7.3 Functions Involving e

Evaluate $\left(1 + \dfrac{1}{n}\right)^{n}$

for n = 1, n = 10, n = 100, n = 1000, n = 10,000, n = 100,000

The natural base e is irrational and is defined as

$$\text{the value as n} \rightarrow \infty, \left(1 + \frac{1}{n}\right)^{n}$$

$$e \approx 2.71828...$$

Example:

$$e^9 \cdot e^2$$

e^{11}

Example:

$$\frac{60e^8}{12e^3}$$

$5e^5$

Example:

$$(-10e^{-5x})^3$$

$\dfrac{-1000}{e^{15x}}$

Example:

Evaluate with a calculator: e^6

$$e^{-0.28}$$

We learned about compound interest in 7.1.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$
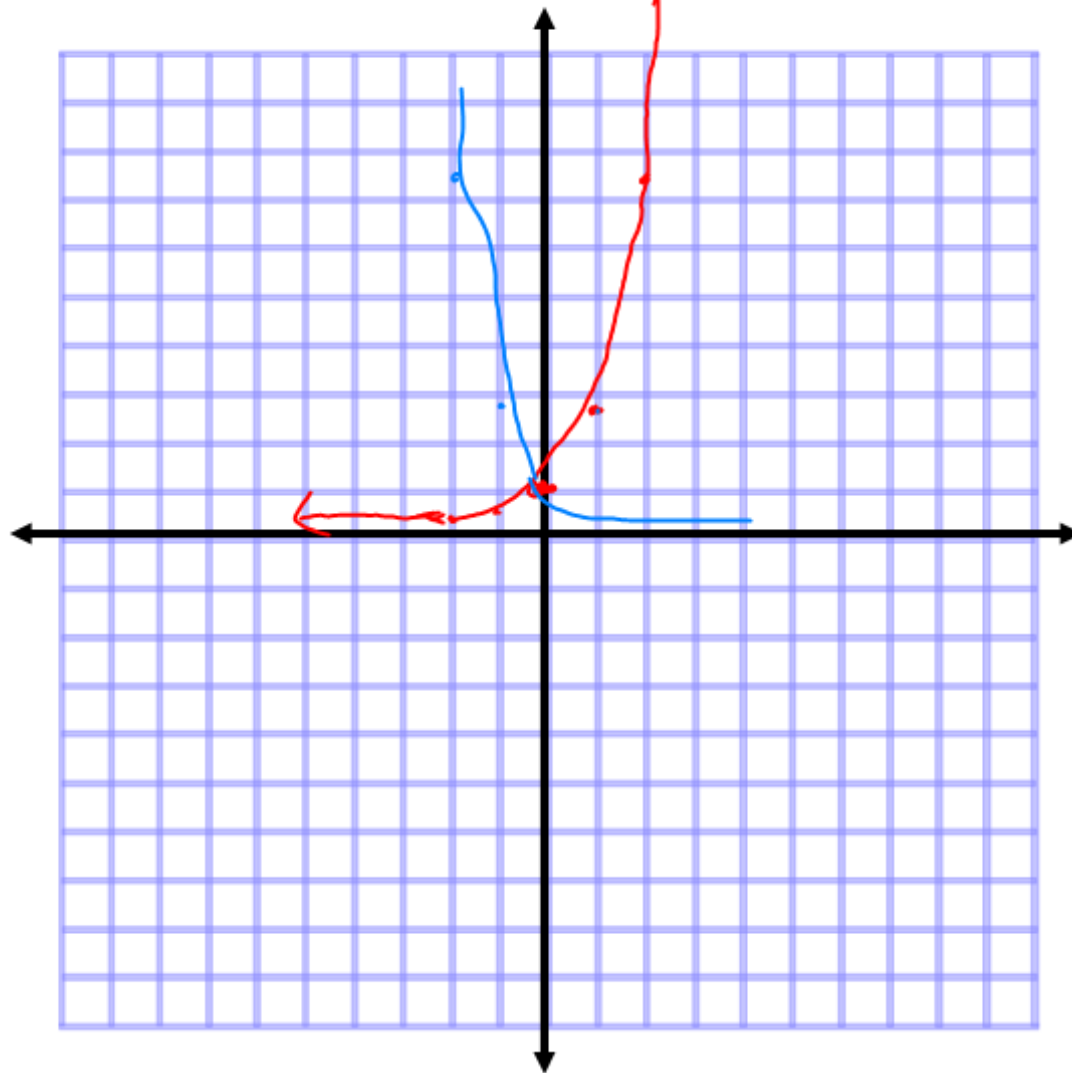
as n $\longrightarrow \infty$, the formula becomes

A = Pe^{rt}, compounded continuously.

Example: You deposit $2500 in an account that pays 5% annual interest compounded continuously. Find the balance after 5 years.

Graphing natural base functions:

Graph: $y = e^x$

$$y = e^{-x}$$

$$\left(\frac{1}{e}\right)^x$$

Pg 495 4 – 16 even, 19, 20, 27, 31 – 34, 56, 58, 68

SIMPLIFYING EXPRESSIONS Simplify the expression.

3. $e^3 \cdot e^4$

4. $e^{-2} \cdot e^6$

5. $(2e^{3x})^3$

6. $(2e^{-2})^{-4}$

7. $(3e^{5x})^{-1}$

8. $e^x \cdot e^{-3x} \cdot e^4$

9. $\sqrt{9e^6}$

10. $e^x \cdot 5e^{x+3}$

11. $\dfrac{3e}{e^x}$

12. $\dfrac{4e^x}{e^{4x}}$

13. $\sqrt[3]{8e^{9x}}$

14. $\dfrac{6e^{4x}}{8e}$

15. ★ **MULTIPLE CHOICE** What is the simplified form of $(4e^{2x})^3$?

Ⓐ $4e^{6x}$ Ⓑ $4e^{8x}$ Ⓒ $64e^{6x}$ Ⓓ $64e^{8x}$

16. ★ **MULTIPLE CHOICE** What is the simplified form of $\sqrt{\dfrac{4(27e^{13}x)}{3e^7x^{-3}}}$?

Ⓐ $6e^{10}x$ Ⓑ $6e^6x^4$ Ⓒ $\dfrac{6e^3}{x^2}$ Ⓓ $6e^3x^2$

EVALUATING EXPRESSIONS Use a calculator to evaluate the expression.

19. e^3 20. $e^{-3/4}$ 27. $2e^{-0.3}$ 22. $e^{1/2}$

GROWTH OR DECAY Tell whether the function is an example of *exponential growth* or *exponential decay*.

31. $f(x) = 3e^{-x}$ 32. $f(x) = \dfrac{1}{3}e^{4x}$ 33. $f(x) = e^{-4x}$ 34. $f(x) = \dfrac{3}{5}e^x$

56. **BIOLOGY** Scientists used traps to study the Formosan subterranean termite population in New Orleans. The mean number y of termites collected annually can be modeled by $y = 738e^{0.345t}$ where t is the number of years since 1989. What was the mean number of termites collected in 1999?

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58. **FINANCE** You deposit $800 in an account that pays 2.65% annual interest compounded continuously. What is the balance after 12.5 years?

68. $\sqrt{15x + 34} = x + 6$ *(p. 452)*