Jews in Toronto

Note: This exercise goes with Chapter 2 of Calculus with Applications.

The following table gives the population of Toronto's Jewish community at various times.*

year	population
1901	3,103
1911	18,294
1921	34,770
1931	46,751
1941	52,798
1951	66,773
1961	85,000
1971	97,000
1981	128,650
1991	162,605

a. Plot the population on the y-axis against the year on the x-axis. Let x represent the years since 1900. Do the data appear to lie along a straight line?

b. Plot the natural logarithm of the population against the year. Does the graph appear to be more linear than the graph in part a?

c. Find an equation for the least squares line for the data plotted in part b.

d. If your graphing calculator has an exponential regression feature, find the exponential function that best fits the original data according to the least squares method. (On a TI-83 calculator, press the STAT key, and then select the CALC menu. `ExpReg` is item 0. The command `ExpReg` $\texttt{L}_1\texttt{,L}_2\texttt{,Y}_1$ finds the least squares exponential function for the data in lists $\texttt{L}_1$ and $\texttt{L}_2$ and stores the result in the function $\texttt{Y}_1$.)

e. Take the natural logarithm of the equation found in part d, and verify that the result is the same as the equation found in part c.

f. If your graphing calculator has a logistic regression feature, find the logistic function that best fits the original data according to the least squares

* From *The Globe and Mail,* Feb. 17, 1995. The data were quoted and fitted to a logistic curve by Ron Lancaster and Charlie Marion, *The Mathematics Teacher,* Vol, 90, No. 2, Feb. 1997.

method. (On a TI-83 calculator, `Logistic` is item B under the STAT-CALC menu.)

g. Plot the exponential function found in part d, the logistic function found in part f, and the original data in the same window. Which function appears to fit the data better, the exponential or the logistic?

h. If the logistic function accurately describes Toronto's Jewish population, what size will that population approach after a long period of time?

Answers can be found on the next page.

Answers to **Jews in Toronto**

a. no
b. no
c. $y = .03421x + 9.191$
d. $y = 9807(1.0348)^x$
f. $y = 484{,}900/(1 + 28.32e^{-.02893x})$
g. logistic
h. 484,900