

## Solving Exponential Equations when the bases are not equal.

- 1) Turn in hw and try number 1-3 on the SATs
- 2) Go over hw.
- 3) Graphic Organizer
- 4) Notes on solving exponential functions
- 5) little quiz
- 6) do your hw

**PROPERTIES OF LOGARITHMS**

**GRAPHIC ORGANIZER**

Name	Rule(s)	Example 1	Example 2
BASIC LOGARITHMS	$\log_b b =$ ; $\log_b 1 =$	<b>Simplify:</b> $\log_{14} 14 =$	<b>Simplify:</b> $\log_3 1 =$
PRODUCT RULE	$\log_b (m \cdot n) =$	<b>Condense:</b> $\log_5 6 + \log_5 7 =$	<b>Expand:</b> $\log_2 63 =$
QUOTIENT RULE	$\log_b \left(\frac{m}{n}\right) =$	<b>Condense:</b> $\log_4 84 - \log_4 12 =$	<b>Expand:</b> $\log 9 =$
POWER RULE	$\log_b m^n =$	<b>Condense:</b> $2 \cdot \log_3 8 =$	<b>Expand:</b> $\log_2 6^{x-1} =$
CHANGE OF BASE FORMULA	$\log_b a =$	<b>Using a common base, evaluate the expression below.</b> $\log_7 32 =$	
<b>REMEMBER:</b> BASE 10 LOGS ARE COMMON LOGS AND WRITTEN WITHOUT A BASE! ( <b>log x</b> )			

© Gina Wilson (All Things Algebra), 2015

Name:		Date:	
Topic:		Class:	
Main Ideas/Questions	Notes/Examples		
<p><b>WARM-UP</b> Using a common base to solve an exponential equation.</p>	<p><b>Directions:</b> Solve the equations below using a common base.</p>		
	<p>1. <math>5^{n+10} = 25</math></p>	<p>2. <math>9^{a+2} = 27^{4a-2}</math></p>	
<p>What if a common base is NOT possible?</p>	<p>① <b>ISOLATE</b> the exponential expression.</p>		
	<p>② <b>TAKE THE LOG</b> of both sides.</p>		
	<p>③ You may need to <b>EXPAND</b> the log. (Use the Power Rule)</p>		
	<p>④ <b>SOLVE</b> and <b>CHECK FOR EXTRANEIOUS SOLUTIONS.</b></p>		
	<p>*Rounded answers may not produce the exact same answer, but will be very close.</p>		
<p><b>Examples</b></p>	<p>3. <math>2^x = 61</math></p>	<p>4. <math>8^{m-7} = 92</math></p>	
	<p>5. <math>4 \cdot 7^n = 148</math></p>	<p>6. <math>4^{3w} - 5 = 3</math></p>	

Name:		Date:	
Topic:		Class:	
Main Ideas/Questions	Notes/Examples		
<b>WARM-UP</b> Using a common base to solve an exponential equation.	<b>Directions:</b> Solve the equations below using a common base.		
	1. $5^{n+10} = 25$ $5^{n+10} = 5^2$ $n+10 = 2$ $\begin{array}{r} -10 \\ -10 \end{array}$ $n = -8$	2. $9^{a+2} = 27^{4a-2}$ $(3^2)^{a+2} = (3^3)^{4a-2}$ $2a+4 = 12a-6$ $4 = 10a-6$ $10 = 10a$ $1 = a$	
What if a common base is NOT possible?	①	ISOLATE the exponential expression.	
	②	TAKE THE LOG of both sides.	
	③	You may need to EXPAND the log. (Use the Power Rule)	
	④	SOLVE and CHECK FOR EXTRANEIOUS SOLUTIONS.	
*Rounded answers may not produce the exact same answer, but will be very close.			
Examples	3. $2^x = 61$ $\log_2 61 = x$ $\frac{\log 61}{\log 2} = x$ $5.9307 = x$	4. $8^{m-7} = 92$ $\log_8 92 = m-7$ $\frac{\log 92}{\log 8} = m$ $2.1745 = m-7$ $9.1745 = m$	
	5. $4 \cdot 7^n = 148$ $7^n = 37$ $\log_7 37 = n$ $\frac{\log 37}{\log 7} = n$ $1.8556 = n$	6. $4^{3w} - 5 = 3$ $4^{3w} = 8$ $\log_4 8 = 3w$ $\frac{\log 8}{\log 4} = 3w$ $1.5 = 3w$ $0.5 = w$	

	<b>7.</b> $7 - 4^{x+1} = 18$	<b>8.</b> $10 \cdot 5^{3k-3} = 40$
	<b>9.</b> $4 \cdot 3^n + 15 = 359$	<b>10.</b> $-2 \cdot 5^p + 7 = -63$
	<b>11.</b> $5 \cdot 9^{v-1} + 1 = 181$	<b>12.</b> $8 \cdot 11^{7k} - 3 = 213$
	<b>13.</b> $6 \cdot 16^{7y+2} - 2 = 82$	<b>14.</b> $3 \cdot 8^{3-7n} + 10 = 94$

