Review Exercise Set 9

Exercise 1: Use the properties of logarithms to simplify the following expression.

$$\log_b \sqrt[3]{64}$$

Exercise 2: Use the properties of logarithms to simplify the following expression.

$$e^{-\frac{3}{2} \ln b}$$

Exercise 3: Use the properties of logarithms to rewrite each expression as a sum and/or difference of logarithms.

a) $$\log_b (a^2 b^3)$$

b) $$\log_b \frac{7}{8xy^2}$$
Exercise 4: Use the properties of logarithms to rewrite each expression as a single logarithm.

a) $3 \log_b (xy) - 5 \log_b z$

b) $\frac{1}{2} \log_b (x - 3) + 3 \log_b (y + 1) - \log_b (2z - 5)$

Exercise 5: Evaluate the following logarithm by using the change-of-base formula.

$\log_4 27$
Review Exercise Set 9 Answer Key

Exercise 1: Use the properties of logarithms to simplify the following expression.

\[
\log_8 \sqrt[3]{64} = \log_8 \sqrt[3]{8^2} = \log_8 8^{\frac{2}{3}} = \frac{2}{3}
\]

Exercise 2: Use the properties of logarithms to simplify the following expression.

\[
e^{-\ln 8} = e^{\ln \frac{1}{8}} = \frac{1}{8}
\]

Exercise 3: Use the properties of logarithms to rewrite each expression as a sum and/or difference of logarithms.

a) \(\log_b (a^2b^3)\)

\[
\log_b (a^2b^3) = \log_b a^2 + \log_b b^3 = 2\log_b a + 3\log_b b = 2\log_b a + 3(1) = 2\log_b a + 3
\]

b) \(\log_b \frac{7}{8xy^2}\)

\[
\log_b \frac{7}{8xy^2} = \log_b 7 - \log_b (8xy^2) = \log_b 7 - [\log_b 8 + \log_b x + \log_b y^2]
\]

\[
= \log_b 7 - \log_b 8 - \log_b x - 2\log_b y
\]
Exercise 4: Use the properties of logarithms to rewrite each expression as a single logarithm.

a) \(3 \log_b (xy) - 5 \log_b z\)

\[
3 \log_b (xy) - 5 \log_b z = \log_b (xy)^3 - \log_b z^5
\]

\[
= \log_b \left( \frac{(xy)^3}{z^5} \right)
\]

b) \(\frac{1}{2} \log_b (x - 3) + 3 \log_b (y + 1) - \log_b (2z - 5)\)

\[
\frac{1}{2} \log_b (x - 3) + 3 \log_b (y + 1) - \log_b (2z - 5) = \log_b (x - 3)^{1/2} + \log_b (y + 1)^3 - \log_b (2z - 5)
\]

\[
= \log_b \sqrt{x - 3} + \log_b (y + 1)^3 - \log_b (2z - 5)
\]

\[
= \log_b \frac{\sqrt{x - 3} \cdot (y + 1)^3}{2z - 5}
\]

Exercise 5: Evaluate the following logarithm by using the change-of-base formula.

\[
\log_4 27
\]

\[
\log_4 27 = \frac{\log 27}{\log 4}
\]

\[
\approx 2.3777
\]