

Adv Alg - Exponential Functions  
More application problems

Name \_\_\_\_\_

1. The amount in trillions of cubic feet of natural gas consumed in the United States from 1940 to 1970 can be modeled by the function  $y = a(1.07)^t$ , where  $t$  is the number of years since 1940.

(a) Assuming 2.91 trillion cubic feet of natural gas was consumed in the US in 1940, estimate how many cubic feet were consumed in 1937.

$$y = 2.91(1.07)^{-3} \quad \boxed{y \approx 2.38 \text{ trillion cubic feet}}$$

(b) Predict the natural gas usage for 2012.

$$y = 2.91(1.07)^{72} \quad \boxed{y \approx 379.77 \text{ trillion cubic feet}}$$

2. From 1971 to 1995, the average number of transistors on a computer chip can be modeled by the function  $y = a(1.59)^t$ , where  $t$  represents the number of years since 1971.

(a) Assuming there was an average of 2300 transistors per chip in 1971, estimate the number of transistors on each chip in 1998.

$$y = 2300(1.59)^{27} \quad \boxed{y \approx 630,159,071 \text{ transistors}}$$

(b) How many transistors were used on each chip in 2011?

$$y = 2300(1.59)^{40} \quad \boxed{y = 2.615849832 \times 10^{11} \text{ transistors}}$$

3. Connor the contractor likes to buy houses, remodel them, live in them for a while and then sell the house and buy another one. Seven and a half years ago, he paid \$137,000 for the house he now lives in. During that time, house values have appreciated according to the model  $y = a(1.024)^t$  where  $a$  is the initial value and  $t$  is time in years.

(a) How much is his house worth now?

$$y = 137,000(1.024)^{7.5} \quad \boxed{y = \$163,670.44}$$

(b) Connor decides to use a real estate agent to sell the house. He must pay the agent a commission of 3.5% of the selling price of the house. Connor has found a buyer willing to pay \$173,900 for the house. After the real estate agent is paid, how much profit will Connor make on the sale of the house?

$$173,900(0.035) = \$6,086.50 \quad \text{profit} \quad 167,813.50$$

$$\text{agent commission: } 173,900 - 6,086.50 = \$167,813.50 \quad \begin{array}{r} 167,813.50 \\ - 137,000.00 \\ \hline \boxed{\$30,813.50} \end{array}$$

4. Since 1972 the US Fish and Wildlife Service has kept a list of endangered species in the United States. In 1972 there were 119 species on the endangered list. For the years from 1972 to 1998, the number of species on the list can be modeled by the equation  $y = ae^{0.0917t}$  where  $t$  is the number of years since 1972.

Estimate the number of species on the endangered list at the present time.  $\rightarrow 2015 - 1972 = 43$

$$y = 119e^{0.0917(43)}$$

$$\boxed{y = 6137 \text{ endangered species}}$$

5. One hundred grams of radium is stored in a container. The amount (in grams) of radium present after  $t$  years can be modeled by the function  $y = ae^{-0.00043t}$ . How much of the radium will be present after 10,000 years?

$$y = 100e^{-0.00043(10,000)}$$

$$y \approx 1.36 \text{ radium present}$$

6. The area of a wound decreases exponentially with time. The area of a wound after  $t$  days can be modeled by the function  $y = ae^{-0.05t}$ . If the initial wound area is 4 square centimeters, how much of the wound area is present after 14 days?

$$y = 4e^{-0.05(14)}$$

$$y \approx 1.99 \text{ cm}^2$$

7. Little Susie is 11 years old today.

Her parents want to begin a savings account to help pay Susie's college expenses. So, as a birthday gift, Susie's parents open a savings account for her with \$5725 at a bank that compounds interest monthly at an interest rate of  $1\frac{3}{8}\%$ .

Susie's grandparents opened a college savings account for her on the day she was born. They invested \$250 in an account that compounds interest continuously at a rate of  $2\frac{1}{2}\%$ .

Susie will begin college on her 18<sup>th</sup> birthday.

(a) How much money will be in the account her parents established for her?

$$A = 5725 \left(1 + \frac{0.01375}{12}\right)^{12(7)}$$

$$A = \$6,303.07$$

(b) How much money will be in the account her grandparents established for her?

$$A = 250e^{0.0225(18)}$$

$$A = \$374.83$$

8. Two brothers won \$16,000 in the lottery and decided to split the money evenly.

John invested \$4000 at an rate of 2% compounded continuously at one bank and \$4000 at another bank that paid 3% interest compounded weekly.

James invested 75% of his share at a bank that pays  $2\frac{1}{2}\%$  compounded continuously and the rest at a bank paying  $3\frac{1}{4}\%$  compounded quarterly.

(a) At the end of 2 years, how much money will John have?

$$A = 4,000 \left(1 + \frac{0.02}{52}\right)^{52(2)} \approx 4,247.27$$

$$A = 4,000e^{0.02(2)} \approx 4,163.24$$

$$+ \$8,410.51$$

(b) At the end of the 2 years, how much money will James have?

$$A = 6,000e^{0.025(2)} \approx 6,307.63$$

$$A = 2,000 \left(1 + \frac{0.0325}{4}\right)^{4(2)} \approx 2,133.76$$

$$+ \$8,441.39$$