

Calculus Study Guide: 9.4

Let $y(x)$ be a solution of $\frac{dy}{dx} = 0.2y(5 - \frac{y}{11})$, with $y(0) = 10$. Find $y(x)$.

$$y' = y(1 - \frac{y}{55}) \quad y = \frac{55}{1 - ce^{-t}} \quad 10 = \frac{55}{1 - c}$$

$$c = -4.5 \quad y = \frac{55}{1 + 4.5e^{-t}}$$

answer: _____

A forest has a carrying capacity of 1000 deer. In 2010 the forest has 100 deer. In 2013 the forest has 150 deer. The growth in the deer population follows a logistic model.

When does the model predict that the deer population will reach 600?

$$y = \frac{1000}{1 - ce^{-kt}}$$

$$c = -9$$

$$y = \frac{1000}{1 + 9e^{-kt}}$$

$$150 = \frac{1000}{1 + 9e^{-3k}}$$

$$150 + 1350e^{-3k} = 1000$$

$$e^{-3k} = 0.629$$

$$-3k = \ln 0.629$$

$$k = 0.154$$

$$600 = \frac{1000}{1 + 9e^{-0.154t}}$$

$$600 + 5400e^{-0.154t} = 1000$$

$$e^{-0.154t} = 0.0741$$

$$-0.154t = \ln 0.0741$$

$$t = 16.9 \text{ years}$$

answer: _____