$$y = \left(1 + \frac{1}{x}\right)^x$$

x	y
10	2.5937
100	2.7048
1000	2.7169
10,000	2.7181

$\downarrow$

e

Base e and Natural Logarithms — Section 9.5

The natural base, $e = \left(1 + \frac{1}{n}\right)^n$ as $n \to \infty$

natural number

≈ 2.7183

1. $e^2 \approx 7.3891$

2. $e^{-1.3} \approx .2725$

The logarithm with base e is called the natural logarithm, sometimes denoted by $\log_e x$, but more often abbreviated $\ln x$.

$\log_e x = \ln x$

① $\ln e = 1$

$\ln e = \log_e e$

$e^n = e$

② $\ln 4$

≈ 1.3863

$\ln 4 = \log_e 4$

$e^n = 4$

③ $\ln 0.05$

-2.9957

$\ln .05 = \log_e .05$

$e^n = .05$

Write an equivalent exponential or logarithmic equation.

$\log_b x = y \leftrightarrow b^y = x$

1. $e^x = 5$

$\ln 5 = x$

$\log e^x = \log 5$

$x \log e = \log 5$

$x = \frac{\log 5}{\log e}$

2. $e^x = 16$

$\ln 16 = x$

3. $\ln x \approx 0.6931$

$e^{0.6931} = x$

4. $\ln x \approx 0.5352$

$e^{0.5352} = x$