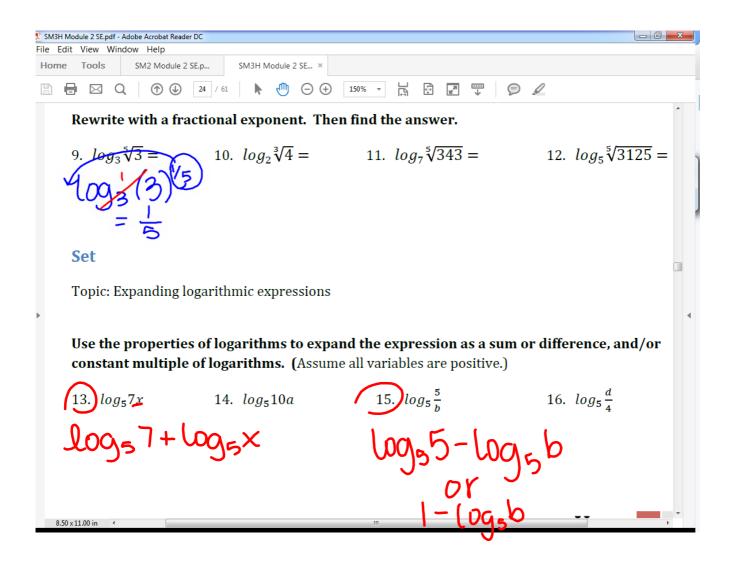
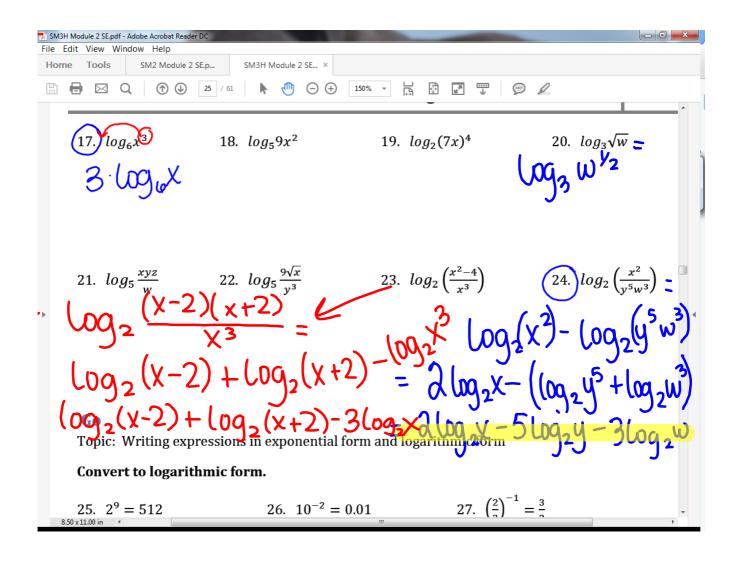
Questions on 2.3 HW? Quiz soon...

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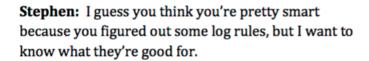
Logarithms Quiz #2: Properties

Use the properties of logarithms to expand the expression as a sum or difference, and/or constant multiple of logarithms.

1)
$$\log_2(5x)$$
 2) $\log_2(\frac{x}{6})$

2.4 Log-Arithm-etic A Practice Understanding Task

Abe and Mary are feeling good about their log rules and bragging about mathematical prowess to all their friends when this exchange occurs:





Abe: Well, we've seen a lot of times when equivalent expressions are handy. Sometimes when you write an expression with a variable in it in a different way it means something different.

What are some examples from your previous experience where equivalent expressions

$$- \left(\log \left(2x \right) = \log 2 + \log x \right)$$

Mary: I was thinking about the Log Logic task where we were trying to estimate and order certain log values. I was wondering if we could use our log rules to take values we know and use them to find values that we don't know.

For instance: Let's say you want to calculate $\log_2 6$. If you know what $\log_2 2$ and $\log_2 3$ are then you can use the product rule and say:

$$\log_2(6) = \log_2(2 \cdot 3) = \log_2 2 + \log_2 3$$

Stephen: That's great. Everyone knows that $log_2 2 = 1$, but what is $log_2 3$?

