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Chapter 7 Review – Exponential and Logarithmic Functions

7.1 Solving Exponential Equations with the Same Base:

1. $13^{5x-6} \cdot 13^{2x} = \frac{13^{3x}}{13^5}$

$$\begin{array}{r} 5x-6+2x = 3x-5 \\ 7x-6 = 3x-5 \\ \underline{-3x \quad -3x} \\ 4x-6 = -5 \\ \underline{+6 \quad +6} \\ 4x = 1 \\ \frac{4x}{4} = \frac{1}{4} \end{array}$$

$x = \frac{1}{4}$

2. $10^{x^2+11x} = \left(\frac{1}{10}\right)^{18}$

$$\begin{array}{r} 10^{x^2+11x} = (10^{-1})^{18} \\ x^2+11x = -18 \\ x^2+11x+18 = 0 \\ (x+9)(x+2) = 0 \\ \begin{array}{l} x+9=0 \quad x+2=0 \\ -9 \quad -9 \quad -2 \quad -2 \end{array} \end{array}$$

$x = -9$ $x = -2$

7.2 Solving Exponential Equations with Different Bases:

3. $4^{x^4} = 8^{4x^2-6}$

$$\begin{array}{r} (2^2)^{x^4} = (2^3)^{4x^2-6} \\ 2^{x^4} = 2^{12x^2-18} \\ 2^{x^4-12x^2+18} = 2^0 \\ 2(x^4-6x^2+9) = 0 \\ 2(x^2-3)(x^2-3) = 0 \\ x^2-3 = 0 \quad x^2-3 = 0 \\ x^2 = 3 \quad x^2 = 3 \\ \boxed{x = \pm\sqrt{3}} \quad \boxed{x = \pm\sqrt{3}} \end{array}$$

4. $9^{7x-3} = 27^{3x-7}$

$$\begin{array}{r} (3^2)^{7x-3} = (3^3)^{3x-7} \\ 14x-6 = 9x-21 \\ \underline{-9x \quad -9x} \\ 5x-6 = -21 \\ \underline{+6 \quad +6} \\ 5x = -15 \\ \frac{5x}{5} = \frac{-15}{5} \\ \boxed{x = -3} \end{array}$$

7.3 & 7.4 Writing different forms:

Write in logarithmic form:

5. $125 = 5^3$

$$\log_5 125 = 3$$

6. $\frac{1}{12} = (12)^{-1}$

$$\log_{12} \frac{1}{12} = -1$$

Write in exponential form:

7. $\log_3 \left(\frac{1}{9}\right) = -2$

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

8. $\log_{36} 6 = \frac{1}{2}$

$$36^{\frac{1}{2}} = 6$$

$\log_b y = x$
 $b^x = y$

Condense each:

9. $\frac{1}{2}(\log_5 y + \log_5 z) - 3 \log_5 x$
 $(\log_5 yz)^{\frac{1}{2}} - \log_5 x^3$
 $\log_5 \frac{\sqrt{yz}}{x^3}$

10. $3 \ln a - \frac{1}{4}(3 \ln b + \ln c)$
 $\ln a^3 - (\ln b^3 c)^{\frac{1}{4}}$
 $\ln \frac{a^3}{\sqrt[4]{b^3 c}}$

Expand each:

11. $\log_2 (x^2 y^4)^3$
 $\log_2 (x^6 y^{12})$
 $6 \log_2 x + 12 \log_2 y$

12. $\log \frac{x^3}{yz^4}$
 $3 \log x - (\log y + 4 \log z)$

7.3 & 7.4 Evaluating:

13. $\log 1000 = x$
 $10^x = 1000$
 $x = 3$

14. $\log_3 81 = x$
 $3^x = 81$
 $x = 4$

15. $\log y = 6$, What is the value of y?
 to
 $10^6 = y$
 $1000000 = y$

16. $\log 4 + 2 \log 5$
 $\log 4 + \log 5^2$
 $\log 4 + \log 25$
 $\log 4(25)$
 $\log 100 = x$
 $10^x = 100$
 $x = 2$

