Chapter 6.6 Notes
Solving Logarithmic and Exponential Functions

1. Solve the following logarithmic equation.

$\log_2 x = 4$

$\log_b(a) = c \rightarrow b^c = a$

$\log_2 x = 4 \rightarrow 2^4 = x \rightarrow 2^4 = \boxed{16}$

type into calculator

2. Solve the following logarithmic equation.

$\log_2(3x) = 2$

$\log_b(a) = c \rightarrow b^c = a$

$\log_2(3x) = 2 \rightarrow 2^2 = 3x \rightarrow \frac{4}{3} = \frac{3x}{3} \rightarrow \boxed{\frac{4}{3}} = x$

* $\log_2(3x) = 2$ — equals this; this to this power { can be read as

3. Solve the following logarithmic equation.

$\log_3(3x-8)=2$

$\log_b(a)=c \rightarrow b^c=a$

$\log_3(3x-8)=2 \rightarrow 3^2=3x-8 \rightarrow 9=3x-8$

$+8 \quad +8$

$17=3x$

$\frac{17}{3}=\frac{3x}{3}$

$\boxed{\frac{17}{3}}=x$

4. Solve the following logarithmic equation.

$\log_4(x+7)=\log_4 15$

$x+7=15$

$-7 \quad -7$

$x=\boxed{8}$

* Since you have 2 logs with the same base, you will just set the things = to each other.

5. Solve the following logarithmic equation.

$$\frac{1}{2}\log_4 x = 3\log_4 5$$

$$\log_4 x^{\frac{1}{2}} = \log_4 5^3$$

$$x^{\frac{1}{2}} = 5^3$$

$$x^{\frac{1}{2}} = 125$$

$$\left(x^{\frac{1}{2}}\right)^2 = 125^2$$

$$x = 15625$$

- Move the number in front of the log to be the exponent of the number after the log.
- Since base are the same, then you can drop the logs + just have the numbers equal each other.
- Then to get rid of the fraction exponent, just multiply it by the number on bottom of fraction. Remember to multiply both sides.

6. Solve the following logarithmic equation.

$$2\log_2(x-9) + \log_2 2 = 3$$

$$\log_2(x-9)^2 + \log_2 2 = 3$$

$$\log_2\left((x-9)^2 \cdot 2\right) = 3$$

$$2^3 = (x-9)^2 \cdot 2$$

$$8 = (x-9)(x-9)\cdot 2$$

$$8 = (x^2 - 9x - 9x + 81)\cdot 2$$

$$8 = (x^2 - 18x + 81)\cdot 2$$

$$8 = 2x^2 - 36x + 162$$

$$-8 \qquad\qquad -8$$

$$0 = 2x^2 - 36x + 154$$

$a \quad b \quad c$

*move the numbers in front of the logs to be exponents

$\log_b(a) = c \rightarrow b^c = a$

only use + sign

$$\frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-(-36) + \sqrt{(-36)^2 - 4(2)(154)}}{2(2)}$$

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7. Solve the following logarithmic equation.

$$\log(7x+7) = 1 + \log(x-1)$$

$$-\log(x-1) \qquad -\log(x-1)$$

$$\log(7x+7) - \log(x-1) = 1$$

$$\log_{10}\frac{(7x+7)}{(x-1)} = 1$$

$\log_b a = c \rightarrow b^c = a$

$$10^1 = \frac{7x+7}{x-1}$$

$$\frac{10}{1} = \frac{7x+7}{x-1}$$

$$10(x-1) = 7x+7$$

$$10x - 10 = 7x + 7$$

$$+10 \qquad +10$$

$$10x = 7x + 17$$

$$-7x \qquad -7x$$

$$3x = 17$$

$$\frac{3x}{3} = \frac{17}{3}$$

$$x = \boxed{\frac{17}{3}}$$

* Move the log on the right to the right by doing the opposite.
* Then since the logs on the left have the same base, we combine them. Since there is a minus sign between them, we set up a fraction.
* Then since the log doesn't have a base, you will make the base a 10.
* Now write in exponential form
* Then cross-multiply.
* Now use the distributive property to get rid of the ( ).
* Now solve for x.

8. Solve the following logarithmic equation.

$$\log_5(x+21) = 3 - \log_5(x+1)$$

$+\log_5(x+1)$ $\quad$ $+\log_5(x+1)$

$$\log_5(x+21) + \log_5(x+1) = 3$$

$$\log_5(x+21)(x+1) = 3$$

$$5^3 = (x+21)(x+1)$$

$$125 = x^2 + 1x + 21x + 21$$

$$125 = x^2 + 22x + 21$$

-125 $\quad$ -125

$$0 = x^2 + 22x - 104$$

$a=1$ $\quad$ $b=22$ $\quad$ $c=-104$

$$\frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-(22) + \sqrt{(22)^2 - 4(1)(-104)}}{2(1)}$$

$$\boxed{4}$$

* move log on right to left by adding or subtracting

* since logs have same base, we combine them.
  - since addition, we multiply.

$\log_b a = c \rightarrow b^c = a$

* use foil method

* move everything to one side + combine.

* use quadratic formula

← quadratic formula use only (+) sign