

**Homework #5****1. Problem 5-1.**

A population of purple rabbits lives on the island of Zulatop. The rabbits have a net growth rate of  $0.09 \text{ yr}^{-1}$ . At the present time there are 176 rabbits on the island. What is the predicted number of rabbits 5, 10, and 20 years from now? Use the simple exponential growth equation to calculate the number of rabbits. **In addition, make a plot of purple rabbit population versus time for a period from 0 to 25 years.**

**1 point****5-1 Population projection of rabbits**

Given: Net growth rate =  $0.09 \text{ yr}^{-1}$ , initial population = 176.

Solution:

**a. Using Eqn 5-11**

$$N_t = N_0 e^{(rt)}$$

$$N_t = 176 e^{(0.09)t}$$

**b. At 5, 10 and 20 years,**

$$t = 5$$

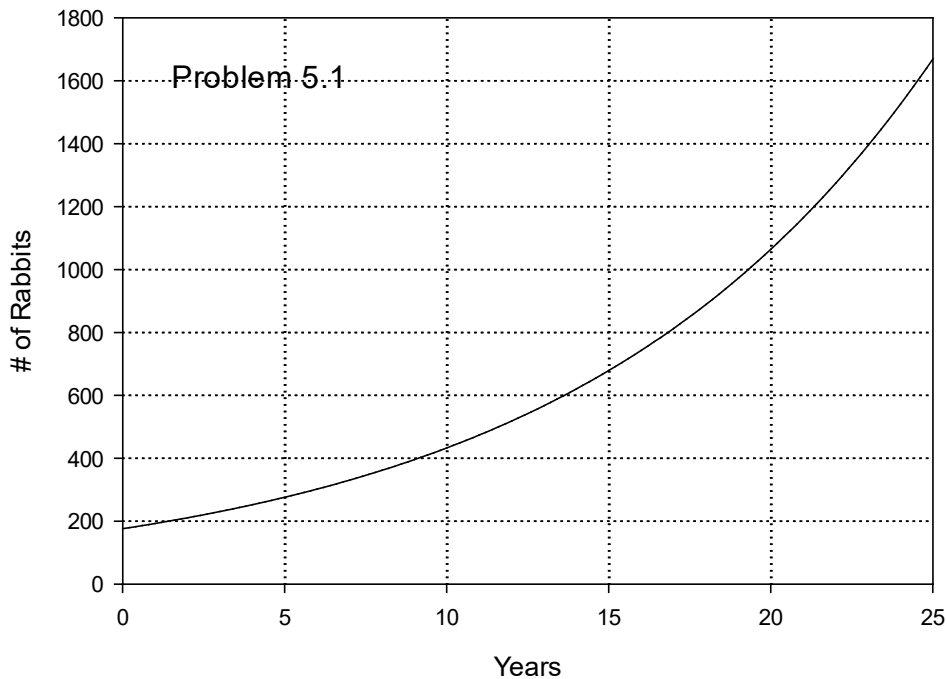
$$N_t = 176 e^{(0.09)(5)} = 276 \text{ rabbits}$$

$$t = 10$$

$$N_t = 176 e^{(0.09)(10)} = 432.89 \text{ or } 433 \text{ rabbits}$$

$$t = 20$$

$$N_t = 176 e^{(0.09)(20)} = 1064.74 \text{ or } 1065 \text{ rabbits}$$



**2. Problem 5-2.**

Recalculate the number of purple rabbits if the carrying capacity is 386 and you use the logistic equation. Assume the number of rabbits at the present time and use the same intervals. **In addition, make a plot of purple rabbit population versus time for a period from 0 to 25 years.**

**1 point**

**5-2 Population projection using logistic equation**

Given: Problem 5-1, carrying capacity = 386.

