Using log rules to solve equations NAME:

The purpose of this worksheet is to practice using the logarithm rules to algebraically solve equations involving logs. We will also see how the graphical solutions are related. For #1 - 3, steps are given to help you solve them. It is possible to solve the equations other ways but **please try to follow the steps given**. Number 4 shows you how to solve the equation from #2 graphically.

1. Solve $3\log_3(x+4) - \log_3 9 = 2$. Round to three decimal places. The steps are outlined below.

a. Figure out what $\log_3 9$ is. Rewrite the equation, substituting that into the left side. Then work to isolate the $\log_3(x+4)$ in the equation.

b. Use the equivalence of $y = \log_b x$ and $b^y = x$ to rewrite your log equation from above in exponential form. Notice this unburies the x from within the log. Solve this equation. (You should have $3^{4/3} = x + 4$.) Round your final answer to three decimal places.

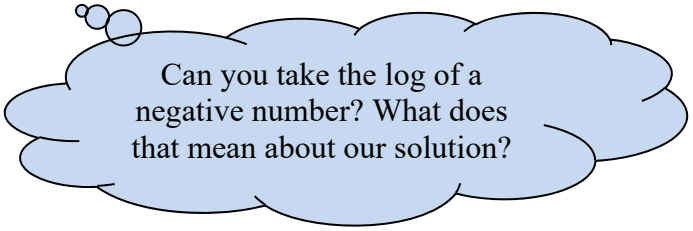
c. Visibly check your answers in the **original** equation whenever you solve logarithmic equations. You may need to use the change of base formula to evaluate the left side of the equation once you substitute your solution.

2. Solve $\log_7(x+9)+\log_7(x+3)=1$. Follow the steps outlined below.

a. Rewrite the equation, using the log rules to rewrite the left side as one log. You will want to FOIL to simplify so that you have the log of a trinomial. (It is best to put that trinomial in parentheses.)

b. Use the equivalence of $y=\log_b x$ and $b^y=x$ to rewrite your equation from above in exponential form. Solve this equation. Notice it is now a quadratic equation. You can use the quadratic formula or factoring to solve it.

c. Did you get two answers? Visibly check both in the original equation. Cross off any solution above that turns out to be extraneous.



3. Solve $\log_4(x^2-9)-\log_4(x+3)=3$. The steps are outlined below.

a. Rewrite the equation, using the log rules to rewrite the left side as one log.

b. Notice x^2-9 is a difference of two squares. So, factor the top of this fraction and simplify. Rewrite your equation, using the simplified version of $\frac{x^2-9}{x+3}$.

c. Use the equivalence of $y=\log_b x$ and $b^y=x$ to rewrite your equation from above in exponential form. Solve this equation.

d. Visibly check your answer. You must do this in the **original** equation! The change of base formula may be needed to evaluate the original equation with your solution.

4. Solve $\log_7(x+9)+\log_7(x+3)=1$ graphically. You'll recall when we solved this algebraically we got an extraneous solution which did *not* work when we checked our answers. This does *not* happen when you solve graphically, assuming you do not use any of the log rules (except for the change of base formula which may be necessary) to rewrite the expressions before you graph. The steps are outlined below.

a. In order to enter the left side into the calculator, the change-of-base formula may be needed. Rewrite the whole equation below, using the change-of-base formula to rewrite the left side. Please do this even if your calculator will do logs of base 4 (so you technically do not need it). Again, do **not** use the log rule you used in number 2 to rewrite the left side. This caused the extraneous solution and we do *not* want that.

b. Graph the left and right sides of the equation, and see where they intersect. Use the standard window. Find the x value where the left and right sides intersect. Copy your graph below and label the solution to the equation.