**Learning Goal:** I will be able to evaluate logarithms and simplify logarithmic expressions ar write a power with different bases.

**Minds On:** Changing bases to solve!

**Action:** Examples

**Consolidation:** page 466 Practice + Exit Card

We will be RAFTing at the end of the period this week.

This way, people who don't want to RAFT can practice the material from that day's lesson.

# Minds On

## Evaluating Logarithms

We should realize by now that a logarithm is an *exponent* and that the logarithm is the answer to the question: ***To what power must the base be raised to produce a specific value?***

Evaluate simple logarithmic expressions using the relationship between powers and logarithms. One strategy is to replace the value with its equivalent power.

$\text{Value} = \text{Base}^{\text{Exponent}}$ $\quad\quad$ $\text{Exponent} = \log_{\text{Base}} \text{Value}$

Or by substitution,

$\text{Exponent} = \log_{\text{Base}} (\text{Base}^{\text{Exponent}})$

# Minds On

**Minds On:**

1. Evaluate each logarithm.

a) $\log_2 4 = 2$

b) $\log_3 27 = 3$

c) $\log_2 32 = 5$

d) $\log_7 49 = 2$

e) $\log_5 (1/5) = -1$

$= \log_5 (5^{-1})$

f) $\log_6 1 = 0$

2. Write each logarithm in exponential form.

a) $\log_2 8 = 3$

$2^3 = 8$

b) $\log_6 36 = 2$

$6^2 = 36$

c) $\log_{16} 4 = ½$

$16^{½} = 4$

$\sqrt{16} = 4$

d) $\log_5 625 = 4$

$5^4 = 625$

e) $\log_3 3 = 1$

$3^1 = 3$

f) $\log_{10} 1 = 0$

$10^0 = 1$

## Minds On

3. Write each exponential equation in logarithmic form.

a) $3^7 = 2187$ $\log_3 2187 = 7$

b) $6^6 = 46656$ $\log_6 46656 = 6$

c) $5^{-2} = 0.04$ $\log_5 0.04 = -2$

d) $7^3 = 343$ $\log_7 343 = 3$

e) $8^4 = 4096$ $\log_8 4096 = 4$

f) $16^{1.5} = 64$ $\log_{16} 64 = 1.5$

# Action

**Example 1:** Use the definition of a logarithm to determine the value of each expression.

a) $\log_4 64$

$= \log_4(4^3)$

$= 3$

$\log_4 64 = 3$

b) $\log_3 \frac{1}{27} = x$

$3^x = \frac{1}{27}$

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

$x = -3$ $\log_3 \frac{1}{27} = -3$

c) $\log_2(-4)$

$2^x = -4$

impossible!

d) $\log_5 \sqrt[3]{25}$

$5^x = \sqrt[3]{25}$

$5^x = \sqrt[3]{5^2}$

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

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

$\log_5 \sqrt[3]{25} = \frac{2}{3}$

# Action

**Example 1:** Evaluate each of the following logarithms:

a) $\log_6 1$

$6^x = 1$

$6^0 = 1$

$x = 0$

$\log_6 1 = 0$

b) $\log_5 5^x$

$5^y = 5^x$

$y = x$

$\log_5 5^x = x$

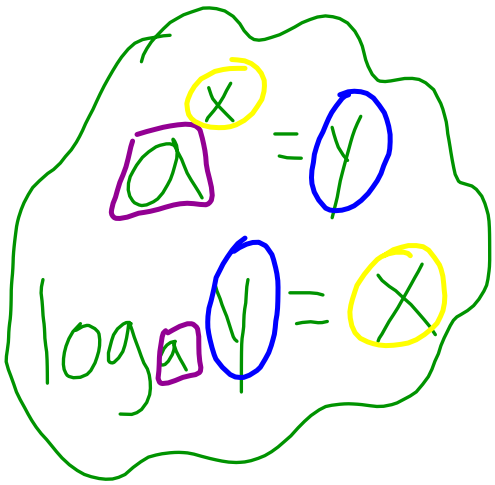
c) $6^{\log_6 x}$

$6^{\log_6 x} = y$

$\log_6 y = \log_6 x$

$x = y$

$6^{\log_6 x} = x$



# Action

**Example 3:** Determine an approximate and an exact value of $\log_5 47$.

*Solution A:* Guess and check

$\log_5 47$

$5^x = 47$

$5^{2.5} = 55.9$

$5^{2.25} = 37.4$

$5^{2.375} = 45.7$

$5^{2.4} = 47.6$

$5^{2.39} = 46.6$

$5^2 = 25$

$5^3 = 125$

* going half-way between our exponents

$5^{2.395} = 47.2$

$5^{2.392} = 47.0$

$\log_5 47 \approx 2.392$

* rounded to 1 decimal place

*Solution B:* Using techology

1. Graph $Y=5^x$ and $Y=47$

2. Find POI

$\log_5 47 = 2.3922312$

## Consolidation

Exit Questions

Evaluate:

a) $\log_2 64$

$2^x = 64$

$x = 6$

$\log_2 64 = 6$

# Consolidation

Exit Questions

Evaluate:

b) $\log_{1/4} x = -2$

$$\left(\frac{1}{4}\right)^{-2} = x$$

$$\left(\frac{4}{1}\right)^{2} = x$$

$$16 = x$$

$$x = 16$$

# Consolidation

## Exit Questions

Evaluate:

c) $\log_2 32^{1/3}$

$2^x = 32^{1/3}$

$2^x = \sqrt[3]{32}$

$2^x = \sqrt[3]{2^5}$

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

$x = 5/3$

$\log_2 32^{1/3} = \frac{5}{3}$

$2^x = 32^{1/3}$

$2^x = 2^{5(1/3)}$

$x = 5/3$

# Consolidation

## Exit Questions

d) $3^{\log_3 11} = y$

$\log_3 y = \log_3 11$

$y = 11$

$3^{\log_3 11} = 11$

$a^x = y$

$\log_a y = x$

## Consolidation

Practice

# Pg. 466

1 - 3, 5, 6, 9 -11, 14

$\log 6 = \log_{10} 6$