Answer Key

Pre-Calculus A 120

Worksheet – Laws of Logarithms (Power, Product and Quotient)

Expand the following logarithms.
Use either the power rule, product rule or quotient rule.

1. $\log_2(9^5) =$ _____

2. $\log_2(21) =$ _____

3. $\log_5\left(\frac{19}{2}\right) =$ _____

4. $\log_2(6a) =$ _____

5. $\log_3(xy) =$ _____

6. $\log_5\left(\frac{a}{3}\right) =$ _____

7. $\log_3(5y) =$ _____

8. $\log_3(a^{10}) =$ _____

Expand the following logarithms using one or more of the logarithm rules.

9. $\log_5\left(\frac{12a}{2}\right) =$ _____

10. $\log_2\left(\frac{a}{b}\right)^5 =$ _____

11. $\log_5\sqrt{x^5y} =$ _____

12. $\log_5\left(\frac{xy}{z}\right)^8 =$ _____

13. $\log_2\left(\frac{1-x}{y}\right)^3 =$ _____

14. $\log_3\sqrt[5]{9x^3} =$ _____

15. $\log_3\sqrt[3]{2x^5} =$ _____

16. $\log_2\left(\frac{9x^{10}}{y^2}\right) =$ _____

17. $\log_2\left(\frac{4a}{5}\right) =$ _____

18. $\log_2\sqrt[3]{x^2a} =$ _____

Write as a single logarithm.

19. $2\log_3 10 - \log_3 4 =$ _____

20. $\frac{2}{3}\log_2 x + \log_2 y =$ _____

21. $\frac{1}{2}\log_5 x + \log_5 y =$ _____

22. $3\log_3 x + 4\log_3 y =$ _____

23. $6\log_3 x + 2\log_3 11 =$ _____

24. $4\log_5 x - \log_5 y + \log_5 z =$ _____

25. $\frac{1}{2}\log_3 144 - \log_3 4 =$ _____

26. $\log_3 a + \log_3 b - 2\log_3 c =$ _____

27. Let $\log_b 2 = x$, $\log_b 3 = y$ and $\log_b 5 = z$.

(a) What is the value of $\log_b 50$ in terms of x, y and z?

(b) What is the value of $\log_b 3000$ in terms of x, y and z?

28. Are $\log_2 16$ and $\log_4 64$ equal? Why or why not?

29. Correct the error
There is an error in the student work shown below.

Directions: Simplify $\log_2 (6x)^5$.

$$\log_2 (6x)^5 = 5 \bullet \log_2 (6 \bullet x)$$
$$= 5 \bullet \log_2 6 + \log_2 x$$
$$= 5\log_2 6 + \log_2 x$$

What is the error in the work above?

Answer Key

1. $5 \log_2 9 = 10 \log_2 3$
2. $\log_2 3 + \log_2 7$
3. $\log_5 19 - \log_5 2$
4. $\log_2 6 + \log_2 a$
5. $\log_3 x + \log_3 y$
6. $\log_5 a - \log_5 3$
7. $\log_3 5 + \log_3 y$
8. $10 \log_3 a$
9. $\log_5 6 + \log_5 a$
10. $5 (\log_2 a - \log_2 b)$
11. $\frac{1}{2}(5\log_5 x + \log_5 y)$
12. $8 (\log_5 x + \log_5 y - \log_5 z)$
13. $3 (\log_2(1 - x) - \log_2 y)$
14. $\frac{1}{5}(2 - 3\log_3 x)$
15. $\frac{1}{3}(\log_3 2 - 5\log_3 x)$
16. $2 \log_2 3 + 10 \log_2 x - 2 \log_2 y$
17. $2 + \log_2 a - \log_2 5$
18. $\frac{1}{3}(2\log_2 x + \log_2 a)$
19. $\log_3 25$
20. $\log_2(x^{2/3} y)$
21. $\log_5(x^{1/2} y)$
22. $\log_3(x^3 y^4)$
23. $\log_3(121x^6)$
24. $\log_5\left(\frac{x^4 z}{y}\right)$
25. 1
26. $\log_5\left(\frac{ab}{c^2}\right)$
27. (a) $x + y + z$; (b) $3(x + z) + y$
28. Yes; they are both equal to 4.
29. The student did not distribute the 5 to $\log_2 6$ and $\log_2 x$; the correct answer is $5(\log_2 6 + \log_2 x)$, or $5 \log_2 6 + 5 \log_2 x$.