4.8 – LOGISTIC MODELS

LOGISTIC MODELS The exponential growth model assumes uninhibited growth meaning that the population grows without limit. However, population growth is eventually limited by living space and food supply. A more realistic model is the **logistic growth model** which describes a model of growth that eventually "levels-off".

Logistic Growth Model: $P(t) = \dfrac{C}{1 + ae^{-kt}}$

where the number C is called the **carrying capacity** of the environment because the value P(t) approaches C as t approaches infinity; in other words, $\lim_{t \to \infty} P(t) = C$ and the number k is called the growth rate.

1) **Population of an Endangered Species** – Often environmentalists will capture an endangered species and transport the species to a controlled environment where the species can produce offspring and regenerate its population. Suppose that six American bald eagles are captured, transported to Montana, and set free. Based on experience, the environmentalists expect the population to grow according to the model

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

where t is measured in years.

a) What is the carrying capacity of the environment? What is the growth rate of the bald eagle?
The carrying capacity is 500. The growth rate is .162 per year.

b) Graph the function in your calculator to compare the graph with your answer above.
The graph approaches 500 asymptotically.

The next few questions are to be answered analytically, not graphically:

c) What is the population after 3 years?

9.57 or 9 eagles.

d) When will the population be 300 eagles?

29.8042 years

e) How long will it take the population to reach one-half of its carrying capacity?

27.2013 years