## 2.12 Logarithmic Function Manipulation

AP Precalculus

**2.12 Practice**

**Instructions: Let x and y be positive constants. Write each expression as a sum or difference of logarithms.**

1. $log_3(xy^3)$

$\log_3 x + \log_3 y^3$

$\log_3 x + 3\log_3 y$

2. $\ln\frac{x^2}{y^3}$

$\ln x^2 - \ln y^3$

$2\ln x - 3\ln y$

3. $\log 1000x^3$

$\log 1000 + \log x^3$

$3 + 3\log x$

4. $log_2(8\sqrt{x})$

$\log_2 8 + \log_2 x^{1/2}$

$3 + \frac{1}{2}\log_2 x$

5. $log_2\sqrt{\frac{16x^3}{y^2}} = \frac{1}{2}(\log_2 16x^3 - \log_2 y^2)$

$\frac{1}{2}(\log_2 16 + \log_2 x^3 - 2\log_2 y)$

$\frac{1}{2}(4 + 3\cdot\log_2 x - 2\log_2 y)$

6. $log_3(9x - 27)$

$\log_3((9)(x-3))$

$\log_3 9 + \log_3(x-3)$

$2 + \log_3(x-3)$

**Instructions: Let x and y be positive constants. Write each as a single logarithm.**

7. $\ln 3 + \ln x$

$\ln 3x$

8. $2log_3 x - 4log_3 y$

$\log_3 x^2 - \log_3 y^4$

$\log_3 \frac{x^2}{y^4}$

9. $\frac{1}{2}(\log x + 3\log y)$

$\frac{1}{2}(\log x + \log y^3)$

$\frac{1}{2}(\log xy^3)$

$\log(xy^3)^{1/2} = \log\sqrt{xy^3}$

10. $3log_5(x-4) - 2log_5 y$

$\log_5(x-4)^3 - \log_5 y^2$

$\log_5 \frac{(x-4)^3}{y^2}$

**CALCULATOR ACTIVE: Instructions: Use the change of base to change each to a logarithm with base 10 or base *e*. Then use a calculator and find the value of the logarithm to the nearest thousandth.**

11. $log_4 123$

$\frac{\log 123}{\log 4}$ or $\frac{\ln 123}{\ln 4}$

3.471

12. $log_9 578$

$\frac{\log 578}{\log 9}$ or $\frac{\ln 578}{\ln 9}$

2.894

**Instructions: Describe any transformations on the function, then find the domain and range of the transformed function.**

13. $f(x) = log_4 16x$

$f(x) = \log_4 16 + \log_4 x$

$f(x) = 2 + \log_4 x$

D: $(0, \infty)$ T: Vertical shift up 2 units

R: $(-\infty, \infty)$

14. $g(x) = log_2 \left(\frac{x}{8}\right)$

$g(x) = \log_2 x - \log_2 8$

$g(x) = \log_2 x - 3$

D: $(0, \infty)$ T: Vertical TRANSLATION DOWN 3

R: $(-\infty, \infty)$

15. $f(x) = log_5 x^2$

$f(x) = 2 \cdot \log_5 x$

$D = (0, \infty)$

$R = (-\infty, \infty)$

T: Vertical Dilation of 2.

16. $h(x) = log_2(32 - 16x)$

$h(x) = \log_2(16(2 - x))$

$h(x) = \log_2 16 + \log_2(-(x-2))$

$h(x) = 4 + \log_2(-(x-2))$

D: $(-\infty, 2)$ T: Vertical shift up 4 Horizontal Reflection

R: $(-\infty, \infty)$

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**2.12 Test Prep**

17. Let x and y be positive constants. Which of the following is equivalent to $5 \log x + 6 \log y$.

(A) $\log(x^5 + y^6)$
(B) $\log(x^5 y^6)$
(C) $\log(x^5 - y^6)$
(D) $\log(5x + 6y)$

$\log x^5 + \log y^6$

$\log x^5 y^6$

18. Let x and y be positive constants. Which of the following is NOT equivalent to:

$log_3(x+3) + 2log_3(x-1) - log_3(x+2)$.

(A) $log_3\left(\frac{2(x+3)(x-1)}{(x+2)}\right)$

(B) $log_3\left(\frac{(x+3)(x-1)(x-1)}{(x+2)}\right)$

(C) $log_3\left(\frac{(x+3)(x-1)^2}{(x+2)}\right)$

(D) $log_3\left(\frac{(x+3)(x^2-2x+1)}{(x+2)}\right)$

$\log_3(x+3) + \log_3(x-1)^2 - \log_3(x+2)$

$\log_3 \frac{(x+3)(x-1)(x-1)}{x+2}$

$(x-1)(x-1)$

$x^2 - 2x + 1$

19. If $\log 3 = x$ and $\log 4 = y$, which of the following expresses $\log\sqrt{12}$?

(A) $\frac{1}{2}(x-y)$

(B) $\frac{1}{2}(xy)$

(C) $\frac{1}{2}x + 2$

(D) $\frac{1}{2}(x+y)$

$\log \sqrt{3 \cdot 4}$

$\log \sqrt{3} + \log \sqrt{4}$

$\log 3^{1/2} + \log 4^{1/2}$

$\frac{1}{2}\log 3 + \frac{1}{2}\log 4$

$\frac{1}{2}(\log 3 + \log 4)$

$\frac{1}{2}(x+y)$

20. Approximate $log_b 18$, given that $log_b 2 \approx .4307$ and $log_b 3 \approx .6827$.

(A) 0.8968

(B) 1.1134

(C) 1.5441

(D) 1.7961

$\log_b 18 = \log_b(2 \cdot 9) = \log_b 2 \cdot 3^2$

$= \log_b 2 + 2\log_b 3$

$= .4307 + 2(.6827)$

$= 1.7961$