$$\frac{4}{\left(-v_0^{-1/2}(kt\sqrt{v_0}+2)\right)^2}=v$$

$$\frac{4v_0}{(kt\sqrt{v_0}+2)^2}=v$$

Integrate again and learn that

$$x=\frac{1}{k\sqrt{v_0}}\frac{-4v_0}{(kt\sqrt{v_0}+2)}+C_1$$

$$x=\frac{-4\sqrt{v_0}}{k(kt\sqrt{v_0}+2)}+C_1.$$

Plug in $t=0$ to learn

$$x_0=\frac{-4\sqrt{v_0}}{2k}+C_1.$$

So,

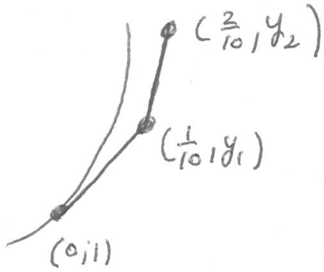
$$x=\frac{-4\sqrt{v_0}}{k(kt\sqrt{v_0}+2)}+x_0+\frac{2\sqrt{v_0}}{k}.$$

We compute

$$\lim_{t\to\infty}x(t)=\lim_{t\to\infty}\frac{-4\sqrt{v_0}}{k(kt\sqrt{v_0}+2)}+x_0+\frac{2\sqrt{v_0}}{k}=\boxed{x_0+\frac{2\sqrt{v_0}}{k}}.$$

3. **Consider the initial value problem** $\frac{dy}{dx}=x^2+y^2$ **,** $y(0)=1$ **. Use Euler's method to approximate** $y(2/10)$ **. Use two steps, each of size** $1/10$ **.**

Consider the picture:



The curve represents the correct solution of the initial value problem. We approximate the real solution with the two line segments. The line segment from $(0,1)$ to $(1/10,y_1)$ has slope equal to $(x^2+y^2)|_{(0,1)}$. The line segment from $(1/10,y_1)$ to $(2/10,y_2)$ has slope equal to $(x^2+y^2)|_{(1/10,y_1)}$. Of course, y_2 is our approximation of $y(2/10)$.