Honors Precalculus

Name ____________________

3.4-3.5 Practice WS

Solve each exponential or logarithmic equation. Check for extraneous solutions.
Complete as much as possible without the aid of a calculator (use only when necessary).

1. $e^{2x} + 5 = 12$

$e^{2x} = 7$

$\ln e^{2x} = \ln 7$

$2x = \ln 7$

$x = \frac{1}{2} \cdot \ln 7 \approx \boxed{.973}$

2. $3^{x+1} + 4 = 8$

$3^{x+1} = 4$

$\log_3 3^{x+1} = \log_3 4$

$x + 1 = \log_3 4$

$x = -1 + \log_3 4 \approx \boxed{.262}$

3. $4^{4x+2} = 54$

$\log_4 4^{4x+2} = \log_4 54$

$4x + 2 = \log_4 54$

$4x = -2 + \log_4 54$

$x = \frac{-2+\log_4 54}{4} \approx \boxed{.219}$

4. $2e^{2x-3} - 3 = 11$

$2e^{2x-3} = 14$

$e^{2x-3} = 7$

$\ln 7 = 2x - 3$

$\frac{3+\ln 7}{2} = x \approx \boxed{2.473}$

5. $9^{x-5} + 4 = 15$

$9^{x-5} = 11$

$\log_9 9^{x-5} = \log_9 11$

$x - 5 = \log_9 11$

$x = 5 + \log_9 11 \approx \boxed{6.091}$

6. $27^x = 3^{2x+3}$

$(3^3)^x = 3^{2x+3}$

$3x = 2x + 3$

$\boxed{x = 3}$

7. $\frac{1}{2}(10^{x+6}) - 5 = 14$

$\frac{1}{2}(10^{x+6}) = 19$

$10^{x+6} = 38$

$\log 10^{x+6} = \log 38$

$x + 6 = \log 38$

$x = -6 + \log 38 \approx \boxed{-4.420}$

8. $4^{3-x} + 2 = \frac{5}{2}$

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

$(2^2)^{3-x} = (2)^{-1}$

$2^{6-2x} = 2^{-1}$

$6 - 2x = -1$

$-2x = -7$

$\boxed{x = 7/2}$

9. $216^{2x-1} = 36^{4x+3}$

$(6^3)^{2x-1} = (6^2)^{4x+3}$

$3(2x-1) = 2(4x+3)$

$6x - 3 = 8x + 6$

$-9 = 2x$

$\boxed{x = -9/2}$

10. $\log_3(x-3) + 3 = 5$

$\log_3(x-3) = 2$

$3^{\log_3(x-3)} = 3^2$

$x - 3 = 3^2$

$x = 3 + 9$

$\boxed{x = 12}$

$3^2 = x - 3$

$9 = x - 3$

$\boxed{12 = x}$

11. $2\ln x - 7 = 4$

$2 \cdot \ln x = 11$

$\ln x = 11/2$

$e^{11/2} = x$

$\boxed{x \approx 244.692}$

12. $\log_7(2-x) = 3$

$7^3 = 2 - x$

$x = 2 - 7^3$

$x = 2 - 343$

$\boxed{x = -341}$

13. $\log_2 x + \log_2(x+1) = 1$

$\log_2 (x^2 + x) = 1$

$2^1 = x^2 + x$

$0 = x^2 + x - 2$

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

$\cancel{x = -2}$ $\boxed{x = 1}$

14. $\ln(2x^2 - 3) = \ln(9x - 13)$

$2x^2 - 3 = 9x - 13$

$2x^2 - 9x + 10 = 0$

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

$x = 5/2$ $\quad x = 2$

$\boxed{x = 5/2, 2}$

15. $\log_4(x-3) + \log_4(x-4) = \frac{1}{2}$

$\log_4 (x^2 - 7x + 12) = 1/2$

$4^{1/2} = x^2 - 7x + 12$

$2 = x^2 - 7x + 12$

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

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

$\boxed{x = 5}$

$\cancel{x = 2}$

17. $\log(x-5) = \log(x-2) + 1$

$\log(x-5) - \log(x-2) = 1$

$\log\left(\frac{x-5}{x-2}\right) = 1$

$10^1 = \frac{x-5}{x-2}$

$10x - 20 = x - 5$

$9x = 15$ $\cancel{x = \frac{15}{9}}$

$\boxed{\text{No Solution}}$

18. $\log_2(7x-8) - \log_2(x+1) - \log_2(x-1) = 1$

$\log_2 \frac{7x-8}{(x+1)(x-1)} = 1$

$2^1 = \frac{7x-8}{x^2-1}$

$2x^2 - 2 = 7x - 8$

$2x^2 - 7x + 6 = 0$

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

$\boxed{x = 3/2 \quad x = 2}$

19. $4^{2x+3} = 5^{x-4}$

$\log 4^{2x+3} = \log 5^{x-4}$

$(2x+3) \cdot \log 4 = (x-4) \cdot \log 5$

$2x \cdot \log 4 + 3\log 4 = x \cdot \log 5 - 4 \cdot \log 5$

$2x \cdot \log 4 - x\log 5 = -3\log 4 - 4\log 5$

$x(\cancel{2\log 4 - \log 5}) = \frac{-3\log 4 - 4\log 5}{2\log 4 - \log 5}$

$\boxed{x \approx -9.110}$

20. Find the exponential model $y = a \cdot e^{bx}$ that fits the points $(0, 1)$ and $\left(3, \frac{1}{4}\right)$.

$1 = ae^{b \cdot 0}$

$1 = a \cdot 1$

$a = 1$

$\frac{1}{4} = (1)e^{b(3)}$

$\frac{1}{4} = e^{3b}$

$\ln \frac{1}{4} = \ln e^{3b}$

$\ln \frac{1}{4} = 3b$

$\frac{1}{3}\ln \frac{1}{4} = b = -.4621$

$\boxed{y = e^{-.4621x}}$

21. A deposit of \$10,000 is made in a savings account for which the interest is compounded continuously. The balance will double in 12 years.
(a) What is the annual interest rate for this account?
(b) Find the balance after 2 years.

$A = Pe^{rt}$

$20{,}000 = 10{,}000e^{r(12)}$

$2 = e^{12r}$

$\ln 2 = \ln e^{12r}$

$\ln 2 = 12r$

$r = \frac{\ln 2}{12} = .05777$

$\boxed{r = 5.78\%}$

$A = 10{,}000e^{(.0578)(2)}$

$\boxed{A = \$11{,}225.47}$

22. The population P (in thousands) of Las Vegas, NV can be modeled by $P = 258.0e^{kt}$ where t is the year, with $t=0$ corresponding to 1990. In 2000, the population was 478,000.
(a) Find the value of k for the model.
(b) Predict the population in 2015.

$t = 10 \quad P = 478$

$478 = 258.0e^{k(10)}$

$1.852713178 = e^{10k}$

$\frac{\ln(\#)}{10} = \frac{10k}{10}$

$\boxed{k = .06167}$

$t = 25$

$P = 258.0e^{(.06167 \times 25)}$

$P = 1205.572196$

$\times 1000$

$\boxed{1{,}205{,}572 \text{ people}}$