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Study Guide and Intervention

Common Logarithms

Common Logarithms Base 10 logarithms are called **common logarithms**. The expression $\log_{10} x$ is usually written without the subscript as $\log x$. Use the $\boxed{\mathsf{LOG}}$ key on your calculator to evaluate common logarithms.

The relation between exponents and logarithms gives the following identity.

Inverse Property of Logarithms and Exponents

$$10^{\log x} = x$$

Example 1

Evaluate log 50 to four decimal places.

[LOG| 50 ≈ 1.6989,70004 ≈ 1.6990

Example 2

Solve $3^{2x+1} = 12$. > change forms

 $\log_3 12 = 2x + 1$

 $\frac{\text{changes}}{\text{common}} \frac{\log 12}{\log 3} = 2 \times + 1$

2.261859507 = 2x + 1 solve forx

1,261859507=2x 1,6309≈×

Exercises

Use a calculator to evaluate each expression to four decimal places.

Solve each equation or inequality. Round to four decimal places.

7.
$$4^{3x} = 12$$

8.
$$6^{x+2} = 18$$

9.
$$5^{4x-2} = 120$$

10.
$$7^{3x-1} \ge 21$$

11.
$$2.4^{x+4} = 30$$

12.
$$6.5^{2x} \ge 200$$

13.
$$3.6^{4x-1} = 85.4$$

14.
$$2^{x+5} = 3^{x-2}$$

15.
$$9^{3x} = 4^{5x+2}$$

16.
$$6^{x-5} = 2^{7x+3}$$

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Study Guide and Intervention (continued

Common Logarithms

Change of Base Formula The following formula is used to change expressions with different logarithmic bases to common logarithm expressions.

Change of Base Formula

For all positive numbers a, b, and n, where $a \ne 1$ and $b \ne 1$, $\log_a n = \frac{\log_b n}{\log_b a}$

Express $\log_8 15$ in terms of common logarithms. Then approximate its value to four decimal places.

Exercises

Express each logarithm in terms of common logarithms. Then approximate its value to four decimal places.

$$2.\log_2 40$$

$$8.\log_3 2$$

$$9.\log_4 28.5$$

10.
$$\log_3 (20)^2$$

11.
$$\log_6 (5)^4$$

12.
$$\log_8 (4)^5$$

13.
$$\log_5 (8)^3$$

14.
$$\log_2 (3.6)^6$$

15.
$$\log_{12} (10.5)^4$$

9-5

Study Guide and Intervention

Base e and Natural Logarithms

Base e and Natural Logarithms The irrational number $e \approx 2.71828...$ often occurs as the base for exponential and logarithmic functions that describe real-world phenomena.

Natural Base *e*

As *n* increases, $\left(1 + \frac{1}{n}\right)^n$ approaches $e \approx 2.71828...$

The functions $y = e^x$ and $y = \ln x$ are inverse functions.

Inverse Property of Base e and Natural Logarithms

$$e^{\ln x} = x$$
 In $e^x =$

Natural base expressions can be evaluated using the e^x and ln keys on your calculator.

Example 1

Evaluate ln 1685.

IN 1685 = 7,4295

Example 2

Write a logarithmic equation equivalent to $e^{2x} = 7$.

 $loge 7=2x \Rightarrow [ln 7=2x]$

Example 3

Evaluate $\ln e^{18}$.



Exercises

Use a calculator to evaluate each expression to four decimal places.

- 1. ln 732
- 2. ln 84,350
- 3. ln 0.735
- 4. ln 100

- 5. ln 0.0824
- 6. ln 2.388
- 7. ln 128,245
- 8. ln 0.00614

Write an equivalent exponential or logarithmic equation.

9.
$$e^{15} = x$$

10.
$$e^{3x} = 45$$

11.
$$\ln 20 = x$$

12.
$$\ln x = 8$$

13.
$$e^{-5x} = 0.2$$

14.
$$\ln (4x) = 9.6$$

15.
$$e^{8.2} = 10x$$

16.
$$\ln 0.0002 = x$$

Evaluate each expression.

17.
$$\ln e^3$$

18.
$$e^{\ln 42}$$

19.
$$e^{\ln 0.5}$$

20.
$$\ln e^{16.2}$$

Lesson 9-5

Study Guide and Intervention (continued)

Base e and Natural Logarithms

Equations and Inequalities with e and In All properties of logarithms from earlier lessons can be used to solve equations and inequalities with natural logarithms.

Solve each equation or inequality.

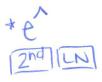
a.
$$3e^{2x} + 2 = 10$$

(* leke example 50 in notes)

$$e^{2x} = 8/3$$
 \Rightarrow Change forms \Rightarrow $\log e^{8/3} = 2x$ $\ln 8/3 = 2x$

DATE

b.
$$\ln (4x - 1) < 2$$



Exercises

Solve each equation or inequality.

1.
$$e^{4x} = 120$$

2.
$$e^x \le 25$$

3.
$$e^{x-2}+4=21$$

4.
$$\ln 6x \ge 4$$

5.
$$\ln(x+3) - 5 = -2$$

6.
$$e^{-8x} \le 50$$

$$7. e^{4x-1} - 3 = 12$$

8.
$$\ln (5x + 3) = 3.6$$

9.
$$2e^{3x} + 5 = 2$$

10.
$$6 + 3e^{x+1} = 21$$

11.
$$\ln(2x - 5) = 8$$