



Today is Earth Day

Restore our Earth!

THE UNIT 5 TEST IS MONDAY, APRIL 26.

*Converting between Logarithmic and Exponential Expressions.

*Evaluating Logarithmic Expressions.

*Simplifying Logarithmic Expressions.

*Solving Exponential and Logarithmic Equations.

*Characteristics of Log Functions



EXPAND:

1. $\log(6 \cdot 11)$

2. $\log(3x^4)$

3. $\log \frac{x}{y^6}$

CONDENSE:

4. $\log 3 - \log 8$

5. $\log 3 + 4 \log x$

6. $\ln a + 4 \ln b - \ln 7$

<https://app.classkick.com/#/login/DTJUSJ>

EXPAND:

1. $\log(6 \cdot 11)$

$$\log 6 + \log 11$$

2. $\log(3x^4)$

$$\log 3 + 4 \log x$$

3. $\log \frac{x}{y^6}$

$$\log x - 6 \cdot \log y$$

WARM-UP

CONDENSE:

4. $\log 3 - \log 8$

$$\log \frac{3}{8}$$

5. $\log 3 + 4 \log x$

$$\log 3x^4$$

6. $\ln a + 4 \ln b - \ln 7$

$$\ln \frac{ab^4}{7}$$

WARM-UP

Warning!! Be careful!!

$$\log(x + y) \neq \log x + \log y$$

$$\log(x - y) \neq \frac{\log x}{\log y}$$

$$\log(x + y) \neq \log x \cdot \log y$$

Problem 1

■ Which of the following logarithms is equal to $4 \log_5 2 - \log_5 4 + \log_5 10$?

A) $\log_5 4$

B) $\log_5 12$

C) $\log_5 16$

D) $\log_5 40$

Problem 2

- Which of the following logarithms is equal to $\log 12b - \log 4c$?

A) $\log \frac{b}{3c}$

B) $\log \frac{3b}{c}$

C) $\log 9bc$

D) $\log 3bc$

Problem 3

- Which expresses the following difference of logarithms as a single logarithm?

$$4 \log 2 - 5 \log y$$

A) $\log \frac{16}{y^5}$

B) $\log \frac{16}{5y}$

C) $\log 16y^5$

D) $\log 80y$

Problem 4

- Write as a sum, difference, or multiple of logarithms: $\log_b \frac{x^2 y^4}{w^{\frac{1}{3}}}$

$$2 \log_b x + 4 \log_b y - \frac{1}{3} \log_b w$$

Problem 5

- Write as a logarithm of a single quantity: $\log_3(x - 4) + \log_3(x + 4)$

$$\log_3(x^2 - 16)$$

Problem 6

- Find the value of x : $4 \cdot 3^{x-1} = 728$

$$x = \log_3 182 + 1$$

Problem 7

- Convert each of the following expressions:

A) $\log a = 6$ $a = 10^6$

B) $\ln y = 5$ $y = e^5$

C) $4^x = 64$ $\log_4 64 = x$

D) $e^{2x} = 37$ $\ln 37 = 2x$

Problem 8

■ Which expression(s) is equivalent to $\log_4 9$?