17. $2 \log_2 8 - 3 \log_2 4$
 $\log_2 8^2 - \log_2 4^3$
 $\log_2 64 - \log_2 64$
 $\log_2 \frac{64}{64}$
 $\log_2 1 = x$
 $2^x = 1$
 $x = 0$

18. $\frac{1}{2} \log_2 4 + 2 \log_2 4 - \log_2 8$
 $\log_2 4^{\frac{1}{2}} + \log_2 4^2 - \log_2 8$
 $\log_2 \sqrt{4} + \log_2 16 - \log_2 8$
 $\log_2 (2)(16)$
 $\log_2 \frac{32}{8}$
 $\log_2 4 = x$
 $2^x = 4$

7.5 & 7.6 Solving: Round all answers to the ten thousandths (4 decimal places)

19. $e^{x+6} + 5 = 1$

$$\begin{array}{r} -5 \quad -5 \\ \hline e^{x+6} = -4 \\ x+6 \ln e = \ln -4 \\ x+6 = \ln -4 \end{array}$$

No solution AH!!

21. $\log_{10}(7x+3) = 3$

$$\begin{array}{r} 10^3 = 7x+3 \\ 1000 = 7x+3 \\ -3 \quad -3 \\ \hline 997 = 7x \\ \frac{997}{7} = \frac{7x}{7} \end{array}$$

142.4286 = x

23. $\log_5(3x+10) - 3 \log_5 4 = 2$

$$\begin{array}{r} \log_5(3x+10) - \log_5 4^3 = 2 \\ \log_5\left(\frac{3x+10}{64}\right) = 2 \end{array}$$

$$5^2 = \frac{3x+10}{64}$$

$$25 = \frac{3x+10}{64}$$

$$\begin{array}{r} 1600 = 3x+10 \\ -10 \quad -10 \\ \hline \end{array}$$

$$\frac{1590}{3} = \frac{3x}{3}$$

530 = x

25. $\ln(x+2) + \ln(x-2) = 0$

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

$$\ln(x^2-4) = 0$$

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

$$1 = x^2-4$$

$$\begin{array}{r} +4 \quad +4 \\ \hline \end{array}$$

$$5 = x^2$$

$$\sqrt{5} = \sqrt{x^2}$$

x = ± 2.2361

20. $10^{2x} = 40$

$$\begin{array}{r} 2x \log 10 = \log 40 \\ \log 10 \quad \log 10 \\ \hline \end{array}$$

$$\begin{array}{r} 2x = 1.6021 \\ \frac{2x}{2} = \frac{1.6021}{2} \end{array}$$

x = .8011

22. $4^{3x+8} - 10 = 142$

$$\begin{array}{r} +10 \quad +10 \\ \hline \end{array}$$

$$4^{3x+8} = 152$$

$$\begin{array}{r} 3x+8 \log 4 = \log 152 \\ \log 4 \quad \log 4 \\ \hline \end{array}$$

$$\begin{array}{r} 3x+8 = 3.624 \\ -8 \quad -8 \\ \hline \end{array}$$

$$\begin{array}{r} 3x = -4.376 \\ \frac{3x}{3} = \frac{-4.376}{3} \end{array}$$

24. $2 \ln x - \ln 3 = 2$

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

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

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

$$7.3891 = \frac{x^2}{3}$$

$$22.1673 = x^2$$

$$\sqrt{22.1673} = \sqrt{x^2}$$

26. $12e^{3x-2} = 8$

$$\begin{array}{r} 12 \quad 12 \\ \hline \end{array}$$

$$e^{3x-2} = .6667$$

$$3x-2 \ln e = \ln .6667$$

$$3x-2 = -.4054$$

$$\begin{array}{r} +2 \quad +2 \\ \hline \end{array}$$

$$\begin{array}{r} 3x = 1.5946 \\ \frac{3x}{3} = \frac{1.5946}{3} \end{array}$$

x = .5315