

LESSON **Practice B**
7-3 **Logarithmic Functions**

Write each exponential equation in logarithmic form.

1. $3^7 = 2187$

2. $12^2 = 144$

3. $5^3 = 125$

Write each logarithmic equation in exponential form.

4. $\log_{10} 100,000 = 5$

5. $\log_4 1024 = 5$

6. $\log_9 729 = 3$

Evaluate by using mental math.

7. $\log 1,000,000$

8. $\log 10$

9. $\log 1$

10. $\log_4 16$

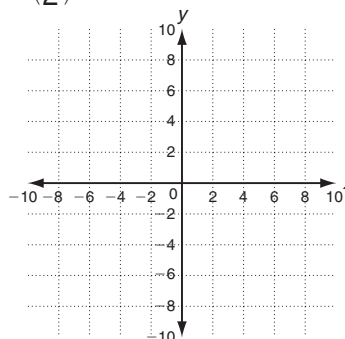
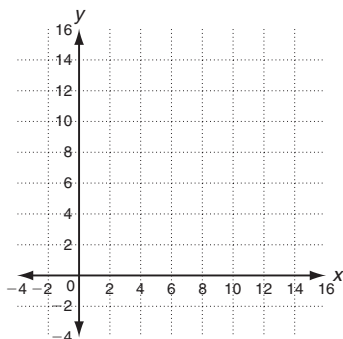
11. $\log_8 1$

12. $\log_5 625$

Use the given x-values to graph each function. Then graph its inverse. Describe the domain and range of the inverse function.

13. $f(x) = 2^x$; $x = -2, -1, 0, 1, 2, 3, 4$

14. $f(x) = \left(\frac{1}{2}\right)^x$; $x = -3, -2, -1, 0, 1, 2, 3$



Solve.

15. The hydrogen ion concentration in moles per liter for a certain brand of tomato-vegetable juice is 0.000316.

a. Write a logarithmic equation for the pH of the juice. _____

b. What is the pH of the juice? _____

LESSON **Practice A**

7-3 Logarithmic Functions

Write each exponential equation in logarithmic form.

- | | | |
|---|--|--|
| 1. $7^3 = 343$
$\log_{\text{base } 7} 343 = \text{exponent}$
$\log_7 343 = \underline{3}$ | 2. $2^6 = 64$
$\log_{\text{base } 2} 64 = \text{exponent}$
$\log_2 64 = \underline{6}$ | 3. $15^2 = 225$
$\log_{\text{base } 15} 225 = \text{exponent}$
$\log_{15} 225 = \underline{2}$ |
| 4. $2^3 = 8$
$\log_2 8 = \underline{3}$ | 5. $17^0 = 1$
$\log_{17} 1 = \underline{0}$ | 6. $1^{12} = 1$
$\log_1 1 = \underline{12}$ |
| 7. $4^5 = 1024$
$\log_4 1024 = \underline{5}$ | 8. $3^6 = 729$
$\log_3 729 = \underline{6}$ | 9. $5^4 = 625$
$\log_5 625 = \underline{4}$ |

Write each logarithmic equation in exponential form.

- | | | |
|---|--|---|
| 10. $\log_4 64 = 3$
$\log_{\text{base } 4} 64 = \text{exponent}$
$4^3 = \underline{64}$ | 11. $\log_8 512 = 3$
$\log_{\text{base } 8} 512 = \text{exponent}$
$8^3 = \underline{512}$ | 12. $\log_6 36 = 2$
$\log_{\text{base } 6} 36 = \text{exponent}$
$6^2 = \underline{36}$ |
| 13. $\log_{10} 100 = 2$
$10^2 = \underline{100}$ | 14. $\log_5 125 = 3$
$5^3 = \underline{125}$ | 15. $\log_9 1 = 0$
$9^0 = \underline{1}$ |
| 16. $\log_2 128 = 7$
$2^7 = \underline{128}$ | 17. $\log_3 243 = 5$
$3^5 = \underline{243}$ | 18. $\log_{100} 1,000,000 = 3$
$100^3 = \underline{1,000,000}$ |

Evaluate by using mental math.

- | | | |
|---|--|---|
| 19. $\log 10,000$
$10^4 = 10,000$
$\log 10,000 = \underline{4}$ | 20. $\log 100,000$
$10^5 = 100,000$
$\log 100,000 = \underline{5}$ | 21. $\log 1$
$10^0 = 1$
$\log 1 = \underline{0}$ |
| 22. $\log_2 16$
$2^4 = 16$
$\log_2 16 = \underline{4}$ | 23. $\log_4 1$
$4^0 = 1$
$\log_4 1 = \underline{0}$ | 24. $\log_9 81$
$9^2 = 81$
$\log_9 81 = \underline{2}$ |
| 25. $\log_{100} 100,000,000$
$100^4 = 100,000,000$
$\log_{100} 100,000,000 = \underline{4}$ | 26. $\log 1,000,000,000$
$10^9 = 1,000,000,000$
$\log 1,000,000,000 = \underline{9}$ | 27. $\log_3 81$
$3^4 = 81$
$\log_3 81 = \underline{4}$ |
| 28. $\log_4 64$
$4^3 = 64$
$\log_4 64 = \underline{3}$ | 29. $\log_5 25$
$5^2 = 25$
$\log_5 25 = \underline{2}$ | 30. $\log 1000$
$10^3 = 1000$
$\log 1000 = \underline{3}$ |

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LESSON **Practice B**

7-3 Logarithmic Functions

Write each exponential equation in logarithmic form.

- | | | |
|--|--|--|
| 1. $3^7 = 2187$
$\log_3 2187 = \underline{7}$ | 2. $12^2 = 144$
$\log_{12} 144 = \underline{2}$ | 3. $5^3 = 125$
$\log_5 125 = \underline{3}$ |
|--|--|--|

Write each logarithmic equation in exponential form.

