11-7 Practice Name: Key

Find the amount of time required for an amount to double at the given rate if the interest is compounded continuously.

1. 1.75%

$t = \frac{\ln 2}{0.0175} = 39.6$

2. 10%

$t = \frac{\ln 2}{0.10} = 6.9$

3. The number of bacteria in a culture is observed for several hours with the following results recorded. Find an equation that models the data.

$y = 6.5828\,(1.1769)^x$

Hor. Asymp.

Use ExpReg

Hours (t)	Number of Bacteria (N) (thousands/cc)
2.5	10.06
5.4	14.59
6.5	20.70
9.2	27.91
9.5	31.50
11.0	40.06

4. The data to the right gives some CPI values from 1955 to 2003.

Year	CPI
1955	26.8
1965	31.5
1975	53.8
1985	107.6
1995	152.4
2003	184.0

Source: *www.bls.gov*

a. Linearize the data.

Yrs since 1950	5	15	25	35	45	53
Ln y	3.29	3.45	3.99	4.68	5.03	5.21

b. Find a regression equation for the linearized data.

$\ln y = 2.9601 + 0.0443x$

c. Use the linear regression equation to find an exponential model for the original data.

$e^{\ln y} = e^{2.9601 + 0.0443x}$

$y = e^{2.9601} \cdot e^{0.0443x}$

$y = 19.2999\, e^{0.0443x}$

d. Use the exponential model to predict the CPI in 2010.

$2010 - 1950 = 60 \text{ years} = x$

$y = 19.2999\, e^{0.0443(60)} = 275.4$

5. Exponential regression can be used in the experimental determination of the half-life of a radioactive element. A scientist starts with a 10-gram sample of uranium-239 and records the measurements shown below.

Time (min)	0	5	10	15	20
U-239 present (g)	10	8.6	7.5	6.3	5.5

Use exp

a. Find a regression equation for the amount y of uranium as a function of time x.

$y = 10.0170\,(0.9703)^x$

b. Write the regression equation in terms of base e.

$y = 10.0170\,(e^{\ln 0.9703})^x$

$y = 10.0170\,e^{-0.0301x}$

c. Use the equation from part b to estimate the half-life of uranium-239.

$5 = 10.0170\,e^{-0.0301x}$

$0.4992 = e^{-0.0301x}$

$\ln 0.4992 = -0.0301x$

$x = \frac{\ln 0.4992}{-0.0301} = 23.1$ min

6. What was the interest rate on an account that took 18 years to double if interest was compounded continuously and no deposits or withdrawals were made during the 18-year period?

$18 = \frac{\ln 2}{r}$ $\quad r = \frac{\ln 2}{18} = 0.0385$

3.9%

7. The table below lists the number of bachelor's degrees granted in the United States for certain years.

Year	1960	1965	1970	1975	1980	1985	1990	1995	2000
Degrees (1000s)	392	494	792	923	930	980	1052	1160	1238

Source: U.S. National Center for Education Statistics

a. Find a function that models the data. Let x be the number of years after 1950 and let y be the number of degrees granted, in thousands.

ln Reg

$y = -826.4217 + 520.4168 \ln x$

b. Why can x not be the number of years since 1960?

We can't find ln 0 because it is undefined.