Solving Exponential Equations

| Name of Method | Method in Symbols | Method in Words |
| :---: | :---: | :---: |
| Relating the bases or One to One Property for Exponential Functions | $\begin{aligned} b^{u} & =b^{v} \\ u & =v \end{aligned}$ | - Requires the exponential equation to have the bases on both sides the same <br> - When the bases are the same the exponents must be equal because of the one-toone property of exponential functions. |
| Convert the exponential equation to a logarithmic equation | $\begin{gathered} y=b^{x} \\ \log _{b} y=x \end{gathered}$ | - Requires the exponential to be isolated on one side of the equation. <br> - Convert to a logarithm using the definition of a logarithm. <br> - Solve the remaining equation by isolating x. |
| Take the $\log$ of both sides. | $y=b^{x}$ <br> $\ln y=\ln b^{x}$ <br> $\ln y=x \ln b$ $\frac{\ln y}{\ln b}=\frac{x \ln b}{\ln b}$ $\frac{\ln y}{\ln b}=x$ | - Requires the exponential to be isolated on one side of the equation. <br> - Take the natural log of both sides. This is allowed by the one-to-one property of logarithms. <br> - Use the power rule for logarithms to multiply by the exponent. <br> - Solve the renaming equation by isolating x . |

Solve the following exponential equations.

1. $3^{2 x-9}=27$
2. $16^{x-3}=8^{x-1}$
3. $3^{x}=8$
4. $5^{x-3}=137$
5. $7^{2 x+9}=3^{8 x+5}$
6. $500 e^{.05 k}+40=1040$
7. $e^{2 x}-2 e^{x}-3=0$

Solving Logarithmic Equations

| Name of Method | Method in Symbols | Method in Words |
| :---: | :---: | :---: |
| Convert to an Exponential | $\begin{gathered} y=\log _{b} x \\ b^{y}=x \end{gathered}$ | - Requires the logarithm to be isolated on one side of the equation. <br> - Convert to an exponential using the definition of a logarithm. <br> - Solve the remaining equation by isolating $x$. |
| Use the one to one property of Logarithms | $\begin{gathered} \log _{b} u=\log _{b} v \\ u=v \end{gathered}$ | - Requires the logarithmic equation to have a log with the same base on both sides. <br> - When the bases of the logarithms are the same the expressions inside must be equal because of the one-to-one property of logarthmic functions. <br> - Solve the remaining equation by isolating x . |

Solve the following logarithmic equations.
7. $\log _{5}(x-4)=\log _{5}=6$
8. $\log _{3} 2+\log _{3}(x-3)=\log _{3} 10$
9. $\log (x+3)+\log (x-2)=\log 14$
10. $\log _{4} x=3$
11. $\log _{5}(x-5)=2$
12. $2 \ln x=8$
13. $\log _{2} x+\log _{2}(x-2)=3$

