

Warm -up

1. Write in Exponential form:

a) $\log_3 x = 7$

$$3^7 = x$$

b) $\log_{10} x = 4$

$$10^4 = 100$$

2. Write in Logarithmic form:

a) $5^x = 12$

$$\log_5 12 = x$$

b) $3^9 = x+5$

$$\log_3 (x+5) = 9$$

3. Evaluate.

a) $\log_6 6^4 = \underline{\underline{4}}$

$$6^R = 6^4 \\ \log_8 R = \log_8 5$$

b) $8^{\log_8 5} = \underline{\underline{5}}$

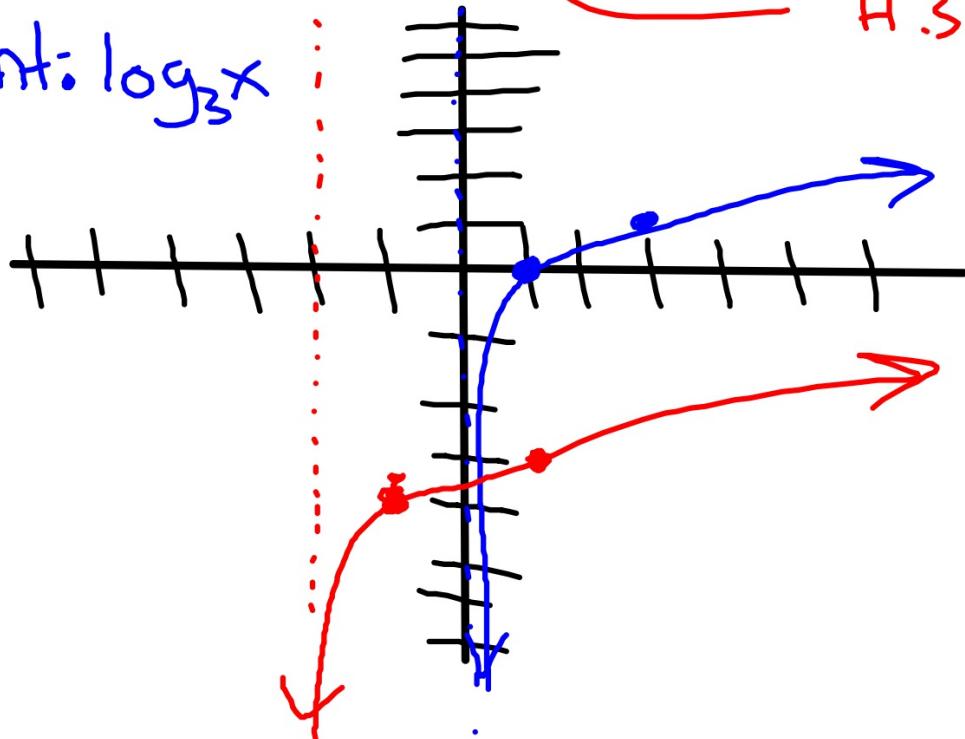
$$8^{\log_8 5} = R$$

$$\log_8 R = \log_8 5$$

Graph the following:

$$\log_3(x+2) - 4$$

Parent: $\log_3 x$



More Practice

$$\log_3 27^x = \underline{3x}$$

$$3^R = 27^x$$

$$3^R = (3)^x$$

$$10^{\log_{10} 5} = \underline{5}$$

$$\log_{10} R = \log_{10} 5$$

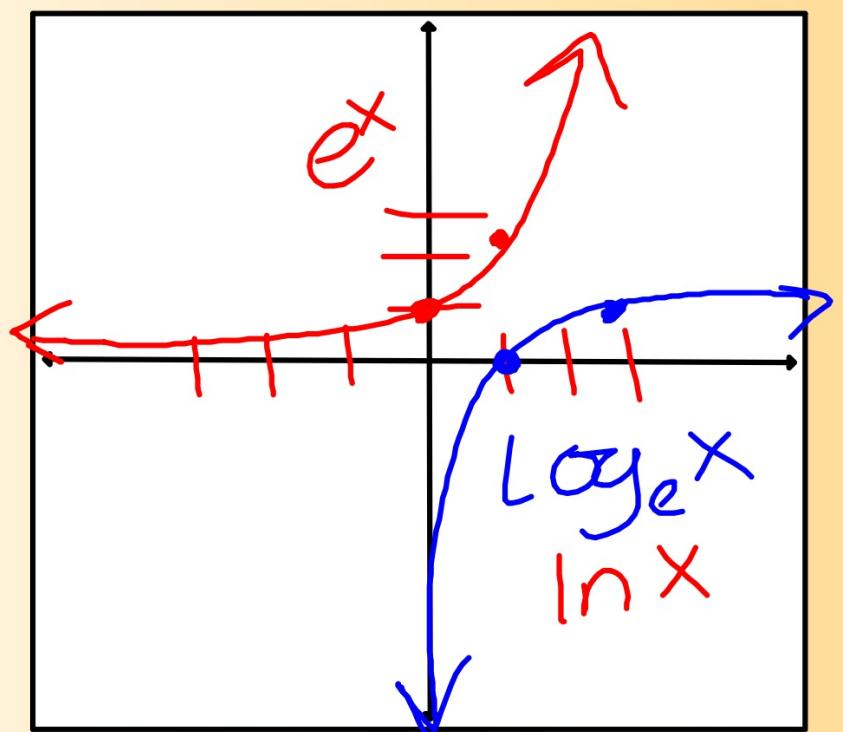
$$\log_7 1 = \underline{0} \quad 7^R = 1$$

