

Section 6.5: Properties of Logarithms

#1 - 12: Evaluate each expression without a calculator. Check your answer using your calculator.

1) $\log_2 16$

This asks the question 2 to what power is 16, $2^x = 16$)

Answer: 4

3) $\log_4 16^3$ I need to rewrite the 16 as 4^2

$\log_4(4^2)^3 = \log_4 4^6$ (this asks 4 to what power is 4^6 , $4^x = 4^6$)

Answer: 6

5) $\log_8 8^5$ (this asks 8 to what power is 8^5 , $8^x = 8^5$)

Answer: 5

7) $\log_3 243$ (this asks 3 to what power is 243, $3^x = 243$)

Answer: 5

9) $\ln(e)$

Rewrite to $\log_e e$ (this asks e to what power is e, $e^x = e$)

Answer: 1

11) $\log_2 64^3$ (I will change the 64 to 2^5)

$\log_2(2^5)^3 = \log_2 2^{15}$ (this asks 2 to what power is 2^{15} , $2^x = 2^{15}$)

Answer: 15

#13 – 24: Expand into sums and differences of logarithms (express powers as factors).

13) $\log_3 (x^2 y^3)$

Write two logs, one for the x the other for the y. put a plus sign between as there is no fraction. Make the powers coefficients

Answer: $2\log_3 x + 3\log_3 y$

$$15) \log_5(x^2y^6z)$$

Create 3 logs, one for each letter, no minuses needed as there are no fractions, make powers into coefficients

$$\text{Answer: } 2\log_5 x + 6\log_5 y + \log_5 z$$

$$17) \log_2 \frac{xy^3}{z^2}$$

Create three logs, one for each letter, the log with the z gets a minus in front since the z is in the denominator, make powers into coefficients

$$\text{Answer: } \log_2 x + 3\log_2 y - 2\log_2 z$$

$$19) \log_2 \frac{xy}{w^2z^5}$$

Create 4 logs, one for each letter, the logs with the w and z get minuses in front since those letters are in the denominator, make powers into coefficients.

$$\text{Answer: } \log_2 x + \log_2 y - 2\log_2 w - 5\log_2 z$$

$$21) \log_4(x^3y^4)$$

Create 2 logs, no minuses needed since no fraction, make powers into coefficients

$$\text{Answer: } 3\log_4 x + 4\log_4 y$$

$$23) \log_2(x^2 \cdot \sqrt[3]{y})$$

Write with fraction exponent

$$\log_2 x^2 y^{1/3}$$

Create two logs, no minuses as no fractions, make powers into coefficients

$$\text{Answer: } 2\log_2 x + \frac{1}{3}\log_2 y$$

#25 - 36: Write the expression as a single logarithm. Write your answer with only positive exponents.

$$25) 3\log_2 x + 4\log_2 y$$

$$= \log_2 x^3 + \log_2 y^4$$

$$\text{Answer} = \log_2(x^3y^4)$$

$$27) 2\log_3 x + 4\log_3 y + \log_3 z$$

$$= \log_3 x^2 + \log_3 y^4 + \log_3 z$$

$$\text{Answer: } \log_3 (x^2 y^4 z)$$

$$29) 5\log_2 x + 3\log_2 y - \log_2 z$$

$$= \log_2 x^5 + \log_2 y^3 - \log_2 z \quad (\text{the } z \text{ will go in the denominator because of the minus})$$

$$\text{Answer: } \log_2 \frac{x^5 y^3}{z}$$

$$31) 4\log x - 2\log y - 3\log z$$

$$= \log x^4 - \log y^2 - \log z^3$$

Both y and z will go in denominator because of the minuses

$$\text{Answer: } \log \frac{x^4}{y^2 z^3}$$

$$33) -2\log_3 x + \log_3 y + \log_3 z$$

$$= \log_3 y + \log_3 z - 2\log_3 x$$

$$= \log_3 y + \log_3 z - \log_3 x^2$$

$$\text{Answer: } \log_3 \frac{yz}{x^2}$$

$$35) \ln x + 3\ln y - 2\ln z$$

$$= \ln x + \ln y^3 - \ln z^2$$

$$\text{Answer: } \ln \frac{xy^3}{z^2}$$

#37 - 45: Use the change of base formula and your calculator to evaluate each logarithm, round your answer to 2 decimal places.

$$37) \log_2 3 \quad (\log 3 / \log 2 \text{ on my calculator})$$

$$\text{Answer: } 1.58$$

$$39) \log_3 5 \quad (\log 5 / \log 3 \text{ on my calculator})$$

$$\text{Answer: } 1.46$$

$$41) \log_4 0.65 \quad (\log 0.65 / \log 4 \text{ on my calculator})$$

$$\text{Answer: } -.31$$

43) $\log_5 18$ ($\log 18 / \log 5$ on my calculator)

Answer: 1.80

45) $\log_9 0.123$ ($\log 0.123 / \log 9$ on my calculator)

Answer: -.95

#46 – 57: Find the following. Given $\log_b x = 5$, $\log_b y = 10$, $\log_b z = 7$.

47) $\log_b y + \log_b z = 10 + 7 = 17$

Answer: 17

49) $\log_b y^4 = 4\log_b y = 4(10) = 40$

Answer: 40

51) $\log_b yz = \log_b y + \log_b z = 10 + 7 = 17$

Answer: 17

53) $\log_b (y^3 z^5) = 3\log_b y + 5\log_b z = 3(10) + 5(7) = 30 + 35 = 65$

Answer: 65

55) $\log_b \frac{x^4}{y} = 4\log_b x - \log_b y = 4(5) - 10 = 20 - 10 = 10$

Answer: 10

57) $\log_b \frac{x}{yz^3} = \log_b x - \log_b y - 3\log_b z = 5 - 10 - 3(7) = 5 - 10 - 21 = -26$

Answer: -26