

2-10⁷⁰-04

Test tomorrow! $ay'' + by' + cy = 0$

p 38. #10

Home buyer can afford no more than \$800/month. Interest rates 9% mortgage term is 20 yrs. What is max amount buyer can afford?

S = principal

$$\frac{ds}{dt} = rS + k \quad S(0) = S_0 \quad S(20) = 0$$

\uparrow 9% \nwarrow \$9600/yr

$$\frac{ds}{dt} = .09S - 9600/\text{year}$$

put in standard form

$$\frac{ds}{dt} - .09s = -9600$$

$$e^{-\int .09 dt} = e^{-.09t}$$

$$e^{-.09t} \left[\frac{ds}{dt} - .09s = -9600 \right]$$

$$\frac{d}{dt} [e^{-.09t} s] = -9600 e^{-.09t}$$

$$e^{-.09t} s = \frac{9600}{.09} e^{-.09t} + C$$

$$s = \frac{9600}{.09} + C e^{.09t}$$

at $t=0, s=S_0$

$$S_0 = \frac{9600}{.09} + C \Rightarrow C = S_0 - \frac{9600}{.09}$$

$$s = \frac{9600}{.09} + \left(S_0 - \frac{9600}{.09} \right) e^{.09t}$$

at $t=20, s=0$

$$0 = \frac{9600}{.09} + \left(S_0 - \frac{9600}{.09} \right) e^{.09 \cdot 20}$$

solve for S_0

Suppose 5,000 l pool is chlorinated by 50% chlorine solution into pool in flow. The solution runs in @ 10 l/min, water flow out at same rate. Pool starts with no chlorine. Find concentration at 1 hour $Q(t)$ = chlorine volume in pool at time t.

what is V (vol of pool) if outflow is 20?

$$\frac{dQ}{dt} = \text{flow of chlorine in} - \text{flow chlorine}$$

same $\Rightarrow \frac{dQ}{dt} = .5 \cdot 10 \text{ l/min} - \frac{Q}{V} (10 \text{ l/min})$

rate $\Rightarrow \frac{dQ}{dt} = .5 \cdot 20 \text{ l/m} - \frac{Q}{5000 - 10t} 20 \text{ l/m}$

$$V = -10t + 5000$$

rate of change of volume is 10 l/min - 20 l/min = -10 l/m