p 348 #20

Honeybees:

$$\frac{dP}{dt} = \frac{1}{4}P \quad \text{when} \quad P < 10{,}000$$

$$P = 5{,}000 \cdot e^{1/4 \cdot t}$$

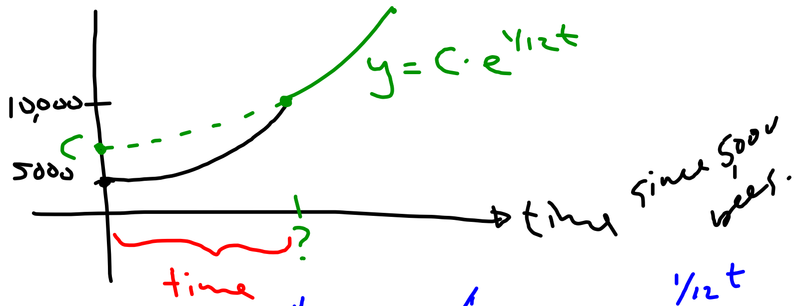
$$\frac{dP}{dt} = \frac{1}{12}P, \quad \text{when} \quad 10{,}000 < P < 50{,}000$$

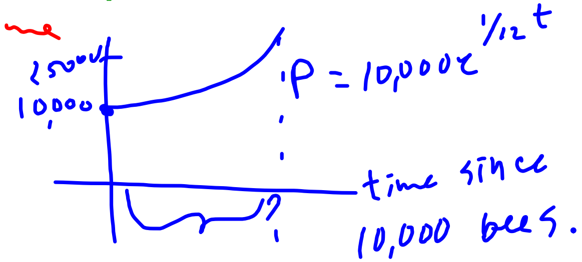
$$P(0) = 5{,}000$$

Find when $P(t) = 25000$

$$P = 5{,}000 \cdot e^{1/4 t} \quad \text{for} \quad P < 10{,}000$$

$$P = C \cdot e^{1/12 t} \quad \text{for} \quad 10{,}000 < P < 50{,}000$$





Solve:

$$\frac{dP}{dt} = \frac{1}{4}P$$

$$\int \frac{1}{P}\,dP = \int \frac{1}{4}\,dt$$

$$\ln P = \frac{1}{4}t + C \qquad , \; P>0$$

$$P = e^{1/4 t} \cdot C$$

$$\boxed{P = C \cdot e^{t/4}}$$

$$P(0) = 5{,}000$$

$$5000 = C \cdot e^{0/4}$$

$$C = 5000$$

p349 #17 "Guppies"

$$\frac{dP}{dt} = .0015\,P(150-P), \quad P(0)=6$$

150 = carrying capacity

$$\frac{dP}{dt} = \frac{k}{150}P(150-P)$$

$$.0015 = \frac{k}{150}$$

$$k = .225$$

$$\frac{dP}{dt} = \frac{.225}{150}P(150-P)$$

* p345

$$P = \frac{150}{1+Ae^{-.225t}}$$

$P(0) = 6$

$$6 = \frac{150}{1+A\cdot e^{-.225(0)}}$$

$$6 = \frac{150}{1+A}$$

$$6+6A = 150$$

$$A = 24$$

$$\boxed{P = \frac{150}{1+24\cdot e^{-.225t}}}$$

$y' = \sin x \qquad y(0) = 5$

$y = -\cos x + C$

??

$5 = -\cos(0) + C$

$5 = -1 + C \qquad C = 6$

$$\frac{dy}{dt} = .007y \qquad y(0) = 2008$$

$$y = c \cdot e^{.007t}$$

$$2008 = c \cdot e^{.007(0)}$$

$$c = 2008$$

Target 6E

Book sections 6.5, 6.6

$$\frac{dP}{dt} = k \cdot P \implies P = C \cdot e^{kt}$$

$$\frac{dP}{dt} = \frac{k}{m} P (m - P) \implies P = \frac{m}{1 + Ae^{-kt}}$$

ex $\quad y(0) = 42{,}568$

$$\frac{dy}{dt} = -\frac{1}{10}y$$

$$y = 42{,}568\, e^{-\frac{1}{10}t}$$

$$21{,}284 = 42{,}568 \cdot e^{-1/10 t}$$

$$\frac{1}{2} = e^{-1/10 t}$$

$$\ln 1/2 = \ln e^{-1/10 t}$$

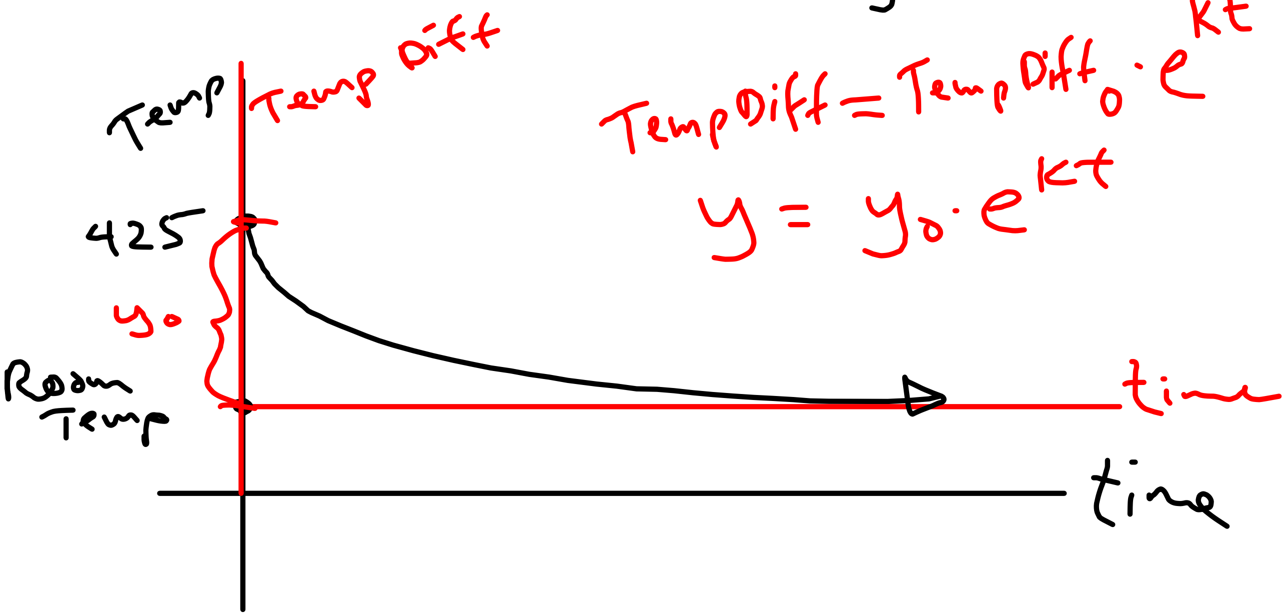
$$\ln 1/2 = -1/10 t \cdot \ln e$$

$$\ln 1/2 = -1/10 t$$

$$-10 \cdot \ln 1/2 = t$$

$$t = 10 \cdot \ln 2$$

"Newton's Law of Cooling"



$$\text{Temp Diff} = \text{Temp Diff}_0 \cdot e^{kt}$$

$$y = y_0 \cdot e^{kt}$$

$$\underbrace{T - T_s}_{\text{Temp diff}} = (\underbrace{T_0 - T_s}_{\text{Temp diff}_0})e^{kt}$$

T_s = room Temp

T_0 = initial temp

T = tem