

Continue

$$y = \log_a x \Rightarrow a^y = x$$

The number a is called the *logarithmic base*

If $a = 10$, then it is \log_{10} and it is called **Common logarithm** (available in calculator as \log)

If $a = e$, then it is \log_e or \ln and it is called **Natural logarithm** (available in calculator as \ln)

$$\log_{10} x = \log x \text{ (Common Logarithm)}$$

$$\log_e x = \ln x \text{ (Natural Logarithm)}$$

1. Convert the following from exponential form to logarithmic form:

- a) $y = x^2$ Answer: $\log_x y = 2$
- b) $2^3 = 8$ Answer: $\log_2 8 = 3$
- c) $9^{1/2} = 3$ Answer: $\log_9 3 = 1/2$
- d) $e^2 = x$ Answer: $\log_e x = 2$ or $\ln x = 2$ (base of e means \ln)
- e) $10^2 = 100$ Answer: $\log_{10} 100 = 2$ or $\log 100 = 2$ (no base means base of 10)

2. Convert the following from logarithmic to exponential form:

- a) $\log_3 9 = 3$ Answer: $x^3 = 9$
- b) $\log x = -1$ Answer: $10^{-1} = x$ (no base means base of 10)
- c) $\ln x = -1$ Answer: $e^{-1} = x$ (\ln means log to the base of e)

3. Solve for x (hint: first, convert each from logarithmic to exponential form)

- a) $\log_9 x = 1$ Answer: $x = 9$
- b) $\log_2 x = 1$ Answer: $x = 2$
- c) $\ln x = 1$ Answer: $x = e$ (why?)

4. Solve for x (hint: first, convert each from logarithmic to exponential form)

- a) $\log_3 x = 0$ Answer: $x = 1$
- b) $\log_2 x = 0$ Answer: $x = 1$
- c) $\ln x = 0$ Answer: $x = 1$ (why?)

$$\log_a a = 1; \log_e e = 1 \text{ or } \ln e = 1 \quad \log_a 1 = 0; \log_e 1 = 0 \text{ or } \ln 1 = 0$$

Properties of logarithms

Rule	Formula	Example
I) Multiplication	$\ln (AB) = \ln A + \ln B$	$\ln 5x = \ln 5 + \ln x$
II) Division	$\ln \frac{A}{B} = \ln A - \ln B$	$\ln 5/x = \ln 5 - \ln x$
III) Power	$\ln A^p = p \ln A$	$\ln 5^x = x \ln 5$

Logarithmic Equations

Solve each logarithmic equation. Round the answer to two decimal places.

1) $\log_2(x+1) = 3$	2) $\log_3(x-1) = 2$
3) $\log_5(x+4) = 2$	4) $\log_4(x+1) = 3$
5) $\log_3(x-1) = 2$	6) $\log_2(x) = 3$
7) $\log_2(x+1) = 2$	8) $\log_3(x) = 2$
9) $\log_2(x+1) = 2$	10) $\log_3(x+1) = 2$

Name: _____ Score: _____

Composition of Function

Choose the correct choice.

- | | |
|--|--|
| 1) $f(x) = x-8; g(x) = x+2$. Find $f \circ g$. | 2) $f(x) = x+3; g(x) = x-2$. Find $f \circ g$. |
| a) $x-10$ | a) $x+1$ |
| b) $x+6$ | b) $x-5$ |
| c) $x-6$ | c) $x-1$ |
| d) $-x-6$ | d) x |
| 3) $f(x) = x-5; g(x) = x-7$. Find $f \circ g$. | 4) $f(x) = 5x+3; g(x) = 1-x$. Find $f \circ g$. |
| a) $x-12$ | a) $-5x-2$ |
| b) $x-2$ | b) $5x+8$ |
| c) $x+2$ | c) $5x+2$ |
| d) $x-10$ | d) $8-5x$ |
| 5) $f(x) = x-3; g(x) = 2x+1$. Find $f \circ g$. | 6) $f(x) = 2x+8; g(x) = 5x+1$. Find $f \circ g$. |
| a) $2x-3$ | a) $10x-10$ |
| b) $2x-5$ | b) $10x+10$ |
| c) $2(x-1)$ | c) $10x+41$ |
| d) $2x-4$ | d) $5x+9$ |
| 7) $f(x) = 2x-1; g(x) = x-9$. Find $f \circ g$. | 8) $f(x) = 1+3x; g(x) = 3x-8$. Find $f \circ g$. |
| a) $2x-10$ | a) $9x-23$ |
| b) $2x-19$ | b) $9x+11$ |
| c) $x-10$ | c) $9x-11$ |
| d) $2x+19$ | d) $9x-25$ |
| 9) $f(x) = 9x+2; g(x) = -x+3$. Find $f \circ g$. | 10) $f(x) = 3-2x; g(x) = x+6$. Find $f \circ g$. |
| a) $9x+29$ | a) $-2x+9$ |
| b) $-9x+1$ | b) $-2x+15$ |
| c) $-9x+29$ | c) $2x+9$ |
| d) $-9x+5$ | d) $-2x-9$ |

$$3^{10x-4} = 10^{10x+6}$$

$$\log(3^{10x-4}) = \log(10^{10x+6})$$

$$(10x-4) \log 3 = (10x+6) \log 10$$

$$10x \log 3 - 4 \log 3 = 10x \log 10 + 6 \log 10$$

$$10x \log 3 - 10x \log 10 = 6 \log 10 - 4 \log 3$$

$$x(10 \log 3 - 10 \log 10) = 6 \log 10 - 4 \log 3$$

$$x = \frac{6 \log 10 - 4 \log 3}{10 \log 3 - 10 \log 10}$$

$$x = -0.782$$

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