## Cheatography

### DiffEq Cheat Sheet by notadoctor via cheatography.com/43403/cs/12924/

3.1 Modeling with Linear DE	
Radioactive Decay	$x(t)=x_0^e^{(kt)}$
Population	$P(t) = P_0^* e^{(kt)}$
Compound Interest	S(t)=S_0*e^(rt)
Cooling/Heating	$T(t)=T_m+(T_0-T_m)^*e^{(kt)}$
Mixing of Two Fluids	dA/dt=R_in-R_out

#### Examples

Population increases proportional to #people at time t. If initial population P0 has doubled in 7 years, how long will it take to triple/quadruple?  $2P0/P0=e^{(kt)} \Rightarrow ln(2)=kt \Rightarrow k=ln(2)/7 \Rightarrow (ln(2)/7)$ 

t(trip)=ln(3)/[ln(2)/7] = 11.09yr => t(quad)=ln(4)/[ln(2)/7] = 14yrA tank contains 1000 L pure h2o. Brine w/ 1 kg/L salt pumped in @ 6L/min; the well-mixed solution is pumped out at the same rate. When will concentration = 0.5kg/L

A'(t)=Rin-Rout => Rin=6kg/min; Rout=(A/1000kg/L)\*(6L/min)=3A/500 kg/min

 $\begin{array}{l} A'(t)+3A/500=6 \Rightarrow A(t)=1000+Ce^{(-3t/500)} \Rightarrow A(0)=0 \Rightarrow C=-1000\\ 1000=1000e^{(-3t/500)}=500 \Rightarrow e^{(-3t/500)}=1/2 \Rightarrow t=115.53s \end{array}$ 

# С

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