QUIZ 2.3

Name: period:

Find the value of:

1. $\log_5(125)$

2. $\log_7(45)$

3. Expand Using rules

$\log_5 9x^2 =$

What Transformations to $\log_3(x)$ are happening here? left, right, up, down, how much?

4. $f(x)=\log_3(x+7)$

5. $f(x)= \log_3(x-2) +9$

Oct 3-7:43 AM

QUIZ 2.3

Name: period:

Find the value of:

1. $\log_5(125)$ $=3$

$5^{3}=125$

2. $\log_7(45)$

$7^{1.96}=45$

3. Expand Using rule from HW2.3

$\log_5 9x^2 =$

$\boxed{\log_5 9 + 2\log_5 x^2}$

$x \cdot x$

$\log_5 x + \log_5 x$

$2\log_5 x$

What Transformations to $\log_3(x)$ are happening here? left, right, up, down, how much?

4. $f(x)=\log_3(x+7)$

left 7

5. $f(x)= \log_3(x-2) +9$

right 2, up 9

Oct 3-7:43 AM

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:

Stephen: I guess you think you're pretty smart because you figured out some log rules, but I want to know what they're good for.

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.

1. What are some examples from your previous experience where equivalent expressions were useful?

Mar 28-11:27 AM

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:

$$2^{0}=6=\log_2 \underset{2\cdot 3}{6} = \log_2(2\cdot 3) = \log_2 2 + \log_2 3$$

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:

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

$$= 1 + 1.585$$

$$= 2.585$$

✓ $2.5849 = \boxed{\log_2 6} = 2.585$

2. Based on what you know about logarithms, explain why 2.585 is a reasonable value for $\log_2 6$.

Mar 28-11:29 AM

Stephen: Oh, oh! I've got one. I can figure out $\log_2 5$ like this:

$$\cancel{\log_2(2+3) = \log_2 2 + \log_2 3}$$
$$= 1 + 1.585$$
$$= 2.585$$
$$2.322 \quad \cancel{\log_2 5 = 2.585}$$

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

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.

$\log_2 3 = 1.585$ $\quad\log_2 5 = 2.322$ $\quad\log_2 7 = 2.807$ $\quad\log_2 2 = 1$ $\quad\log_2 1 = 0$

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: $\log_b(x^k) = k\log_b x$

Mar 28-11:30 AM

4. $\log_2 9 = \log_2(3\cdot 3) = \log_2 3 + \log_2 3$
$= 1.585 + 1.585 = \boxed{3.17}$
$9 = 3^2$
$2(1.585) = 3.17$

1, 2, 3, 5, 7

5. $\log_2 10 = \log_2(2\cdot 5) = \log_2 2 + \log_2 5$
$= 1 + 2.322 = \boxed{3.322}$
$10 = 2\cdot 5$

6. $\log_2 12 = \log_2(2^2\cdot 3) = \log_2 2^2 + \log_2 3$
$= 2(1) + 1.585$
$= 2 + 1.585 = \boxed{3.585}$
12 = 3 · 4, 4 = 2 · 2; 12 = 2 · 6, 6 = 2 · 3

7. $\log_2\left(\frac{7}{3}\right) = \log_2 7 - \log_2 3$
$= 2.807 - 1.585 = \boxed{1.222}$

Mar 28-11:30 AM

8. $\log_2\left(\frac{30}{7}\right) = \log_2\left(\frac{2\cdot3\cdot5}{7}\right)$ $\log_2 2 + \log_2 3 + \log_2 5 - \log_2 7$

$30 = 2\cdot15 = 2\cdot3\cdot5$

$30 = 3\cdot10 = 3\cdot2\cdot5$

$1 + 1.585 + 2.322 - 2.807 = \boxed{2.1}$

9. $\log_2 486 = \log_2(2\cdot3^5)$ $\log_2 2 + \log_2 3^5$

$486 = 2\cdot243$, $243 = 3\cdot81$, $81 = 9\cdot9$, $9 = 3\cdot3$, $9 = 3\cdot3$

$1 + 5(1.585)$

$1 + 7.925 = \boxed{8.925}$

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?

* $\log_2 2 = 1$ $\log_2 1 = 0$

Mar 28-11:31 AM

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

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

$-[x\cdot x]$

13. $\log 3 - \log 5 = \frac{\log 3}{\log 5}$ Never True

$\log_{10}\left(\frac{3}{5}\right) = \frac{\log 3}{\log 5}$

$-.22 \neq .68$

14. $5\log x = \log x^5$ ✓ Always

Mar 28-11:33 AM

15. $2\log x + \log 5 = \log(x^2 + 5)$ Never

16. $\frac{1}{2}\log x = \log\sqrt{x}^{1/2}$ ✓ true

17. $\log(x-5) = \frac{\log x}{\log 5}$ Never,

Mar 28-11:33 AM

Name Logarithmic Functions 2.4

Ready, Set, Go!

