PC - Functions

Name _____

Logs…let's build a cabin!

$a = \log_b c$ means $b^a = c$

Solve for p. (Round to 3 decimal places).

1. $84^p = 70$

$\log_{84} 70 = p$

$\frac{\log 70}{\log 84} = p \approx 0.959$

2. $\log_5 p = 4$

$5^4 = p$

$p = 625$

3. $\log_p 35 = 3$

$\sqrt[3]{p^3} = \sqrt[3]{35}$

$p \approx 3.271$

4. $\log_2(10+3p) = 5$

$2^5 = 10 + 3p$

$32 = 10 + 3p$

$p \approx 7.333$

5. $\log_8(p+1) - \log_8 p = 2$

$\log_8 \frac{p+1}{p} = 2$

$p\ 64 = \frac{p+1}{p} \cdot p$

$64p = p + 1$

$-p \quad -p$

$p \approx 0.016$

6. $\log_5(5x) = 2 + \log_5(x-4)$

$\log_5(5x) - \log_5(x-4) = 2$

$\log_5 \frac{5x}{x-4} = 2 \rightarrow 25x - 100 = 5$

$(x-4)25 = \frac{5x}{x-4}(x-4)$

$20x = 100$

$x = 5$

7. $\log(p+3) + \log(p-3) = \log(16)$

$\log(p+3)(p-3) - \log(16) = 0$

$\log \frac{(p+3)(p-3)}{16} = 0 \rightarrow 10^0 = \frac{(p+3)(p-3)}{16}$

$16 = p^2 - 9 \rightarrow p^2 - 25 = 0$

$-16 \quad -16$

$(p+5)(p-5) = 0$

$p = 5$

$p = -5$ (ext)

8. $\log(3p+1) - \log(p-2) = 1$

$\log \frac{3p+1}{p-2} = 1$

$10^1 = \frac{3p+1}{p-2} \cdot p-2$

$10p - 20 = 3p + 1$

$7p = 21$

$p = 3$

9. $5^{(4p-7)} = 125$

$\log_5 125 = 4p - 7$

$\frac{\log 125}{\log 5} = 4p - 7$

$p = 2.5$

10. $3^{7p} = \frac{1}{27}$

$\log_3 \frac{1}{27} = 7p$

$\frac{\log \frac{1}{27}}{\log 3} = 7p$

$p \approx -0.429$

11. $\ln(\ln p) = 2$

$e^2 = \ln p$

$e^{e^2} = p$

$p \approx 1618.178$

12. $\log_3(\log_4 p) = 0$

$3^0 = \log_4 p$

$1 = \log_4 p$

$4 = p$

13. $\log_8 p + \log_8(p+12) = 2$

$\log_8 p(p+12) = 2$

$64 = p^2 + 12p$

$p^2 + 12p - 64 = 0$

$(p+16)(p-4) = 0$

$p = -16$ ext

$p = 4$

Typo: to make it fair for us w/o new OS for TI-84 Plus!

Simplify the following. Then, evaluate the expression. (Round to 3 decimal places).

14. $3\log_3 4 - (\log_3 6 + \log_3 4)$

$\log_3 \frac{4^3}{6 \cdot 4} = \log_3 \frac{16}{6}$

$\log_3 \frac{8}{3} = \frac{\log \frac{8}{3}}{\log 3} \approx 0.893$

15. $-2\log_5 40 + \log_5 100 - \log_5 10$

$\log_5 \frac{40^{-2} \cdot 100}{10} = \log_5 \frac{1}{160}$

$= \frac{\log \frac{1}{160}}{\log 5} \approx -3.153$

16. Why do we need to use the change of base formula?

Because we can not type logs of base other than 10 or e into most of our calculators.

Evaluate the following to 3 decimal places. Show what you punched into the calculator:

17. $\log_4 12$

$\frac{\log 12}{\log 4} \approx 1.792$

18. $\log_{70} 35$

$\frac{\log 35}{\log 70} \approx 0.837$

19. $\log_{\frac{1}{3}} 28$

$\frac{\log 28}{\log \frac{1}{3}} \approx -3.0$

20. *Population Growth of the Virgin Islands.*
The population of the U.S. Virgin Islands has a growth rate of 2.6% per year. In 1990, the population was 512,000. The land area of the Virgin Islands is 3,097,600 square yards. Assuming this growth continues and is exponential, after how long will there be one person for every square yard of land?

$3{,}097{,}600 = 512{,}000(1.026)^t$

$6.05 = 1.026^t$

$\log_{1.026} 6.05 = t = \frac{\log 6.05}{\log 1.026} \approx 70.13 \text{ yr}$

21. **America is eating less beef**. The average consumption of beef is decreasing exponentially by approximately 1.6% per year. In 1985, the average annual consumption was about 80 lb. per person.
a). Write an equation to show how the consumption has changed since then.

$y = 80(0.984)^t$

b). Use your equation to estimate the consumption of beef in the year 2006.

$y = 80(0.984)^{21} \approx 57.01 \text{ lb}$

c). After how many years (theoretically) will the average be 20 lb. per person?

$\frac{20}{80} = \frac{80(0.984)^t}{80}$

$\frac{1}{4} = (0.984)^t$

$\log_{0.984} \frac{1}{4} = t = \frac{\log \frac{1}{4}}{\log 0.984} \approx 85.9 \text{ yr}$