HONORS MATH 3 – SOLVING LOG EQUATIONS NAME key

SOLVE.

$\log_3 \frac{10}{5}$

1. $\log_3 x^{-5} = 10$

$-5\log_3 x = 10$

$\log_3 x = -2$

$3^{-2} = x$

$x = \frac{1}{9}$

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

$\log_3 2 = \log_3 n$

$n = 2$

3. $3^{n+7} = 44$

$\log_3 44 = n+7$

$3.44452 = n+7$

$-3.555 = n$

4. $1 + \ln 9p = 2$

$\ln 9p = 1$

$e^1 = 9p$

$\frac{e^1}{9} = p$

$p = .302$

5. $7\log_4(x+2) = 0$

$\log_4(x+2) = 0$

$4^0 = x+2$

$1 = x+2$

$x = -1$

6. $e^{6x} - 5 = 10$

$e^{6x} = 15$

$\ln 15 = 6x$

$\frac{\ln 15}{6} = x$

$x = .45134$

7. $8 + \ln -5x = 6$

$\ln -5x = -2$

$e^{-2} = -5x$

$\frac{e^{-2}}{-5} = x$

$x = -.0271$

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

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

$\ln x^2 = 4$

$e^4 = x^2$

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

$x = \pm 7.39$

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

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

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

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

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

$3x+7 = 1.8394$

$3x = -5.1606$

$x = -1.72$

10. $5(2)^{n+9} = 92$

$2^{n+9} = \frac{92}{5}$

$\log_2 \frac{92}{5} = n+9$

$4.2016 = n+9$

$n = -4.798$

11. $\log_7 -5k - 7 = -4$

$\log_7 -5k = 3$

$7^3 = -5k$

$343 = -5k$

$k = -68.6$

12. $e^{x-8} - 6 = 87.6$

$e^{x-8} = 93.6$

$\ln 93.6 = x-8$

$4.53903 = x-8$

$x = 12.53903$

13. ~~$\log_4$~~$(-19n+1) =$ ~~$\log_4$~~(n^2+91)

$-19n+1 = n^2+91$

$0 = n^2+19n+90$

$0 = (n+10)(n+9)$

$n = -10 \quad n = -9$

14. $e^{2x} - 4e^x - 5 = 0$ think of as

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

$e^x - 5 = 0 \qquad e^x + 1 = 0$

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

$\ln 5 = x \qquad \ln -1 = x$

$x = 1.6094$

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

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

cannot take log of a negative

15. $\log \sqrt[3]{(9x-8)^2} = \frac{4}{3}$

$\log (9x-8)^{2/3} = 4/3$

$10^{4/3} = (9x-8)^{2/3}$

$21.5443469 = (9x-8)^{2/3}$

$100 = 9x-8$

$108 = 9x$

$x = 12$

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

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

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

$x = 3x-3$

$-2x = -3$

$x = \frac{3}{2}$

17. $3^{2x+3} = 4^{x-2}$

$\log_3 4^{x-2} = 2x+3$

$(x-2)(1.2619) = 2x+3$

$1.2619x - 2.528 = 2x+3$

$-5.528 = .7381x$

$x = -7.4895$

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

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

$y^2+y-6 = 0$

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

$y = -3$ $y = 2$

19. $2\log(y+2) = 1 + \log(y^2-4)$

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

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

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

$10y-20 = y+2$

$9y = 22$

$y = 2.444$

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

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

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

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

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

$x = .1353$ $x = .3679$

21. $4^{x+1} = 5^{2x-3}$

$\log_4 5^{2x-3} = x+1$

$(2x-3)(1.16096) = x+1$

$2.32192x - 3.48288 = x+1$

$1.32192x = 4.48288$

$x = 3.3912$

23. $\log_3(x^2-5)^4 = 4$

$4\log_3(x^2-5) = 4$

$\log_3(x^2-5) = 1$

$3^1 = x^2-5$

$8 = x^2$

$x = \pm 2.828$

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

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

$3^1 = x-3$

$6 = x$

25. $5e^{3x+1} - 3 = 10$

$5e^{3x+1} = 13$

$e^{3x+1} = 13/5$

$\ln(\frac{13}{5}) = 3x+1$

$.95551 = 3x+1$

$-.0445 = 3x$

$x = -.0148$

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

doesn't work when plugged in

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

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

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

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

$e^{10} = x$ $x = 8886110.521$

$x = e^9$

$x = 8103.08$

treat it as:

$x^2 + x - 12 = 0$

$(x+4)(x-3) = 0$

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

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

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

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

$x = e^5$ $x = e^2$

$x = 148.41$ $x = 7.39$

28. $\log(\sqrt[4]{10-5x})^3 = 3$

$3\log(10-5x)^{1/4} = 3$

$\log(10-5x)^{1/4} = 1$

$10^1 = (10-5x)^{1/4}$

$10{,}000 = 10-5x$

$9990 = -5x$

$x = -1998$

29. $2\log^2 x = 2 + 3\log x$

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

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

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

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

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

$x = .3162$

treat it as:

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

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

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

$\log_5 (6x^2+5x)^{1/2} = 1$

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

$25 = 6x^2+5x$

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

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

$3x = 5$ $2x = -5$

$x = 5/3$ $x = -5/2$ doesn't work