Section 6.8
General Exponential Growth & Decay

$A = A_0 e^{kt}$
(Law of uninhibited growth)

1) find the A_0
2) given on set of info → find k
3) find any requested info

A_0 = initial amnt
A = final amnt
K = rate
t = time
$k > 0$ (growth)
$k < 0$ (decay)

6.8 (6) a) $N = N_0 e^{kt}$

b) $N_0 = 500$
$t = 1 \quad N = 800$
$\frac{800}{500} = \frac{500 e^{k(1)}}{500}$
$8/5 = e^k$
$\ln(8/5) = \ln e^k$
$\ln(8/5) = k \cdot \ln e \to 1$
$k = 0.47$ per hour

$N = 500 e^{0.47t}$

c) How many after 5hrs? ($t = 5$)
$N = 500 e^{0.47(5)} = 5,243$

$N = 20,000$

$\frac{20,000}{500} = \frac{500 e^{0.47t}}{500}$
$40 = e^{0.47t}$
$\ln 40 = \ln e^{0.47t}$
$\ln 40 = \ln 0.47t \cdot \ln e \to 1$
$\frac{\ln 40}{0.47} = t = 7.85$ hours

Half life = time for half of something to decay
1000 → 500 left

(12) carbon 14 has half life of 5,600 yrs
70% of its carbon 14
say we had 1000mg to start with

$N = N_0 e^{kt} \to 500 = 1000 e^{k(5600)}$
$\frac{500}{1000} = \frac{1}{2} = e^{5600k}$

$\ln \frac{1}{2} = \ln e^{5600k}$

$\ln \frac{1}{2} = 5600k \cdot \ln e^{1}$

$\frac{\ln \frac{1}{2}}{5600} = -1.23776 \times 10^{-4} = -0.000123776 = k$

$N = 1000e^{-0.000123776t}$

$N = 700$

$700 = 1000e^{-0.000123776t}$

$7/10 = e^{-0.000123776t}$

$\ln(7/10) = \ln e^{-0.000123776t}$

$\ln(7/10) = -0.000123776t \cdot \ln e^{1}$

$2881.6 = t$

Logistics Functions

$P(t) = \frac{c}{1 + ae^{-bt}}$

b = rate

c = limiting value (carrying comp)

a = initial condition

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$P(t) = \frac{500}{1 + 83.33e^{-.162t}}$

(t = years)

a) 500

b) 16.2%

c) $t = 3$

$P(3) = \frac{500}{(1 + 83.33e^{-0.162(3)})} \approx$ ap. 9.6 → 10 eagles