

<u>Your tı</u>	<u>urn:</u>	"Isolate the radical"	"Undo the radical"
Solve:	$\sqrt{3x}$ –	$\overline{5} = x - 3$	

Solving an Exponential Equation: The easiest problem
$2^x = 2^{4-x}$ Exponents have to be equal to each other!
$x = 4 - x \qquad x = 2$
+X +X Check your answer!
$2x = 4$ $2^2 = 2^{4-2}$
÷x ÷x – –
$7^{2x+1} = 7^{13-4x} \qquad x = 2$
2x + 1 = 13 - 4x
+4x +4x
6x + 1 = 13
-1 -1
6x = 12

Equivalent Powers with different bases.
$4^{1} = 2^{2} \qquad \qquad \frac{\text{Harder}}{4^{2} = (2^{2})^{2}} = 2^{4}$ $8^{1} = 2^{3} \qquad \qquad 9^{2} = (3^{2})^{2} = 3^{4}$ $9^{2x} = (3^{2})^{2x} = 3^{4x}$
Change the base of the power as indicated: $27^1=3^?$
$16^2 = 4^?$ $25^{2x} = 5^?$

Solving u	using "convert to same base"
$9^{2x} = 27^{x-1}$	"convert to same base"
	Check your answer!

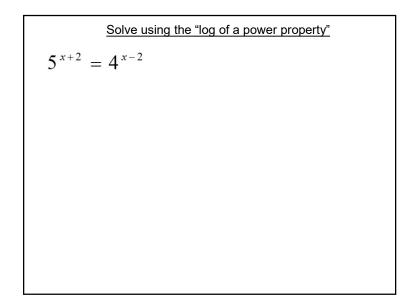
Solving usir	ng "convert to same base"
$2^{4x-1} = 8^{x-1}$	"convert to same base"
$2^{4x-} = (2^3)^{x-1}$	Exponent of a power Exponent Property
$2^{4x-1} = 2^{3x-3}$	x = -2
4x - 1 = 3x - 3 -3x -3x	Check your answer! $2^{4(-2)-1} = 8^{-2-1}$
$\begin{array}{c} x - 1 = -3 \\ +1 & +1 \end{array}$	$2^{-9} = 8^{-3}$ ($2^{-9} = 8^{-3}$) ⁻¹ $2^{9} = 8^{3}$ 512 = 512

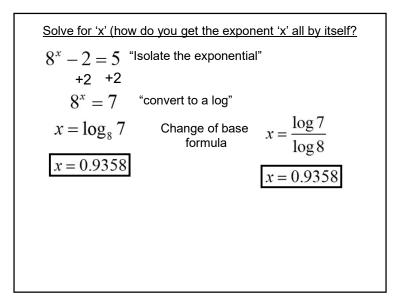
Solving using "log of a power" property		
$9^{2x} = 27^{x-1}$	lake natural	log of both side
$\ln 9^{2x} = \ln 27^{x-1}$	¹ "log of pw	r property"
$2x\ln 9 = (x-1)\ln 1$	27	0.5x = -1.5
÷ In 9 ÷ In	9	*2 *2
. ln 27		x = -3
$2x = (x-1)\frac{\ln 27}{\ln 9}$	simplify	Same solution as previous method!
2x = (x-1)(1.5)	simplify	$(3^2)^{2x} = (3^3)^{x-1}$
2x = 1.5x - 1.5		$3^{4x} = 3^{3x-3}$
-1.5x -1.5x		4x = 3x - 3
		x = -3

Solve using "convert to same base"
$\bigotimes^{x+2} = \bigotimes^{x-2} 8 \text{ and } 4 \text{ are } \underline{\text{both}} \text{ powers of } 2.$
$ \bigotimes^{x+2} = \bigotimes^{x-2} 8 \text{ and } 4 \text{ are } \underline{\text{both powers of } 2}. $ $ (2^3)^{x+2} = (2^2)^{x-2} $ Power of a Power property $ 2^{3x+6} = 2^{2x-4} $ "undo the power"
$2^{3x+6} = 2^{2x-4}$ "undo the power"
3x + 6 = 2x - 4 Did I do a step mentally? -2x -2x
-2x -2x
x + 6 = -4 $x = -10$
-6 -6

