

### Activity 3.3 - Answer Key

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#### Problem 1

State the product, quotient, and power rules of logarithms

$$\text{Product: } \log_a(MN) = \log_a M + \log_a N$$

$$\text{Quotient: } \log_a\left(\frac{M}{N}\right) = \log_a M - \log_a N$$

$$\text{Power: } \log_a M^r = r \log_a M$$

#### Problem 2

Evaluate:  $\log_2\left(\frac{1}{2}\sqrt{xy^2}\right)$ , given  $\log_2(x) = 6$  and  $\log_2(y) = 4$

$$\begin{aligned} &= \log_2 \frac{1}{2} + \log_2 x^{\frac{1}{2}} + \log_2 y^2 \\ &= \log_2 \frac{1}{2} + \frac{1}{2} \log_2 x + 2 \log_2 y \\ &= -1 + 3 + 8 \\ &= 10 \end{aligned}$$

#### Problem 3

Evaluate:  $\log_2\left(x^{\frac{1}{25}}y^{\frac{1}{25}}\right)$ , given  $\log_2(x) = 6$  and  $\log_2(y) = 4$

$$\begin{aligned} &= \log_2 \left[ (xy)^{\frac{1}{25}} \right] \\ &= \frac{1}{25} (\log_2 [xy]) \\ &= \frac{1}{25} (\log_2 x + \log_2 y) \\ &= \frac{1}{5} (10) \\ &= \frac{2}{5} \end{aligned}$$

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**Problem 4**

Write in expanded form:  $f(x) = \log_2 \left[ \frac{(x-1)(x+1)}{x^2-4} \right]$

$$\begin{aligned} &= \log_2 \left[ \frac{(x-1)(x+1)}{(x-2)(x+2)} \right] \\ &= \log_2[(x-1)(x+1)] - \log_2[(x-2)(x+2)] \\ &= \log_2(x-1) + \log_2(x+1) - [\log_2(x-2) + \log_2(x+2)] \\ &= \log_2(x-1) + \log_2(x+1) - \log_2(x-2) - \log_2(x+2) \end{aligned}$$

**Problem 5**

Write in condensed form:  $f(x) = 2 \ln(x) + \frac{1}{2} \ln(x^2 - 1) - \frac{1}{2} \ln(x^2 + 1)$

$$\begin{aligned} &= \ln x^2 + \ln(x^2 - 1)^{\frac{1}{2}} - \ln(x^2 + 1)^{\frac{1}{2}} \\ &= \ln x^2 + \ln \sqrt{x^2 - 1} - \ln \sqrt{x^2 + 1} \\ &= \ln \left[ \frac{x^2 \sqrt{x^2 - 1}}{\sqrt{x^2 + 1}} \right] \end{aligned}$$

**Problem 6**

Write in expanded form:  $f(x) = \ln \left[ \frac{a^2(b+1)}{c\sqrt{d}} \right]$

$$\begin{aligned} &= \ln(a^2(b+1)) - \ln(cd^{\frac{1}{2}}) \\ &= \ln a^2 + \ln(b+1) - [\ln c + \ln d^{\frac{1}{2}}] \\ &= 2 \ln a + \ln(b+1) - \ln c - \frac{1}{2} \ln d \end{aligned}$$

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#### Problem 7

Write in condensed form:  $f(x) = 2 \log(a) + \frac{1}{2} \log(b) - \frac{1}{3} \log(c) - 5 \log d$

$$= \log a^2 + \log b^{\frac{1}{2}} - \log c^{\frac{1}{3}} - \log d^5$$

$$= \log(a^2 \sqrt{b}) - [\log \sqrt[3]{c} + \log d^5]$$

$$= \log(a^2 \sqrt{b}) - \log[\sqrt[3]{c} \cdot d^5]$$

$$= \log \left[ \frac{a^2 \sqrt{b}}{d^5 \sqrt[3]{c}} \right]$$

#### Secret Word

What was the secret word you found?

JACKETS