- | | | |
|--|--|--|
| 4. $\log_{10} 100,000 = 5$
$10^5 = \underline{100,000}$ | 5. $\log_4 1024 = 5$
$4^5 = \underline{1024}$ | 6. $\log_9 729 = 3$
$9^3 = \underline{729}$ |
|--|--|--|

Evaluate by using mental math.

- | | | |
|---|---|---|
| 7. $\log 1,000,000$
$10^6 = 1,000,000$
$\log 1,000,000 = \underline{6}$ | 8. $\log 10$
$10^1 = 10$
$\log 10 = \underline{1}$ | 9. $\log 1$
$10^0 = 1$
$\log 1 = \underline{0}$ |
| 10. $\log_4 16$
$4^2 = 16$
$\log_4 16 = \underline{2}$ | 11. $\log_8 1$
$8^0 = 1$
$\log_8 1 = \underline{0}$ | 12. $\log_5 625$
$5^4 = 625$
$\log_5 625 = \underline{4}$ |

Use the given x-values to graph each function. Then graph its inverse. Describe the domain and range of the inverse function.

- | | |
|---|---|
| 13. $f(x) = 2^x; x = -2, -1, 0, 1, 2, 3, 4$

Domain: $\{x x > 0\}$;
range: all real numbers | 14. $f(x) = \left(\frac{1}{2}\right)^x; x = -3, -2, -1, 0, 1, 2, 3$

Domain: $\{x x > 0\}$;
range: all real numbers |
|---|---|

Solve.

15. The hydrogen ion concentration in moles per liter for a certain brand of tomato-vegetable juice is 0.000316.
- a. Write a logarithmic equation for the pH of the juice. $\text{pH} = -\log(0.000316)$
- b. What is the pH of the juice? $\underline{3.5}$

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LESSON **Practice C**

7-3 Logarithmic Functions

Write each exponential equation in logarithmic form.

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|--|--|--|
| 1. $20^3 = 8000$
$\log_{20} 8000 = \underline{3}$ | 2. $11^4 = 14,641$
$\log_{11} 14,641 = \underline{4}$ | 3. $a^b = c$
$\log_a c = \underline{b}$ |
|--|--|--|

Write each logarithmic equation in exponential form.

- | | | |
|--|--|--|
| 4. $\log_{10} 10,000,000 = 7$
$10^7 = \underline{10,000,000}$ | 5. $\log_6 216 = 3$
$6^3 = \underline{216}$ | 6. $\log_p q = r$
$p^r = \underline{q}$ |
|--|--|--|

Evaluate by using mental math.

- | | | |
|--|--|---|
| 7. $\log 1$
$10^0 = 1$
$\log 1 = \underline{0}$ | 8. $\log 10,000$
$10^4 = 10,000$
$\log 10,000 = \underline{4}$ | 9. $\log 1,000$
$10^3 = 1,000$
$\log 1,000 = \underline{3}$ |
| 10. $\log_5 3125$
$5^5 = 3125$
$\log_5 3125 = \underline{5}$ | 11. $\log_{15} 1$
$15^0 = 1$
$\log_{15} 1 = \underline{0}$ | 12. $\log_4 256$
$4^4 = 256$
$\log_4 256 = \underline{4}$ |

Use the given x-values to graph each function. Then graph its inverse. Describe the domain and range of the inverse function.

- | | |
|---|---|
| 13. $f(x) = 0.1^x; x = -1, 0, 1, 2$

Domain: $\{x x > 0\}$;
range: all real numbers | 14. $f(x) = \left(\frac{5}{2}\right)^x; x = -3, -2, -1, 0, 1, 2, 3$

Domain: $\{x x > 0\}$;
range: all real numbers |
|---|---|

Solve.

15. The hydrogen ion concentration in moles per liter of a certain solvent is 0.00794.
- a. Write a logarithmic equation for the pH of the solvent. $\text{pH} = -\log(0.00794)$
- b. What is the pH of the solvent? $\underline{2.1}$

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LESSON **Review for Mastery**

7-3 Logarithmic Functions

A **logarithm** is another way to work with exponents in equations.

If $b^x = a$, then $\log_b a = x$.

If b to the x power equals a , then x is the logarithm of a in base b .

Use the definition of the logarithm to write exponential equations in logarithmic form and to write logarithmic equations in exponential form.

Exponential Form	Logarithmic Form
$3^4 = 81$	$\log_3 81 = 4$
Logarithmic Form	Exponential Form
$\log_5 125 = 3$	$5^3 = 125$

If no base is written for a logarithm, the base is assumed to be 10.

Example: $\log 100 = 2$ because $10^2 = 100$.

Assume the base is 10.

Write each exponential equation in logarithmic form.

- | | | |
|--|---|--|
| 1. $7^2 = 49$
$b = 7, x = 2, a = 49$
$\log_7 49 = \underline{2}$ | 2. $6^3 = 216$
$b = 6, x = 3, a = 216$
$\log_6 216 = \underline{3}$ | 3. $2^5 = 32$
$b = 2, x = 5, a = 32$
$\log_2 32 = \underline{5}$ |
|--|---|--|

Write each logarithmic equation in exponential form.

- | | | |
|---|--|--|
| 4. $\log_9 729 = 3$
$b = 9, x = 3, a = 729$
$9^3 = \underline{729}$ | 5. $\log_2 64 = 6$
$b = 2, x = 6, a = 64$
$2^6 = \underline{64}$ | 6. $\log 1000 = 3$
$b = 10, x = 3, a = 1000$
$10^3 = \underline{1000}$ |
|---|--|--|

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