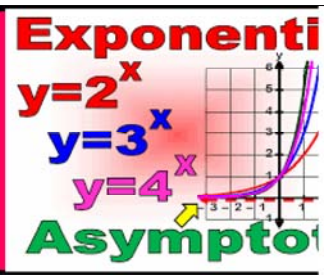

Unit 2

Exponents and Logarithms




4.8 Log Laws

Ex.) log (3) + log 5 = 1.17...

log 15 = 1.17...

Ex.) log 25 - log 5 = 0.698...

log 5 = 0.698...

Ex.) log $3^2$ = 0.954...

2log 3 = 0.954...

*Exponents and Logarithms*

$$y = a^x \leftrightarrow x = \log_a y$$

$$\log_b c = \frac{\log_a c}{\log_a b}$$

*Laws of Logarithms*

$$\log_b(M \cdot N) = \log_b M + \log_b N$$

$$\log_b\left(\frac{M}{N}\right) = \log_b M - \log_b N$$

$$\log_b(M^n) = n \log_b M$$

*Exponential functions*

$$y = a \cdot b^x$$

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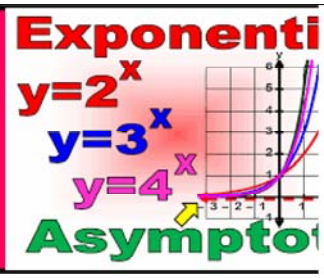


Ex.) Use log laws to determine the value of each of the following expressions.

show work

a) $\log_6 3 + \log_6 12$

$= \log_6 (3 \cdot 12)$

$= \boxed{\log_6 36}$ simplified

$= \boxed{2}$ evaluated

b) $\log 520 - \log 52$

$= \log \left(\frac{520}{52}\right)$

$= \log_{10} 10$

$= \boxed{1}$


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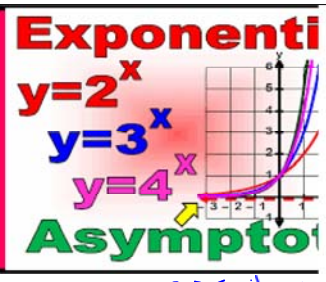


Ex.) Write the following as a single logarithmic expression where $b > 1$, $x > 0$, and $y > 0$.

positive

a) $\log_b(2x) + \log_b(3x)$

$= \log_b(2x^1 \cdot 3x^1)$

$= \log_b(6x^2)$

b) $2\log_b x - \log_b y$

$= \log_b(x^2) - \log_b y$

$= \log_b\left(\frac{x^2}{y}\right)$


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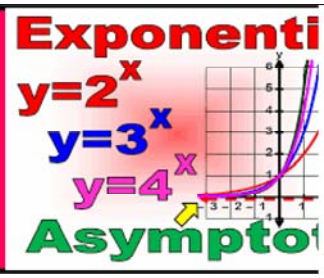


Ex.) Simplify the following expressions into a single logarithm:

a) $\log_2 16 - \log_2 4$

$= \log_2\left(\frac{16}{4}\right)$

$= \boxed{\log_2 4}$

$= \boxed{2}$

b) $\log_6 9 + \log_6 8 - \log_6 2$

$= \log_6\left(\frac{9 \times 8}{2}\right)$

$= \boxed{\log_6 36}$

$= \boxed{2}$

c) $\log_2 2 + \log_2 3 - \log_2 6 - \log_2 8$

$= \log_2\left(\frac{2 \times 3}{6 \times 8}\right)$

$= \boxed{\log_2\left(\frac{1}{8}\right)}$

$= \boxed{-3}$


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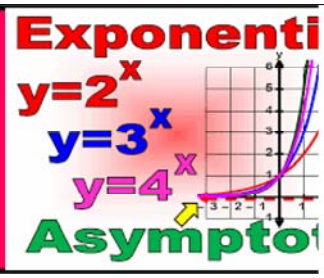


d) $\log_3 x + \log_3 2x - \log_3 y - \log_3 x^2$

$= \log_3 \left(\frac{x \cdot 2x}{y \cdot x^2}\right)$

$= \log_3 \left(\frac{2}{y}\right)$

$\log_3 (2y^{-1})$

e) $\ln(a+b) + \ln(a-b)$

$\ln x = \log_e x$

$= \ln((a+b)(a-b))$

$= \ln(a^2 - ab + ab - b^2)$

$= \ln(a^2 - b^2)$

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$\sqrt[2]{x} = x^{\frac{1}{2}}$ $\sqrt[3]{x} = x^{\frac{1}{3}}$

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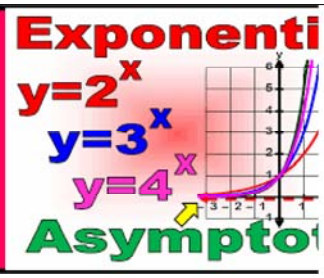


f) $\frac{1}{2}\log_2 16 - \frac{1}{3}\log_2 8$

$= \log_2(16^{1/2}) - \log_2(8^{1/3})$

$= \log_2\sqrt{16} - \log_2\sqrt[3]{8}$

$= \log_2 4 - \log_2 2$

$= \log_2\left(\frac{4}{2}\right)$

$= \log_2 2$

$= \boxed{1}$

g) $2\ln 5 + 2\ln 2$

$= \ln 5^2 + \ln 2^2$

$= \ln 25 + \ln 4$

$= \ln(25 \times 4)$

$= \boxed{\ln 100}$

$\approx 4.605$

h) $4\log x - \log x^3$

$= \log x^4 - \log x^3$

$= \log\left(\frac{x^4}{x^3}\right)$

$= \boxed{\log x}$

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