Abe: Oh, I saw this somewhere. Uh, $log_2 3 = 1.585$. So Mary's idea really works. You say:

$$\log_2(2 \cdot 3) = \log_2 2 + \log_2 3$$

$$= 1 + 1.585$$

$$= 2.585$$

$$\log_2 6 = 2.585$$

2. Based on what you know about logarithms, explain why 2.585 is a reasonable value for

$$2^{2.585}$$
 $3^{2.585}$ $= 6$ $3^{2.585}$ $= 6$ $3^{2.585}$ $= 6$ Since 2^{2} = 4 and 2^{3} -8, and (e is in between 448, it makes sense that $3^{2.585}$ = 6.

Stephen: Oh, oh! I've got one. I can figure out log₂ 5 like this:

$$\log_2 5 = \log_2(2+3) = \log_2 2 + \log_2 3$$

$$= 1 + 1.585$$

$$= 2.585$$

$$\log_2 5 = 2.585$$

3. Can Stephen and Mary both be correct? Explain who's right, who's wrong (if anyone) and why.

Mary is correct, she used the product rule property.

Now you can try applying the log rules yourself. Use the values that are given and the ones that yo know by definition like $\log_2 2 = 1$ to figure out each of the following values. Explain what you did in the space below each question.

$$\log_2 3 = 1.585$$
 $\log_2 5 = 2.322$ $\log_2 7 = 2.807$

The three rules, written for any base b > 1 are:

Log of a Product Rule:
$$\log_b(xy) = \log_b x + \log_b y$$

Log of a Quotient Rule:
$$\log_b \left(\frac{x}{y}\right) = \log_b x - \log_b y$$

Log of a Power Rule:
$$\log_b(x^k) = k \log_b x$$

4.
$$\log_2 9 = \log_2(3^2) = 2 \cdot \log_2 3 = 2(1.585) = 3.17$$

5.
$$\log_2 10 = \log_2(5.2) - \log_2 5 + \log_2 2 - 2.322 + 1$$

= 3.322

$$6. \log_2 12 = \log_2 \left(\right)$$

7.
$$\log_2\left(\frac{7}{3}\right) = \left(00\right)_2$$

8.
$$\log_2(\frac{30}{7}) = (\log_2(\frac{2 \cdot 3 \cdot 5}{7}) = (\log_2 2 + (\log_2 3 + (\log_2 5 - (\log_2 7 + (\log_2 5 + 2.322) - 2.807) = (\log_2 (\frac{2 \cdot 3 \cdot 5}{7}) = (\log_2 (\frac{2 \cdot 3 \cdot 5}{7}) = (\log_2 2 + (\log_2 3 + (\log_2 5 - (\log_2 7 + \log_2 5 + \log_2$$

9.
$$\log_2 486 = \log_2(2.3^5) = \log_2 2 + \log_2 3^5 = \log_2 2 + 5 \cdot \log_2 3^5 = \log_2 2 + \log_2 3^5 = \log_2 3^5 =$$

10. Given the work that you have just done, what other values would you need to figure out the value of the base 2 log for any number?

Sometimes thinking about equivalent expressions with logarithms can get tricky. Consider each of the following expressions and decide if they are always true for the numbers in the domain of the logarithmic function, sometimes true, or never true. Explain your answers. If you answer "sometimes true" then describe the conditions that must be in place to make the statement true.

11.
$$\log_4 5 - \log_4 x = \log_4 \left(\frac{5}{x}\right)$$
 \triangle

$$\log 3 - \log x - \log x = \log \left(\frac{3}{x^2}\right) \frac{N}{\log^2 x} - \log x = \log \left(\frac{3}{x^2}\right) = \log 3$$

13.
$$\log x - \log 5 = \frac{\log x}{\log 5}$$

$$14. 5 \log x = \log x^5$$

15.
$$2 \log x + \log 5 = \log(x^2 + 5)$$

$$16. \ \frac{1}{2} \log x = \log \sqrt{x}$$



$$17. \log(x-5) = \frac{\log x}{\log 5}$$

Homework

Finish 2.4 "Ready, Set, Go"