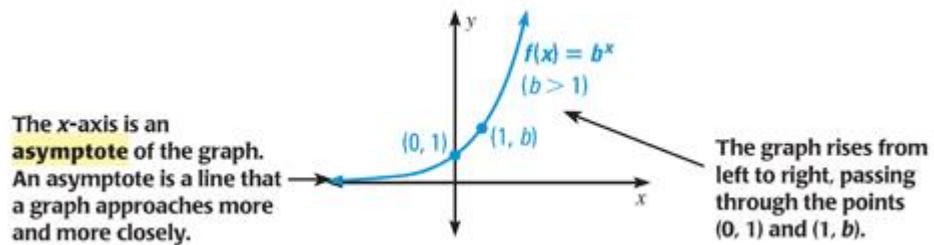


Algebra II – Chapter 7

7.1: Graph Exponential Growth Functions

- Have you heard of growing exponentially?
- An exponential function has the form $y = ab^x$, where b is a positive number (not 1)

Exponential growth function:



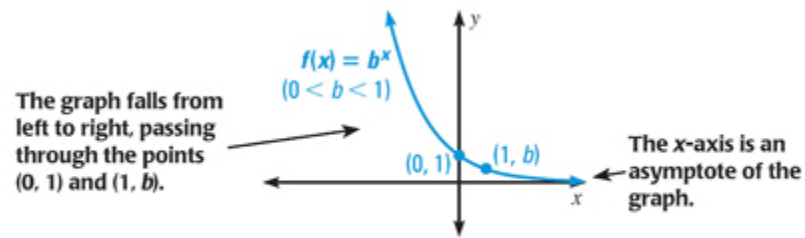
Examples - Graph the function. State the domain and range.

1) $y = 4^x$

2) $y = \frac{1}{2} * 3^x$

3) $f(x) = 3^{x+1} + 2$

7.2: Graph Exponential Decay Functions



The domain of $f(x) = b^x$ is all real numbers. The range is $y > 0$.

Graph

1) $y = \left(\frac{2}{3}\right)^x$

2) $y = -2\left(\frac{3}{4}\right)^x$

Graph - state the domain and range

3) $y = \left(\frac{1}{4}\right)^{x-1} + 1$

4) $g(x) = -3\left(\frac{3}{4}\right)^{x-5} + 4$

7.3: Use Functions Involving e

In math, we have special numbers: π , i , e . Natural base, e , is known as the Euler number

Euler number is irrational. It's definition is: As n approaches $+\infty$, $(1 + \frac{1}{n})^n$ approaches $e \approx 2.71828182$

Simplify the expression:

1) $e^7 * e^4$

2) $2e^{-3} \cdot 6e^5$

3) $\frac{24e^8}{4e^5}$

4) $(10e^{-4x})^3$

5) Exponential growth or decay?

- $y = 1/2e^{4x}$
- $y = 2e^{-5x}$

Graph. State the domain and range.

5. $y = 2e^{0.5x}$

6. $y = 1.5e^{0.25(x-1)} - 2$

7.1 & 7.3 Interest

7.1 - Exponential growth model

Exponential Growth Models

- When a real-life quantity increases by a fixed percent each year (or other period of time), the amount, y , after t years can be modeled by the equation:

$$y = a \underbrace{(1 + r)}_{\text{Growth Factor}}^t$$

a is the initial amount, r is the percent increase

- From 1997 to 2002, the number n (in millions) of DVD players sold in the US can be modeled by $n = 0.42(2.47)^t$ where t is the number of years since 1997. Identify the initial amount, the growth factor, and the annual percent increase. Graph and estimate the number of DVD players sold in 2001.

7.1 - **Compound Interest** is calculated using exponential growth functions.

The diagram shows the compound interest formula $A = P(1 + \frac{r}{n})^{nt}$ with the following labels and arrows:

- Amount**: points to A
- Principal**: points to P
- rate of interest**: points to r
- time in years**: points to t
- number of times per year, interest is compounded**: points to n

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- You deposit \$2000 in an account that pays 4% interest. Find the balance after 3 years if the interest is compounded daily.

