Bruce Wei

P421-69 $\quad y = Ce^{kt}$

a). $\begin{cases} 125 = Ce^{2k} \\ 350 = Ce^{4k} \end{cases}$

$e^{2k} = \frac{350}{125} = \frac{14}{5}$

$k = \frac{1}{2} \ln \frac{14}{5} \approx 0.515$

$\therefore C = \frac{y}{e^{0.515t}}$

$= \frac{125}{e^{0.515 \times 2}}$

≈ 45

b) $y = 45e^{0.515t}$

c) $y = 45 \cdot e^{0.515 \times 8}$

$= 2770$

d) $45e^{0.515t} = 25000$

$t = 12.27$

ses 33–40, complete the table for

Initial Quantity	Amount After 1000 *Years*	Amount After 10,000 *Years*
20 g		
	1.5 g	
		0.1 g
		3 g
5 g		
	1.6 g	
	2.1 g	
		0.4 g

Radioactive radium has a half-life of
years. What percent of a given amount
ars?

rbon-14 dating assumes that the carbon
lay has the same radioactive content as it
this is true, the amount of ^{14}C absorbed by
ral centuries ago should be the same as the
rbed by a tree growing today. A piece of
tains only 15% as much of the radioactive
modern charcoal. How long ago was the
the ancient charcoal? (The half-life of ^{14}C

Exercises 43–48, complete the table for
ich interest is compounded continuously.

ual e	*Time to Double*	*Amount After 10 Years*
%		
	$7\frac{3}{4}$ yr	
	5 yr	
		\$1292.85
		\$5436.56

n Exercises 49–52, find the principal P
at rate r, compounded monthly, so that
ilable for retirement in t years.

50. $r = 6\%,\quad t = 40$

52. $r = 9\%,\quad t = 25$

In Exercises 53–56, find the time neces-
le if it is invested at a rate of r compounded
thly, (c) daily, and (d) continuously.

54. $r = 6\%$

56. $r = 5.5\%$

Population **In Exercises 57–61, the population (in millions) of a country in 2007 and the expected continuous annual rate of change k of the population are given.** *(Source: U.S. Census Bureau, International Data Base)*

(a) Find the exponential growth model $P = Ce^{kt}$ for the population by letting $t = 0$ correspond to 2000.

(b) Use the model to predict the population of the country in 2015.

(c) Discuss the relationship between the sign of k and the change in population for the country.

	Country	*2007 Population*	k
57.	Latvia	2.3	−0.006
58.	Egypt	80.3	0.017
59.	Paraguay	6.7	0.024
60.	Hungary	10.0	−0.003
61.	Uganda	30.3	0.036

CAPSTONE

62. (a) Suppose an insect population increases by a constant number each month. Explain why the number of insects can be represented by a linear function.

(b) Suppose an insect population increases by a constant percentage each month. Explain why the number of insects can be represented by an exponential function.

63. ***Modeling Data*** One hundred bacteria are started in a culture and the number N of bacteria is counted each hour for 5 hours. The results are shown in the table, where t is the time in hours.

t	0	1	2	3	4	5
N	100	126	151	198	243	297

(a) Use the regression capabilities of a graphing utility to find an exponential model for the data.

(b) Use the model to estimate the time required for the population to quadruple in size.

64. ***Bacteria Growth*** The number of bacteria in a culture is increasing according to the law of exponential growth. There are 125 bacteria in the culture after 2 hours and 350 bacteria after 4 hours.

(a) Find the initial population.

(b) Write an exponential growth model for the bacteria population. Let t represent time in hours.

(c) Use the model to determine the number of bacteria after 8 hours.

(d) After how many hours will the bacteria count be 25,000?

65. ***Learning Curve*** The management at a certain factory has found that a worker can produce at most 30 units in a day. The learning curve for the number of units N produced per day after a new employee has worked t days is $N = 30(1 - e^{kt})$. After 20 days on the job, a particular worker produces 19 units.