9-5 Study Guide and Intervention
Base e and Natural Logarithms

Base e and Natural Logarithms The irrational number $e \approx 2.71828...$ often occurs as the base for exponential and logarithmic functions that describe real-world phenomena.

Natural Base e	As n increases, $\left(1 + \dfrac{1}{n}\right)^n$ approaches $e \approx 2.71828....$ $\ln x = \log_e x$

The functions $y = e^x$ and $y = \ln x$ are inverse functions.

Inverse Property of Base e and Natural Logarithms	$e^{\ln x} = x$ $\quad$ $\ln e^x = x$

Natural base expressions can be evaluated using the e^x and ln keys on your calculator.

Example 1 **Evaluate ln 1685.**
Use a calculator.
$\ln 1685 \approx 7.4295$

Example 2 **Write a logarithmic equation equivalent to $e^{2x} = 7$.**
$e^{2x} = 7 \rightarrow \log_e 7 = 2x$ or $2x = \ln 7$

Example 3 **Evaluate $\ln e^{18}$.**
Use the Inverse Property of Base e and Natural Logarithms.
$\ln e^{18} = 18$

Exercises

Use a calculator to evaluate each expression to four decimal places.

1. $\ln 732$ **2.** $\ln 84{,}350$ **3.** $\ln 0.735$ **4.** $\ln 100$

5. $\ln 0.0824$ **6.** $\ln 2.388$ **7.** $\ln 128{,}245$ **8.** $\ln 0.00614$

Write an equivalent exponential or logarithmic equation.

9. $e^{15} = x$ **10.** $e^{3x} = 45$ **11.** $\ln 20 = x$ **12.** $\ln x = 8$

13. $e^{-5x} = 0.2$ **14.** $\ln (4x) = 9.6$ **15.** $e^{8.2} = 10x$ **16.** $\ln 0.0002 = x$

Evaluate each expression.

17. $\ln e^3$ **18.** $e^{\ln 42}$ **19.** $e^{\ln 0.5}$ **20.** $\ln e^{16.2}$

Lesson 9-5