

1. You deposit \$1000 in a savings account. Which of the following will produce the largest balance?

- a. 6% annual interest rate, compounded annually
- b. 6% annual interest rate, compounded continuously
- c. 6.25% annual interest rate, compounded quarterly

Sketch the graphs in the same viewing window. Prove your findings and explain your reasoning.

$$.) A = 1000 \left(1 + \frac{.06}{1} \right)^{1.1} = \$1060$$

$$) A = 1000 e^{.06 \cdot 1} = \$1061.84$$

$$) A = 1000 \left(1 + \frac{.0625}{4} \right)^{4.1} = \$1063.98$$

2. Which would produce a larger balance: an annual interest rate of 8.05% compounded monthly or an annual interest rate of 8% compounded continuously? Explain. Use your graphing calculator as an aid.

3. You deposit \$1000 in each of two savings accounts. The interest for the accounts is paid according to the two options described in Question 2. How long would it take for the balance in one of the accounts to exceed the balance in the other account by \$100? By \$100,000? Use your graphing calculator as an aid.

4. A population of insects is modeled by the equation $P(t) = 4000e^{0.02t}$ where t is the time in days.

- a. What is the initial population of insects?
- b. What will the population be in one week?

4000

$$P(7) = 4000 e^{0.02(7)} \\ = \boxed{4601}$$

5. Sociologists have found that information spreads among a population at an exponential rate. Suppose that the function $y = 525 (1 - e^{-0.038t})$ models the number of people in a town of 525 people who have heard news within t hours of its distribution.

- a. How many people have heard about the opening of a new grocery store within 24 hours of the announcement?
- b. Graph the function on a graphing calculator. When will 90% of the people have heard about the grocery store opening?

$$a) y = 525(1 - e^{-0.038(24)})$$

$$= 314$$

$$b) 60.846$$

on graphing calc.

6. Suppose the number of flies in a population is modeled by the equation $Q(t) = 20e^{0.03t}$ where t is in hours.

- a. What is the initial number of flies in the population? 20
- b. How many flies will there be in three days?

$$\begin{aligned} Q(3) &= 20e^{.03(72)} \\ &= \boxed{173} \end{aligned}$$

7. The Kwans are saving for their daughter's college education. If they deposit \$12,000 in an account bearing 6.4% interest compounded continuously, how much will be in the account when Ann goes to college in 12 years?

$$A = Pe^{rt}$$

$$A = 12000e^{.064(12)}$$

$$= \$25,865.41$$

8. The yield, y , in millions of cubic feet of trees per acre for a forest stand that is t years old is given by $y = 6.7e^{\frac{-48.1}{t}}$.

- a. Find the yield after 15 years. • 271
- b. Find the yield after 50 years. 2.560
- c. Graph the yield per year on a graphing calculator for 150 years. Does the yield ever decrease? If so, when?

9. We have a beetle problem. A researcher has estimated that the initial population of beetles in Bucks County is 2000 and it is increasing at a rate of 11% per week. If we reach 10,000 beetles by the end of the summer (16 weeks) we will have a state of emergency. By your calculations, is this going to occur?

$$A = Pe^{rt}$$

$$A = 2000 e^{.11(16)}$$

$$A = 11,625$$

Yes

10. Although it remains the sixth largest state, Pennsylvania's population growth remains among the slowest in the nation at 1.2%, which ranks the state 46th in population growth. If this trend continues, what will Pennsylvania's population be in 2025, if it was 12,500,000 in 2006?

$$A = 12,500,000 e^{.012 \cdot 19}$$

$$A = 15,701,067 \text{ people}$$

11. Business owners keep track of the value of their assets for tax purposes. Suppose the value of a computer depreciates at a rate of 25% a year. Determine the value of a laptop computer two years after it has been purchased for \$3750.

Year 0 \rightarrow \$3750

Year 1 \rightarrow \$2812.50

Year 2 \rightarrow \$2109.38

12. Find the projected population of each location in 2015.

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- a. In Honolulu County, HI, the population was 876,156 in 2000. The average yearly rate of growth is 0.74%.
 - b. The population in Kings County, NY has demonstrated an average increase of 0.53% over several years. The population in 2000 was 2,465,326.
 - c. Rock County, Wisconsin had a population of 139,510 in 1990 and 152,307 in 2000.
 - d. The population in Linn County, Iowa was 168,767 in the 1990 U.S. Census and 191,701 in the 2000 U.S. Census.

$$a) A = 876,156 e^{.074 \cdot 15}$$

$$A = 2,658,571$$

$$b) A = 2,465,326 e^{.053 \cdot 15}$$

$$A = 5,459,319$$

$$d) 191,701 - 168,767 = \frac{22,934}{10} = 2,293.4$$

$$A = 139,510 e^{.009(25)} \approx 174,700$$

$$c) 152,307 - 139,510 = \frac{12,797}{10} = \frac{1,279.7}{139,510} = .009 \left\{ \begin{array}{l} A = 139,510 \\ A \approx 174,700 \end{array} \right.$$