

7.4 Properties of Logarithms

<p>Product Property</p> $\log_b m \cdot n$ \downarrow $\log_b m + \log_b n$	Condense into a single logarithm. Simplify if possible.		
	<p>1. $\log_2 7 + \log_2 4$</p> $\log_2 7 \cdot 4$ $\log_2 28$	<p>2. $\log 25 + \log 4$</p> $\log_{10} 100$ 2	<p>3. $\log_4 2x + \log_4 4x^2$</p> $\log_4 8x^3$
	Expand using the product property.		
	<p>4. $\log 9x$</p> $\log 9 + \log x$	<p>5. $\log_7 2xy$</p> $\log_7 2 + \log_7 x + \log_7 y$	<p>6. $\log_2 abc$</p> $\log_2 a + \log_2 b + \log_2 c$
<p>Quotient Property</p> $\log_b \frac{m}{n}$ \downarrow $\log_b m - \log_b n$	Condense into a single logarithm. Simplify if possible.		
	<p>7. $\log_3 24 - \log_3 8$</p> $\log_3 \frac{24}{8}$ $\log_3 3 = 1$	<p>8. $\log_2 15 - \log_2 15$</p> $\log_2 \frac{15}{15}$ $\log_2 1$ 0	<p>9. $\log_4 x^9 - \log_4 x^2$</p> $\log_4 \frac{x^9}{x^2}$ $\log_4 x^7$
	Expand using the quotient property.		
	<p>10. $\log_4 \frac{32}{7}$</p> $\log_4 32 - \log_4 7$	<p>11. $\log \frac{x}{y}$</p> $\log x - \log y$	<p>12. $\log_2 \frac{x^3}{y^4}$</p> $\log_2 x^3 - \log_2 y^4$
<p>Power Property</p> $\log_b m^n$ \downarrow $n \cdot \log_b m$	Condense into a single logarithm. Simplify if possible.		
	<p>13. $5 \cdot \log_4 2$</p> $\log_4 2^5$ $\log_4 32$	<p>14. $7 \cdot \log_2 x$</p> $\log_2 x^7$	<p>15. $\frac{1}{3} \cdot \log 8$</p> $\log 8^{1/3}$ $\log 2$
	Expand using the power property.		
	<p>16. $\log_2 8^7$</p> $7 \log_2 8$ $7 \cdot 3$ 21	<p>17. $3 \cdot \log 4^{(x-1)}$</p> $3(x-1) \log 4$	<p>18. $\log_7 \sqrt{w} \leftarrow w^{1/2}$</p> $\frac{1}{2} \log_7 w$

Putting It All Together

Directions: Rewrite as a single logarithm. Simplify if possible.

CONDENSING LOGS

19. $2 \cdot \log 6 - \log 9$
 $\log 6^2 - \log 9$
 $\log \frac{36}{9} = \log 4$

20. $4 \cdot \log_4 a + 2 \cdot \log_4 b$
 $\log_4 a^4 + \log_4 b^2$
 $\log_4 a^4 b^2$

21. $7 \cdot \log_4 u - 3 \cdot \log_4 (v^2)$
 $\log_4 u^7 - \log_4 v^6$
 $\log_4 \left(\frac{u^7}{v^6}\right)$

22. $\log_2 15 + \log_2 4 - \log_2 6$
 $\log_2 \frac{15 \cdot 4}{6} = \log_2 \frac{60}{6}$
 $\log_2 10$

23. $\log_3 4 + \log_3 y + \frac{1}{2} \log_3 49$
 $\log_3 4 \cdot y + \log_3 (49^{1/2})$
 $\log_3 4y \cdot 7 = \log_3 28y$

24. $\frac{1}{3}(\log_5 8 + \log_5 27) - \log_5 3$
 $\frac{1}{3}(\log_5 8 \cdot 27) - \log_5 3$
 $\frac{1}{3} \log_5 216 - \log_5 3$
 $\log_5 216^{1/3} - \log_5 3$
 $\log_5 6 - \log_5 3 = \log_5 \frac{6}{3} = \log_5 2$

25. $3 \cdot \log_2 4 - \log_2 32$
 $\log_2 4^3 - \log_2 32$
 $\log_2 64 - \log_2 32 = \log_2 \frac{64}{32}$
 $\log_2 2 = 1$

26. $2 \cdot \log 6 - \frac{1}{4} \log 16 + \log 3$
 $\log 36 - \log 2 + \log 3$
 $\log \frac{36}{2} \cdot 3$
 $\log 54$

EXPANDING LOGS

Directions: Expand each logarithm.

27. $\log_6 (xyz^4)$
 $\log_6 x + \log_6 y + \log_6 z^4$
 $\log_6 x + \log_6 y + 4 \log_6 z$

28. $\log_4 \left(\frac{a^9}{b}\right) \log_4 a^9 - \log_4 b$
 $9 \log_4 a - \log_4 b$

29. $\log_7 (q^4 r^2)^2$
 $2 \cdot \log_7 (q^4 r^2)$
 $2(\log_7 q^4 + \log_7 r^2)$
 $2(4 \log_7 q + 2 \log_7 r)$
 $8 \log_7 q + 4 \log_7 r$

30. $\log_2 \left(\frac{y}{z^5}\right)^2 \cdot 2(\log_2 \frac{y}{z^5})$
 $2(\log_2 y - \log_2 z^5)$
 $2(\log_2 y - 5 \log_2 z)$
 $2 \log_2 y - 10 \log_2 z$

31. $\log \sqrt{7x^3}$ $\log (7^{1/2} x^{3/2})$
 $\log 7^{1/2} + \log x^{3/2}$
 $\frac{1}{2} \log 7 + \frac{3}{2} \log x$

32. $\log_3 \sqrt[3]{m^5 n^2}$ $\log_3 m^{5/4} n^{2/4}$
 $\log_3 m^{5/4} + \log_3 n^{1/2}$
 $\frac{5}{4} \log_3 m + \frac{1}{2} \log_3 n$