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The function  $y = e^x$  has an inverse, the **natural logarithmic function**,  $y = \log_e x$ , or  $y = \ln x$ .

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**Problem 1** Simplifying a Natural Logarithmic Expression

a.  $\ln 7 + 2 \ln 5$

b.  $3 \ln x - 2 \ln 2x$

c.  $3 \ln x + 2 \ln y + \ln 5$

**A Practice** Write each expression as a single natural logarithm.

1.  $4 \ln 8 + \ln 10$

2.  $2 \ln 8 - 3 \ln 4$

**Problem 2** Solving a Natural Logarithmic Equation**Got It?** What are the solutions of each equation?

a.  $\ln x = 2$

b.  $\ln (3x + 5)^2 = 4$

c.  $\ln 2x + \ln 3 = 2$

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**A Practice** Solve each equation. Check your answers.

3.  $2 \ln 2x^2 = 1$

4.  $\ln (2m + 3) = 8$

**Problem 3** Solving an Exponential Equation**Got It?** What is the solution of each equation?

a.  $e^{x-2} = 12$

b.  $2e^{-x} = 20$

c.  $e^{3x} + 5 = 15$

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**A Practice** Use natural logarithms to solve each equation.

5.  $e^{x+1} = 30$

6.  $7 - 2e^{\frac{x}{2}} = 1$