

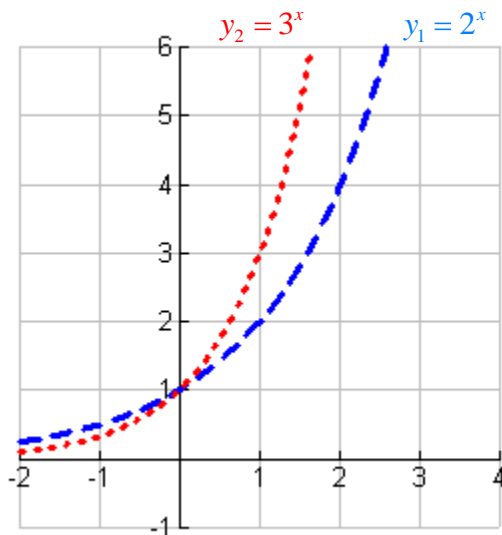
MA 160  
Section 1.5, Exponential Models

A. Applied Exponential Growth

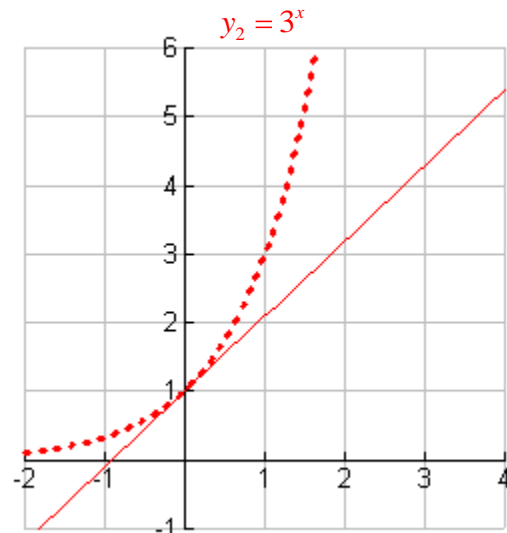
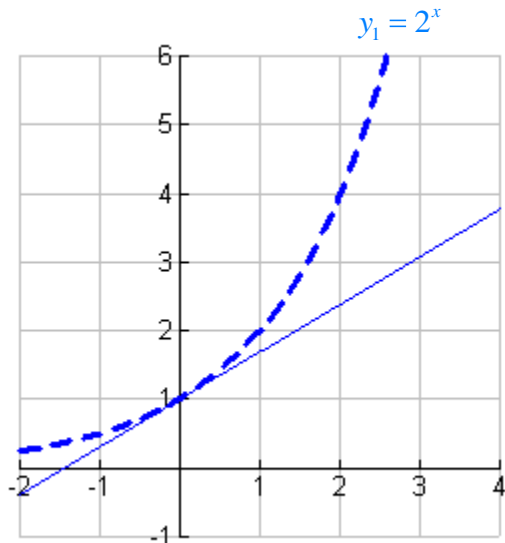
1. A bacteria culture starts with 500 bacteria and doubles in size every hour.
  - a) How many bacteria are there after 1 hour?
  - b) How many bacteria are there after 2 hours?
  - c) How many bacteria are there after 3 hours?
  - d) How many bacteria are there after  $t$  hours?
  - e) Estimate the bacteria population after 20 hours.
  - f) Suppose the bacterial culture doubles in size every 3 hours. How many bacteria are there after  $t$  hours?

B. The function  $f(x) = e^x$

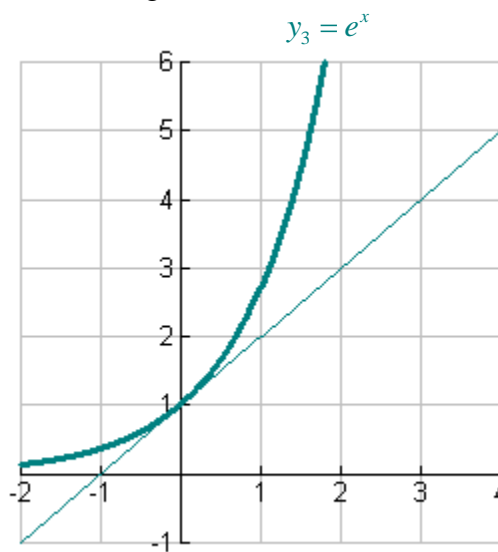
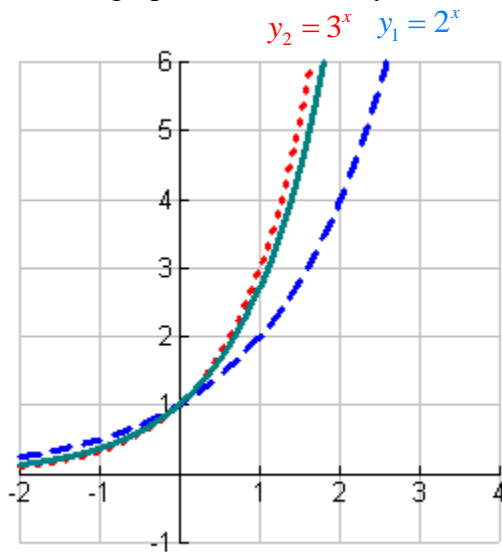
1. Given a family of exponential functions of the form  $y = a^x$ , recall the relationship between the base  $a$  and the graphs. Describe, in your own words, this relationship.



2. Using the graphs below, estimate the slope of the tangent line at  $x = 0$  for each of the two functions from the illustration above. Being as accurate as possible, determine if each slope is greater than one or less than one.



3. Does it seem reasonable that there should be a function of the form  $y = a^x$  with a tangent line slope exactly one when  $x = 0$ ? Well, there is! The function is shown on the two graphs below. Verify that the slope of the tangent line is one.



The slope of the tangent line to the function  $y = e^x$  is equal to one when  $x = 0$ .

4. The character  $e$  represents a number. By studying the graph above on the left, and comparing the three functions, estimate a value for  $e$ .

Instructor notes: Use TEC (Tools for Enriching Calculus) set for Graphs and Tangents, but start with  $f_1(x)$  away from  $e^x$ . Move the slider until the slope is at 1, then note that the base of the exponent must be about  $e$ .