The Natural Log

$\log_{10} x$

$\log_e x$

Graph $f(x) = e^x$ and its Inverse



$$f^{-1}(x) =$$

The Natural Logarithmic Function

$\log_e x$ is written as $\ln x$

where $x > 0$

Evaluating Natural Logs

$$f(x) = \ln x$$

$$1) f(2) = 0.693$$

$$2) f(0.3) = -1.20$$

$$3) f(-.07) = \text{A nonreal answer}$$

Properties of Natural Logarithms

1. $\ln 1 = \textcircled{O}$

$$\log_e 1 = \textcircled{X} \quad e^R = 1$$

2. $\ln e = 1$

$$\log_e e = \textcircled{X} \quad e^R = e$$

3. ~~$\ln(e^x) = \textcircled{X}$~~

$$\log_e e^R = R \quad e^R = e^x$$
$$e^{\ln x} = \textcircled{X}$$
$$\log_e x = R$$

4. $\ln x = \ln y$

$$x = y$$

$$\sqrt{x} = \sqrt{y}$$
$$x = y$$

One to One Property

$$\log_e R = \log_e x$$

Using Properties of Natural Logarithms

Example 1: Simplify $\ln\left(\frac{1}{e}\right) = -1$

$$\log_e\left(\frac{1}{e}\right) = R \quad e^R = \frac{1}{e}$$

Example 2: Simplify $e^{\ln 5} = 5$

$$e^{\log_e 5} = R \quad \log_e R = \log_e 5$$

Example 3: Simplify $6 \ln e = 6$

$$6 \log_e e = R$$
$$\log_e e^6 = R$$

Using Properties of Natural Logarithms

Example 4: Simplify $\ln 1$

$$\frac{\log_e 1}{3} = \textcircled{O}$$
$$\cancel{3} \quad \log_e 1 = 3R$$

Example 5: Simplify $\ln e$

$$\frac{\log_e e}{4} = \frac{1}{\cancel{4}} \quad \textcircled{O} = 3R$$
$$\cancel{4} \quad \log_e e = 4R \quad e^{\cancel{4}R} = e^1 \quad \frac{1}{\cancel{4}} = \frac{4R}{4}$$

Example 6: Simplify

$$15 \ln 1 = \textcircled{O}$$

Example 7: Simplify

$$\ln e^{(1/3)} = \frac{1}{\cancel{4}} = R$$
$$\log_e e^{\cancel{3}R} = R \quad e^{\cancel{3}R} = e^{1/3}$$

More Examples

$$\log_2(16) = \underline{\underline{4}}$$

$2^R = 16$

$$\ln e^{-2} = \underline{\underline{-2}}$$

$$e^{\ln(12)} = \underline{\underline{12}}$$

$e^{\log_e 12} = R$

$\log_e R = \log_e 12$

$$\log (1/10) = \underline{\underline{-1}}$$

$$\log_{10} (\frac{1}{10}) = R$$

$$\log_{10} \underline{\underline{R}} = \frac{1}{10}$$

$$\log_2 8^4 = \underline{\underline{12}}$$

$$\log_2 8^4 = R$$

$$2^R = 8^4 \Rightarrow 2^R = (2^3)^4$$

$$\ln (1/e^3) = \underline{\underline{-3}}$$

$$\log_e \underline{\underline{(e^3)}} = R$$

Write in Log Form: $e^5 = 148.41$

$$\log_e 148.41 = 5 \quad (\ln 148.41 = 5)$$

Write in Exponential Form: $\ln 4 = 1.39$

$$e^{1.39} = 4 \quad \log_e 4 = 1.39$$

