

3. HOW TO USE LOG RULES?

Use the properties of logs we explored in problem 2 above to evaluate the logarithm in each problem:

3A. $\log_8 32 + \log_8 2$

3C. $\log_a(a^9)$

3B. $\log_{81}(\sqrt[7]{3})$

3D. $(5)^{\log_5(125)}$

Problem 3A)

$$\log_8(32) + \log_8(2) = \log_8(32 \cdot 2)$$

$$= \log_8(64)$$

$$= 2$$

Recall: $\square \log_b(M \cdot N) = \log_b(M) + \log_b(N)$

$$\square \log_b(M) = m \Leftrightarrow b^m = M$$

$$\Rightarrow \log_8(64) = m \Rightarrow 8^m = 64$$

$$\Rightarrow 8^m = 8^2 \Rightarrow \boxed{m = 2}$$

Problem 3B)

$$\log_{81}(\sqrt[7]{3}) = \log_{81}(3^{1/7})$$

$$= \frac{1}{7} \underbrace{\log_{81}(3)}$$

Note:

$$\log_{81}(3) = m \Rightarrow 81^m = 3$$

$$\Rightarrow (3^4)^m = 3$$

$$\Rightarrow 3^{4m} = 3^1$$

$$\Rightarrow 4m = 1$$

$$\Rightarrow m = \frac{1}{4}$$

$$\Rightarrow \log_{81}(3) = \frac{1}{4}$$

$$= \frac{1}{7} \cdot \frac{1}{4}$$

$$= \boxed{\frac{1}{28}}$$

Problem 3C)

$$\begin{aligned}\log_a(a^9) &= 9 \cdot \underbrace{\log_a(a)} \\ &= 9 \cdot 1\end{aligned}$$

Recall:

$$\log_b(M^p) = p \cdot \log_b(M)$$

Note:

$$\log_a(a) = m \Rightarrow a^m = a^1$$

$$\Rightarrow m = 1$$

$$\Rightarrow \log_a(a) = 1$$

Problem 3D) consider

$$5^{\log_5(125)} = 5^m$$

where $m = \log_5(125)$

$$\Rightarrow 5^m = 125$$

$$\Rightarrow 5^m = 5^3$$

$$\Rightarrow m = 3$$

$$\Rightarrow 5^{\log_5(125)} = 5^m = 5^3 = 125$$

exponents
and logarithms
are inverses

$$\hookrightarrow \cancel{5^{\log_5(125)}} = 125$$