Concepts
Exponential Functions

Based on power point presentations by Pearson Education, Inc.
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Learning Objectives

1. Memorize the definition of the basic exponential function.
2. Memorize characteristics of the graphs of basic exponential functions.
3. Apply transformations to basic exponential functions.
4. Graph basic exponential functions and their transformations by hand.

1. The Basic Exponential Function (1 of 3)

The basic exponential function *f* with base *b* is defined by

f(x) **= b^x**, where *b* is any positive number but never equal to 1

Domain: All real numbers or $(-\infty, \infty)$

Range: All positive real numbers or $(0, \infty)$

Examples:

$p(x) = 2^x$

$k(x) = 5^x$

$h(x) = 10^x$

The Basic Exponential Function (2 of 3)

The Natural Exponential Function - A Special Case

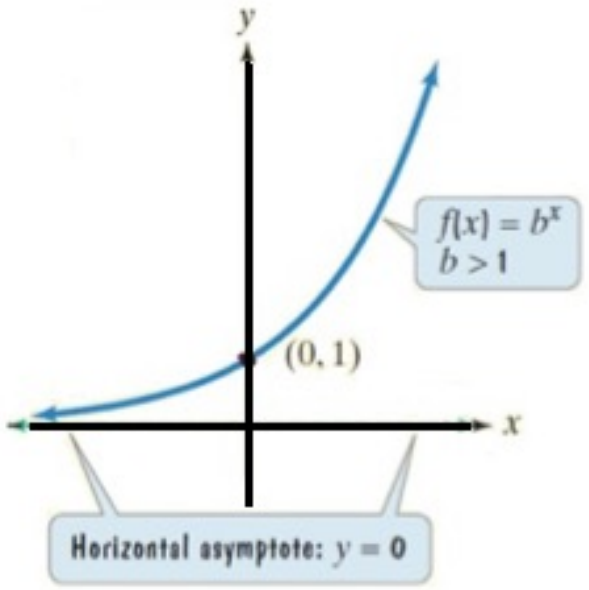
The function $g(x) = e^x$ is called the natural exponential function. The irrational number ***e***, approximately equal to ***2.72***, is called the natural base.

NOTE: In algebra, we never use 2.72 to represent the number ***e***. Instead, we use the calculator value exclusively.

The Basic Exponential Function (3 of 3)

Basic Characteristics of the Graph:

- The graph consists of a SMOOTH curve.
- The *x*-axis is a horizontal asymptote. The graph gets closer and closer to it but never touches it.
- There is no *x*-intercept.
- The *y*-intercept is at (0, 1).



2. Transformations of the Graphs of Basic Exponential Functions

Transformations* of the basic exponential functions $\boldsymbol{f(x) = b^x}$ have the same type of graph, however, it can lie anywhere in the coordinate system (depending on the transformation).

The domains of transformations of exponential functions consist of *all real numbers*.

*Remember, that transformations may consist of vertical shifts, horizontal shifts, stretching and condensing, reflections across the *x*- and *y*-axis, etc.

Vertical shifts WILL affect the location of the horizontal asymptote!

3. Graphing Basic Exponential Functions and their Transformations by Hand

1. Find the equation of the horizontal asymptote. Use a dashed line to graph it unless it is the *x*-axis.
2. Find the point associated with the *y*-intercept.
3. Find additional points. Best is to find two to three points to either side of the *y*-intercept.
4. Use the information obtained in the steps above to graph the function keeping in mind the shape of the graph of a basic exponential function.