

Warm-up!

Solve:

A) $\log$

B)

C)

Log Functions Day 5:

- Quiz
- (2.13) Solving Log Equations

Homework: Solving Log Equations

General approach to exponential equations

1. Isolate the logarithmic part
2. Use both sides as an exponent
3. Solve for x (distribute, rearrange, factor)
4. Check for extraneous solutions. (cannot do $\log(\text{negative})$)

Example A:

$$3\log_2(x-4) + 7 = 16$$

$$3\log_2(x-4) = 9$$

$$2^{\log_2(x-4)} = 2^3$$

$$x-4 = 8$$
$$x = 12$$

$$x=12$$
$$3\log_2(8) + 7 = 16$$

Example B+C

$$\frac{\ln(2x-4) + 10}{7} = 2$$

$$\ln(2x-4) + 10 = 14$$

$$e^{(\ln(2x-4))} = e^{(4)}$$

$$2x-4 = e^4$$

$$2x = e^4 + 4$$

$$x = \frac{e^4 + 4}{2}$$

$$x = \frac{1}{2}e^4 + 2$$

$$\frac{1}{2}\log(5-x) - 4 = -3$$

$$\frac{1}{2}\log(5-x) = 1$$

$$10^{(\log(5-x))} = 10^{(2)}$$

$$5-x = 100$$

$$-x = 95$$

$$x = -95$$

Example D+E

$$\log_3(12) - \log_3(2x) = 0$$

$$\left(\log_3 \left(\frac{12}{2x} \right) \right) = 0$$

$$\frac{12}{2x} = 1$$

$$12 = 2x$$

$$x = 6$$

$$\log_3(12) - \log_3(2x) = 1$$

$$\left(\log_3 \left(\frac{12}{2x} \right) \right) = 1$$

$$\frac{12}{2x} = 3$$

$$12 = 6x$$

$$x = 2$$

General approach to logarithmic equations

1. Get logs by themselves. This could potentially involve condensing logs with log properties.
2. Use both sides as an exponent.
3. Solve for x (distribute, rearrange, factor)
4. Check for extraneous solutions. (cannot do $\log(\text{negative})$)

Example F:

$$\log_5(2x + 1) - \log_5(x - 3) = 1$$

$$\log_5\left(\frac{2x+1}{x-3}\right) = 1$$

$$\frac{2x+1}{x-3} = 5$$

$$2x+1 = 5(x-3)$$

$$2x+1 = 5x-15$$

$$16 = 3x$$

$$x = 16/3$$

This is wrong. Do not do this. Every time you do this, a puppy forgets how to play fetch. And that's just sad.

$$\log_4(5) + \log_4(2x + 1) = \log_4(6x + 13)$$

$$\underset{4}{\log_4(5)} + \underset{4}{\log_4(2x + 1)} = \underset{4}{\log_4(6x + 13)}$$

$$5 + (2x + 1) = 6x + 13$$

,

Example G+H

$$\log_3(2x-1) = 2 - \log_3(x-2)$$

$$\log_3(2x-1) + \log_3(x-2) = 2$$

$${}_3(\log_3((2x-1)(x-2))) = {}_3(2)$$

$$(2x-1)(x-2) = 9$$

$$2x^2 - 5x + 2 = 9$$

$$2x^2 - 5x - 7 = 0$$

$$(2x-7)(x+1) = 0$$

$$x = \frac{7}{2} \quad x = -1$$

$$2 \log_3 x - \log_3(x-1) = 2 \log_3 2$$

$$\log_3\left(\frac{x^2}{x-1}\right) = \log_3(2^2)$$

$${}_3(\log_3\left(\frac{x^2}{x-1}\right)) = {}_3(\log_3(4))$$

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

$$x^2 = 4x - 4$$

$$x^2 - 4x + 4 = 0$$

$$(x-2)(x-2) = 0$$

$$x = 2$$

Example I+J

$$2 \log_4(3x + 2) = \log_4(x + 3) + 2$$

$$\log_2((x + 4)^3) = 2 \log_2(x + 4) + 3$$

Example K

Let $f(x) = \ln(x - 1) + \ln(x + 3)$ and $g(x) = \ln(2x + 13)$.

Find all values of x where the graph of f and the graph of g intersect in the xy -plane.

$$\ln(x-1) + \ln(x+3) = \ln(2x+13)$$

$$e^{\ln((x-1)(x+3))} = e^{\ln(2x+13)}$$

$$(x-1)(x+3) = 2x+13$$

$$x^2 + 2x - 3 = 2x + 13$$

$$x^2 - 16 = 0$$

$$(x-4)(x+4) = 0$$

$$x = 4$$

$$~~x = -4~~$$