SECTION 10-4 COMMON LOGS

The pH level of a substance is given by the formula: $pH = -\log_{10} H^+$ where H^+ is the substance's hydrogen ion concentration. If the hydrogen concentration of sauerkraut is 2987×10^{-4}, what is its pH level?

$pH = -\log_{10}(2987 \times 10^{-4})$
$pH = -\log(2987 \times 10^{-4})$
$pH \approx 3.5$

Good news! Your calculator will do base$_{10}$ logs. It's called "common log" and is literally the LOG button on your calculator!

Solving exponential equations using common logarithms.

Examples: 1) $3^x = 11$ If the idea is to get x by itself, how do I get rid of the 3?

$3^x = 11$
$\log 3^x = \log 11$
$x \log 3 = \log 11$
$x = \frac{log11}{log3}$

simply pop it into your calc. and bam…

$x \approx 2.1828$

Answer: take the common log of both sides. Since base$_{10}$ is the only "common" log, it is unnecessary to include the $_{10}$ when writing it.

2) $6^x = 42$

$\log 6^x = \log 42$
$x \log 6 = \log 42$
$x = \frac{log42}{log6}$
$x \approx 2.086$

3) $5^{3y} < 8^{y-1}$

$\log 5^{3y} < \log 8^{y-1}$
$3y \log 5 < (y-1)\log 8$
$3y \log 5 < y \log 8 - \log 8$
$3y \log 5 - y \log 8 < -\log 8$
$y(3\log 5 - \log 8) < -\log 8$
$y < \frac{-log8}{3\log 5 - \log 8}$
$y < -0.7564$
keep in mind it is an ≈

CHANGE OF BASE FORMULA

$$\log_a n = \frac{\log_b n}{\log_b a}$$ **where a,b and n are positive numbers (a,b ≠ 1)**

Question? If you can use any base you want, what should we use?

Answer: base$_{10}$ (common log) because we can use the calculator!!

Examples:

Approximate all answers to 4-decimal places.

4) $\log_4 25$

$\log_4 25 = \frac{log25}{log4}$
≈ 2.3219

5) $\log_6 8$

$\log_6 8 = \frac{log8}{log6}$
≈ 1.1606

6) $\log_6 9^{w-5} = 2$

$(w-5)\log_6 9 = 2$
$(w-5)\frac{log9}{log6} = 2$
$w - 5 = 2 \bullet \frac{log6}{log9}$
$w = 2 \bullet \frac{log6}{log9} + 5$
$w \approx 6.6309$