Bell Ringer

Solve these equations to find the value of x in the form $x = \frac{\ln a}{\ln b}$, where $a, b \in \mathbb{Q}$

a $e^{2x} - e^{x} = 0$

b $4^{x} - 3(2^{x}) = 0$

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

$x = \ln 1$

$$\begin{array}{r} 2x = x \\ -x \quad -x \\ \hline x = 0 \end{array}$$

d $(6^{x})(2^{x-1}) = 2(4^{x+2})$

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Real #'s $\mathbb{R}$

Rational #'s $\mathbb{Q} = \left\{ \frac{a}{b} \mid a, b \in \mathbb{Z} \right\}$

Integers $\mathbb{Z} = \{\ldots -3, -2, -1, 0, 1, 2, 3 \ldots\}$

Natural #'s $\mathbb{N} = \{1, 2, 3, 4 \ldots\}$

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Solving logarithmic equations

Some logarithmic equations can be solved by ensuring that both sides of the equation contain logarithms written to the same base. Then you can equate the **arguments**.

In other words...

"get them to be the same base then cancel"

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Ex

Solve $\log_a(x^2) = \log_a(3x+4)$

Answer

$\log_a(x^2) = \log_a(3x+4)$	
$x^2 = 3x + 4$	*Equate the arguments.*
$x^2 - 3x - 4 = 0$	*Solve the quadratic.*
$(x-4)(x+1) = 0$	
$x = 4$ *or* $x = -1$	

You **must** check that both solutions are possible.
Remember you cannot find the logarithm of a negative number.
Substituting $x = 4$ and $x = -1$ into both sides of the original equation gives the log of a positive number so here both solutions are possible.

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Solve $\ln(12-x)=\ln x+\ln(x-5)$

Answer

$\ln(12-x)=\ln x+\ln(x-5)$ $\ln(12-x)=\ln x(x-5)$ $\ln(12-x)=\ln(x^2-5x)$ $12-x=x^2-5x$ $x^2-4x-12=0$ $(x-6)(x+2)=0$ $x=6$ or $x=-2$	*Equate arguments.* *Solve the quadratic.*
When $x=6$ $\ln x$ and $\ln(x-5)$ are positive. When $x=-2$ $\ln x$ and $\ln(x-5)$ are negative so $x=6$ is the only solution.	*Check solutions.*

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