

5.4 Logarithmic Equations

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
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Logarithmic Equations
TYPE I: LOG = LOG
Every TERM IS A LOG!

Cannot take the logarithm of a **NEGATIVE #.**

~~$\log_2(-5)$~~

ERROR: NONREAL ANSWER

- CONDENSE each logarithm **side to ONE log.**
- Use the **One-to-One Property**: If $\log_b m = \log_b n$, then **$m = n$**
- SOLVE** and **CHECK FOR EXTRANEOUS SOLUTIONS.**

1. $\log_5(5x+9) = \log_5(6x)$

$$\begin{array}{r} 5x+9 = 6x \\ -5x \quad -5x \\ \hline 9 = x \end{array}$$

$\checkmark \log_5(5 \cdot 9 + 9) = \log_5(6 \cdot 9)$

2. $\log_2(1-4n) = \log_2(2n+43)$

$$\begin{array}{r} 1-4n = 2n+43 \\ -2n \quad -2n \\ \hline 1-6n = 43 \\ -1 \quad -1 \\ \hline -6n = 42 \\ -6 \quad -6 \\ \hline n = -7 \end{array}$$

3. $\log_9(6-3w) = \log_9(-2w)$

$$\begin{array}{r} 6-3w = -2w \\ +3w \quad +3w \\ \hline 6 = w \end{array}$$

~~$6 = w$~~ extraneous

NO REAL SOLUTION

4. $\log(y+5) + \log 4 = \log 72$

$$\begin{array}{r} \log 4(y+5) = \log 72 \\ 4(y+5) = 72 \\ 4y+20 = 72 \\ -20 \quad -20 \\ \hline 4y = 52 \\ \frac{4y}{4} = \frac{52}{4} \end{array}$$

$y = 13$

5. $3 \cdot \log_7 4 = \log_7(4a-8)$

$$\begin{array}{r} \log_7 4^3 = \log_7(4a-8) \\ 64 = 4a-8 \\ +8 \quad +8 \\ \hline 72 = 4a \\ \frac{72}{4} = \frac{4a}{4} \\ \hline 18 = a \end{array}$$

6. $\log_4 68 - \log_4 4 = \log_4(3n+11)$

$$\begin{array}{r} \log_4 \left(\frac{68}{4}\right) = \log_4(3n+11) \\ 17 = 3n+11 \\ -11 \quad -11 \\ \hline 6 = 3n \\ \frac{6}{3} = \frac{3n}{3} \\ \hline 2 = n \end{array}$$

7. $\frac{1}{2} \log_6 25 = \log_6(23-4w)$

$$\begin{array}{r} \log_6 \sqrt{25} = \log_6(23-4w) \\ \sqrt{25} = 23-4w \\ 5 = 23-4w \\ -23 \quad -23 \\ \hline -18 = -4w \\ -4 \quad -4 \\ \hline 4.5 = w \end{array}$$

8. $\log_3(2p-5) = 2 \cdot \log_3 6 - \log_3 4$

$$9. \log_4(m^2) = \log_4(18 - 7m)$$

$$10. \log 2 + \log(k^2) = \log(k^2 + 16)$$

TYPE 2:
LOG = NUMBER
ONE LOG =
a #

① CONDENSE and ISOLATE the logarithm.

② Write the equation in EXPONENTIAL FORM.

③ SOLVE and CHECK FOR EXTRANEIOUS SOLUTIONS.

$$11. \log_2(x-4) = 6$$

$$x-4 = 2^6$$

$$x-4 = 64$$

$$+4 \quad +4$$

$$\boxed{x = 68}$$

$$12. \log_3(4x+8) - 7 = -3$$

$$\log_3(4x+8) = 4$$

$$4x+8 = 3^4$$

$$4x+8 = 81$$

$$4x = 73$$

$$\boxed{x = 18.25}$$

$$13. \log(2x) + \log(x-5) = 2$$

$$14. 2 \cdot \log x - \log 4 = 2$$

NOT GOING TO
BE TESTED!

$$15. \log_6(x+9) + \log_6 x = 2$$

$$16. \log(x-3) + \log x = 1$$