

Section 6.8 General Exponential Growth + Decay

$$A = A_0 e^{kt}$$

(Law of uninhibited growth)

- | | |
|---------------------------------------|----------------------------------|
| 1) find the A_0 | $A_0 =$ initial amt |
| 2) given on set of info
→ find k | $A =$ final amt |
| 3) find any requested info | $k =$ rate |
| | $t =$ time |
| | $k > 0$ (growth) |
| | $k < 0$ |
| | $k < 0$ (decay) |

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

b) $N_0 = 500$
 $t = 1 \quad N = 800$
 $\frac{800}{500} = \frac{500 e^{k(1)}}{500}$

$8/5 = e^k$
 $\ln(8/5) = \ln e^k$
 $\ln(8/5) = k \cdot \ln e \rightarrow 1$
 $k = 0.47$ per hour

$N = 500 e^{0.47t}$

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

$N = 20,000$

$\frac{20,000}{500} = \frac{500 e^{0.47t}}{500}$

$40 = e^{0.47t}$

$\ln 40 = \ln e^{0.47t}$

$\ln 40 = \ln 0.47t \cdot \ln e \rightarrow 1$

$\frac{\ln 40}{0.47} = t = 7.85$ hours

Half life = time for half of something to decay

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

1000 → 500 left

$N = N_0 e^{kt} \rightarrow 500 = 1000 e^{k(5600)}$

$\frac{500}{1000} = \frac{1}{2} = e^{5600k}$

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

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

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

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

$$N = 700$$

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

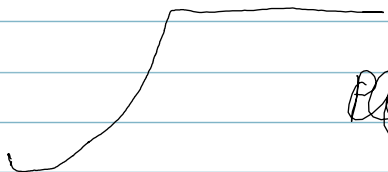
$$\frac{7}{10} = e^{-0.000123776t}$$

$$\ln\left(\frac{7}{10}\right) = \ln e^{-0.000123776t}$$

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

$$2881.6 = t$$

Logistics Functions



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

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$$b = rate$$

$c =$ limiting value (carrying cap)

$a =$ initial condition

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$$P(t) = \frac{500}{1 + 83.33e^{-0.162t}}$$

($t =$ years)

a) 500

b) 16.2%

c) $t = 3$

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