

LESSON
4-4

Practice B
Properties of Logarithms

Express as a single logarithm. Simplify, if possible.

1. $\log_3 9 + \log_3 27$

2. $\log_2 8 + \log_2 16$

3. $\log_{10} 80 + \log_{10} 125$

4. $\log_6 8 + \log_6 27$

5. $\log_3 6 + \log_3 13.5$

6. $\log_4 32 + \log_4 128$

Express as a single logarithm. Simplify, if possible.

7. $\log_2 80 - \log_2 10$

8. $\log_{10} 4000 - \log_{10} 40$

9. $\log_4 384 - \log_4 6$

10. $\log_2 1920 - \log_2 30$

11. $\log_3 486 - \log_3 2$

12. $\log_6 180 - \log_6 5$

Simplify, if possible.

13. $\log_4 4^6$

14. $\log_5 5^{x-5}$

15. $7^{\log_7 30}$

16. $12^{\log_{12} 1}$

17. $\log_8 8^5$

18. $\log_3 9^4$

Evaluate. Round to the nearest hundredth.

19. $\log_{12} 1$

20. $\log_3 30$

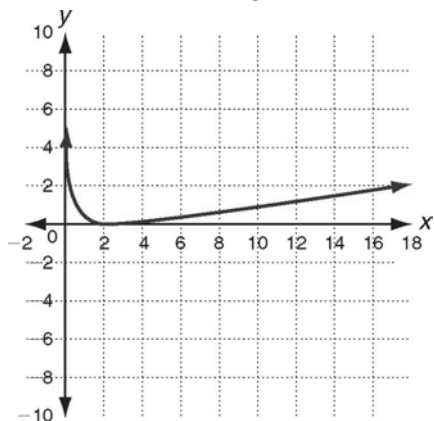
21. $\log_5 10$

Solve.

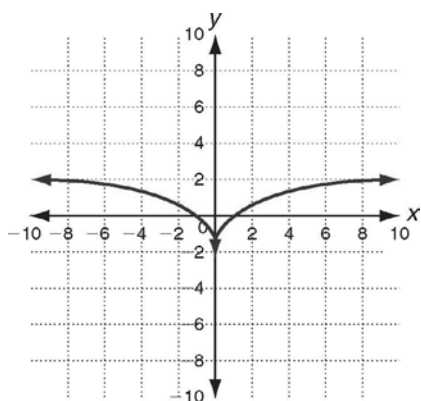
22. The Richter magnitude of an earthquake, M , is related to the energy released in ergs, E , by the formula $M = \frac{2}{3} \log \left(\frac{E}{10^{11.8}} \right)$.

Find the energy released by an earthquake of magnitude 4.2.

4. Domain: $x > 0$; range: $y > 0$



5. Domain: $x \neq 0$; range: all real numbers



4-4 PROPERTIES OF LOGARITHMS

Practice A

- | | |
|---------------------|---------------------------|
| 1. 4 | 2. 64; 64; 6 |
| 3. 3125; 3125; 5 | 4. $\log_{10} 10,000 = 4$ |
| 5. $\log_6 6 = 1$ | 6. $\log_8 64 = 2$ |
| 7. $\log_5 25 = 2$ | 8. $\log_3 3 = 1$ |
| 9. $\log_2 32 = 5$ | 10. $\log_4 16 = 2$ |
| 11. $\log_6 36 = 2$ | 12. $\log_5 125 = 3$ |
| 13. 4 | 14. 4 |
| 15. 9 | 16. 4 |
| 17. 12 | 18. 2 |
| 19. 1.59 | 20. 1.77 |
| 21. 1.46 | 22. 10^{22} ergs |

Practice B

- | | |
|---------------------------|----------------------|
| 1. $\log_3 243 = 5$ | 2. $\log_2 128 = 7$ |
| 3. $\log_{10} 10,000 = 4$ | 4. $\log_6 216 = 3$ |
| 5. $\log_3 81 = 4$ | 6. $\log_4 4096 = 6$ |

Problem Solving

- $\text{pH} = -\log(0.0000629)$
 - $\text{pH} = 4.2$
- $\text{pH} = -\log(0.0000032)$
 - $\text{pH} = 5.5$
 - Rainwater in eastern Ohio has a lower pH than that in central California by 1.3 units.
- D
- J
- A
- H

Reading Strategies

- $4^2 = 16$; $\log_5 0.2 = -1$; $\log_6 1 = 0$
- $\log_b 1 = 0$ is the same as $b^0 = 1$ and any number to the 0 power is 1.
- $f^{-1}(x) = \log_4 x$
- $g^{-1}(x) = \log_{\frac{1}{2}} x$
 - Domain of $g(x)$ is all real numbers
range of $g(x)$ is $y > 0$
domain of $g^{-1}(x)$ is $x > 0$
range of $g^{-1}(x)$ is all real numbers.

- | | |
|----------------------|-----------------------------|
| 7. $\log_2 8 = 3$ | 8. $\log_{10} 100 = 2$ |
| 9. $\log_4 64 = 3$ | 10. $\log_2 64 = 6$ |
| 11. $\log_3 243 = 5$ | 12. $\log_6 36 = 2$ |
| 13. 6 | 14. $x - 5$ |
| 15. 30 | 16. 1 |
| 17. 5 | 18. 8 |
| 19. 0 | 20. 3.10 |
| 21. 1.43 ergs | 22. $1.26 \times 10^{18.1}$ |

Practice C

- | | |
|---------------------|----------------------------|
| 1. $\log_6 216 = 3$ | 2. $\log_3 3 = 1$ |
| 3. $\log_4 16 = 2$ | 4. $\log_6 1296 = 4$ |
| 5. $\log_5 125 = 3$ | 6. $\log_8 32,768 = 5$ |
| 7. $\log_5 625 = 4$ | 8. $\log_2 4 = 2$ |
| 9. $\log_3 81 = 4$ | 10. $\log_8 4096 = 4$ |
| 11. $\log_7 7 = 1$ | 12. $\log_{10} 10,000 = 4$ |
| 13. 6 | 14. 8^x |
| 15. 20 | 16. $2x + 1$ |
| 17. $2x - 2$ | 18. 17 |