

Unit 3: Exponential and Logarithmic Functions

Activity 6: Solving Exponential Equations

Homework Assignment

1. Show two ways of solving the problem below.

$$3^{x+2} - 3^x = 216$$

2. Solve the following exponential equations using a common base.

a) $4^x = 16^{(x-2)}$	b) $6^{2x} = 216^{(3x-5)}$	c) $\left[\frac{1}{2}\right]^{4x+1} = \left[\frac{1}{4}\right]^{3x+3}$
d) $(5)(5)^{x+2} = 25^{2x}$	e) $3^{(x+3)} - 3^x = 78$	

3. Solve the following exponential equations using logarithms.

a) $3^x = 9^{x+3}$	b) $75(1.08)^n = 450$	c) $48(1.03)^n = 96$	d) $2^x = 3^{x+1}$
--------------------	-----------------------	----------------------	--------------------

Homework Assignment SOLUTIONS

1. Show two ways of solving the problem below.

$$3^{x+2} - 3^x = 216$$

Using a common base:

$$3^{x+2} - 3^x = 216$$

$$3^x(3^2 - 1) = 216$$

$$3^x = \frac{216}{8}$$

$$3^x = 27$$

$$3^x = 3^3$$

$$x = 3$$

Or using logarithms:

$$3^{x+2} - 3^x = 216$$

$$3^x(3^2 - 1) = 216$$

$$3^x = \frac{216}{8}$$

$$3^x = 27$$

$$\log 3^x = \log 27$$

$$x \log 3 = \log 27$$

$$x = \frac{\log 27}{\log 3}$$

$$x = 3$$

2. Solve the following exponential equations using a common base.

<p>a) $4^x = 16^{(x-2)}$ $4^x = (4^2)^{x-2}$ $4^x = 4^{2x-4}$ $x = 2x - 4$ $-x = -4$ $x = 4$</p>	<p>b) $6^{2x} = 216^{(3x-5)}$ $6^{2x} = 216^{(3x-5)}$ $6^{2x} = (6^3)^{3x-5}$ $6^{2x} = 6^{9x-15}$ $2x = 9x - 15$ $-7x = -15$ $x = \frac{15}{7}$</p>	<p>c) $\left[\frac{1}{2}\right]^{4x+1} = \left[\frac{1}{4}\right]^{3x+3}$ $(2^{-1})^{4x+1} = (2^{-2})^{3x+3}$ $2^{-4x-1} = 2^{-6x-6}$ $-4x-1 = -6x-6$ $2x = -5$ $x = -\frac{5}{2}$</p>
<p>d) $(5)(5)^{x+2} = 25^{2x}$ $(5)^1 (5)^{x+2} = 25^{2x}$ $5^{x+3} = (5^2)^{2x}$ $5^{x+3} = 5^{4x}$ $x+4 = 4x$ $-3x = -4$ $x = \frac{4}{3}$</p>	<p>e) $3^{(x+3)} - 3^x = 78$ $3^{(x+3)} - 3^x = 78$ $3^x (3^3 - 1) = 78$ $3^x (26) = 78$ $3^x = 3$ $x = 1$</p>	

3. Solve the following exponential equations using logarithms.

<p>a) $3^x = 9^{x+3}$ $3^x = 9^{x+3}$ $\log 3^x = \log 9^{x+3}$ $x \log 3 = (x+3) \log 9$ $x \log 3 = x \log 9 + 3 \log 9$ $x \log 3 - x \log 9 = 3 \log 9$ $x(\log 3 - \log 9) = 3 \log 9$ $x = \frac{3 \log 9}{\log 3 - \log 9}$ $x = -6$</p>	<p>b) $75(1.08)^n = 450$ $75(1.08)^n = 450$ $1.08^n = 6$ $\log 1.08^n = \log 6$ $n \log 1.08 = \log 6$ $n = \frac{\log 6}{\log 1.08}$ $n \approx 23.28$</p>	<p>c) $48(1.03)^n = 96$ $48(1.03)^n = 96$ $1.03^n = 2$ $\log 1.03^n = \log 2$ $n \log 1.03 = \log 2$ $n = \frac{\log 2}{\log 1.03}$ $n \approx 23.45$</p>	<p>d) $2^x = 3^{x+1}$ $2^x = 3^{x+1}$ $\log 2^x = \log 3^{x+1}$ $x \log 2 = (x+1) \log 3$ $x \log 2 = x \log 3 + \log 3$ $x \log 2 - x \log 3 = \log 3$ $x(\log 2 - \log 3) = \log 3$ $x = \frac{\log 3}{\log 2 - \log 3}$ $x \approx -2.71$</p>
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------