7-5B Solving Logarithmic Equations using Properties

- *solve logarithmic equations using properties of logs.*
- *A.CED.1*

Use the following to solve logarithmic equations:

- product property If $\log_b m + \log_b n$, then $\log_b mn$
- quotient property If $\log_b m - \log_b n$, then $\log_b \left(\frac{m}{n}\right)$
- power property If $p \cdot \log_b m$, then $\log_b m^p$
- properties of equality If $b^m = b^n$ or $\log_b m = \log_b n$, then $m = n$
- definition of a logarithm If $\log_b m = n$, then $m = b^n$.

you must check your answers:

- x **MUST** be a positive value
- extraneous solutions may occur

Examples: Solve, check your solutions.

1. $4\log_2 x - \log_2 5 = \log_2 125$

$\log_2 \frac{x^4}{5} = \log_2 125$

$5 \cdot \frac{x^4}{5} = 125 \cdot 5$

$\sqrt[4]{x^4} = \sqrt[4]{625}$

$x = 5$

Examples: Solve, check your solutions.

2. $\log_8 x + \log_8(x - 12) = 2$

$X = b^Y$

$\log_8 x \cdot (x-12) = 2$

$\log_8 (x^2 - 12x) = 2$

$x^2 - 12x = 8^2 / 64$

$x^2 - 12x - 64 = 0$

$(x-16)(x+4) = 0$

$x - 16 = 0$ or $x + 4 = 0$

$x = 16$ ~~$x = -4$~~

Examples: Solve, check your solutions.

3. $3\log_5 x - \log_5 4 = \log_5 16$

$\log_5 x + 2\log_5 7 = \log_5 4 - \log_5 2$

$\log_5 \frac{x^3}{4} = \log_5 16$

$\log_5 x \cdot 7^2 = \log_5 \frac{4}{2}$

$4 \cdot \frac{x^3}{4} = 16 \cdot 4$

$49x = 2$

$\sqrt[3]{x^3} = \sqrt[3]{64}$

$\log_5 x + \log_5 3 - \log_5 2$

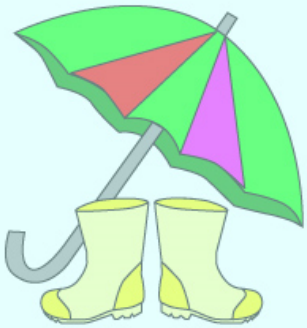
$x = 4$

$\frac{3x}{2}$

Page 489

~~33 - 55 odds~~

36 – 58 evens



46. $\log_2\left(\frac{15b-15}{-b^2+1}\right)=1$

$15(b-1)$

$2\cdot 3 \div 4$ $\quad (1-b^2)$

$\frac{2\cdot 3}{4}$ $\quad (1+b)(1-b)$

$\log_2\left(\frac{-15}{b+1}\right)=1$ $\quad \frac{15(b-1)}{(b+1)(+b\ \mp 1)}$

$\frac{-15}{(b+1)}=2^1$ $\quad -1\ \ -1$

$15b-15=2(-b^2+1)$

$15b-15=-2b^2+2$ $\quad \frac{15(\quad)}{-1(b+1)(\quad)}$

$15b=-2b^2+17$

$2b^2+15b-17=0$

$(\quad)$

① $\log_b x = y \rightarrow x = b^y$

12. $\log_x 32 = \frac{5}{2}$

$32 = x^{5/2}$

$(32)^2 = (\sqrt{x^5})^2$

$\sqrt[5]{1024} = \sqrt[5]{x^5}$

$= x$

$5\sqrt{1024} = 4$

② $\log_b m = \log_b n$

$m = n$

17. $\frac{1}{100,000}$

7-3 (front) 7-4 (back)

① odds on front ③ evens on front

② odds on back ④ evens on back

21.

x	y
1	
13	
-2	

1. $2^{3x} = 2^5$

40 → 4, 10 → 2, 5

1.5440

1.544

2.9

3.

11. $x^3 = 1000$

$= 10^3$

2.5

$4^{1/2} \cdot 4 \cdot 5$

$\frac{1}{2}$

3.00000

20.

$(x-1)$

↓

powers

3

x	y
2	
4	
10	

14. $27^{?} = 81$

$(3^3)^y = 3^4$

$3^{3y} = 3^4$

$\frac{3y}{3} = \frac{4}{3}$

$y = 4/3$

17. $10^{?} = \frac{1}{100{,}000}$

10^{5}

$10^{y} = 10^{-5}$

15. $25^{?} = 5$

$(5^{2})^{y} = 5^{1}$

$5^{2y} = 5^{1}$

$\frac{2y}{2} = \frac{1}{2}$

$y = 1/2$

19. $f(x) = 4\log_{\frac{1}{2}} x$

x	y
(2	4)
(4	8)
(1	0)

$4 \cdot \log_2 2$ ①

$4 \cdot \log_2 2$ ②

$4 \cdot \log_2 2^{0}$

v.A.

$x = 0$

y-axis

asymptote

$y = ax^2 + bx + c \longrightarrow y = a(x-h)^2 + k$

$\left(\frac{b}{2}\right)^2$

$y = x^2 + 8x - 5$

new $c = \frac{8}{2} = 4^2 = 16$

$\frac{-10}{2} = (-5)^2 = 25$

$(x-5)^2$

$y + 5 + 16 = x^2 + 8x + 16$

$y = (x+4)^2 - 21$

$V(-4, -21)$

V.A. $x = -3$

21. $f(x) = 2\log_4(x+3) - 2$

x	y
1	0
-2	-2
13	2

$2 \cdot \log_4 4$

$\log_4 4^2$