Le: #12
3.4

Derive $v(t)$ formula for object going upward

m mass

b = air resistance prop const

$g = 9.81\ m/s^2$

$$\frac{dv}{dt} = -\frac{mg}{m} - \frac{bv}{m}$$

$$\frac{dv}{dt} = -g - \frac{bv}{m}$$

$$\frac{dv}{dt} + \frac{b}{m}v = -g$$

$$\mu(t) = e^{\int \frac{b}{m} dt} = e^{\frac{b}{m}t}$$

$$v = \frac{\int \mu(t)\, Q(t)\, dt + c}{\mu(t)}$$

$$= \frac{-g\int e^{\frac{b}{m}t}\, dt + c}{e^{(b/m)t}}$$

$u = b/m\ t$

$du = \frac{b}{m} dt$

$\frac{m}{b} du = dt$

$$= \frac{-g\left(\frac{m}{b}\right) e^{\frac{b}{m}t} + c}{e^{(b/m)t}}$$

$$v = -\frac{gm}{b} + c\, e^{(-b/m)t}$$

When $t=0$, $v=v_0$!

$$v_0 = -\frac{gm}{b} + c$$

$$v_0 + \frac{mg}{b} = c$$

$$v = \frac{-mg}{b} + \left(v_0 + \frac{mg}{b}\right) e^{\frac{-b}{m}t}$$