Learning Goal: I will be able to solve logarithmic equations.

Minds On: Whiteboards - re-write it!

Action: Solving Logarithmic Equations - note and examples

Consolidation: Exit Question

Minds On

Rewrite each as a power with an exponent.
ie: re-write to elimite the decimals or fractions.

0.25 $= \frac{25}{100}$ $= \frac{1}{4}$ $= \frac{1}{2^2}$ $= 2^{-2}$	9/25 $= \frac{3^2}{5^2}$ $= \left(\frac{3}{5}\right)^2$ or $\left(\frac{5}{3}\right)^{-2}$	1/4 $= 4^{-1}$ or $= 2^{-2}$
1/16 $= 16^{-1}$ $= 4^{-2}$ $= 2^{-4}$	0.04 $= \frac{4}{100} = \frac{1}{25}$ $= 25^{-1}$ $= 5^{-2}$	0.01 $= \frac{1}{100} = 100^{-1}$ $= 10^{-2}$

Action

Solving Logarithmic Equations

Example 1: Selecting an algebraic strategy to solve a logarithmic equation

The Richter scale is used to compare the intensities of earthquakes. The Richter scale magnitude, R, of an earthquake is determined using $R = \log(a/T) + B$, where a is the amplitude of the vertical ground motion in microns (μ), T is the period of the seismic wave in seconds, and B is a factor that accounts for the weakening of the seismic waves (1 μ is equivalent to 10^{-6} m). An earthquake measured 5.5 on the Richter scale, and the period of the seismic wave was 1.8 s. If B equals 3.2, what was the amplitude, a, of the vertical ground motion?

$$R = \log\left(\frac{a}{T}\right) + B$$

$$5.5 = \log\left(\frac{a}{1.8}\right) + 3.2$$

$$2.3 = \log\left(\frac{a}{1.8}\right)$$

$$2.3 = \log a - \log 1.8$$

$$+\log 1.8 \qquad +\log 1.8$$

$$\log a = 2.3 + \log 1.8$$

$$\log_{10} a = 2.56$$

$$a = 10^{2.56}$$

$$a = 363.1\ \mu$$

OR

$$2.3 = \log_{10}\left(\frac{a}{1.8}\right)$$

$$10^{2.3} = \frac{a}{1.8}$$

$$a = 1.8 \times 10^{2.3}$$

$$a = 354.1$$

- better answer
- less rounding.

Action

Example 2

a) $\log_x 0.04 = -2$

$x^{-2} = 0.04$

$x^{-2} = \frac{4}{100}$

$\frac{1}{x^2} = \frac{4}{100}$

$\frac{1}{x^2} = \frac{1}{25}$

$\frac{1}{x^2} = \frac{1}{5^2}$

$\therefore x = 5$

b) $\log_7(3x - 5) = \log_7 16$

$x^{-2} = 0.04$

$\log x^{-2} = \log 0.04$

$-2 \log x = \log 0.04$

$\log_{10} x = \frac{\log 0.04}{-2}$

$10^{\left(\frac{\log 0.04}{-2}\right)} = x$

$x = 5$

Action

b) $\log_7(3x-5) = \log_7 16$

$3x - 5 = 16$

$3x = 21$

$\boxed{x = 7}$

Action

Example 3: Representing sums and differences as single logs to solve equations

a) $\log_2 30x - \log_2 5 = \log_2 12$

$\log_2\left(\frac{30x}{5}\right) = \log_2 12$

$\frac{30x}{5} = 12$

$30x = 60$

$\boxed{x = 2}$

b) $\log x + \log x^2 = 12$

$\log(x \cdot x^2) = 12$

$\log_{10} x^3 = 12$

$\sqrt[3]{10^{12}} = \sqrt[3]{x^3}$

$x = 10^4$

$x = 10{,}000$

Action

Example 4: Quadratic log equations

Solve $\log_2(x + 3) + \log_2(x - 3) = 4$

$\log_2((x+3)(x-3)) = 4$

$\log_2(x^2 - 9) = 4$

$2^4 = x^2 - 9$

$x^2 = 25$

$x = \pm 5$

Check each answer

Can't take log (negative)

$\therefore x \neq -5$

$\boxed{x = 5}$

Consolidation

Exit Question

How do we know if any of our solutions are inadmissible?

If we have $\log_a$(negative) the solution is inadmissible.

Consolidation

Practice

Pg. 491
A few from: 1, 2, 4, 5, 7
9, 12