HUNGERFORD/LIAL (GRAPHING) APPLICATIONS PROBLEMS

Chapter 5, Section 1

Physics In order to launch a rocket or other object into space from the surface of a planet or other celestial body, the object must be launched with *escape velocity*. The escape velocity of a celestial body is related to its mass and radius by the equation $v = \sqrt{\frac{2GM}{R}}$, where G is a constant with the value of about 6.7×10^{-11}. Find the escape velocity, in kilometers per hour, for the following celestial bodies. Give your answer in scientific notation, rounded to one digit.

(a) Sun: $M = 2 \times 10^{30}$, $R = 7 \times 10^{8}$

(b) Earth: $M = 6 \times 10^{24}$, $R = 6 \times 10^{6}$

(c) Moon: $M = 7 \times 10^{22}$, $R = 2 \times 10^{6}$

Chapter 5, Section 3

Social Science The number of persons in the United States who are over the age of 65 has been increasing rapidly in this century. From the years 1900 to 2000, the number of thousands of persons over the age of 65 can be accurately modeled by the equation

$$y = \frac{40{,}644.58}{\left(1 + e^{6.98 - 0.077x}\right)^{\frac{1}{2.65}}}$$, where $x = 0$ represents the year 1900.

Over the same time period, the total population (in thousands) of the United States can be modeled by the equation

$y = 82{,}998.57e^{0.012x}$, where $x = 0$ represents the year 1900.

Source: U.S. Bureau of the Census (Universal Almanac 1997, pages 304 and 305)

(a) Use a graphing utility to graph both equations on the same coordinate axis. Compare the two graphs.
(b) What would the model predict that the number of people over the age of 65 would be in the year 1970? Compare this with 20,107 thousand , which is the actual number of people over age 65 in the population that year. Based on this result, do you think this is a good model? Explain.
(c) How many more persons over the age of 65 lived in the United States in 1990 than in 1910?
(d) What percent of the total population was over the age of 65 in 1990? In 1910?

Chapter 5, Section 5

Natural Science The loudness of sound is measured in units called decibels. The decibel rating of a sound is given by $D(i) = 10 \log\left(\frac{i}{i_0}\right)$ where i is the intensity of the sound and i_0 is the minimum intensity detectable by the human ear (the so-called *threshold sound*). Find the decibel rating of each of the following sounds whose intensities are given. Round answers to the nearest whole number.

(a) Car without muffler, $10{,}800{,}000{,}000 i_0$

(b) Toilet flushing, $5{,}020{,}000 i_0$

(c) Cat purring, $32 i_0$

(d) Conversation (average), $1{,}100{,}000 i_0$

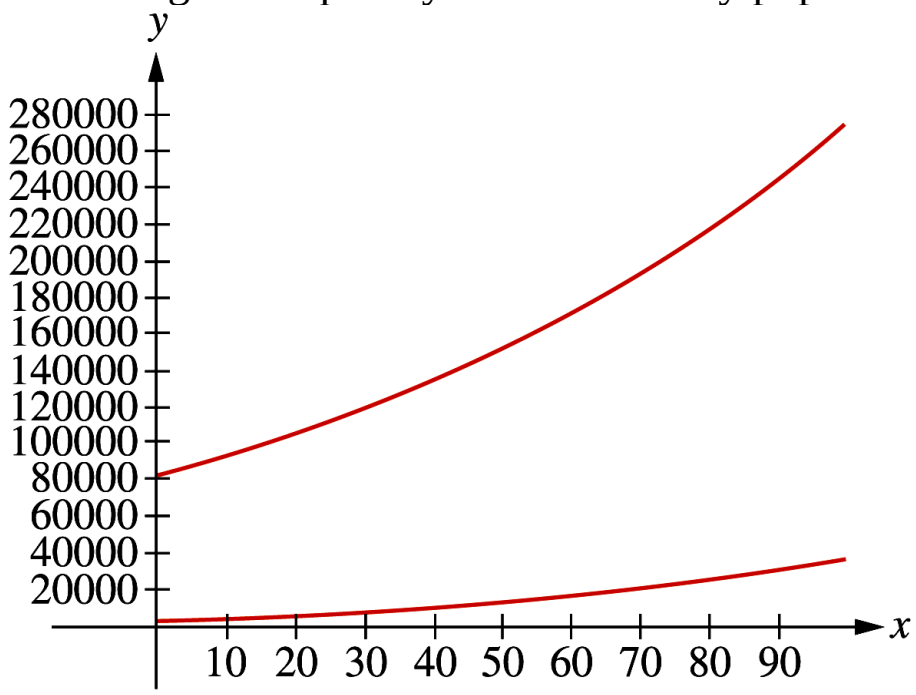
HUNGERFORD/LIAL (GRAPHING)
ANSWERS

Chapter 5, Section 1

(a) 6×10^5 kilometers per hour
(b) 1×10^4 kilometers per hour
(c) 2×10^3 kilometers per hour

Chapter 5, Section 3

(a) They are both increasing, but the total population is increasing more quickly than the elderly population.



(b) 20,797.5 thousand, it is 690.5 thousand more than the actual number; Answers will vary.
(c) 27,093.64 thousand
(d) 1990: About 12.68%; 1910: About 4.17%

Chapter 5, Section 5

(a) 100 decibels
(b) 67 decibels
(c) 15 decibels
(d) 60 decibels