

## 6.4 Properties of Logarithms

Obj: 1. Simplify & evaluate expressions.  
2. Solve equations

Product Property:

$$\log_b(m \cdot n) = \log_b m + \log_b n$$

Quotient Property:

$$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$$

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Given  $\log_2 3 = 1.585$ , approximate the following:

$$\log_2 12$$

$$\log_2(3 \cdot 4)$$

$$\log_2 3 + \log_2 4$$

$$1.585 + 2$$

$$3.585$$

$$\log_2 1.5$$

$$\log_2\left(\frac{3}{2}\right)$$

$$\log_2 3 - \log_2 2$$

$$1.585 - 1$$

$$.585$$

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Given  $\log_2 3 = 1.585$ , approx:

$$\log_2 18$$

$$\log_2 (3 \cdot 3 \cdot 2)$$

$$\log_2 3 + \log_2 3 + \log_2 2$$

$$1.585 + 1.585 + 1$$

$$4.17$$

$$\log_2 \frac{3}{4}$$

$$\log_2 3 - \log_2 4$$

$$1.585 - 2$$

$$-.415$$

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Write as a single logarithm:

$$\log_3 10 - \log_3 5$$

$$\log_3 \left( \frac{10}{5} \right)$$

$$\log_3 2$$

$$\log_b u + \log_b v - \log_b uw$$

$$\log_b (uv) - \log_b (uw)$$

$$\log_b \left( \frac{uv}{uw} \right)$$

$$\log_b \left( \frac{v}{w} \right)$$

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$$\log_4 18 - \log_4 6$$

$$\log_4 \left( \frac{18}{6} \right)$$

$$\log_4 3$$

$$\log_b (4x) - \log_b (3y) + \log_b y$$

$$\log_b \left( \frac{4x}{3y} \right) + \log_b y$$

$$\log_b \left( \frac{4x}{3y} \cdot \frac{y}{1} \right)$$

$$\log_b \left( \frac{4x}{3} \right)$$

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### Power Property

$$\log_b m^p = p \log_b m$$

Evaluate:

$$\begin{aligned} & \log_5 25^4 \\ & 4 \cdot \log_5 25 \\ & 4 \cdot 2 \\ & 8 \end{aligned}$$

$$\begin{aligned} & 100 \cdot \log_3 27 \\ & 100 \cdot 3 \\ & 300 \end{aligned}$$

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## EXponential/Logarithmic Inverse Property

$$* \log_b b^x = x$$

$$x \log_b b$$

$$x \cdot 1$$

$$* \underline{b}^{\log_b x} = x$$

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Evaluate:

$$\underline{3}^{\log_3 4} + \log_5 25$$

$$4 + 2$$

$$6$$

$$\log_2 32 - 5^{\log_5 3}$$

$$5 - 3$$

$$2$$

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$$7^{\log_7 11} - \log_3 81$$

$$11 - 4$$

$$7$$

$$\log_8 8^5 + 3^{\log_3 8}$$

$$5 + 8$$

$$13$$

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### One to One Property

If  $\log_b x = \log_b y$  then  $x = y$ .

Solve:  $\log_3(x^2 + 7x - 5) = \log_3(\underline{6x + 1})$

$$x^2 + 7x - 5 = \cancel{6x + 1}$$

$$x^2 + x - 6 = 0$$

$$(x - 2)(x + 3) = 0$$

$$x - 2 = 0 \quad x + 3 = 0$$

$$x = 2 \quad \cancel{x = -3}$$

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