Solution:

**a. Using Eqn 4-14**

$$N(t) = \frac{K(N_0)}{(N_0 + (K - N_0)e^{-rt})}$$

$$N(t) = \frac{386(176)}{(176 + (386 - 176)e^{-(0.09)t})}$$

$$N(t) = \frac{67936}{\dots}$$

$$(176 + (210)e^{-(0.09)t})$$

b. At 5, 10, and 20 years

$$t = 5$$

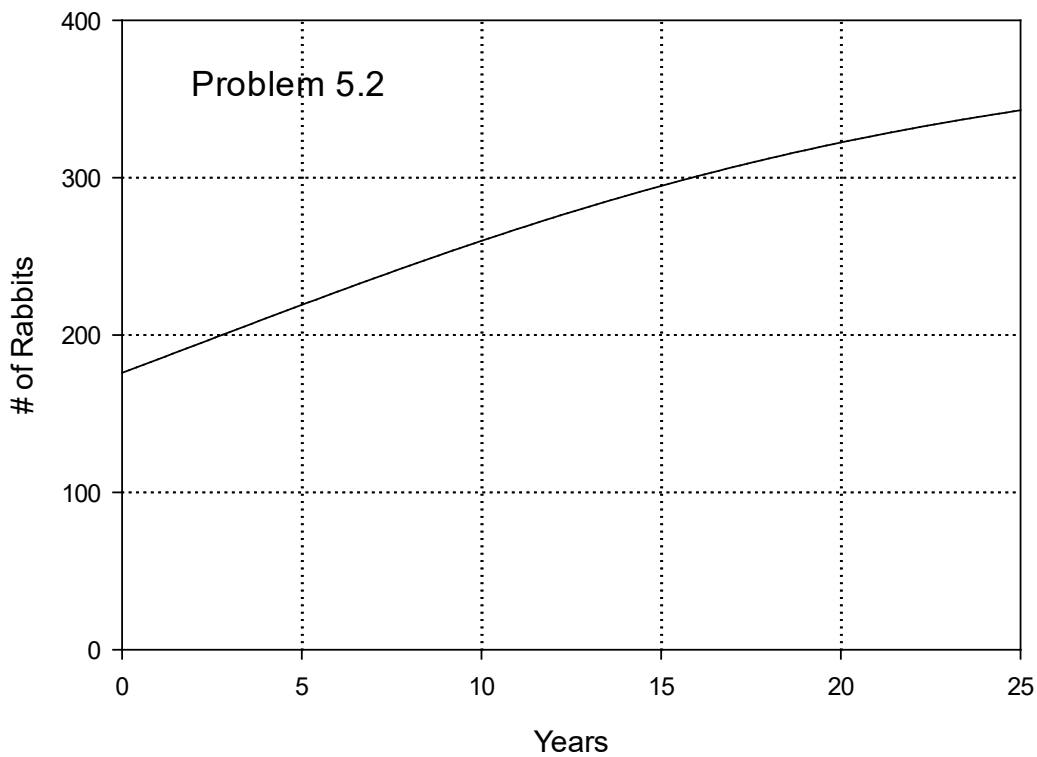
$$N(t) = \frac{67936}{(176 + (210)e^{-(0.09)(5)})} = 219.23 \text{ or } 219 \text{ rabbits}$$

$$t = 10$$

$$N(t) = \frac{67936}{(176 + (210)e^{-(0.09)(10)})} = 259.92 \text{ or } 260 \text{ rabbits}$$

$$t = 20$$

$$N(t) = \frac{67936}{(176 + (210)e^{-(0.09)(20)})} = 322.42 \text{ or } 322 \text{ rabbits}$$



### 3. Problem 5-3.

The concentration of diazinon has been measured to be 23.3 µg/L in Lake Pekko. The bioconcentration factor for diazinon is 337 L/kg. What is the expected concentration of diazinon in fish living in Lake Pekko?

Given: Diazinon = 23.3 µg/L, bioconcentration factor = 337 L/kg.

Solution:

$$\text{Conc.} = (23.3 \mu\text{g/L})(337 \text{ L/kg}) = 7850 \mu\text{g/kg}$$

**0.5**  
**points**

### 4. Problem 5-4.

The bioconcentration factor for bis(2-ethylhexyl)phthalate, a commonly used plasticizer, in the organism *Daphnia* is 5200 L/kg. If the concentration of bis(2-ethylhexyl)phthalate in a lake is 3.6 µg/L, estimate the concentration of bis(2-ethylhexyl)phthalate in *Daphnia* in units of µg/kg.

Given: bis(2-ethylhexyl)phthalate = 3.6 µg/L, bioconcentration factor = 5200 L/kg.

Solution:

$$\text{Conc.} = (3.6 \mu\text{g/L})(5200 \text{ L/kg}) = 18,720 \mu\text{g/kg}$$

**0.5**  
**points**