PROB. 11-24

$v_0 = 25 \frac{ft}{s}$ @ $X_0 = 0$, $a = 10 - 0.9v^2$

FIND $v$ @ $x = 30$ ft

$a = f(v)$

$a = v\frac{dv}{dx} = (10 - 0.9v^2)$

$dx = \frac{v\,dv}{(10 - 0.9v^2)}$

$\int_{x_0}^{x} dx = \int_{v_0}^{v} \frac{v\,dv}{(10 - 0.9v^2)}$

LET $w = 10 - 0.9v^2$, $dw = -1.8v\,dv$

$v\,dv = -\frac{1}{1.8}\,dw$

LIMITS: @ $v = v_0$, $w = 10 - 0.9v_0^2$

@ $v = v$, $w = 10 - 0.9v^2$

$X - X_0 = \int_{10-0.9v_0^2}^{10-0.9v^2} \left(\frac{-\frac{1}{1.8}\,dw}{w}\right)$

$X - X_0 = -\frac{1}{1.8}\ln\left(\frac{10 - 0.9v^2}{10 - 0.9v_0^2}\right)$

$v = \sqrt{\left(\frac{1}{0.9}\right)\left\{10 - (10 - 0.9v_0^2)\exp\left[1.8(X_0 - X)\right]\right\}}$

$v = \sqrt{\left(\frac{1}{0.9}\right)\left\{10 - (10 - 0.9 \cdot 25^2)\exp\left[1.8(-30)\right]\right\}}$

$v = 3.33 \frac{ft}{s}$