,y_1) = -\frac{3}{2}.$$

Thus,

$$y_2 = -\frac{3}{8} + \frac{3}{2} = \frac{9}{8}.$$

$$\boxed{\text{Our approximation of } y(\tfrac{1}{2}) \text{ is } y_2 = \tfrac{9}{8}.}$$