Ready

Topic: Solving simple exponential and logarithmic equations

You have solved exponential equations before based on the idea that

$a^x = a^y$, *if and only if* $x = y$. $3^2 = 3^2$

You can use the same logic on logarithmic equations. $\log_a x = \log_a y$ *if and only if* $x = y$

Rewrite each equation so that you set up a one-to-one correspondence between all of the parts. Then solve for x.

Example: *Original equation:*	*Rewritten equation:*	*Solution:*
a.) $3^x = 81$	$3^x = 3^4$	$x = 4$ ✓
b.) $\log_2 x - \log_2 5 = 0$ $+\log_2 5$	$\log_2 x = \log_2 5$	$x = 5$

1. $3^{x+4} = 243$
$3^{x+4} = 3^5$
$x = 1$

2. $\left(\frac{1}{2}\right)^x = 8$
$2^{-x} = 2^3$
$x = -3$

3. $\left(\frac{3}{4}\right)^x = \frac{27}{64}$ $\frac{3^3}{4^3} = \left(\frac{3}{4}\right)^3$
$x = 3$

4. $\log_2 x - \log_2 13 = 0$

5. $\log_2(2x-4) - \log_2 8 = 0$
$\log_2(2x-4) = \log_2 8$
$2x - 4 = 8$
$+4 \quad +4$
$2x = 12$
$x = 6$

6. $\log_2(x+2) - \log_2 9x = 0$

7. $\frac{\log 2x}{\log 14} = 1$

8. $\frac{\log(5x-1)}{\log 29} = 1$
$\log(5x-1) = \log 29$
$5x - 1 = 29$
$+1 \quad +1$
$5x = 30$
$x = 6$

9. $\frac{\log 5^{(x-2)}}{\log 625} = 1$

Sep 20-10:40 AM

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Use the given values and the properties of logarithms to find the indicated logarithm. Do not use a calculator to evaluate the logarithms.

Given: $\log_{10} 16 \approx 1.2$

$\log_{10} 5 \approx 0.7$

$\log 8 \approx 0.9$

$* \log_{10} 10 = 1$

$\log_{10} 1 = 0$

10. Find $\log \frac{5}{8}$

$\log 5 - \log 8$

$.7 - .9 = \boxed{-.2}$

11. Find $\log 25$

12. Find $\log \left(\frac{1}{2}\right) \frac{5}{10}$

$\log 5 - \log 10$

$.7 - 1 = \boxed{-.3}$

13. Find $\log 80$

14. ~~Find $\log \frac{1}{49}$~~ typo skip

Given $\log_3 2 \approx 0.6$

$\log_3 5 \approx 1.5$

$\log_3 3 = 1$

$\log_3 1 = 0$

15. Find $\log_3 16$

16. Find $\log_3 108$

17. Find $\log_3 \frac{3}{50} = \log_3 \left(\frac{3}{5^2 \cdot 2}\right)$

50 = 5 · 10 = 5 · 2 · 5

$\log_3 3 - [2\log_3 5 + \log_3 2]$

$1 - [2(1.5) + .6]$

$1 - [3.6] = \boxed{-2.6}$

18. Find $\log_3 \frac{8}{15}$

19. Find $\log_3 486$

20. Find $\log_3 18$

21. Find $\log_3 120$

22. Find $\log_3 \frac{32}{45}$ $\quad 2^5 \quad 3^2 \cdot 5$

$5\log_3 2 - [2\log_3 3 + \log_3 5]$

$5(.6) - [2(1) + 1.5]$

$3 - 3.5 = \boxed{-.5}$

Sep 20-10:40 AM

Go Calculator Page

Topic: Using the definition of logarithm to solve for x.

Use your calculator and the definition of $\log x$ (recall: the base is 10) to find the value of x. (Round your answers to 4 decimals.)

23. $\log_{10} x = -3$

$\boxed{10^{-3} = x}$

$.001 = x$

24. $\log x = 1$

25. $\log x = 0$

26. $\log x = \frac{1}{2}$

27. $\log x = 1.75$

28. $\log x = -2.2$

29. $\log x = 3.67$

30. $\log x = \frac{3}{4}$

31. $\log x = 6$

Sep 20-10:41 AM