Solving using "log of a pov	wer" property
$8^{x+2} = 4^{x-2}$ Take natura	l log of both side
$\ln 8^{x+2} = \ln 4^{x-2}$ "log of pwr p	property"
$(x+2)\ln 8 = (x-2)\ln 4$	3x + 6 = 2x - 4
÷ ln 8 ÷ ln 8	-2x - 6 -2x - 6
$(x+2) = (x-2)\frac{\ln 4}{\ln 8}$ simplify	x = -10
x + 2 = (x - 2)(0.66666666) simplify	
$x + 2 = (x - 2)\left(\frac{2}{3}\right)$ 3(x + 2) = (x - 2)\left(\frac{2}{3}\right)(3)	
$3(x+2) = (x-2)\left(\frac{2}{3}\right)(3)$	

Sometimes you can't rewrite the bases so you have no choice. U	
$5^{x} = 7^{2x-1}$ $\ln 5^{x} = \ln 7^{2x-1}$	x = 2.42x - 1.21 + 1.21 + 1.21
$x \ln 5 = (2x - 1) \ln 7$ ÷ ln 5 ÷ ln 5	1.21 + x = 2.42x -x -x
$x = (2x-1)\frac{\ln 7}{\ln 5}$	1.21 = 1.42x ÷ 1.42 ÷ 1.42
x = (2x - 1)(1.21)	x = 0.85





Solve using "undo the exponential"
$3^{2x-1}+5=7$ "Isolate the exponential"

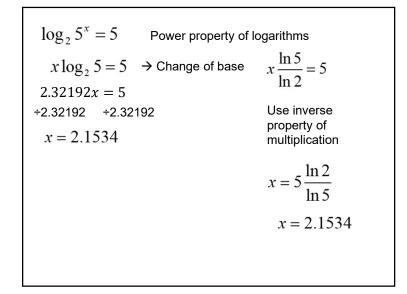
The easiest log equation.	
$\log(x+3) = \log(2x-1)$	
$x + 3 = 2x - 1 \rightarrow x = 2$	
Why does this work?	101/
$y = y \qquad y = \log(x+3)$ $y = \log(2x-1)$	$10^{y} = x + 3$ $10^{y} = 2x - 1$
	$10^{5} = 2x - 1$
Substitution Property	
$x + 3 = 10^y = 2x - 1$	
x + 3 = 2x - 1	

Extraneous solution: an apparent solution that does not work when plugged back into the original equation.
You <u>MUST</u> check the solutions in the original equation <u>for any equation</u> this is of the <u>function type</u> that has a <u>restricted domain</u> .
Square root equations Radicands cannot be negative
Square roots do not equal negative numbers
Rational equations Denominators cannot equal zero
Log equations Logarands cannot be zero or negative

Solve: $\log(x - 5) = \log(2x + 3)$

Remember to check for extraneous solutions by plugging the solution for 'x' back into the original equation.

Can you have a negative logarand?



Solve: $\log_2 5^x = 4$ $\log_3 4^{5x} = 6$

Solving Logs requirir	ng condensing the product.
$\log 2x + \log(x-5) = 2$	"condense the product"
$\log 2x(x-5) = 2$	"undo the logarithm"
$10^2 = 2x(x-5)$	Quadratic $ ightarrow$ put in standard form
$100 = 2x^2 - 10x$	
$2x^2 - 10x - 100 = 0$	Divide both sides by '2'
$x^2 - 5x - 50 = 0$	factor
(x-10)(x+5) = 0	Zero product property
x = 10, -5	

Check for extraneous solutions: x = 10, x $\log 2x + \log(x-5) = 2$ $\log(2 * 10) + \log(10 - 5) = 2$ $\log(20) + \log(5) = 2$ All logarands are positive \odot $\log 100 = 2$ "Condense the product" $10^2 = 100$ Checks $\log(2)(-5) + \log(-5 - 5) = 2$ $\log(-10) + \log(-10) = 2$ Negative logarands \otimes x = 5 is an extraneous solution. $\ln 5^{x+2} + \ln 5^2 = 2$ $\log_2 4x + \log_2 3 = 6$

More complicated Logarithmic Equations	
$2 + \log_2 5^{x-2} = 7$ "Isolate the logarithm"	
-2 -2 -2 $\log_2 5^{x-2} = 5$ "undo the logarithm"	
$(x-2)\log_2 5 = 5$ $\div \log_2 5 \div \log_2 5$	
x - 2 = 2.15338	
+2 $+2$ Add '2' to both sides.	
x = 4.1524	

$$3 + \log_4 3^{2x-1} = 6$$

-7+2 ln 4^{x-3} = 5
$$\log_4 (5x-1) = 3$$