Algebra 2

Ch. 8 Handout 8.5

Exponential and Logarithmic Equations

An **exponential equation** is an equation of the form $b^{cx} = a$, where the exponent includes a variable.

A **logarithmic equation** is an equation that includes a logarithmic expression.

* when you can't get the bases the same with your exponents then take the common log of both sides

Solve each equation. Round to the nearest ten-thousandth.

1. $5^{2x} = 16$

$\log 5^{2x} = \log 16$

$\frac{2x \log 5}{2 \log 5} = \frac{\log 16}{2 \log 5}$

$x = \frac{\log 16}{2 \log 5}$

$x \approx .8614$

2. $3^x = 4$

$\log 3^x = \log 4$

$\frac{x \log 3}{\log 3} = \frac{\log 4}{\log 3}$

$x = \frac{\log 4}{\log 3}$

$x \approx 1.2619$

Solve each equation. Round to the nearest ten-thousandth.

3. $6^{2x} = 21$

$\log 6^{2x} = \log 21$

$\frac{2x \log 6}{2 \log 6} = \frac{\log 21}{2 \log 6}$

$X = \frac{\log 21}{2 \log 6}$

$X \approx .8496$

4. $3^{x+4} = 101$

$\log 3^{(x+4)} = \log 101$

$\frac{(x+4)\log 3}{\log 3} = \frac{\log 101}{\log 3}$

$x + 4 = \frac{\log 101}{\log 3}$

$-4 \quad -4$

$X = \frac{\log 101}{\log 3} - 4$

$X \approx .2009$

Solve each equation.

5. $3\log x - \log 2 = 5$

single form

$\log x^3 - \log 2 = 5$

$\log \frac{x^3}{2} = 5$

*write in exp. form

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

$2 \cdot 100{,}000 = \frac{x^3}{2}(2)$

$\sqrt[3]{x^3} = \sqrt[3]{200{,}000}$

$x = \sqrt[3]{200{,}000}$

$x \approx 58.4804$

6. $\log(7 - 2x) = -1$

*write in exp. form

$10^{-1} = 7 - 2x$

$\frac{1}{10} = 7 - 2x$

$-7 \quad -7$

$\frac{1}{10} - \frac{7(10)}{1(10)} = -2x$

$\frac{1}{10} - \frac{70}{10} = -2x$

$\left(-\frac{1}{2}\right) \frac{-69}{10} = (-2x)\left(+\frac{1}{2}\right)$

$\frac{69}{20} = x$

Solve each equation.

7. $\log 6 - \log 3x = -2$

single form

$\log_{10} \frac{6}{3x} = -2$

*write in exp. form

$10^{-2} = \frac{6}{3x}$

$1 \cdot 3x = 6 \cdot 100$

$3x = 600$

$x = 200$

8. $\log(2x - 2) = 4$

*write in exp. form

$10^4 = 2x - 2$

$10{,}000 = 2x - 2$

$+2 \quad +2$

$\frac{10{,}002}{2} = \frac{2x}{2}$

$5001 = x$

Change of Base Formula

For any positive numbers M, b, and c, with

$$b \neq 1 \text{ and } c \neq 1,\ \log_b M = \frac{\log M}{\log b}$$

9. Use the ~~Change of Base Formula~~ to evaluate $\log_6 12$.

$\log_6 12 = x$

* write in exp. form

$6^x = 12$

* take common log of both sides

$\log 6^x = \log 12$

$\frac{x \log 6}{\log 6} = \frac{\log 12}{\log 6}$

$x = \frac{\log 12}{\log 6} \approx 1.3869$

Solve each equation.

10. $2^x = \frac{1}{8}$

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

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

$x = -3$

OR

$\log 2^x = \log \frac{1}{8}$

$x \log 2 = \log \frac{1}{8}$

$x = \frac{\log \frac{1}{8}}{\log 2}$

$x = -3$

11. $\log_4 2 = x$

$4^x = 2^1$

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

$2x = 1$

$x = \frac{1}{2}$

Solve each equation.

12. $10^{6x} = 1$

$\log 10^{6x} = \log 1$

$\frac{6x \log 10}{6 \log 10} = \frac{\log 1}{6 \log 10}$

$x = \frac{\log 1}{(6 \log 10)} = 0$

13. Solve $5^{2x} = 125$.

$5^{2x} = 5^3$

$2x = 3$

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

Assignment:

Day 1: pgs 464-467 1-11 odds, 25-47 odds, 53-59 odds, 79-95 odds