

Let  $b$ ,  $R$ , and  $S$  are positive real numbers with  $b \neq 1$ , and  $c$  any real number

- $\log_b(RS) = \log_b R + \log_b S$
- $\log_b\left(\frac{R}{S}\right) = \log_b R - \log_b S$
- $\log_b R^c = c \log_b R$

Prove the Product Rule for Logarithms:  $\log_b(RS) = \log_b R + \log_b S$   
 Let  $x = \log_b R$  and  $y = \log_b S$

Assuming  $x$  and  $y$  are positive, use properties of logarithms to write the expression as a **sum or difference** of logarithms or multiples of logarithms

A)  $\log(8x)$   
 $\log 8 + \log x$

B)  $\ln\left(\frac{5}{x}\right)$   
 $\ln 5 - \ln x$

C)  $\log_2(x^5) = 5 \log_2 x$

D)  $\log(8x^2y^4)$   
 $\log 8 + \log x^2 + \log y^4$   
 $\log 8 + 2 \log x + 4 \log y$

$$(x^4)^{\frac{1}{3}} = x^{\frac{4}{3}}$$

E)  $\ln\left(\frac{\sqrt{x^2+5}}{\sqrt[3]{x^4}}\right) = \ln \sqrt{x^2+5} - \ln \sqrt[3]{x^4}$   
 $\ln (x^2+5)^{\frac{1}{2}} - \ln x^{\frac{4}{3}}$   
 $\frac{1}{2} \ln (x^2+5) - \frac{4}{3} \ln x$

Let  $b$ ,  $R$ , and  $S$  are positive real numbers with  $b \neq 1$ , and  $c$  any real number

- $\log_b(RS) = \log_b R + \log_b S$

- $\log_b\left(\frac{R}{S}\right) = \log_b R - \log_b S$

- $\log_b R^c = c \log_b R$

Assuming  $x$ ,  $y$  and  $z$  are positive, use properties of logarithms to write the expression as a **single** logarithm

A)  $\log x + \log 6$

$$\log 6x$$

B)  $\ln x - \ln 6$

$$\ln \frac{x}{6}$$

C)  $\frac{1}{4} \log x$

$$\log x^{\frac{1}{4}} = \log \sqrt[4]{x}$$

D)  $6 \log x - \frac{1}{2} \log y$

$$\log x^6 - \log y^{\frac{1}{2}}$$

$$\log \frac{x^6}{\sqrt{y}}$$

$$\log x^{10} y^{11} z^3$$

E)  $5 \log(x^2 y) + 3 \log(y^2 z)$

$$\log(x^2 y)^5 \cdot (y^2 z)^3$$

$$\log x^{10} y^5 \cdot y^6 z^3$$

$$\log x^{10} y^{11} z^3$$

F)  $\ln x^5 - 2 \ln(xy)$

$$\ln \frac{x^5}{y^2}$$

$$\ln \frac{x^5}{x^2 y^2} = \ln \frac{x^3}{y^2}$$