

## Math 111 Worksheet #7 Solutions

1. Write the following in exponential form.

$$(a) \log_6 216 = 3 \quad \Rightarrow \quad 6^3 = 216$$

$$(b) \log \sqrt[3]{10} = \frac{1}{3} \quad \Rightarrow \quad 10^{1/3} = \sqrt[3]{10}$$

$$(c) \ln e^2 = 2 \quad \Rightarrow \quad e^2 = e^2$$

2. Write the following in logarithmic form.

$$(a) 2^3 = 8 \quad \Rightarrow \quad \log_2 8 = 3$$

$$(b) 10^{-2} = .01 \quad \Rightarrow \quad \log .01 = -2$$

3. Find the following.

$$(a) 10^{\log 5} = 5$$

$$(b) \ln(e^3) = 3$$

$$(c) e^{\ln(t^2+3)} = t^2 + 3$$

$$(d) \log(10^{25-t}) = 25 - t$$

$$(e) \log 10000 = \log 10^4 = 4$$

$$(f) \ln 5 \quad \text{There is no way to simplify this one. We can approximate it as 1.6094.}$$

4. Solve the following equations.

$$(a) 4^x = 512$$

We can use either log base 10 or log base  $e$ . I will use log base  $e$  or natural log.

$$\begin{aligned} \text{Taking the natural log of both sides:} \quad & \ln(4^x) = \ln(512) \\ & x \cdot \ln(4) = \ln(512) \\ \Rightarrow \quad & x = \frac{\ln(512)}{\ln(4)} = 4.5 \end{aligned}$$

$$\text{Check: } 4^{4.5} = 512 \checkmark$$

$$(b) 5(16^t) = 160$$

Again, we can use either log base 10 or log base  $e$ . I will use log base  $e$  or natural log.

There are a couple of ways to solve.

$$\bullet \text{ Divide by 5 first.} \quad \Rightarrow \quad 16^t = 32$$

$$\begin{aligned} \text{Take the natural log of both sides:} \quad & \ln(16^t) = \ln(32) \\ & t \cdot \ln(16) = \ln(32) \\ \Rightarrow \quad & t = \frac{\ln(32)}{\ln(16)} = 1.25 \end{aligned}$$

- Take the natural log of both sides first:  $\ln(5 \cdot 16^t) = \ln(160)$   
Use a log property:  
 $\ln(5) + \ln(16^t) = \ln(160)$   
 $\ln(5) + t \cdot \ln(16) = \ln(160)$   
 $t \cdot \ln(16) = \ln(160) - \ln(5)$   
 $\Rightarrow t = \frac{\ln(160) - \ln(5)}{\ln(16)} = 1.25$

Check:  $5 \cdot 16^{1.25} = 160 \checkmark$