

Expand or condense the logarithm

1.  $\log_3 \frac{\sqrt{x}}{27z^4}$

$$\log_3 \sqrt{x} - \log_3 27 - \log_3 z^4$$

$$\frac{1}{2} \log_3 x - 3 - 4 \log_3 z$$

2.  $\log \pi + 2 \log w - \log 2$

$$\log \frac{\pi w^2}{2}$$

3.  $2 \log_2 (2x) - 3 \log_2 y - \log_2 z$

$$\log_2 \frac{4x^2}{y^3 z}$$

4.  $2(\log 2x - \log y) - (\log 3 + 2 \log 5)$

$$2 \log 2x - 2 \log y$$

$$\log \frac{4x^2}{y^2} - \log 75$$

$$\log \frac{4x^2}{\frac{y^2}{75}} = \log \frac{4x^2}{75y^2}$$

5.  $\log_4 \sqrt[4]{\frac{a^3 \sqrt{c}}{b}}$

$$\log \left( \frac{a^3 c^{1/2}}{b} \right)^{1/4}$$

$$\frac{1}{4} (3 \log a + \frac{1}{2} \log c - \log b)$$

6.  $3 \log a + \frac{1}{3} \log (b+1) - \log 7$

$$\log \frac{a^3 \sqrt[3]{b+1}}{7}$$

7.  $5 \log_4 2 + 2 \log_4 5$

$$\log_4 \frac{32}{25}$$

8.  $\log \frac{a^2 \sqrt[3]{b}}{4c^5}$

$$2 \log a + \frac{1}{3} \log b - \log 4 - 5 \log c$$

$$9. \frac{1}{6} \log 8 - \frac{1}{4} \log 9 + \frac{1}{2} \log 24 \quad \sqrt{24} = 2\sqrt{6}$$

$$\log \frac{8^{1/6} \cdot 24^{1/2}}{9^{1/4}} = \log \frac{\sqrt[6]{8} \cdot \sqrt{24}}{\sqrt[4]{9}}$$

this can be simplified!  
we'll do it in class

$$10. \log_4 \frac{4a^5}{3b^3}$$

$$\log_4 4 + 5 \log_4 a - \log_4 3 - 3 \log_4 b$$

$$1 + 5 \log_4 a - \log_4 3 - 3 \log_4 b$$

$$11. \ln y - 2(\ln x + \ln x) \quad 2 \ln x$$

$$\ln y - 4 \ln x$$

$$\ln \frac{y}{x^4}$$

$$12. \log \frac{(x+2)y^2}{z^7}$$

$$\log(x+2) + 2 \log y - 7 \log z$$

$$13. \frac{1}{4} \log_5 81 - \left( 2 \log_5 6 - \frac{1}{2} \log_5 4 \right)$$

$$\log_5 \frac{\sqrt[4]{81} \cdot \sqrt{4}}{36}$$

$$\log_5 \frac{3 \cdot 2}{36} = \log_5 \frac{1}{6}$$

$$14. 2(\log_6 15 - \log_6 5) + \frac{1}{2} \log_6 \frac{1}{25}$$

$$\log_6 \frac{15^2}{5^2} + \log_6 \sqrt{\frac{1}{25}}$$

$$\log_6 9 + \log_6 \frac{1}{5}$$

$$\log_6 \frac{9}{5}$$

$$15. \log_3 \left( \frac{4(x-5)^2}{x^4(x-1)^3} \right)$$

$$\log_3 4 + 2 \log_3(x-5) - 4 \log_3 x - 3 \log_3(x-1)$$

$$16. \frac{1}{2} \log_7(81y^{12}) - \log_7(3) + \log_7(2y^2)$$

$$\log_7 \frac{\sqrt{81y^{12}} \cdot 2y^2}{3}$$

$$\log_7 \frac{9y^6 \cdot 2y^2}{3} = \log_7 6y^8$$