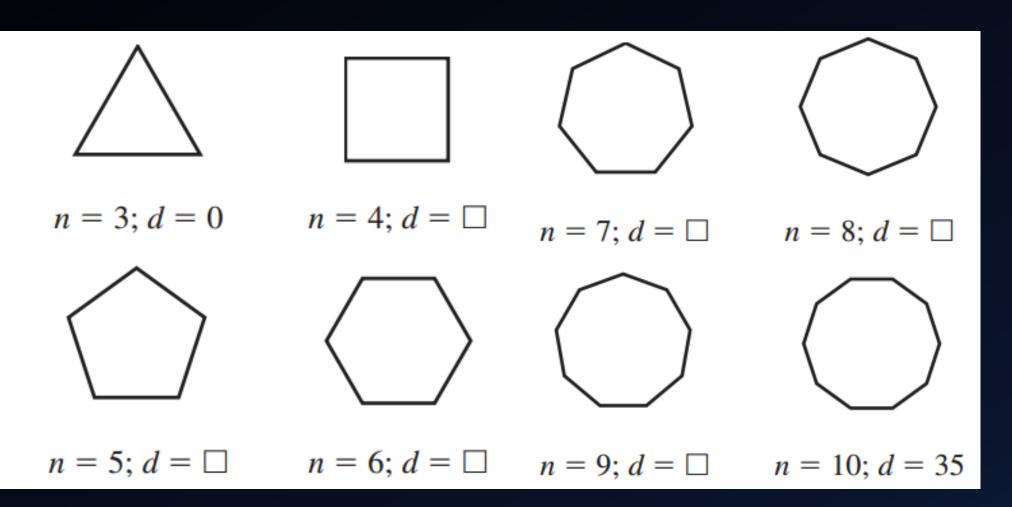**EXPLORATION 1**   **Diagonals of a Regular Polygon**

How many diagonals does a regular polygon have? Can the number be expressed as a function of the number of sides? Try this Exploration.

$n = 3; d = 0$ $n = 4; d = \square$ $n = 7; d = \square$ $n = 8; d = \square$

$n = 5; d = \square$ $n = 6; d = \square$ $n = 9; d = \square$ $n = 10; d = 35$

Guiding Question: "What parent curve is a best fit?"

- Create a scatter plot of your data using your graphing calculator
- Graph the plot
- Perform different types of regressions to find the curve of best fit
- How good is the curve of best fit?
- Use your regression equation to predict the number of diagonals a 128-gon has.

2)

PROBLEM: The table below shows the growth in the computer price index (CPI) for housing for selected years between 1980 and 2003 (based on 1983 dollars). How can we construct a function to predict the housing CPI for the years 2004–2010?

Computer Price Index (Housing)	
Year	Housing CPI
1980	81.1
1985	107.7
1990	128.5
1995	148.5
1998	160.4
1999	163.9
2000	169.6
2001	176.4
2002	180.3
2003	184.8

3)

Year	Number of locations
1987	17
1988	33
1989	55
1990	84
1991	116
1992	165
1993	272
1994	425
1995	676
1996	1015
1997	1412
1998	1886
1999	2498

Modeling the Growth of a Business

In 1971, Starbucks Coffee opened its first location in Pike Place Market—Seattle's legendary open-air farmer's market. By 1987, the number of Starbucks stores had grown to 17 and by 1999 there were 2498 locations. The data in the table below (obtained from Starbucks Coffee's web site, www.starbucks.com) summarizes the growth of this company from 1987 through 1999.

2. Refer to page 157 in this chapter. Look at the types of graphs displayed and the associated regression types. Notice that the Exponential Regression model with $b > 1$ seems to most closely match the plotted data. Use your grapher or computer to find an exponential regression equation to model this data set (see your grapher's guidebook for instructions on how to do this).

3. Use the exponential model you just found to predict the total number of Starbucks locations for 2000 and 2001.

4. There were 2498 Starbucks locations in 2000 and 4709 locations in 2001. (You can verify these numbers and find more up-to-date information in the investors's section of the Starbucks web site.) Why is there such a big difference between your predicted values and the actual number of Starbucks locations? What real-world feature of business growth was not accounted for in the exponential growth model?

5. You need to model the data set with an equation that takes into account the fact that a business's growth eventually levels out or reaches a carrying capacity. Refer to page xxx again. Notice that the Logistic Regression modeling graph appears to show exponential growth at first, but eventually levels out. Use your grapher or computer to find the logistic regression equation to model this data set (see your grapher's guidebook for instructions on how to do this).

6. Use the logistic model you just found to predict the total number of Starbucks locations for 2000 and 2001. How do your predictions compare with the actual number of locations for 2000 and 2001? How many locations do you think there will be in the year 2020?

4)

Find a the best regression model for the given problem

Table 1.16 Women's 100-Meter Freestyle

Year	Time	Year	Time
1952	66.8	1980	54.79
1956	62.0	1984	55.92
1960	61.2	1988	54.93
1964	59.5	1992	54.64
1968	60.0	1996	54.50
1972	58.59	2000	53.83
1976	55.65	2004	53.84

Source: The World Almanac and Book of Facts 2005.

Find a the best regression model for the given problem

5)

Table 1.15 Crude Oil Imports from Canada

Year	Barrels/day $\times$ 1000
1995	1,040
1996	1,075
1997	1,198
1998	1,266
1999	1,178
2000	1,348
2001	1,356
2002	1,445
2003	1,549
2004	1,606

Source: Energy Information Administration, Petroleum Supply
Monthly, as reported in The World Almanac and Book of Facts 2005.

Do you expect this models to work today? If so, what can you say about oil imports from Canada?