Algebra 2
Unit: Exponential and Logarithmic Functions
Section: Solving Exponential and Logarithmic Equations

Extra example problems:

1. $4^x = 5$

$\log(4^x) = \log(5)$

$x\log 4 = \log 5$

$x = \frac{\log 5}{\log 4} \approx 1.1610$

2. $7^x = 12$

$\log(7^x) = \log(12)$

$x\log 7 = \log 12$

$x = \frac{\log 12}{\log 7} \approx 1.2770$

3. $13^{x-1} = 2$

$\log(13^{x-1}) = \log(2)$

$(x-1)\log 13 = \log 2$

$x\log 13 - \log 13 = \log 2$

$x\log 13 = \log 2 + \log 13$

$x = \frac{\log 2 + \log 13}{\log 13}$

$x \approx 1.2702$

4. $8^{x-2} = 14$

$\log(8^{x-2}) = \log(14)$

$(x-2)\log 8 = \log 14$

$x\log 8 - 2\log 8 = \log 14$

$x\log 8 = \log 14 + 2\log 8$

$x = \frac{\log 14 + 2\log 8}{\log 8}$

$x \approx 3.2691$

5. $5^{x+1} = 3$

$\log(5^{x+1}) = \log(3)$

$(x+1)\log 5 = \log 3$

$x\log 5 + \log 5 = \log 3$

$x\log 5 = \log 3 - \log 5$

$x = \frac{\log 3 - \log 5}{\log 5}$

$x \approx -0.3174$

6. $2^{x+1} = 7$

$\log(2^{x+1}) = \log(7)$

$(x+1)\log 2 = \log 7$

$x\log 2 + \log 2 = \log 7$

$x\log 2 = \log 7 - \log 2$

$x = \frac{\log 7 - \log 2}{\log 2}$

$x \approx 1.8074$

7. $\log_7 x = 4$

$7^4 = x$

$2401 = x$

8. $\log_2 x = 8$

$2^8 = x$

$256 = x$

9. $\log_2(3x - 8) = 6$

$2^6 = 3x - 8$

$64 = 3x - 8$

$72 = 3x$

$24 = x$

10. $\log_x 121 = 2$

$x^2 = 121$

$\sqrt{x^2} = \pm\sqrt{121}$

$x = 11$

Only the positive answer is valid.

11. $4 \log_6(2y + 8) = 8$

Divide both sides by 4 first.

$\log_6 (2y + 8) = 2$

$6^2 = 2y + 8$

$36 = 2y + 8$

$28 = 2y$

$14 = y$

12. $3 \log_5(x^2 + 9) - 6 = 0$

Add 6 to both sides and divide by 3.

$\log_5 (x^2 + 9) = 2$

$5^2 = x^2 + 9$

$25 = x^2 + 9$

$0 = x^2 - 16$

$0 = (x + 4)(x - 4)$

$x = -4, 4$

13. $\log_6 (8x) - 7 = -3$

Add 7 to both sides first.

$\log_6 (8x) = 4$

$6^4 = 8x$

$1296 = 8x$

$162 = x$

14. $\log_4 (10x) - 3 = 0$

Add 3 to both sides first.

$\log_4 (10x) = 3$

$4^3 = 10x$

$64 = 10x$

$6.4 = x$

15. $2(5)^{w+3} = 34$

Divide both sides by 2 first.

$5^{w+3} = 17$

$\log(5)^{w+3} = \log 17$

$(w + 3)\log 5 = \log 17$

$w\log 5 + 3\log 5 = \log 17$

$w\log 5 = \log 17 - 3\log 5$

$w = \dfrac{\log 17 - 3\log 5}{\log 5}$

$w \approx -1.2396$

16. $4(2)^{x-5} = 12$

Divide both sides by 4 first.

$2^{x-5} = 3$

$\log(2)^{x-5} = \log 3$

$(x - 5)\log 2 = \log 3$

$x\log 2 - 5\log 2 = \log 3$

$x\log 2 = \log 3 + 5\log 2$

$x = \dfrac{\log 3 + 5\log 2}{\log 2}$

$x \approx 6.5850$

17. $9^{2x-1} + 4 = 20$

Subtract 4 from both sides first.

$9^{2x-1} = 16$

$\log(9)^{2x-1} = \log 16$

$(2x - 1)\log 9 = \log 16$

$2x\log 9 - \log 9 = \log 16$

$2x\log 9 = \log 16 + \log 9$

$x = \dfrac{\log 16 + \log 9}{2\log 9}$

$x \approx 1.1309$

18. $5^{x^2-3} + 2 = 74$

Subtract 2 from both sides first.

$5^{x^2-3} = 72$

$\log 5^{x^2-3} = \log 72$

$(x^2 - 3)\log 5 = \log 72$

$x^2\log 5 - 3\log 5 = \log 72$

$x^2\log 5 = \log 72 + 3\log 5$

$x^2 = \dfrac{\log 72 + 3\log 5}{\log 5}$

$x \approx 2.3785$

19. $\log_2 4 + \log_2 x = 5$

Combine the logs using the product property:

$\log a + \log b = \log (ab)$

$\log_2 (4x) = 5$

$2^5 = 4x$

$32 = 4x$

$8 = x$

20. $\log_8 2 + \log_8 (2x) = 2$

Combine the logs using the product property:

$\log a + \log b = \log (ab)$

$\log_8 (4x) = 2$

$8^2 = 4x$

$64 = 4x$

$16 = x$

Use this area to take any notes or work out any of the problems: