# Chapter 11 – 2b Derivatives of Exponential and Logarithmic Functions

### Review

Exponential growth and decay: where r > 0 indicates growth and r < 0 indicates decay.

**Example 11.** Find the derivative of

**Example 12.** The salvage value S (in dollars) of a company airplane after t years is estimated to be



Depreciation is the change in the salvage value relative to time.

A) What is the rate of depreciation at t = 1 year?

B) What is the rate of depreciation at t = 5 years?

C) What is the rate of depreciation at t = 10 years?

**Example 13.** Cholera bacteria divide every half hour. If we start with a colony of 10 bacteria, after t hours the number of bacteria will be



A) What is the instantaneous rate of change in the number of bacteria after 1 hour?

B) What is the instantaneous rate of change in the number of bacteria after 5 hours?

C) What is the instantaneous rate of change in the number of bacteria after 10 hours?

**Example 14.** A study at a children’s hospital found the following relationship between systolic blood pressure (P, in millimeters of mercury) and weight (x, in pounds):



A) What is the instantaneous rate of change in pressure relative to weight when the weight is 40 pounds?

B) What is the instantaneous rate of change in pressure relative to weight when the weight is 90 pounds?

**Example 15.** A mathematical model for world population growth is given by



where P0 is the population at time t = 0, P is the population at time t, r is the continuous compound rate of growth, and t is the time in years. The current world population is approximately 6.9 billion and the current growth rate is about 1.3% compounded continuously.

A) Based on this model, how long will it take to reach a world population of 8 billion people?

B) What is the current instantaneous rate of change in the population relative to time?

C) What will be the instantaneous rate of change at t = 5 years?