7.3 - Continuously Compounded Interest

The diagram shows the formula $A = Pe^{rt}$ on a light blue background. The word "Amount" is positioned above the equation with a red arrow pointing down to the letter "A". The word "Principal" is positioned below the equation with a red arrow pointing up to the letter "P". The words "rate of interest" and "time in years" are positioned to the right of the equation with red arrows pointing to the "r" and "t" respectively. The words "the mathematical constant e" are positioned below the equation with a red arrow pointing up to the letter "e". A small copyright notice "© mathwarehouse.com" is in the top right corner of the diagram.

2) You deposit \$2500 in an account that pays 5% annual interest compounded continuously. Find the balance after:

- 2 years

- 5 years

- 25 years

7.4: Evaluate Logarithms and Graph Logarithmic Functions

Logarithmic Functions

Any function of the form
 $f(x) = \log_b x$ where the
logarithm of base b is defined as
follows ($b > 0$ and $b \neq 1$)

$$y = \log_b x \Leftrightarrow b^y = x$$

The logarithm goes to the basement to find the answer which equals the exponent.

Rewrite in exponential form or evaluate without using a calculator:

- 1) $\log_3 81 = 4$
- 2) $\log_7 7 = 1$
- 3) $\log_5 0.2$
- 4) $\log_{36} 6$
- 5) *Use a calculator to evaluate: $\log 0.746$*

Common Logarithm

Using **10** as the base

$$y = \log_{10} x = \log x$$

Natural Logarithm

Using **e** as the base

$$y = \log_e x = \ln x$$

Inverse Property of Logs

$$\log_b b^x = x$$

$$b^{\log_b x} = x$$

- 6) Simplify: $7^{(\log_7 x)}$
- 7) Simplify: $\log_5 125^x$
- 8) Find the inverse of the function: $y = 2^x - 3$
- 9) Graph: $y = \log_6 x$

7.5: Apply Properties of Logarithms

Property	Definition	Example
Product	$\log_b mn = \log_b m + \log_b n$	$\log_3 9x = \log_3 9 + \log_3 x$
Quotient	$\log_b \frac{m}{n} = \log_b m - \log_b n$	$\log_{\frac{1}{4}} \frac{4}{5} = \log_{\frac{1}{4}} 4 - \log_{\frac{1}{4}} 5$
Power	$\log_b m^p = p \cdot \log_b m$	$\log_2 8^x = x \cdot \log_2 8$
Equality	If $\log_b m = \log_b n$, then $m = n$.	$\log_8(3x - 4) = \log_8(5x + 2)$ so, $3x - 4 = 5x + 2$

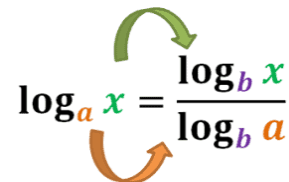
Use $\log 5 \approx 0.898$ and $\log 8 \approx 1.161$ to evaluate:

1) $\log\left(\frac{5}{8}\right)$

2) $\log 40$

3) Expand the expression: $3x^4$

4) Condense the expression: $\ln 4 + 3 \ln 3 - \ln 12$



The diagram shows the change of base formula: $\log_a x = \frac{\log_b x}{\log_b a}$. A green arrow curves from the base 'a' in the denominator to the base 'b' in the numerator. An orange arrow curves from the argument 'x' in the numerator to the argument 'a' in the denominator.

$$\log_a x = \frac{\log_b x}{\log_b a}$$

5) Evaluate using change of base: $\log_8 14$

7.6: Solve Exponential and Logarithmic Equations

If $b^x = b^y$ then $x=y$

1) Solve: $9^{2x} = 27^{x-1}$

2) Solve: $100^{7x+1} = 1000^{3x-2}$

3) Solve: $81^{3-x} = \left(\frac{1}{3}\right)^{5x-6}$

What if we can't rearrange? Then we use log or ln.

4) Solve: $2^x = 5$

5) Solve: $7^{9x} = 15$

6) Solve: $4e^{-0.3x} - 7 = 13$

If $\log x = \log y$, then $x=y$

7) $(5x + 9) = 6x$

8) $\ln(x + 19) = \ln(7x + 8)$

9) $\log_4(-x) + \log_4(x + 10) = 2$

7.7: Write and Apply Exponential and Power Functions

Write an exponential function $y = ab^x$ whose graph passes through the given points:

(1, 40), (3, 640)

Use the points (x, y) to find a model for the data:

(1, 3.3), (2, 10.1), (3, 30.6), (4, 92.7), (5, 280.9)

Write a power function $y = ax^b$ whose graph passes through the given points:

(3, 14), (9, 44)