

## Logarithmic Functions

$$y = \log_a x \quad x = a^y \text{ (exponential form)}$$

### Properties of Logarithms

1.  $\log_a 1 = 0$  because  $a^0 = 1$
2.  $\log_a a = 1$  because  $a^1 = a$
3.  $\log_a a^x = x$  and  $a^{\log_a x} = x$  Inverse Property
4. If  $\log_a x = \log_a y$  then  $x = y$  One-to-one

### Natural Logarithms

$$y = \ln x \text{ if } x = e^y$$

### Properties of Logarithms

1.  $\ln 1 = 0$  because  $e^0 = 1$
2.  $\ln e = 1$  because  $e^1 = e$
3.  $\ln e^x = x$  and  $e^{\ln x} = x$  inverse properties
4. If  $\ln x = \ln y$  then  $x = y$  one-to-one

### Logarithmic Properties

1. Product  $\log_a(xy) = \log_a x + \log_a y$
2. Quotient  $\log_a(x/y) = \log_a x - \log_a y$
3. Power  $\log_a x^y = y \log_a x$

### Natural Logarithmic Properties

1. Product  $\ln(xy) = \ln x + \ln y$

Use calculator to evaluate the function

a.  $\log_{10}10 = 1$

b.  $\log_{10}2.5 = .3979400$

c.  $\ln 2 = .6931472$

d.  $\ln(-1) = \text{ERROR}$  domain of  $\ln x$  is the set of positive real numbers,  
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