Name____

Chapter 3 Exponential and Logarithmic Functions

Section 3.1 Exponential Functions and Their Graphs

Objective: In this lesson you learned how to recognize, evaluate, and graph exponential functions.

Important Vocabulary Define each term or concept.

Algebraic functions Functions of *x* that can be expressed as a finite number of sums, differences, multiples, quotients, powers and roots.
Transcendental functions Functions that are not algebraic.

Natural base *e* The irrational number $e \approx 2.718281828\ldots$

Continuous compounding Increasing the number of compoundings in the compound interest formula without bound leads to continuous compounding, which is given by the formula $A = Pe^{rt}$.

I. Exponential Functions (Page 218)

> ***What you should learn***
> How to recognize and evaluate exponential functions with base *a*

The **exponential function *f* with base *a*** is denoted by ______$f(x) = a^x$______, where $a > 0$, $a \neq 1$, and *x* is any real number.

Example 1: Use a calculator to evaluate the expression $5^{3/5}$.
2.626527804

II. Graphs of Exponential Functions (Pages 219–221)

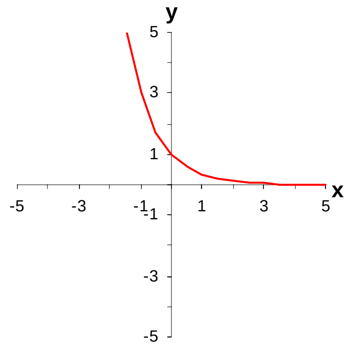
> ***What you should learn***
> How to graph exponential functions and use the One-to-One Property

For $a > 1$, is the graph of $y = a^x$ increasing or decreasing over its domain? ________Increasing________

For $a > 1$, is the graph of $y = a^{-x}$ increasing or decreasing over its domain? ________Decreasing________

For the graph of $y = a^x$ or $y = a^{-x}$, $a > 1$, the domain is ______$(-\infty, \infty)$______, the range is ______$(0, \infty)$______, and the intercept is ______(0, 1)______. Also, both graphs have ______the *x*-axis______ as a horizontal asymptote.

Example 2: Sketch the graph of the function $f(x) = 3^{-x}$.



The graph of the exponential function passes the

_________Horizontal Line_______ Test, and therefore, the function is a one-to-one function (and, thus, has an inverse function).

State the One-to-One Property for exponential functions and explain how it may be used to solve simple exponential equations.

For $a > 0$ and $a \neq 1$, $a^x = a^y$ if and only if $x = y$. To solve an exponential equation, write each side of the equation with the same base and then equate exponents (using the One-to-One Property) to solve for the variable.

III. The Natural Base *e* (Page 222)

What you should learn
How to recognize, evaluate, and graph exponential functions with base *e*

The **natural exponential function** is given by the function

_____ $f(x) = e^x$ _____. In this function, ___ e ___ is the constant and ___ x ___ is the variable.

Example 3: Use a calculator to evaluate the expression $e^{3/5}$.
1.8221188

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IV. Applications of Exponential Functions (Pages 223–225)

After t years, the balance A in an account with principal P and annual interest rate r (in decimal form) is given by the formulas:

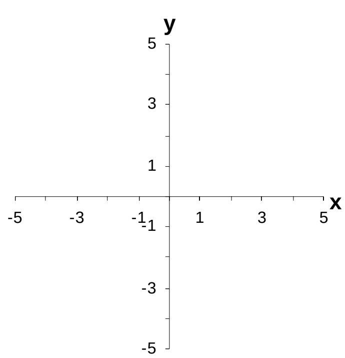
For n compoundings per year: $A = P(1 + r/n)^{nt}$

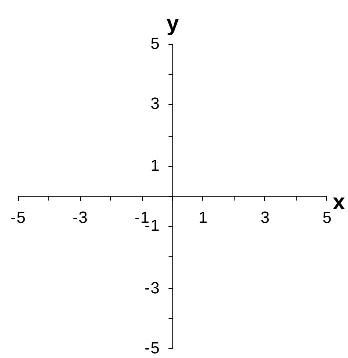
For continuous compounding: $A = Pe^{rt}$

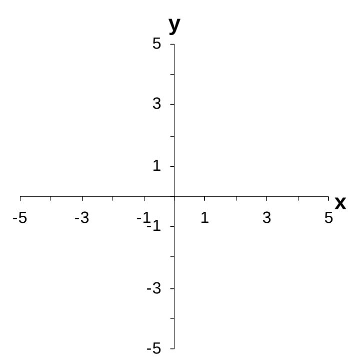
Example 4: Find the amount in an account after 10 years if $6000 is invested at an interest rate of 7%,
(a) compounded monthly.
(b) compounded continuously.
(a) $12,057.97 (b) $12,082.52

What you should learn
How to use exponential functions to model and solve real-life applications

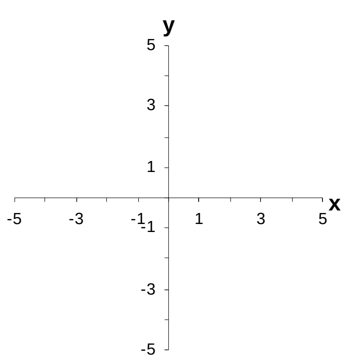
Additional notes

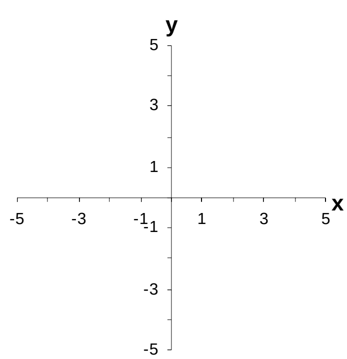


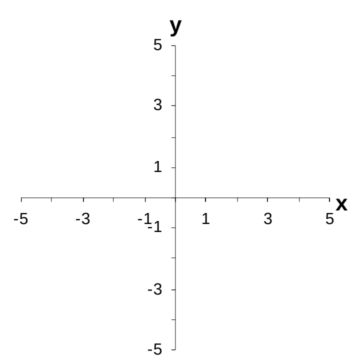




Additional notes







Homework Assignment

Page(s)

Exercises