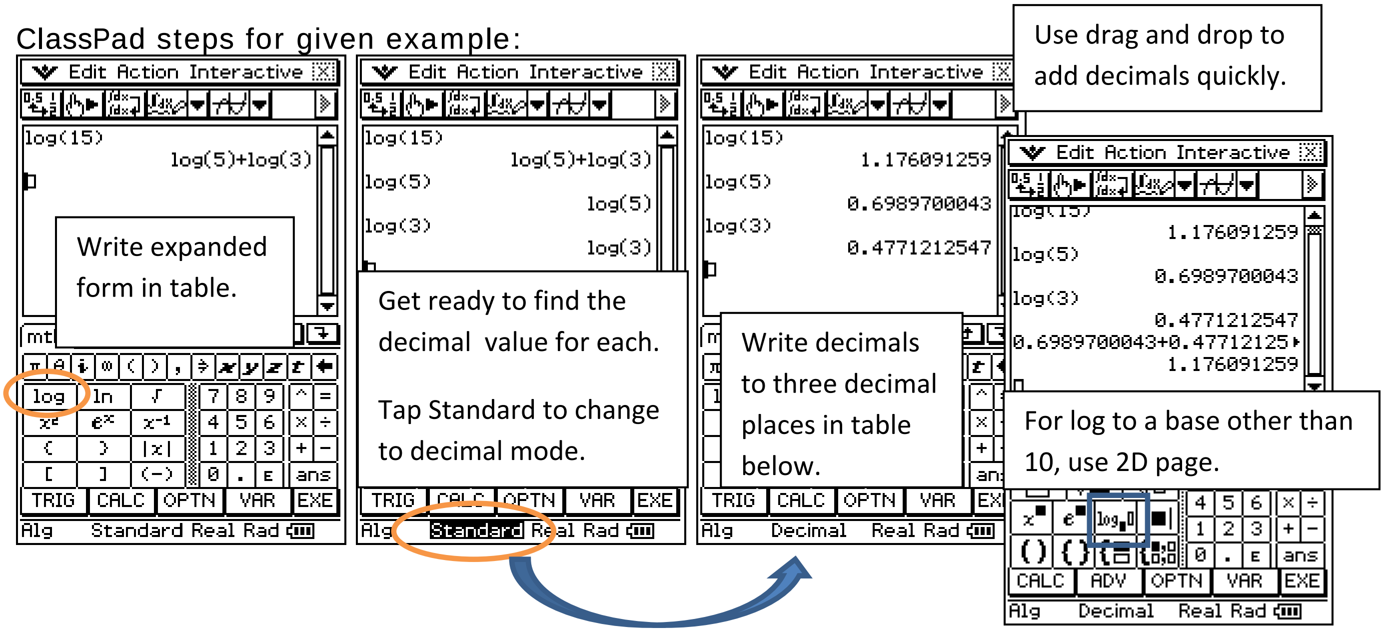
Properties of Logarithms Name: ______________________________

$$\log_b(xy) = \log_b x + \log_b y \qquad \log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y \qquad \log_b\left(x^n\right) = n\log_b x$$

Use the ClassPad to explore some examples and convince yourself the laws are true!

ClassPad steps for given example:

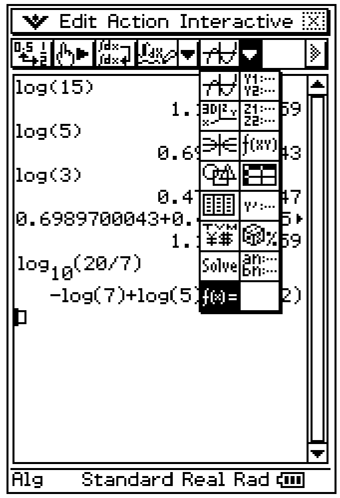


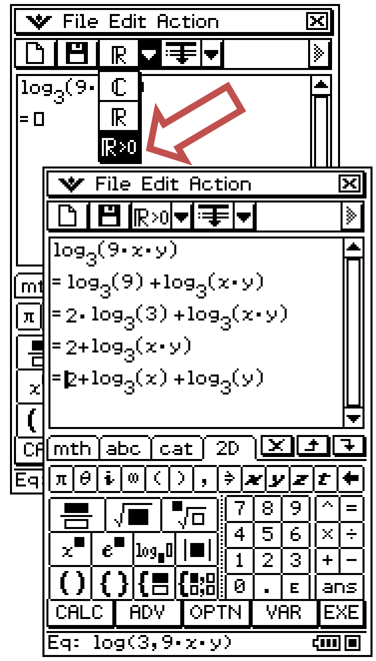
Problem #		Log (write decimal form)	Expansion (write both expanded exact form and decimal form)
Example	Log form	log 15=log(3•5)	log 3 + log 5
	Decimal	1.176	.477 + .699 = 1.176 ✓
1.	Log form	$\log 14 = \log(2 \bullet 7)$	
	Decimal		
2.	Log form	$\log\left(\frac{5}{3}\right) = \log(5 \div 3)$	
	Decimal		
3.	Log form	$\log(81) = \log\left(3^4\right)$	
	Decimal		

Practice expanding log expressions using the Verify application:

Example

a) To begin, open Main
b) Tap the last n on the toolbar
c) Select f(x)=
d) Type in expression to simplify and press E
e) Important: Tap the n and select R>0
f) On the next line, begin to simplify
g) If the ClassPad is happy, you can continue





Hint: Use drag and drop to save time.

Practice

Use Verify to verify each step. Express the following in terms of sums and differences of logarithms. When finished expanding, write the expanded form.

1. $\log_3(\frac{x^3 y}{3})$ =

2. $\log_2(16\sqrt{y})$ =

3. $\log_b(\frac{\sqrt{x+y}}{x})$ =

Use Verify to verify each step. Express the following as a single logarithm and, if possible, simplify.

4. $\log_4(x) - 3\log_4(y)$ =

5. $\frac{1}{3}\log_5(x) + 2\log_5(3x+y)$ =

6. $\ln(x+1) - 3(\ln(x) + \ln(y))$ =

Use ClassPad to explore $\log_b(xy) = \log_b x + \log_b y$ by graphing:

To begin, open the Graph&Tab... application (g).

Enter **y_1 = log(x)** and **y_2 = log(6)**, and graph them at the same time.

Enter **y_3 = log(x) + log(6)** and graph it together with y_1 and y_2.

How does this graph (**y_3**) compare to the other two?

Use the Law of Logs to write log(x) + log(6) as a single log below, then graph it as **y_4** (choose a different style by tapping the line to the right of **y_4**).

What do you notice?

Change the value of the log in y_2 (larger numbers are easier to see on the graph) and change y_3 and y_4 correspondingly. Write them here:

Do your previous observations hold for this example, too?