H1 Mathematics

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Chapter 18

Graphing Techniques

Chapter 19

Exponential and Logarithmic Functions

1. Given that $\log_2 x = p$ and $\log_8 y = q$, express the following terms of p and/or q:

   (a) $\log_2 xy$

   Sol.

   $$\begin{aligned}\log_8 y &= q\\ \frac{\log_2 y}{\log_2 8} &= q\\ \frac{\log_2 y}{3} &= q\\ \log_2 y &= 3q\end{aligned}$$

   $$\begin{aligned}\log_2 xy &= \log_2 x + \log_2 y\\ &= p + 3q\end{aligned}$$

   (b) $\log_4 \frac{x}{y}$

   Sol.

   $$\begin{aligned}\log_2 x &= p\\ \frac{\log_4 x}{\log_4 2} &= p\\ \frac{\log_4 x}{\frac{1}{2}} &= p\\ \log_4 x &= \frac{p}{2}\end{aligned}$$

   $$\begin{aligned}\log_8 y &= q\\ \frac{\log_4 y}{\log_4 8} &= q\\ \frac{\log_4 y}{\frac{3}{2}} &= q\\ log_4 y &= \frac{3q}{2}\end{aligned}$$

   $$\begin{aligned}\log_4 \frac{x}{y} &= \log_4 x - \log_4 y\\ &= \frac{p}{2} - \frac{3q}{2}\\ &= \frac{p-3q}{2}\end{aligned}$$

   (c) $\log_x 4y$

   Sol.

   $$\begin{aligned}\log_x 4y &= \log_x 4 + \log_x y\\ \log_x 4 &= \frac{\log_2 4}{\log_2 x}\\ &= \frac{2}{p}\\ \log_x y &= \frac{\log_2 y}{\log_2 x}\\ &= \frac{3q}{p}\end{aligned}$$

   $$\begin{aligned}\log_x 4y &= \frac{2}{p} + \frac{3q}{p}\\ &= \frac{2+3q}{p}\end{aligned}$$

   (d) $x^2 y$

   Sol.

   $$\begin{aligned}\log_2 x^2 y &= \log_2 x^2 + \log_2 y\\ &= 2\log_2 x + \log_2 y\\ &= 2p + 3q\end{aligned}$$

   $$\begin{aligned}x^2 y &= 2^{2p+3q}\\ &= 2^{2p}2^{3q}\\ &= 4^p 8^q\end{aligned}$$

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