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

Minds On: Whiteboards - re-write it!

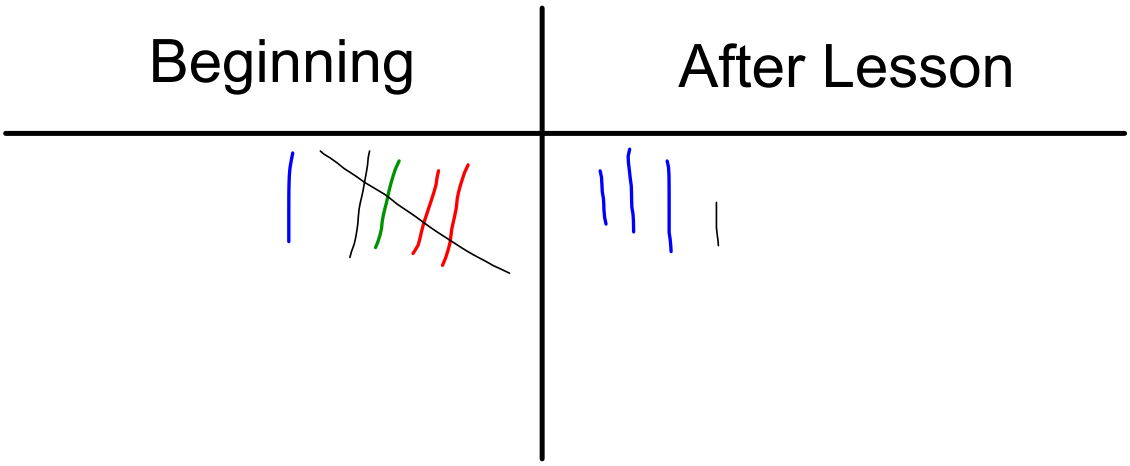
Action: Solving Logarithmic Equations - note and examples

Consolidation: Exit Question

Class Vote

Do we want RAFT at the beginning of the period, or after the lesson?

Put a tick mark for your vote as you come in.



Minds On

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

0.25 $= \frac{1}{4^1} = 4^{-1}$ | $\frac{1}{2^2} = 2^{-2}$

1/16 $= 2^{-4} \quad = 4^{-2} \quad = 16^{-1}$

9/25

$3^2 \quad 5^2$

$= \frac{3^2}{5^2} \quad = \left(\frac{3}{5}\right)^2 \quad = \left(\frac{5}{3}\right)^{-2}$

0.04

$\frac{1}{25} = \frac{1}{5^2} = 5^{-2}$

1/4

2^{-2}

0.01

$\frac{1}{100} = \frac{1}{10^2} = 10^{-2}$

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?

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

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

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

$Y = \log_a X$

$X = a^Y$

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

didn't work

$2.3 = \log_{10} a - \log_{10} 1.8$

$2.3 + \log_{10} 1.8 = \log_{10} a$

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

$$a = 359.15\,\mu$$

Action

Example 2

a) $\log_x 0.04 = -2$

$x^{-2} = 0.04$

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

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

$x^{-2} = 5^{-2}$

$x = 5$

$x^{-2} = 0.04$

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

$-2 \log x = \log 0.04$

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

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

$x = 5$

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

$3x - 5 = 16$

$3x = 21$

$x = 7$

Action

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

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

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

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

$30x = 60$

$x = 2$

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

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

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

OR

$3\log x = 12$

$\log_{10} x = 4$

$x = 10^4$

$10^{12} = x^3$

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

$x = 10^{12/3}$

$x = 10^4$

Action

Example 4: Quadratic log equations

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

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

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

$x^2-9 = 2^4$

$x^2-25=0$

$(x+5)(x-5)=0$

$x^2 = 25$

$x = \pm 5$

$x = 5$

because $x=-5$ is inadmissible

* can't take log of a negative number

if $x=5$

$\log_2(8) + \log_2(2) = 4$

$3+1=4$

$4=4$ ✓

if $x=-5$

$\log_2(-2) + \log_2(-4) = 4$

impossible

Consolidation

Exit Question

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

we would take log of a negative

* negative x's are possible

Consolidation

Practice

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