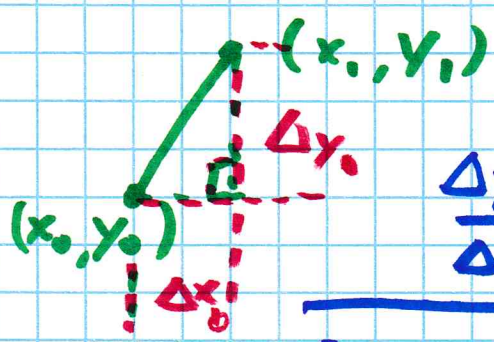
6.1.71 $y' = 3x - 2y$ approx. soln. through $(0,3)$ using Euler's method w/ $\Delta x = .05$ and 10 steps

x	0	.05	.1	.15	.2	.25	.3	.35	.4
y	3	2.7	2.4375	2.2088	2.01	1.839	1.693	1.569	1.464
y'	-6	-5.25	-4.575	-3.9675	-3.42	-2.929	-2.486	-2.087	-1.729
Δy	-.3	-.2625	-.22875	-.1984	-.171	-.146	-.124	-.104	-.0864

x	.45	.5
y	1.378	1.3075
y'	-1.406	
Δy	-.07	



$$\frac{\Delta y_n}{\Delta x_n} = y_n'$$

$$\Delta y_n = y_n' \cdot \Delta x$$

Separation of Variables

A D.E. is seperable if it can be written in the form

$$f(x) = g(y) \cdot dy/dx \quad \text{or} \quad f(x) = g(y) \cdot y'$$

Where:

* $f(x)$ has no dependance on y and
* $g(y)$ has no dependance on x

if $f(x) = g(y)\, dy/dx$

then $f(x)\,dx = g(y)\,dy \Rightarrow \int f\,dx = \int g\,dy$

Exponential DE's

$$dy/dx = k \cdot y$$

Separation of vars.

$$\frac{1}{y} \cdot dy/dx = k \quad \text{or} \quad \frac{1}{y} y' = k$$

$$\frac{1}{y}\,dy = k\,dx, \qquad \int \frac{1}{y}\,dy = \int k\,dx$$

$$\ln|y| = kx + C$$

$b :=$ a number > 0

$$|y| = e^{kx+C} = \boxed{e^{C}} \cdot e^{kx}$$

$$|y| = b \cdot e^{kx} \Rightarrow y = \pm b\, e^{kx}$$

$$\boxed{y = a\, e^{kx}}$$

Newton's Law of Cooling

Rate of Temperature change of a body is directly proportional to the difference in Temp. between the body and its surroundings.

T - body temp t - time

T_s - temp. of surroundings (assume const.)

k - const.

$$\boxed{dT/dt = k(T - T_s)}$$

$$\frac{1}{T-T_s} T' = k \quad , \quad \frac{1}{T-T_s} dT = k\,dt$$

$$\int \frac{1}{T-T_s} dT = \int k\,dt \quad , \quad \ln|T-T_s| = kt + C$$

$$T - T_s = a \cdot e^{kt} \Rightarrow \boxed{T = ae^{kt} + T_s}$$