SOLVING LOG EQUATIONS DAY 2

NAME Key Spr 17

SOLVE.

1. $\log_3 10 - \log_3 5 = \log_3 n$

$\log_3 10/5 = \log_3 n$

$\boxed{2 = n}$

2. $-3 \cdot 3^{n+10} = -92$

$3^{n+10} = 92/3$

$\log_3 \frac{92}{3} = n+10$

$3.11591 = n+10$

$\boxed{-6.8841 = n}$

3. $ln - x = 4$

$e^4 = -x$

$-e^4 = x$

$\boxed{x = -54.5982}$

4. $\ln 3x^2 - \ln 3 = 4$

$\ln \frac{3x^2}{3} = 4$

$\ln x^2 = 4$

$e^4 = x^2$

$\pm\sqrt{e^4} = x$

$\boxed{x = \pm 7.3891}$

5. $\ln 5 - \ln(3x+7) = 1$

$\ln \frac{5}{3x+7} = 1$

$e^1 = \frac{5}{3x+7}$

$(3x+7)e^1 = 5$

$3x+7 = 5/e^1$

$3x+7 = 1.8394$

$3x = -5.1606$

$\boxed{x = -1.7202}$

6. $\log_{14}(4n+6) = \log_{14}(6-n)$

$4n+6 = 6-n$

$5n = 0$

$\boxed{n = 0}$

7. $e^{2x} - 4e^x - 5 = 0$

*pretend:

$x^2 - 4x - 5 = 0$

$(x-5)(x+1) = 0$

reality:

$(e^x - 5)(e^x + 1) = 0$

$e^x = 5 \quad e^x = -1$

$\ln 5 = x \quad \cancel{\ln -1 = x}$

$\boxed{x = 1.6094}$

8. $e^{8x+1} + 6 = 12$

$e^{8x+1} = 6$

$\ln 6 = 8x+1$

$1.79176 = 8x+1$

$.79176 = 8x$

$\boxed{x = .099}$

9. $9\log_{12} x - 7 = 11$

$9\log_{12} x = 18$

$\log_{12} x = 2$

$12^2 = x$

$\boxed{x = 144}$

10. $\ln x - \ln(x-1) = \ln 3$

$\ln \frac{x}{x-1} = \ln 3$

$\frac{x}{x-1} = 3$

$x = 3(x-1)$

$x = 3x-3$

$-2x = -3$

$\boxed{x = 3/2}$

11. $\ln(-4x) = \ln(4x+8)$

$-4x = 4x+8$

$-8x = 8$

$\boxed{x = -1}$

12. $-3 \cdot 11^{7n} + 5 = -3$

$-3 \cdot 11^{7n} = -8$

$11^{7n} = 8/3$

$\log_{11} 8/3 = 7n$

$.40904 = 7n$

$\boxed{n = .0584}$

13. $\log_5(y^2 + 5y + 6) = \log_5(y+3) + \log_5 4$

$\log_5(y^2+5y+6) = \log_5(4y+12)$

$y^2+5y+6 = 4y+12$

$y^2+y-6 = 0$

$(y+3)(y-2) = 0$

$\cancel{y = -3}$ $\boxed{y = 2}$

14. $2\log(y+2) = 1 + \log(y^2-4)$

$2\log(y+2) - \log(y^2-4) = 1$

$\log(y+2)^2 - \log(y^2-4) = 1$

$\log \frac{(y+2)^2}{(y^2-4)} = 1$

$\log \frac{\cancel{(y+2)}(y+2)}{\cancel{(y+2)}(y-2)} = 1$

$10^1 = \frac{y+2}{y-2}$

$10y - 20 = y+2$

$9y = 22$

$\boxed{y = 2.444}$

15. $\ln^2 x + \ln x^3 + 2 = 0$

$\ln^2 x + 3\ln x + 2 = 0$

pretend:

$x^2 + 3x + 2 = 0$

$(x+2)(x+1) = 0$

reality:

$(\ln x + 2)(\ln x + 1) = 0$

$\ln x = -2$ $\quad$ $\ln x = -1$

$e^{-2} = x$ $\quad$ $e^{-1} = x$

$\boxed{x = .1353 \quad x = .3679}$

16. $\log(n-6) - 7 = -7$

$\log(n-6) = 0$

$10^0 = n - 6$

$1 = n - 6$

$\boxed{7 = n}$

17. $\log_3(x^2 - 9) - \log_3(x+3) = 1$

$\log_3 \frac{x^2-9}{x+3} = 1$

$\log_3 \frac{\cancel{(x+3)}(x-3)}{\cancel{x+3}} = 1$

$3^1 = x - 3$

$\boxed{6 = x}$

18. $-4\log_{11}(-10x+1) = -8$

$\log_{11}(-10x+1) = 2$

$11^2 = -10x + 1$

$121 = -10x + 1$

$120 = -10x$

$\boxed{x = -12}$

19. $\ln x + \sqrt{\ln x} = 12$

$\ln x + (\ln x)^{1/2} - 12 = 0$

$\ln x + \ln^{1/2} x - 12 = 0$

pretend:

$x^2 + x - 12 = 0$

$(x+4)(x-3)$

reality:

$(\ln^{1/2} x + 4)(\ln^{1/2} x - 3) = 0$

$(\ln^{1/2} x = -4)^2$ $\quad$ $(\ln^{1/2} x = 3)^2$

$\ln x = 16$ $\quad$ $\ln x = 9$

$e^{16} = x$ $\quad$ $e^9 = x$

$\cancel{x = 8{,}886{,}110.521}$

*doesn't work when plugged in!

20. $\ln^2 x - \ln x^7 + 10 = 0$

$\ln^2 x - 7\ln x + 10 = 0$

pretend:

$x^2 - 7x + 10$

$(x-5)(x-2)$

reality:

$(\ln x - 5)(\ln x - 2) = 0$

$\ln x = 5$ $\quad$ $\ln x = 2$

$e^5 = x$ $\quad$ $e^2 = x$

$\boxed{x = 148.413 \quad x = 7.3891}$

~~21. $\ln x + \sqrt{\ln x} = 12$~~

~~22. $\ln x - \ln x^7 + 10 = 0$~~

$\boxed{x = 8103.8}$

23. $2\log^2 x = 2 + 3\log x$

$2\log^2 x - 3\log x - 2 = 0$

pretend:

$2x^2 - 3x - 2 = 0$

$(2x+1)(x-2) = 0$

reality:

$(2\log x + 1)(\log x - 2) = 0$

$2\log x = -1$ $\quad$ $\log x = 2$

$\log x = -1/2$ $\quad$ $10^2 = x$

$10^{-1/2} = x$ $\quad$ $\boxed{x = 100}$

$\boxed{x = .3162}$

24. $\log_5 \sqrt{x} + \log_5 \sqrt{6x+5} = 1$

$\log_5 \sqrt{x(6x+5)} = 1$

$(5^1)^2 = (\sqrt{x(6x+5)})^2$

$25 = x(6x+5)$

$25 = 6x^2 + 5x$

$0 = 6x^2 + 5x - 25$

$0 = (3x-5)(2x+5)$

$\boxed{x = 5/3}$ $\quad$ $\cancel{x = -5/2}$

Doesn't work when plugged in!