Exponential Eq's!!!!!!!!!!!

Type I Exponential Equation: You can express each side using the **same base....**
Example: Find $\log_{\sqrt{2}} 4$

(1) Set the expression equal to x. → $\log_{\sqrt{2}} 4 = x$

(2) Use the **definition** to re-write the expression as an exponential expression. → $\sqrt{2}^{\,x} = 4$

(3) Use your knowledge of exponents to re-write each side of the equation using the same base. → $(2^{\frac{1}{2}})^{x} = 2^{2}$

$2^{\frac{1}{2}x} = 2^{2}$

(4) Set the exponents equal to each other, and solve for x! → $\frac{1}{2}x = 2$

$\boxed{x = 4}$

Type II Exponential Equation: You cannot express each side using the same base.......
Example: $2^{x+1} = 5^{1-2x}$

(1) Take the natural logarithm **(Ln)** of both sides. → $\ln 2^{x+1} = \ln 5^{1-2x}$

(2) Use the **power rule** to re-write the expression. → $(x+1)\ln 2 = (1-2x)\ln 5$

(3) Use the distributive law to remove parentheses. → $x\ln 2 + \ln 2 = \ln 5 - 2x\ln 5$

(4) Get all x terms on one side, and other terms on the other side. → $x\ln 2 + 2x\ln 5 = \ln 5 - \ln 2$

(5) Factor out a common factor of x. → $x(\ln 2 + 2\ln 5) = \ln 5 - \ln 2$

(6) Divide bothsides by the coefficient of x. → $x = \frac{\ln 5 - \ln 2}{\ln 2 + 2\ln 5}$

(7) **Carefully** calculate the result on your calc....

$\boxed{x = .2342242698}$

Exponential Eq's, BASE 'e'!!!!!!!

Example: $500e^{.3x} = 600$

(1) Isolate the 'e' part of the equation. → $e^{.3x} = \frac{600}{500}$

(2) Take the natural logarithm (Ln) of both sides. → $\ln e^{.3x} = \ln(6/5)$

(3) Remember, Ln $e^x = x$. → $.3x = \ln(1.2)$

(4) Solve for x, and calculate carefully... → $x = \frac{\ln(1.2)}{.3}$

$$\boxed{x = .6077385226}$$

Logarithmic Eq's!!!!!

Type I Logarithmic Equations: One single 'log' statement is equal to a constant number.
Example: $\log_2 (x+4)^3 = 6$

(1) **Use the definition** to re-write the logarithmic expression as an exponential expression. → $2^6 = (x+4)^3$

$64 = (x+4)^3$

(2) Use your algebraic prowess to **solve for x.**

$\sqrt[3]{64} = \sqrt[3]{(x+4)^3}$

$4 = x+4$

$\boxed{x=0}$!!

Type II Logarithmic Equations: 'Log' statements potentially everywhere!
Example: $\log_4 (x^2-9) - \log_4 (x+3) = 3$

(1) Get all 'log' terms on one side of the equation. → o.k

(2) Use the **product, <u>quotient</u>, power rules** to compile all 'log' statements into a single 'log' statement: → $\log_4 \left(\frac{x^2-9}{x+3} \right) = 3$

(3) Now, you have a **Type I** equation, as above, so use the definition etc. exactly as above in the 1st example. → $4^3 = \frac{x^2-9}{x+3}$

$64 = \frac{(\cancel{x+3})(x-3)}{\cancel{x+3}}$

$64 = x-3$

$\boxed{x=67}$!!