Useful logarithmic relationships

Unless otherwise indicated, assume $\log = \log_{10}$ (base 10 log)

If $\log (x) = y$, then $10^y = x$

$\log (a \cdot b) = \log (a) + \log (b)$

$\log \left( \frac{a}{b} \right) = \log (a) - \log (b)$

$\log (a^n) = n \cdot \log (a)$

The natural log uses base $e$ instead of base 10.

If $\ln (x) = y$, then $e^y = x$

pH, pOH, $pK_w$, $pK_a$, and $pK_b$ are all log relationships.

\[
\text{pH} = -\log [H_3O^+] \\
[H_3O^+] = 10^{-\text{pH}}
\]

Note that the following are common errors when working with logs. Avoid these errors:

$\log \left( \frac{a}{b} \right) \neq \frac{\log (a)}{\log (b)}$

$\log (a + b) \neq \log (a) + \log (b)$