OpenAlgebra.com A free math study guide with notes and YouTube video tutorials. **Table of Contents Algebra Worksheets Videos & Interactives About Us Solving Exponential Equations** In this section, we will make use of what we have learned about exponential functions to solve equations. Playlist on Solving Exponential Equations One-to-One Property of **Exponential Functions** If  $b^n = b^m$ then n = m**Step 1**: Express both sides in terms of the same base.

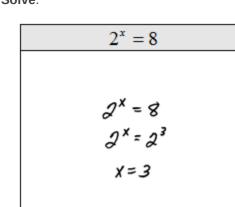
Make use of the above property if you are able to express both sides of the equation in terms of the same base.

**Step 2**: Equate the exponents.

**Step 3**: Solve the resulting equation.

Solve  $5^{3x-2} = 125^{2x}$  $5^{3x-2} = 125^{2x}$  $5^{3x-2} = (5^3)^{2x}$  $5^{3x-2} = 5^{6x}$ 3x - 2 = 6x-2 = 3x

Solve.



$$32^{x-2} = 64$$

$$32^{x-2} = 64$$

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

$$2^{5x-10} = 2^{6}$$

$$5x-10 = 6$$

$$x = \frac{16}{5}$$

$$100^{x} = 1000^{2x-1}$$

$$/00^{x} = /000^{2x-1}$$

$$(10^{2})^{x} = (10^{3})^{2x-1}$$

$$/0^{3x} = /0^{6x-3}$$

$$2x = 6x - 3$$

$$-4x = -3$$

$$x = \frac{3}{4}$$

$$81^{-x} = 9^{-x-2}$$

$$81^{-x} = 9^{-x-2}$$

$$(9^2)^{-x} = 9^{-x-2}$$

$$9^{-2x} = 9^{-x-2}$$

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

$$x = 2$$

$$x = 2$$

$$14^{2x-1} = 64$$

$$4^{2x-1} = 64$$

$$2x = 3/6^{x-3}$$

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

$$6^{2x} = 6^{3x-9}$$

$$2x = 3x-9$$

$$-x = -9$$

$$x = 9$$
It is not always the case that we will be able to express both sides of an equation in terms of the same base. For this reason we will

make use of the following property.

$$4^{2x-1} = 64$$

$$4^{2x-1} = 64$$

$$4^{2x-1} = 4^{3}$$

$$2x-1 = 3$$

$$2x = 4$$

$$x = 2$$

$$36^{x} = 216^{x-3}$$

$$36^{x} = 216^{x-3}$$

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

$$6^{2x} = 6^{3x-9}$$

$$2x = 3x-9$$

$$-x = -9$$

$$x = 9$$

One-to-One Property of

Logarithmic Functions  $\log_b x = \log_b y$ if and only if x = y

**Step 1**: Isolate the exponential and then apply the logarithm to both sides.

Make use of the above property if you are unable to express both sides of the equation in terms of the same base.

**Step 2**: Apply the power rule for logarithms and write the exponent as a factor of the base. **Step 3**: Solve the resulting equation.

Solve 
$$3^{2x-1} = 10$$

$$3^{2x-1} = 10$$

$$\log(3^{2x-1}) = \log(10)$$

$$(2x-1) \log 3 = \log(10)$$

$$(2x-1) \log 3 = \frac{\log(10)}{\log 3}$$

$$2x-1 = \frac{1}{\log 3}$$

$$2x = 1 + \frac{1}{\log 3}$$

$$x = \frac{1}{2} + \frac{1}{2\log 3}$$

$$x \approx 1.55$$

Solve.

$$7^{2x} = 5$$

$$10g 7^{3x} = 10g 5$$

$$3x \cdot \log 7 = \log 5$$

$$x = \frac{\log 5}{3\log 7}$$

$$x^{2} \cdot 2757$$

$$e^{-x} = 1$$

$$e^{-x} = 1$$

$$lne^{-x} = ln 1$$

$$-x \cdot lne = ln 1$$

$$-x \cdot 1 = 0$$

$$x = 0$$

 $5(0.3)^{x-2} = 30$ 

$$e^{x-6} = 150$$
 $ln e^{x-6} = ln 150$ 
 $(x-6) \cdot ln e = ln 150$ 
 $x-6 = ln 150$ 
 $x = 6 + ln 150$ 
 $x = 100$ 

$$2-10^{x} = -28$$
 $-10^{x} = -30$ 
 $10^{x} = 30$ 
 $\log 10^{x} = \log 30$ 
 $\log 10 = \log 30$ 
 $0 = \log 30$ 

 $2-10^x = -28$ 

$$5(.3)^{x-2} = 30$$

$$(.3)^{x-2} = 6$$

$$\log (.3)^{x-2} = \log 6$$

$$(x-2) \log .3 = \log 6$$

$$x-2 = \frac{\log 6}{\log .3}$$

$$x = 2 + \frac{\log 6}{\log .3}$$

$$x \approx .5118$$

$$2-10^{x} = -28$$

$$2-10^{x} = -28$$

$$3-10^{x} = -28$$

$$-10^{x} = -30$$

$$10^{x} = 30$$

$$10^{x} = 30$$

$$10^{x} = \log 4$$

$$10^{x} = \log$$

equation involves the natural base e. We choose these because there is a button for them on the calculator. However, we could certainly choose any base that we wish; this is the basis for the derivation of the change of base formula.

Prove $\log_b x = \frac{\log_a x}{\log_a b}$				
y = 10gbx				
P <sub>A</sub> = X				
logaby = logax				
y. logab = logax				
y = logax logab				
So $\log_b X = \frac{\log_a X}{\log_a b}$				

## YouTube Videos:

$$2^x = 3$$

 $16^{x-1} = 64$ 

$$10^{x+1} = 1000$$

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

 $2^{x} = 10$ 

**Newer Post** 

 $2 + 3^{2x-3} = 10$ 

 $2-10^x = -28$ 

Posted by John Redden MBLFO Labels: algebra, algebra 2, equation, exponential, exponential equations, log, logarithm, math, solve, solving

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