

## 11-6 Natural Logarithms

Logarithms that are based on the number  $e$  rather than 10, we are using natural logarithms.

Natural logarithms are abbreviated  $\ln x$ .

$$\log_e x = \ln x$$

If  $\ln e = x$  and  $e^x = e$ , then  $x = 1$  and so  $\ln e = 1$

Each of the properties of common logarithms are also true for natural logarithms.

Product  $\log_e mn = \log_e m + \log_e n$ ;  $\ln mn = \ln m + \ln n$

Quotient  $\log_e \frac{m}{n} = \log_e m - \log_e n$ ;  $\ln \frac{m}{n} = \ln m - \ln n$

Power  $\log_e m^p = p \log_e m$ ;  $\ln m^p = p \ln m$

Equality  $\log_e m = \log_e n$  then  $m = n$ ;  $\ln m = \ln n$ ;  $m = n$

As with common logarithms, natural logarithms also can be reversed with an antilogarithm that is written as  $\text{anti} \ln x$ . If  $\ln x = a$  then  $x = \text{anti} \ln a$ .

Normally  $\text{anti} \ln x$  is written as  $e^x$ .