<p>7. <math>7 \cdot 4^{x+1} = 18</math>  <math>-4^{x+1} = 11</math>  <math>4^{x+1} = -11</math>  <math>\log_4(-11) = x+1</math></p> <p style="border: 1px solid black; padding: 5px; display: inline-block;">No Solution!</p> <p>*Logs cannot be negative!*</p>	<p>8. <math>10 \cdot 5^{3k-3} = 40</math>  <math>5^{3k-3} = 4</math>  <math>\log_5 4 = 3k-3</math>  <math>\frac{\log 4}{\log 5} = 3k-3</math>  <math>0.8614 = 3k-3</math>  <math>3.8614 = 3k</math>  <span style="border: 1px solid black; padding: 2px;"><math>1.2871 = k</math></span></p>
<p>9. <math>4 \cdot 3^n + 15 = 359</math>  <math>4 \cdot 3^n = 344</math>  <math>3^n = 86</math>  <math>\log_3 86 = n</math>  <math>\frac{\log 86}{\log 3} = n</math></p> <p style="border: 1px solid black; padding: 2px;"><math>4.0545 = n</math></p>	<p>10. <math>-2 \cdot 5^p + 7 = -63</math>  <math>-2 \cdot 5^p = -70</math>  <math>5^p = 35</math>  <math>\log_5 35 = p</math>  <math>\frac{\log 35}{\log 5} = p</math></p> <p style="border: 1px solid black; padding: 2px;"><math>2.2091 = p</math></p>
<p>11. <math>5 \cdot 9^{v-1} + 1 = 181</math>  <math>5 \cdot 9^{v-1} = 180</math>  <math>9^{v-1} = 36</math>  <math>\log_9 36 = v-1</math>  <math>\frac{\log 36}{\log 9} = v-1</math>  <math>1.6309 = v-1</math>  <span style="border: 1px solid black; padding: 2px;"><math>2.6309 = v</math></span></p>	<p>12. <math>8 \cdot 11^{7k} - 3 = 213</math>  <math>8 \cdot 11^{7k} = 216</math>  <math>11^{7k} = 27</math>  <math>\log_{11} 27 = 7k</math>  <math>\frac{\log 27}{\log 11} = 7k</math>  <math>1.3745 = 7k</math>  <span style="border: 1px solid black; padding: 2px;"><math>0.1964 = k</math></span></p>
<p>13. <math>6 \cdot 16^{7y+2} - 2 = 82</math>  <math>6 \cdot 16^{7y+2} = 84</math>  <math>16^{7y+2} = 14</math>  <math>\log_{16} 14 = 7y+2</math>  <math>\frac{\log 14}{\log 16} = 7y+2</math>  <math>0.9518 = 7y+2</math>  <math>-1.0482 = 7y</math>  <span style="border: 1px solid black; padding: 2px;"><math>-0.1497 = y</math></span></p>	<p>14. <math>3 \cdot 8^{3-7n} + 10 = 94</math>  <math>3 \cdot 8^{3-7n} = 84</math>  <math>8^{3-7n} = 28</math>  <math>\log_8 28 = 3-7n</math>  <math>\frac{\log 28}{\log 8} = 3-7n</math>  <math>1.6025 = 3-7n</math>  <math>-1.3975 = -7n</math>  <span style="border: 1px solid black; padding: 2px;"><math>0.1996 = n</math></span></p>

Gina Wilson (All Things Algebra), 2015

Name: \_\_\_\_\_

Unit 7: Exponential & Logarithmic Functions



Date: \_\_\_\_\_ Bell: \_\_\_\_\_

Homework 7: Solving Exponential Equations  
(using logs)

**\*\* This is a 2-page document! \*\***

<b>Directions:</b> Solve each exponential equation using logarithms.	
1. $3^x = 18$	2. $7^y = 24$
3. $12^{n-3} = 60$	4. $2^{3a} = 142$
5. $15^{3v-5} = 87$	6. $4^{8n-2} = 84$
7. $4 \cdot 10^k = 60$	8. $16^n - 6 = 45$

Name: \_\_\_\_\_

Unit 7: Exponential & Logarithmic Functions



Date: \_\_\_\_\_ Bell: \_\_\_\_\_

Homework 7: Solving Exponential Equations  
(using logs)

