

Write your questions  
and thoughts here!

## Properties of Logarithmic Functions

Property	But also...
Product Property: $\log_b(xy) = \log_b x + \log_b y$	
Quotient Property: $\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$	
Power Property: $\log_b x^k = k \log_b x$	

## Expanding and Condensing

a.  $\log(4x^2y)$

c.  $2 \log_2 x + \frac{1}{2} \log_2(y + 1)$

c.  $\log\left(\frac{\sqrt[3]{x+5}}{y^2}\right)$

d.  $2 \log_3(ab^2) - 3 \log_3 c + \frac{1}{3} \log_3 d$

## Change of Base Formula

LOG

$$\log_b x = \frac{\log_a x}{\log_a b}$$

$$\log_4 12$$

LN

\*Dirty little secret

MATH

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## Logarithmic Function Manipulation Graphically

Expand the function:  $f(x) = \log_2(4x)$

What happens to the graph?

Expand the function:  $f(x) = \ln(x - 4)^2$

What happens to the graph?

Try on your own!

Find the domain/range and describe any transformations on each function.

$$\log_3(18 - 9x)$$

### 2.12 Logarithmic Function Manipulation

AP Precalculus

### 2.12 Practice

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

1.  $\log_3(xy^3)$

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

3.  $\log(1000x^3)$

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

5.  $\log_2 \left( \sqrt{\frac{16x^3}{y^2}} \right)$

6.  $\log_3(9x - 27)$

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

7.  $\ln 3 + \ln x$

8.  $2 \log_3 x - 4 \log_3 y$

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

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

**CALCULATOR ACTIVE. 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.  $\log_4 123$

12.  $\log_9 578$

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

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

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

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

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

## 2.12 Logarithmic Function Manipulation

## 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)  $\log(5x + 6y)$
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18. Let  $x$  and  $y$  be positive constants. Which of the following is **NOT** equivalent to  $\log_3(x + 3) + 2 \log_3(x - 1) - \log_3(x + 2)$

- (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)  $\log_3\left(\frac{(x+3)(x^2-2x+1)}{(x+2)}\right)$
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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)  $\frac{1}{2}(x + y)$
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20. Approximate  $\log_b 18$ , given that  $\log_b 2 \approx 0.4307$  and  $\log_b 3 \approx 0.6827$ .

- (A) 0.8968      (B) 1.1134      (C) 1.5441      (D) 1.7961