8-2 Solving Exponential Equations

Master

An **exponential equation** is one in which a variable occurs in the exponent.

An exponential equation in which each side can be expressed in terms of the same base can be solved using the property:

if $b^x = b^y$, then $x = y$. (where $b > 0$ and $b \neq 1$)

➡ *If the bases are the same, set the exponents equal.*

Examples:

	Solve for x.	Answer
1.	$7^{2x+1} = 7^{3x-2}$	Since the bases are the same, set the exponents equal to one another: $2x + 1 = 3x - 2$ $3 = x$
2.	$3^{2x-1} = 27^{x}$	27 can be expressed as a power of 3: $3^{2x-1} = \left(3^3\right)^{x} = 3^{3x}$ $2x - 1 = 3x$ $-1 = x$
3.	$5^{3x-8} = 25^{2x}$	25 can be expressed as a power of 5: $5^{3x-8} = \left(5^2\right)^{2x} = 5^{4x}$ $3x - 8 = 4x$ $-8 = x$

If you can express both sides of the equation as powers of the same base, you can set the exponents equal to solve for x.

http://regentsprep.org/Regents/math/algtrig/ATE8/exponentialEquations.htm

Need Help? Watch these on You tube!

http://www.youtube.com/watch?v=GEzkoEN6OoA
http://www.youtube.com/watch?v=KvQaHxRTt4U

So.... *How do you solve an exponential equation? Follow the steps below:*

1. Rewrite each side of the equation so they have the same base.
   Use your power card to help you change it to the lowest base!
2. Set the exponents equal to each other because of the property of equality

Property of EQUALITY: If $b^x = b^p$, then $x = p$ (where $b > 0$ and $b \neq 1$)

3. Solve the "simple equation".
4. Check the solution by substituting the value into the ***original*** equation!

Practice: Solve each exponential equation.

1. $2^{3x+1} = 4$

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

$3x+1=2$

$3x=1$

$x=\frac{1}{3}$

2. $3^{2x+2} = 27^{x-1}$

$3^{2x+2} = (3^3)^{x-1}$

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

$2x+2=3x-3$

$5=x$

3. $4^{3x-5} = 32^{2x+3}$

$2^{2(3x-5)} = 2^{5(2x+3)}$

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

$6x-10 = 10x+15$

$-25 = 4x$

$-6.25 = x$

4. $25^{2x} = 125^{x+2}$

$5^{2(2x)} = 5^{3(x+2)}$

$4x=3x+6$

$x=6$

5. $2^{3x} = 4^{x+2}$

$2^{3x} = 2^{2(x+2)}$

$3x=2x+4$

$x=4$

6. $9^{x+1} = 27^{x+4}$

$3^{2(x+1)} = 3^{3(x+4)}$

$2x+2=3x+12$

$-10=x$

7. $3^{2x+1} = \frac{1}{9}$

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

$2x+1=-2$

$2x=-3$

$x=\frac{-3}{2}=-1.5$

8. $8^{x-2} = \frac{1}{16}$

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

$3x-6=-4$

$3x=2$

$x=\frac{2}{3}\approx 0.7$

9. $5^{6x-2} = \left(\frac{1}{25}\right)^{x+1}$

$5^{6x-2} = 5^{-2(x+1)}$

$6x-2=-2x-2$

$8x=0$

$x=0$

10. $343^{2x-9} = 49^{x+6}$

$7^{3(2x-9)} = 7^{2(x+6)}$

$6x-27=2x+12$

$4x=39$

$x=\frac{39}{4}=9.75$

11. $128^{x-5} = 16^{2x-5}$

$2^{7(x-5)} = 2^{4(2x-5)}$

$7x-35=8x-20$

$-15=x$

12. $16^{2x+5} = 64^{3x-2}$

$2^{4(2x+5)} = 2^{6(3x-2)}$

$8x+20=18x-12$

$32=10x$

$x=3.2$