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## 10.4. Advanced Algebra Common Logarithms

DATE: 12/11

Target 4E. Solve exponential and logarithmic equations.



**Common Logarithms:** base 10 logarithms (common logarithms are usually written without the subscript 10;  $y = \log_{10} x$  is written as  $y = \log x$ )

$$\log_{10} x = \log x$$

Sometimes an application of logarithms requires that you use the inverse of logarithms, or **exponentiation**. Here is an example:

Solve  $\log x = \frac{1}{4}$  for  $x$ .

Method 1: Loop

$$\log_{10} x = \frac{1}{4}$$

$$1.7783 = 10^{\frac{1}{4}} = x$$

Method 2: Exponentiation

$$10^{\log_{10} x} = 10^{\frac{1}{4}}$$

$$x = 10^{\frac{1}{4}} = 1.7783$$

Choose 1  
Method

**Solve Logarithmic Equations Using Exponentiation**

Solve each equation and round to four decimals if necessary.

1.  $\log_4 r = 3$

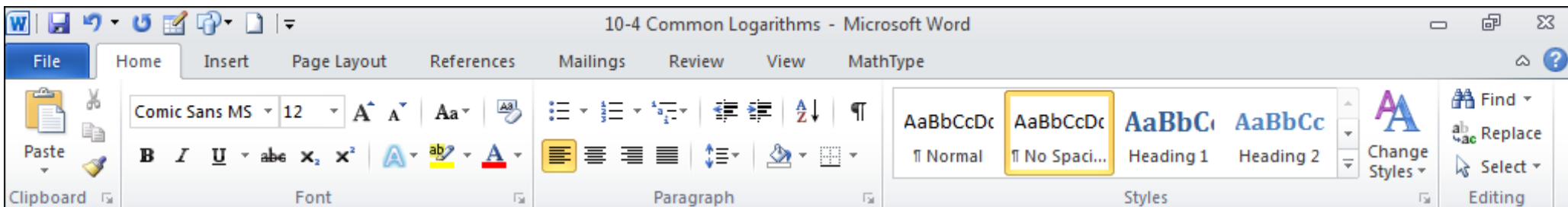
$$4^3 = r$$

$$64 = r$$

2.  $\log z = -2$

$$10^{\log_{10} z} = 10^{-2}$$

$$z = 10^{-2} = \frac{1}{100}$$



3.  $\log_3(4x - 5) = 5$

$$3^5 = 4x - 5$$

$$243 = 4x - 5$$

$$+5 \quad +5$$

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$$\frac{248}{4} = \frac{4x}{4}$$

$$62 = x$$

4.  $\log_2 y = \frac{1}{2}$

$$2^{\log_2 y} = 2^{\frac{1}{2}}$$

$$y = 2^{\frac{1}{2}} \approx 1.4142$$

Solving Exponential Equations Using Logarithms

Solve each equation and round to four decimals if necessary.

5.  $3^x = 11$

$$\log_3 11 = x$$

$$2.1827 \approx x$$

Method 1: Rewrite in log form.

Choose fav. method

6.  $11^x = 25.4$

$$\log 11^x = \log 25.4$$

$$\frac{x \cdot \log 11}{\log 11} = \frac{\log 25.4}{\log 11}$$

$$x \approx 2.1827$$

Method 2: Take log of both sides and use log properties - longer.

Recall:  $\log x = \log_{10} x$

Two methods  
Choose 1 method

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7.  $4^{5n} = 30$

Try it ☺

8.  $3.1^{a-3} = 9.42$

$$\log_{3.1} 9.42 = a - 3$$

$$1.9824 = a - 3$$

$$4.9824 \approx a$$

I choose  
"loopy loop"

9.  $3^{n+2} = 14.5$

Try it ☺

10.  $4^{3c} = 10$

$$\log_4 10 = 3c$$

$$\frac{1.6610}{3} = \frac{3 \cdot c}{3} \quad 0.5537 \approx c$$

11.  $6^{x+2} = 18$

Try it ☺

12.  $7^{3x-1} = 21$

$$\log_7 21 = 3x - 1$$

$$1.5646 = 3x - 1$$

$$+ 1$$

$$\frac{2.5646}{3} = \frac{3x}{3}$$

$$0.8549 \approx x$$