TOPIC: SOLVING EXPONENTIAL & LOGARITHMIC EQUATIONS

Solving Exponential Equations Using Like Bases

- We **evaluated** exp. functions for given x; we **solve** exp. *equations* for unknown to make the statement ________.
  - To solve exp. equations, rewrite each side to have same _______ & set __________ equal, solving for ____.

Recall — Exponential *Function*	New — Exponential *Equation*
$f(x) = 2^x$	$16 = 2^x$
$f(4) = 2^4$	$2^{\_\_} = 2^x$
$f(4) = 16$	$\_\_\_\_\_ = \_\_\_\_\_$

EXAMPLE Solve each exponential equation by expressing each side as a power of the same base.

(***A***) $64 = 2^x$

(***B***) $5^{x+1} = \sqrt{5}$

(***C***) $27 = 9^x$

COMMON POWERS

Squares	Cubes
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	**Other**
$7^2 = 49$	
$8^2 = 64$	$2^4 = 16$
$9^2 = 81$	$2^5 = 32$
$10^2 = 100$	$3^4 = 81$

TOPIC: SOLVING EXPONENTIAL & LOGARITHMIC EQUATIONS

PRACTICE Solve the exponential equations.

(***A***) $4^{x+7} = 16$

(***B***) $100^{x} = 10^{x+17}$

(***C***) $81^{x+1} = 27^{x+5}$

TOPIC: SOLVING EXPONENTIAL & LOGARITHMIC EQUATIONS

Solving Exponential Equations Using Logs

◆ If you ***CANNOT*** rewrite sides of exponential equation to have the same base, solve using log or ln.

Like Bases	Unlike Bases
$16 = 2^x$	$17 = \quad 2^x$
$2^4 = 2^x$	$2^{???} = 2^x$
$4 = x$	

Properties of Logarithms

Name	Property
Product Rule	$\log_b(m \times n) = \log_b m + \log_b n$
Quotient Rule	$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$
Power Rule	$\log_b m^n = n \log_b m$

EXAMPLE Solve each exponential equation by using logs.

(***A***) $10^x + 64 = 100$

(***B***) $3 = 2^{x+1}$

HOW TO: SOLVE EXP. EQNS WITH LOGS

1) ____________ exp. expression(s)
2) If base 10: Take _____ of both sides
If NOT base 10: Take ___ of both sides
3) Use log rules to get x out of exponent
4) __________ for x
5) (If asked) Approximate using calculator

◆ Recall: The log or ln of some number is a _____________, not a variable! Treat it like any other number.

TOPIC: SOLVING EXPONENTIAL & LOGARITHMIC EQUATIONS

PRACTICE Solve the exponential equations.

(***A***)

$$2 \cdot 10^{3x} = 5000$$

(***B***)

$$900 = 10^{x+17}$$

(***C***)

$$e^{2x+5} = 8$$

(***D***)

$$7^{2x^2-8} = 1$$

TOPIC: SOLVING EXPONENTIAL & LOGARITHMIC EQUATIONS

Solving Logarithmic Equations

◆ When solving log equations, you'll encounter two possibilities: $\log_b M = \log_b N$ **OR** $\log_b M = c$

- If a logarithmic equation can be written as $\log_b M = \log_b N$, set _____ = _____ & solve for $\boldsymbol{x}$.

Recall: Exponential Equation	New: Logarithmic Equation
$16 = 2^x$	$\log_2(x+1) = \log_2 5$
$2^4 = 2^x$	______ = _____
$4 = x$	______ = _____

EXAMPLE Solve the log equation.

$$\ln(x+4) - \ln 2 = \ln 8$$

Properties of Logarithms

Name	Property
Product Rule	$\log_b(m \times n) = \log_b m + \log_b n$
Quotient Rule	$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$
Power Rule	$\log_b m^n = n \log_b m$

- If a log equation ***CANNOT*** be written as $\log_b M = \log_b N$ put in _______________ form, then solve for $\boldsymbol{x}$.

Recall:

Equals

$$c = \log_b M$$

To the power of

EXAMPLE Solve the log equation.

$$\log_2(4x) = 5$$

HOW TO:SOLVE LOG EQNS: EXP FORM

1) ___________ log expression

2) Put in exponential form

3) _________ for $\boldsymbol{x}$.

4) _______ solution by plugging $\boldsymbol{x}$ in $\boldsymbol{M}$

- If $\boldsymbol{M} > \boldsymbol{0}$, DONE
- If $\boldsymbol{M} < \boldsymbol{0}$, _____ a solution

TOPIC: SOLVING EXPONENTIAL & LOGARITHMIC EQUATIONS

PRACTICE Solve the logarithmic equations.

(***A***)

$$\log_3(3x+9) = \log_3 5 + \log_3 12$$

(***B***)

$$\log(x+2) + \log 2 = 3$$

(***C***)

$$\log_7(6x+13) = 2$$