Section 31.6: Elementary Applications

Wednesday, April 10, 2013
12:08 PM

note: we will omit the electrical circuit applications

why do we care about solving DEs? because they show up in so many applications!

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example: The rate of growth for a population at time t is proportional to the size of the population at that time. If the initial population is P_0 at $t=0$, find an expression for $P(t)$.

population is P or $P(t)$

growth rate is $\frac{dP}{dt}$

$$\frac{dP}{dt} \propto P$$

$$\frac{dP}{dt} = kP \qquad k = \text{some constant}$$

separable:

$$\int \frac{dP}{P} = \int k\,dt$$

$$\ln P = kt + C$$

$$P = e^{kt+C}$$

$$= e^{kt} e^{C}$$

what is e raised a constant?

$= e^{kt} e^{c}$ raised constant? another constant!

$$P = C_1 e^{kt}$$

but when $t = 0$, $P = P_0$

$$P_0 = C_1 e^{0} \qquad C_1 = P_0$$

$$\boxed{P = P_0 e^{kt}}$$