

Unit 3: Exponential and Logarithmic Functions

Activity 5: Solving Logarithmic Equations

Homework/Formative Assessment

1. Put the following sequence of steps in the correct order:

$$4x + 50 = 100$$

$$4x + 50 = 10^2$$

$$\log_{10}(4x + 50) = 2$$

$$x = 25/2$$

$$4x = 50$$

2. Solve the following logarithmic equations and check your answers.

a) $\log_2(x - 4) = 4$	b) $\log(2x - 3) = 1$
c) $\log_5(3x + 8) = 2$	d) $\log_x(9) = 2$
e) $\log_2(x + 2) = -2$	f) $\log_3(4x - 7) = 3$

3. Explain why no solutions exist for the following equation: $\log_{-3}27 = x$.

4. Solve for x in the following equation:

$$\log_3x - \log_36 = \log_318 - \log_32$$

5. Solve $\log_2(x - 5) + \log_2(x - 2) = 2$

6. Estimate the value of the following:

a) \log_2200	b) \log_319	c) \log_4150
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Homework/Formative Assessment - SOLUTIONS

1. Put the following sequence of steps in the correct order:

$$4x + 50 = 100$$

$$4x + 50 = 10^2$$

$$\log_{10}(4x + 50) = 2$$

$$x = 25/2$$

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$$\log_{10}(4x + 50) = 2$$

$$4x + 50 = 10^2$$

$$4x + 50 = 100$$

$$4x = 50$$

$$x = 25/2$$

2. Solve the following logarithmic equations and check your answers.

<p>a) $\log_2(x - 4) = 4$ $x - 4 = 2^4$ $x = 16 + 4$ $x = 20$</p>	<p>b) $\log(2x - 3) = 1$ $2x - 3 = 10^1$ $2x = 10 + 3$ $x = \frac{13}{2}$</p>
<p>c) $\log_5(3x + 8) = 2$ $3x + 8 = 5^2$ $3x = 25 - 8$ $x = \frac{17}{3}$</p>	<p>d) $\log_x(9) = 2$ $9 = x^2$ $\pm\sqrt{9} = 3$ $\pm 3 = x$ $3 = x$ (-3 is not in domain)</p>
<p>e) $\log_2(x + 2) = -2$ $x + 2 = 2^{-2}$ $x = \frac{1}{4} - 2$ $x = -\frac{7}{4}$</p>	<p>f) $\log_3(4x - 7) = 3$ $4x - 7 = 3^3$ $4x = 27 + 7$ $x = \frac{34}{4}$ $x = \frac{17}{2}$</p>

3. Explain why no solutions exist for the following equation: $\log_{-3}27 = x$.

Written in exponential form, you have $(-3)^x = 27$. There is no exponent that you can raise -3 (a negative) to that will give a result of 27 (a positive).

4. Solve for x in the following equation:

$$\log_3 x - \log_3 6 = \log_3 18 - \log_3 2$$

$$\log_3 x - \log_3 6 = \log_3 18 - \log_3 2$$

$$\log_3 x = \log_3 18 - \log_3 2 + \log_3 6$$

$$\log_3 x = \log_3 \left(\frac{18}{2} \times 6 \right)$$

$$\log_3 x = \log_3 (54)$$

$$x = 54$$

5. Solve $\log_2(x - 5) + \log_2(x - 2) = 2$

$$\log_2(x - 5) + \log_2(x - 2) = 2$$

$$\log_2(x - 5)(x - 2) = 2$$

$$\log_2(x^2 - 7x + 10) = 2$$

$$x^2 - 7x + 10 = 2^2$$

$$x^2 - 7x + 10 = 4$$

$$x^2 - 7x + 10 - 4 = 0$$

$$x^2 - 7x + 6 = 0$$

$$(x - 6)(x - 1) = 0$$

$$x = 6 \text{ or } x = 1$$

$x = 6$ ($x = 1$ is not in the domain of this function, since if you put it back into the input $(x - 5)$ or $(x - 2)$ you will get a negative)

6. Estimate the value of the following:

a) $\log_2 200$ $2^x = 200$ $x \approx 7.64$	b) $\log_3 19$ $3^x = 19$ $x \approx 2.68$	c) $\log_4 150$ $4^x = 150$ $x \approx 3.61$
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