

Key

## Math III Logs and Exponential

Transforming from exponential form to logarithmic form

**Exponential Form**

$$y = b^x$$

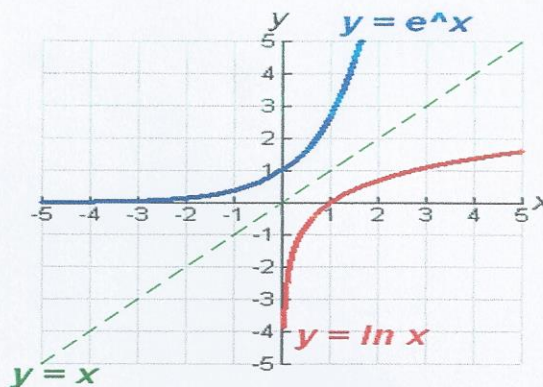
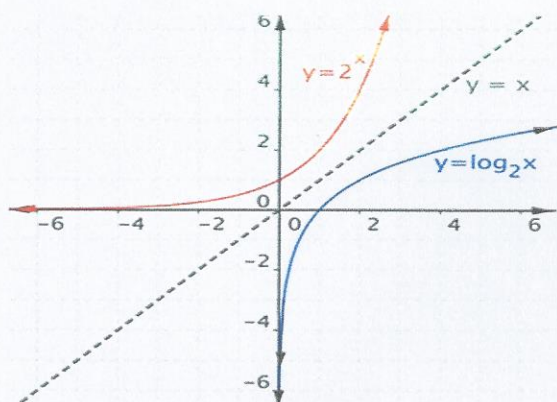
$$y = e^x$$

**Logarithmic Form**

$$y = \log_b x$$

$$y = \ln x$$

$y = b^x$  and  $y = \log_b x$  are inverses of each other as well as  $y = e^x$  and  $y = \ln x$ . Their graphs are reflections across the  $y = x$  line



### Logarithm Rules

$$\log_b(xy) = \log_b x + \log_b y$$

$$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$$

$$\log_b(x^y) = y \log_b x$$

$$\log_b x = \frac{\log x}{\log b}$$

1. Which is the function  $2^{x-1} = 8$  written in logarithmic form?

A.  $\log_2 x - 1 = 8$

C.  $\log_8 x - 1 = 2$

B.  $x = \log_2 8 + 1$

D.  $x = \log_2 8 - 1$

$$\begin{aligned} 2^{x-1} &= 8 \\ \log_2 8 &= x-1 \\ +1 & \quad +1 \\ x &= \log_2 8 + 1 \end{aligned}$$

$$\frac{4500}{2500} = \frac{2500 e^{.08x}}{2500}$$

$$\frac{9}{5} = e^{.08x} \rightarrow \ln\left(\frac{9}{5}\right) = \frac{.08x}{.08}$$

$$x = \frac{\ln\left(\frac{9}{5}\right)}{.08}$$

2. Sally opened a savings account that earns 8% interest compounded continuously in order to save money for a \$4500 car. So far Sally has saved \$2500. How many years did it take for Sally to save enough money to buy the car if she did not add any more money to the account?

- A.  $x = \frac{\ln\left(\frac{9}{5}\right)}{.08}$       B.  $x = \frac{.08}{\ln\left(\frac{9}{5}\right)}$       C.  $x = \log_{1.08}\left(\frac{9}{5}\right)$       D.  $x = \log_9 1.08$

3. Which of the following is equivalent to  $e^{4x} = 2981$ ?

- A.  $x = \frac{\ln 2981}{4}$       B.  $x = \frac{4}{\ln 2981}$       C.  $x = \frac{\ln 4}{2981}$       D.  $x = \frac{2981}{\ln 4}$

$$\ln e^{4x} = \ln 2981$$

$$4x = \frac{\ln 2981}{4}$$

$$x = \frac{\ln 2981}{4}$$

4. Which of the following is equivalent to  $2^{3x-4} = 32$ ?

- A.  $x = \frac{\log_2 32}{3} + 4$       B.  $x = \frac{\log_2 32+4}{3}$       C.  $\log_2 3x - 4 = 32$

$$2^{3x-4} = 32$$

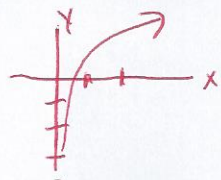
$$\log_2(32) = 3x - 4$$

$$\frac{\log_2(32) + 4}{3} = \frac{3x}{3}$$

$$x = \frac{\log_2(32) + 4}{3}$$

5. Given the function:  $f(x) = 2 \log_2(2x)$

A. Sketch the graph



B. State the x-intercept?  
 $x = 1/2$

C. State the domain and range? Domain  $x > 0$   
Range  $\mathbb{R}$

D. Describe the end behavior as  $x$  approaches  $\infty$ .  
 $x \rightarrow +\infty \quad f(x) \rightarrow +\infty$