Name _____ Date _____

LESSON 4.7

Study Guide

For use with the lesson "Predict with Linear Models"

GOAL **Make predictions using best-fitting lines.**

Vocabulary

The line that most closely follows a trend in data is called the **best-fitting line**.

Using a line or its equation to approximate a value between two known values is called **linear interpolation.**

Using a line or its equation to approximate a value outside the range of known values is called **linear extrapolation.**

A **zero of a function** $y = f(x)$ is an x-value for which $f(x) = 0$ (or $y = 0$).

EXAMPLE 1 Interpolate using an equation

Nesting Eagles The table shows the number of pairs of nesting Bald Eagles at a national wildlife reserve from 1998 to 2002.

Year	1998	2000	2001	2002
Pairs of Nesting Eagles	5	12	18	25

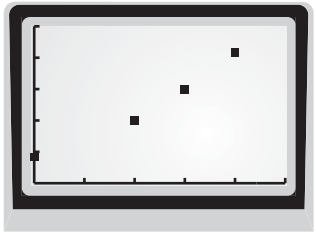
a. Make a scatter plot of the data.

b. Find an equation that models the number of pairs of nesting Bald Eagles as a function of the number of years since 1998.

c. Approximate the number of nesting eagle pairs in 1999.

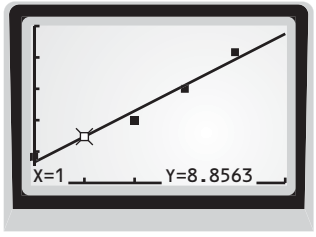
Solution

a. Enter the data into lists on a graphing calculator. Make a scatter plot, letting the number of years since 1998 be the x-values (0, 2, 3, 4) and the number of nesting eagle pairs be the y-values.



b. Perform a linear regression using the paired data. The equation of the best-fitting line is approximately $y = 5x + 4$.

c. Graph the best-fitting line. Use the trace feature and the arrow keys to find the value of the equation when $x = 1$.



There were about 9 nesting pairs in 1999.

EXAMPLE 2 Extrapolate using an equation

Nesting Eagles Look back at Example 1.

a. Use the equation from Example 1 to approximate the number of nesting Bald Eagle pairs in 2003 and 2005.

b. In 2003 there were actually 31 pairs of nesting eagles. In 2005 there were actually 34 pairs of nesting eagles. Describe the accuracy of the extrapolations made in part (a).

Solution

a. Evaluate the equation of the best-fitting line from Example 1 for $x = 5$ and $x = 7$.

The model predicts about 29 pairs in 2003 and about 39 pairs for 2005.

b. The difference between the predicted number of pairs and the actual number of pairs are 2 and 5, respectively. The difference in actual and predicted numbers increased from 2003 to 2005. So, the equation of the best-fitting line gives a less accurate prediction for years farther from the given data.

Exercise for Examples 1 and 2

1. Sales The table shows the sales (in thousands of dollars) of pet care items at one pet store during the period 1998 to 2003.

Year	1998	2000	2002	2003
Dollar amount spent (thousands)	21	25	32	37

a. Find an equation that models the sales (in thousands of dollars) of pet care items as a function of the number of years since 1998.

b. Predict the sales of pet care items for the years 2001 and 2004. Tell whether the prediction is an interpolation or an extrapolation.

c. Which of the predictions from part (b) would you expect to be more accurate? *Explain* your reasoning.