Math Virtual Learning

College Prep Algebra

April 20, 2020

College Prep Algebra
Lesson: April 16, 2020

Objective/Learning Target:
How to solve logarithmic equations with exponentials

Let's Get Started:
Exponentials and Logarithms are INVERSE Functions.
That fact makes the equations below
express the exact same thing!

$$17^3 = 4913 \qquad\qquad \log_{17} 4913 = 3$$

Seventeen multiplying
itself three times
creates 4913.

4913 repeatedly divided
by seventeen makes
three—so three
seventeens make 4913.

Lesson:
To learn how to solve logarithmic equations, you will need to remember your properties of logarithms from the lesson on 4/14.

Watch these videos below to see how to solve logarithmic equations.

- [Video 1](#)
- [Video 2](#) watch and stop at 7:51
- [Video 3](#) watch from 5:23 to 9:45

Practice: Use the calculator linked here.
Scientific Calculator

Work the problems on a sheet of paper. Then review
the worked solutions on the following slides.

Solving Logarithmic Equations with Exponentials

1) $2 \log_7 (-2r) = 0$

$\log_7 (-2r)^2 = 0$

$(-2r)^2 = 7^0$

$(-2r)(-2r)$

$\dfrac{4r^2}{4} = \dfrac{1}{4}$

$r^2 = \dfrac{1}{4}$

$r = \pm \sqrt{\dfrac{1}{4}}$

$r = +\dfrac{1}{2}$ or $-\dfrac{1}{2}$

Check:

$r = \dfrac{1}{2}$ $-2r = -2 \cdot \dfrac{1}{2} = \dfrac{-2}{2} = -1$

So $2\log_7 (-2 \cdot \dfrac{1}{2})$

NOPE $= 2 \log_7 (-1)$ ↘ ERROR

$r = \dfrac{-1}{2}$ $-2r = -2 \cdot \dfrac{-1}{2} = +\dfrac{2}{2} = 1$

$2 \log_7 (1) = 0$ ← put into calc.

Yep $\boxed{r = \dfrac{-1}{2}}$ $2 \cdot \dfrac{\log 1}{\log 7}$

$= 0$ ★

2) $-10 + \log_3 (n+3) = -10$

$\underline{+10 \qquad\qquad\qquad +10}$

$\log_3 (n+3) = 0$

$n+3 = 3^0$

$n+3 = 1$

$\underline{-3 \qquad -3}$

$n = -2$

Check:

$-10 + \log_3 (-2+3)$

$-10 + \log_3 (1)$

$-10 + \dfrac{\log 1}{\log 3}$ put into calc.

-10 ★

So $\boxed{n = -2}$

3) $\dfrac{-2 \log_5 (7x)}{2} = \dfrac{2}{-2}$

$\log_5 (7x) = -1$

$\dfrac{7x}{7} = \dfrac{5^{-1}}{7}$ ← calculator

$x = 0.02857\ldots$

or $\dfrac{1}{35}$

Check

$-2 \log_5 \left(7 \cdot \tfrac{1}{35}\right)$

on calc

$-2 \cdot \dfrac{\log \left(7 \cdot \tfrac{1}{35}\right)}{\log (5)}$

$\boxed{x = \dfrac{1}{35}}$ ✦

4) $\log (-m) + 2 = 4$

$\dfrac{-2 \quad -2}{\log (-m) = 2}$

$\log = \log_{10}$

$-m = 10^2$

$\dfrac{-m}{-1} = \dfrac{100}{-1}$

$m = -100$

check

$\log (-(-100)) + 2$

$\log (100) + 2$

$\underset{\text{calc}}{^{\text{in}}}$ 4 ✦

$\boxed{m = -100}$

5) $-6\log_3(x-3) = -24$

$$\frac{-6}{-6} \qquad \frac{-24}{-6}$$

$\log_3(x-3) = 4$

$$x - 3 = 3^4$$
$$x - 3 = 81$$
$$+3 \qquad +3$$
$$x = 84$$

Check

$-6\log_3(84-3)$

$-6 \cdot \dfrac{\log(84-3)}{\log 3}$

calc

-24 �

$\boxed{x = 84}$

6) $\log(x) + \log(8) = 2$

$\log(x \cdot 8) = 2$

$\log(8x) = 2$

$\left(\log_{10}\right)$

$$8x = 10^2$$
$$8x = 100$$
$$\frac{8x}{8} \qquad \frac{100}{8}$$

$x = 12.5$

Check

$\log(12.5) + \log(8)$

in calc

2 ✱

$\boxed{x = 12.5}$

7) $\log(x) - \log(2) = 1$

$\log\left(\frac{x}{2}\right) = 1$

$\frac{x}{2} = 10^1$

$(2)\frac{x}{2} = 10\ (2)$

$x = 20$

● Check

$\log(20) - \log(2)$
in calc.

1 ☆

$\boxed{x = 20}$

8) $\log(2) + \log(x) = 1$

$\log(2 \cdot x) = 1$

$\log(2x) = 1$

$2x = 10^1$

$\frac{2x}{2} = \frac{10}{2}$

$x = 5$

Check

$\log(2) + \log(5)$
in calc

1 ☆

$\boxed{x = 5}$

9) $\log_8(2) + \log_8(4x^2) = 1$

$\log_8(2 \cdot 4x^2) = 1$

$\log_8(8x^2) = 1$

$8x^2 = 8^1$

$\dfrac{8x^2}{8} = \dfrac{8}{8}$

$x^2 = 1$

$x = \pm\sqrt{1}$

$x = 1 \text{ or } -1$

Check

$x = 1 \quad \log_8(2) + \log(4(-1)^2)$

$\qquad \ast 1 \quad \underline{\text{in calc}}$

$x = +1 \quad \log_8(2) + \log(4(1)^2)$

$\qquad \ast 1 \quad \text{in calc}$

(BOTH)

$\boxed{x = -1 \text{ or } 1}$

---

10) $\ln(2) - \ln(3x + 2) = 1$

$\ln\left(\dfrac{2}{3x+2}\right) = 1$

(means $\log_e$) (loge)

$\dfrac{2}{3x+2} = e^1$

$\dfrac{(3x+2)\ 2}{3x+2} = e(3x+2)$ (don't dist!)

$2 = e(3x+2)$

$\dfrac{2}{e} = \dfrac{e(3x+2)}{e}$

$\dfrac{2}{e} = 3x + 2$

$\quad -2 \qquad -2$

$\dfrac{\frac{2}{e} - 2}{3} = \dfrac{3x}{3}$

$\boxed{\dfrac{2/e - 2}{3} = x}$

Check: in calc

$\ln(2) - \ln\left(3 \cdot \frac{2/e - 2}{3} + 2\right)$

$\ast 1 \quad$ so.

Additional Practice

[More Practice Problems with Answers:](#)
[SKIP #13-18](#)