A) $9 \log 4$

B) $\frac{\log 9}{\log 4}$

C) $\frac{\log 4}{\log 9}$

D) $\frac{\ln 9}{\ln 4}$

Problem 9

- Evaluate the following: $\log_{\frac{1}{2}} 9$

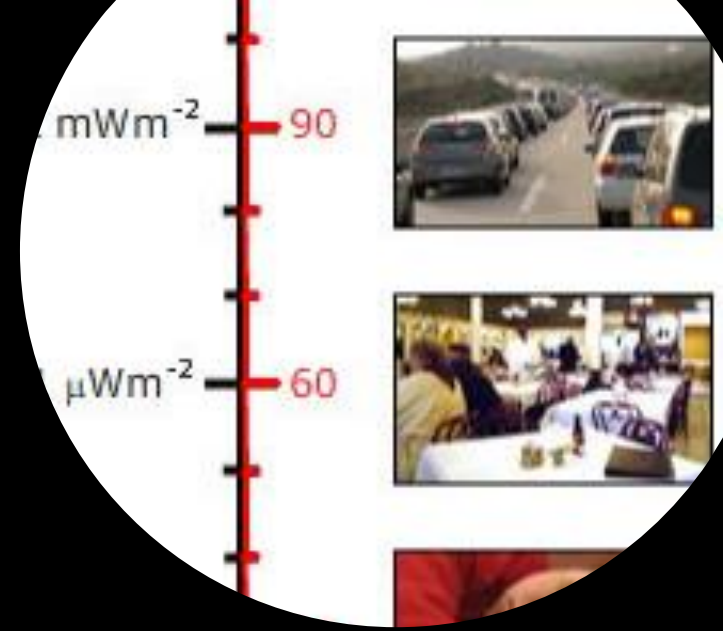
-3.1699

Problem 10

- The function $f(t) = 4000(1.002)^t$ can be used to determine the value of a savings account t months after it was opened with an initial investment of \$4000. How many months will it take for the balance to reach \$4,100?

It will take approximately 12 months for the balance to reach \$4,100.

Applying Logarithms to the Real World



Problem 11

- The pH of a chemical solution is modeled by the equation, $p(t) = -\log t$, where t is the concentration of hydronium ions in moles per liter. Pure water has a pH of 6.52. What is the hydronium ion concentration of pure water? (Write in exponential form.)

The hydronium ion concentration of pure water is $10^{-6.52}$ mol/l.



**SOLVING
EXPONENTIAL
AND
LOGARITHMIC
EQUATIONS**

STEPS:

1. Get the LOG, LN, or e expression alone.
2. Convert to the opposite form.
Logarithmic \rightarrow Exponential
Exponential \rightarrow Logarithmic
3. Simplify.
4. Solve for x.

Solving Equations

Example

Solve: $3^{x+1} = 5$

STEPS:

1. Get the LOG, LN, OR e expression alone.
2. Convert to the opposite form.
Logarithmic ---> Exponential
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4. Solve for x.

Solving logarithmic equations

Example:

Solve: $3^{x+1} = 5$

$$\log_3 5 = x + 1$$

$$1.46 = x + 1$$

$$\begin{array}{r} -1 \\ -1 \end{array}$$

$$x = 0.46$$

STEPS:

1. Get the LOG, LN, OR e expression alone.
2. Convert to the opposite form.
Logarithmic ---> Exponential
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3. Simplify.
4. Solve for x.

Solving Equations

Example:

Solve: $e^{x-1} = 10$

STEPS:

1. Get the LOG, LN, OR e expression alone.
2. Convert to the opposite form.
Logarithmic ---> Exponential
Exponential ---> Logarithmic
3. Simplify.
4. Solve for x.

Solving logarithmic equations

Example 12:

Solve: $e^{x-1} = 10$

$$\begin{aligned} \ln 10 &= x - 1 \\ 2.30 &= x - 1 \\ \underline{+1} \quad \quad \underline{+1} \\ x &= 3.30 \end{aligned}$$

STEPS:

1. Get the LOG, LN, OR e expression alone.
2. Convert to the opposite form.
Logarithmic ---> Exponential
Exponential ---> Logarithmic
3. Simplify.
4. Solve for x.

Problem 12

- Solve for x : $2^{4x} = 16$

$$x = 1$$

Problem 13

- Solve for x :
 $4e^{2x} - 3 = 13$

$$x = 0.6931$$



Take
Note

ONE More Property of Logarithms

Property of Equality

$$\text{If } \log_a x = \log_a y$$

$$\text{then } x = y$$



Take
Note

ONE More Property of Logarithms

Property of Equality

If $\ln x = \ln y$

then $x = y$

Problem 14

- Solve for x : $\log_7(6x - 16) = \log_7(x - 1)$





Problem 15

- Solve for x : $\ln(7 + 2x) = \ln(3x + 3)$

$$x = 4$$

Problem 16

- Solve for x : $\log_2(5x^2 + 2x) = \log_2(2x^2 + 8)$

$$x = \frac{4}{3} \quad x = -2$$

CHECK



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solution

Problem 15

- Solve for x : $\ln(7 + 2x) = \ln(3x + 3)$

$$x = 4$$



CHECK



YOUR

solution

Problem 17

- Solve for x : $\log_3 2x + 9 = 3$

$$x = 9$$

Problem 18

- Solve for x :
 $\log_6(x - 9) + \log_6 x = 2$

$$x = 12$$