**\*\* This is a 2-page document! \*\***

Directions: Solve each exponential equation using logarithms.	
<p>1. <math>3^x = 18</math>  <math>\log_3 18 = x</math>  <math>\frac{\log 18}{\log 3} = x</math>  <math>2.6309 = x</math></p>	<p>2. <math>7^y = 24</math>  <math>\log_7 24 = y</math>  <math>\frac{\log 24}{\log 7} = y</math>  <math>1.6332 = y</math></p>
<p>3. <math>12^{y-3} = 60</math>  <math>\log_{12} 60 = y - 3</math>  <math>\frac{\log 60}{\log 12} = y - 3</math>  <math>1.6477 = y - 3</math>  <math>4.6477 = y</math></p>	<p>4. <math>2^{3a} = 142</math>  <math>\log_2 142 = 3a</math>  <math>\frac{\log 142}{\log 2} = 3a</math>  <math>7.1497 = 3a</math>  <math>2.3832 = a</math></p>
<p>5. <math>15^{3v-5} = 87</math>  <math>\log_{15} 87 = 3v - 5</math>  <math>\frac{\log 87}{\log 15} = 3v - 5</math>  <math>1.6491 = 3v - 5</math>  <math>6.6491 = 3v</math>  <math>2.2164 = v</math></p>	<p>6. <math>4^{8n-2} = 84</math>  <math>\log_4 84 = 8n - 2</math>  <math>\frac{\log 84}{\log 4} = 8n - 2</math>  <math>3.1962 = 8n - 2</math>  <math>5.1962 = 8n</math>  <math>0.6495 = n</math></p>
<p>7. <math>4 \cdot 10^k = 60</math>  <math>10^k = 15</math>  <math>\log_{10} 15 = k</math>  <math>\frac{\log 15}{\log 10} = k</math>  <math>1.1761 = k</math></p>	<p>8. <math>16^n - 6 = 45</math>  <math>16^n = 51</math>  <math>\log_{16} 51 = n</math>  <math>\frac{\log 51}{\log 16} = n</math>  <math>1.4181 = n</math></p>



<b>9.</b> $13^{c-8} - 9 = 17$	<b>10.</b> $2 \cdot 8^{5r} = 28$
<b>11.</b> $10^{2x-7} - 3 = 57$	<b>12.</b> $8^{6-4x} + 6 = 22$
<b>13.</b> $6 \cdot 4^m - 14 = 88$	<b>14.</b> $9 \cdot 12^{r+4} - 8 = 127$
<b>15.</b> $-5 \cdot 4^{6x} + 5 = -30$	<b>16.</b> $8 \cdot 11^{3p-9} + 10 = 194$

<p>9. <math>13^{c-8} - 9 = 17</math>  <math>13^{c-8} = 26</math>  <math>\log_{13} 26 = c-8</math>  <math>\frac{\log 26}{\log 13} = c-8</math>  <math>1.2702 = c-8</math>  <math>9.2702 = c</math></p>	<p>10. <math>2 \cdot 8^{5r} = 28</math>  <math>8^{5r} = 14</math>  <math>\log_8 14 = 5r</math>  <math>\frac{\log 14}{\log 8} = 5r</math>  <math>1.2691 = 5r</math>  <math>0.2538 = r</math></p>
<p>11. <math>10^{2x-7} - 3 = 57</math>  <math>10^{2x-7} = 60</math>  <math>\log_{10} 60 = 2x-7</math>  <math>\frac{\log 60}{\log 10} = 2x-7</math>  <math>1.7782 = 2x-7</math>  <math>8.7782 = 2x</math>  <math>4.3891 = x</math></p>	<p>12. <math>8^{6-4x} + 6 = 22</math>  <math>8^{6-4x} = 16</math>  <math>\log_8 16 = 6-4x</math>  <math>\frac{\log 16}{\log 8} = 6-4x</math>  <math>1.3 = 6-4x</math>  <math>-4.6 = -4x</math>  <math>1.16 = x</math></p>
<p>13. <math>6 \cdot 4^m - 14 = 88</math>  <math>6 \cdot 4^m = 102</math>  <math>4^m = 17</math>  <math>\log_4 17 = m</math>  <math>\frac{\log 17}{\log 4} = m</math>  <math>2.0437 = m</math></p>	<p>14. <math>9 \cdot 12^{r+4} - 8 = 127</math>  <math>9 \cdot 12^{r+4} = 135</math>  <math>12^{r+4} = 15</math>  <math>\log_{12} 15 = r+4</math>  <math>\frac{\log 15}{\log 12} = r+4</math>  <math>1.09 = r+4</math></p>
<p>15. <math>-5 \cdot 4^{6x} + 5 = -30</math>  <math>-5 \cdot 4^{6x} = -35</math>  <math>4^{6x} = 7</math>  <math>\log_4 7 = 6x</math>  <math>\frac{\log 7}{\log 4} = 6x</math>  <math>1.4037 = 6x</math>  <math>0.2339 = x</math></p>	<p>16. <math>8 \cdot 11^{3p-9} + 10 = 194</math>  <math>8 \cdot 11^{3p-9} = 184</math>  <math>11^{3p-9} = 23</math>  <math>\log_{11} 23 = 3p-9</math>  <math>\frac{\log 23}{\log 11} = 3p-9</math>  <math>1.3076 = 3p-9</math>  <math>10.3076 = 3p</math>  <math>3.4359 = p</math></p>

Solve on the little piece of paper I  
give you:

$$3^{x-1} + 2 = 6$$