

I. Expand each logarithmic expression

1. $\log_2 2x^2y^3$ $\log_2 2 + \log_2 x^2 + \log_2 y^3$ $1 + 2\log_2 x + 3\log_2 y$	2. $\log_5 \frac{10x}{y^2}$ $\log_5 10 + \log_5 x - \log_5 y^2$ $\log_5 5 + \log_5 2 + \log_5 x - 2\log_5 y$ $1 + \log_5 2 + \log_5 x - 2\log_5 y$
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II. Condense each logarithmic expression

3. $\log_3 x + \log_3 y - 3\log_3 z$ $\log_3 x + \log_3 y - \log_3 z^3$ $\log_3 \left(\frac{xy}{z^3} \right)$	4. $3\log_4 2 - (2\log_4 x + \log_4 y)$ $\log_4 2^3 - (\log_4 x^2 + \log_4 y) = \log_4 \left(\frac{8}{x^2 y} \right)$
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III. Solve each equation.

4. $\log_4 x = \frac{3}{2}$ $4^{3/2} = x$ $(\sqrt{4})^3 = x$ $2^3 = x$ $x = 8$	5. $\log_y 16 = -4$ raise both to $-\frac{1}{4}$ power $y^{-4} = 16 \rightarrow y^4 = 16^{-1} = \frac{1}{16}$ $y = \sqrt[4]{\frac{1}{16}} = \frac{1}{2}$
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6. $\log_a \frac{1}{8} = -3$ $a^{-3} = \frac{1}{8}$ $a^{-3} = 2^{-3}$ $a = 2$	7. $\log_7 n = -\frac{1}{2}$ $7^{-1/2} = n$ $n = \frac{1}{7^{1/2}} = \frac{1}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{7}$
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8. $\log_{\sqrt{5}} y = \frac{4}{3}$ $(\sqrt{5})^{4/3} = y$ $(5^{1/2})^{4/3} = y$ $y = 5^{4/6} = 5^{2/3}$ $y = 5^{2/3} = \sqrt[3]{25}$	9. $\log_x \sqrt[3]{9} = \frac{1}{6}$ $(x^{1/6})^6 = (9^{1/3})^6$ $x = 9^{6/3} = 9^2 = 81$
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10. $\log_8 (3x+7) = \log_8 (7x+4)$ $3x+7 = 7x+4$ $3 = 4x$ $x = 3/4$	11. $\log_4 (8x+20) = \log_4 (x+6)$ $8x+20 = x+6$ $7x = -14$ $x = -2$
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12. $\log_3 (9x-1) = \log_3 (4x-16)$ $9x-1 = 4x-16$ $5x = -15$ $x = -3$	13. $\log_{12} (x-9) = \log_{12} (3x-13)$ $x-9 = 3x-13$ $-2x = -4$ $x = 2$
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14. $\log_5 (x^2-30) = \log_5 6$ $x^2-30 = 6$ $\sqrt{x^2} = \sqrt{36}$ $x = +6$ $x = -6$	15. $\log_4 (x^2+6) = \log_4 5x$ $x^2+6 = 5x$ $x^2-5x+6 = 0$ $(x-2)(x-3) = 0$ $x = 2$ $x = 3$
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16. $\log x + \log 6 = 1$ $\log_{10} 6x = \log_{10} 10$ $6x = 10$ $x = 10/6 = 5/3$	17. $\log_2 x = \frac{1}{2} \log_2 81$ $\log_2 x = \log_2 81^{1/2}$ $\log_2 x = \log_2 9$ $x = 9$
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18. $\log_3 14 + \log_3 x = \log_3 42$ $\log_3 14x = \log_3 42$ $14x = 42$ $x = 3$	19. $\log_4 (y-1) = \log_4 16$ $\log_4 (y-1) = \log_4 4^2$ $y-1 = 16$ $y = 17$
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20. $\log_3 (1-2x) = \log_3 (x+10)$ $1-2x = x+10$ $3x = -9$ $x = -3$	21. $\log_7 (m+1) + \log_7 (m-5) = 1$ $\log_7 (m+1)(m-5) = \log_7 7$ $m^2-4m-5 = 7$ $m^2-4m-12 = 0$ $(m-6)(m+2) = 0$ $m = 6$ $m = -2$
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22. $\log_5 7 + \frac{1}{2} \log_5 4 = \log_5 x$ $\log_5 7 + \log_5 2 = \log_5 x$ $\log_5 14 = \log_5 x$ $x = 14$	23. $\log_8 (y+1) - \log_8 y = \log_8 4$ $\log_8 \frac{y+1}{y} = \log_8 4$ $\frac{y+1}{y} = 4$ $y+1 = 4y$ $3y = 1$ $y = 1/3$
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24. $\log_6 (x-3) + \log_6 (x+2) = 2$ $\log_6 \frac{x-3}{x+2} = \log_6 6^2$ $\frac{x-3}{x+2} = 36$ $x-3 = 36(x+2)$ $x-3 = 36x+72$ $-35x = 75$ $x = -75/35 = -15/7$	
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$\log_6 (x-3)(x+2) = \log_6 6^2$
 $x^2-x-6 = 36$
 $x^2-x-42 = 0$
 $(x-7)(x+6) = 0$
 $x = 7$
 $x = -6$