4.6 Laws of Logarithms

I. $x = a^p$ and $y = a^q \Rightarrow p = \log_a x$ and $q = \log_a y$

then $xy = a^p \cdot a^q = a^{p+q}$

so that $\log_a xy$

$= \log_a a^{p+q} = p + q$

$\therefore \log_a xy = \log_a x + \log_a y$

Ex) write $\log_2(x+1) + \log_2(5)$ as 1 log

$\log_2(5(x+1))$

$\log_2(5x+5)$

II. $\log_a \frac{x}{y} = \log_a x - \log_a y$

III. $\log_a x^n = n \log_a x$

IV. $\log_a \frac{1}{x} = \log_a x^{-1} = -\log_a x$

[Ex] Express $\log_2 5 + \frac{1}{2}\log_2 36 - \log_2 10$ as 1 log.

* 1 piece at a time

$\log_2 36^{1/2}$

$\log_2 5 + \log_2 6 - \log_2 10$

$\log_2 (5 \cdot 6) - \log_2 10$

$\log_2 \left(\frac{30}{10}\right) = \log_2 3$

Ex Express as a single log

$\log(x) - \log(y) - \log(z)$

$\log(x) - (\log(y) + \log(z))$

$\log(x) - \log(yz)$

$\log\left(\frac{x}{yz}\right)$

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1, 2, 3 (a, c, d, e)