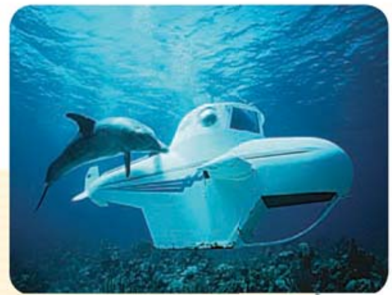
7.3 Use Functions Involving e

TEKS 2A.4.B, 2A.11.B, 2A.11.C, 2A.11.F



Before You studied exponential growth and decay functions.

Now You will study functions involving the natural base e.

Why? So you can model visibility underwater, as in Ex. 59.

Key Vocabulary
- natural base e

The history of mathematics is marked by the discovery of special numbers such as π and i. Another special number is denoted by the letter e. The number is called the **natural base e** or the *Euler number* after its discoverer, Leonhard Euler (1707–1783). The expression $\left(1 + \frac{1}{n}\right)^n$ approaches e as n increases.

n	10^1	10^2	10^3	10^4	10^5	10^6
$\left(1 + \frac{1}{n}\right)^n$	2.59374	2.70481	2.71692	2.71815	2.71827	2.71828

KEY CONCEPT *For Your Notebook*

The Natural Base e

The natural base e is irrational. It is defined as follows:

As n approaches $+\infty$, $\left(1 + \frac{1}{n}\right)^n$ approaches $e \approx 2.718281828$.

EXAMPLE 1 Simplify natural base expressions

REVIEW EXPONENTS
For help with properties of exponents, see p. 330.

Simplify the expression.

a. $e^2 \cdot e^5 = e^{2+5}$
$= e^7$

b. $\frac{12e^4}{3e^3} = 4e^{4-3}$
$= 4e$

c. $(5e^{-3x})^2 = 5^2(e^{-3x})^2$
$= 25e^{-6x} = \frac{25}{e^{6x}}$

EXAMPLE 2 Evaluate natural base expressions

Use a calculator to evaluate the expression.

Expression	Keystrokes	Display
a. e^4	2nd [e^x] 4) ENTER	54.59815003
b. $e^{-0.09}$	2nd [e^x] (–) .09) ENTER	0.9139311853