

6.3 Modelling Data with Lines of Best Fit

YOU WILL NEED
 • graphing technology

Keep in Mind

- ▶ A scatter plot is useful when looking for trends in a given set of data.
- ▶ If the points on a scatter plot seem to follow a linear trend, then there may be a linear relationship between the independent and dependent variables.
- ▶ If the points on a scatter plot follow a linear trend, technology can be used to determine and graph the equation of the line of best fit.
- ▶ A line of best fit can be used to predict values that are not recorded or plotted. To do so, read values from the line of best fit on a scatter plot, or use the equation of the line of best fit.

Example

The winning times for the men's 20 km biathlon in the Winter Olympics from 1964 to 2010 (except for 2002) are shown in the table.

Year	1964	1968	1972	1976	1980	1984
Winning Time (min)	80.4	73.8	75.9	74.2	68.3	71.9
Year	1988	1992	1994	1998	2006	2010
Winning Time (min)	56.6	57.6	57.4	56.2	54.3	48.4

- a) Use technology to create a scatter plot, and use linear regression to determine the equation of the line of best fit.
- b) Determine a possible winning time for the event in the 2002 Winter Olympics.
- c) Compare your estimate with the actual winning time of 51.0 min.

Solution

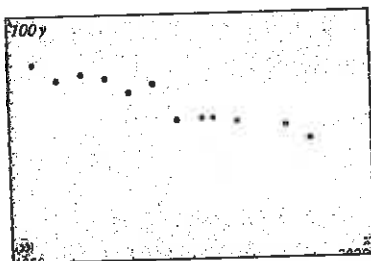
Step 1. I entered the data into my graphing calculator.

year	time		
1964	80.4		
1968	73.8		
1972	75.9		
1976	74.2		
1980	68.3		

Name: _____

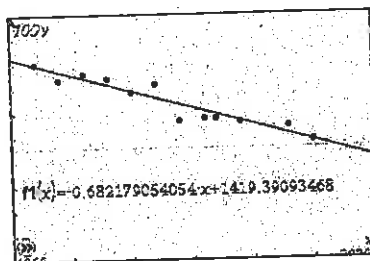
Date: _____

Step 2. I plotted the points, with "year" as the independent variable and "time" as the dependent variable.



The data looked roughly linear.

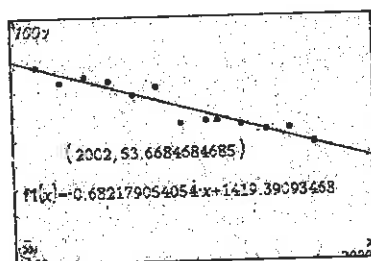
Step 3. I determined the equation for the line of best fit using linear regression.



a) The equation is

$$f(x) = -0.682\dots x + 1419.390\dots$$

Step 4. I traced along the graph to determine a possible winning time in 2002.



b) According to the equation, the winning time would be about 53.7 min.

Step 5. I compared the estimated time with the actual time.

c) The estimate was about 4 min slower than the actual winning time of 51.0 min.

Practice

1. The winning times for the women's 100 m freestyle swim in the Summer Olympics for most years from 1984 to 2008 are shown.

a) Use linear regression to determine the equation for the line of best fit for the data.

b) Determine a possible winning time for the event in the 1996 Summer Olympics.

c) Compare your estimate with the actual winning time of 54.50 s.

Year	Winning Time (s)
1984	55.92
1988	54.93
1992	54.64
2000	53.83
2004	53.84
2008	53.12

Name: _____

Date: _____

2. A city council needs to buy 15 000 L of liquid de-icer for the coming winter.

One supplier provides the following quote:

- 9 kL for \$1.30/L
- 10 kL for \$1.20/L
- 11 kL for \$1.15/L
- 12 kL for \$1.10/L
- 13 kL for \$1.05/L
- 14 kL for \$0.95/L

TIP

Recall that 1 kL = 1000 L.

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- 16 kL for \$0.84/L

a) