10.01 Practice:

Simplify. Your answers should only contain positive exponents.

1. $(x^{-2}x^{-3})^4$

$(x^{-5})^4 = x^{-20}$

$= \boxed{\frac{1}{x^{20}}}$

2. $\frac{\cancel{3}xy^3 2y^3}{\cancel{3}x^2y^{-4}} \rightarrow \frac{2x^1y^6}{x^2y^{-4}}$

$\frac{2x^1y^6y^4}{x^2} \rightarrow \boxed{\frac{2y^{10}}{x}}$

3. $\frac{2a^{-4}}{(2a^{-4})^3}$

$\frac{2a^{-4}}{(2^1a^{-4})^3}$

$\frac{2a^{-4}}{2^3a^{-12}} \rightarrow \frac{2a^{-4}\cdot a^{12}}{8} \rightarrow \boxed{\frac{a^8}{4}}$

Solve. *If $a^m = a^n$, then $m = n$

4. $27^x = 3^{2x+3}$

$\cancel{3}^{3x} = \cancel{3}^{2x+3}$

$3x = 2x + 3$

$\boxed{x = 3}$

5. $8^{2x+2} = 4^{x+15}$

$\cancel{2}^{3(2x+2)} = \cancel{2}^{2(x+15)}$

$6x + 6 = 2x + 30$

$4x = 24$

$\boxed{x = 6}$

6. $3^{x^2} + 5 = 6$

$3^{x^2} = 1$

$3^{x^2} = 3^0$

$x^2 = 0$

$\boxed{x = 0}$

7. $16^a \cdot 64^{3-3a} = 64$

$4^{2a} \cdot 4^{3(3-3a)} = 4^3$

$\cancel{4}^{2a+3(3-3a)} = \cancel{4}^3$

$2a + 9 - 9a = 3$

$-7a + 9 = 3$

$-7a = -6$

$\boxed{a = 6/7}$

8. $243^{x+2} \cdot 9^{2x-1} = 9$

$3^{5(x+2)} \cdot 3^{2(2x-1)} = 3^2$

$\cancel{3}^{5(x+2)+2(2x-1)} = \cancel{3}^2$

$5x + 10 + 4x - 2 = 2$

$9x + 8 = 2$

$9x = -6$

$\boxed{x = \frac{-6}{9} = \frac{-2}{3}}$

9. $\frac{125^{-3a}}{25^{3a}} = 125$

$\frac{5^{3(-3a)}}{5^{2(3a)}} = 5^3$

$\cancel{5}^{-9a-6a} = \cancel{5}^3$

$-15a = 3$

$\boxed{a = \frac{-3}{15} = \frac{-1}{5}}$

10. $2^x \cdot \frac{1}{32} = 32$

$2^x \cdot \frac{1}{2^5} = 2^5$

$2^x \cdot 2^{-5} = 2^5$

$\cancel{2}^{x-5} = \cancel{2}^5$

$x - 5 = 5$

$\boxed{x = 10}$

11. $\frac{4^{3x-1}}{64} = 4^x$

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

*subtract exponents

$4^{3x-1-3} = 4^x$

$\cancel{4}^{3x-4} = \cancel{4}^x$

$3x - 4 = 1x$

$2x = 4$

$\boxed{x = 2}$

12. $\frac{343^{-2x}}{49^{x-3}} = 5^0$

$\frac{7^{3(-2x)}}{7^{2(x-3)}} = 7^0$

$\cancel{7}^{-6x-2(x-3)} = \cancel{7}^0$

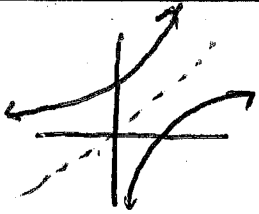
$-6x - 2x + 6 = 0$

$-8x + 6 = 0$

$x = \frac{-6}{-8}$ or $\boxed{x = 3/4}$

$y=b^x \to x=b^y$

$y=\log_b x$



4

Inverse function:
1) swap x and y
2) Solve for y

10.02 Intro to Log Function

Date: ____________________

A logarithmic function is the *inverse* of an exponential function.

Definition: Let b and y be positive numbers with $b \neq 1$. Then, the ***logarithm of y with base b*** is denoted by $\log_b y$ and is defined as follows:

$$\log_b y = x \textit{ if and only if } b^x = y$$

Examples: Convert from exponential form into logarithmic form.

1. $2^3 = 8$ 2. $5^{-3} = \frac{1}{125}$ 3. $81^{1/4} = 3$

$\log_2 8 = 3$ $\log_5 \frac{1}{125} = -3$ $\log_{81} 3 = \frac{1}{4}$

Examples: Convert from logarithmic form into exponential form.

4. $\log_5 25 = 2$ 5. $\log_7 \frac{1}{343} = -3$ 6. $\log_{32} 2 = \frac{1}{5}$

$5^2 = 25$ $7^{-3} = \frac{1}{343}$ $32^{1/5} = 2$

$e \approx 2.72$

- ***Common log*** is log base 10
- Denoted as $\log N$, it is understood to mean $\log_{10} N$
- The LOG button on the calculator evaluates $\log_{10} N$

- ***Natural log*** is log base e
- Denoted as $\ln N$, it is understood to mean $\log_e N$
- The LN button on the calculator evaluates $\log_e N$

Examples: Rewrite in exponential form.

7. $\log 100 = 2$ 8. $\ln 7 = x$

$\log_{10} 100 = 2$ $\log_e 7 = x$

$\boxed{10^2 = 100}$ $e^x = 7$

Examples: Rewrite in logarithmic form.

9. $10^{-2} = \frac{1}{100}$ 10. $e^2 = 7.389$

$\log_{10} \frac{1}{100} = -2$ $\log_e 7.389 = 2$

$\boxed{\log \frac{1}{100} = -2}$ $\boxed{\ln 7.389 = 2}$

Examples: Evaluate the following logarithms.

11. $\log 1 = x$ 12. $\log_{64} 8 = x$ 13. $\log_5 \frac{1}{625} = x$

$\log_{10} 1 = x$ $64^x = 8$ $5^x = \frac{1}{625}$

$10^x = 1$ $\boxed{x = \frac{1}{2}}$ $\boxed{x = -4}$

$\boxed{x = 0}$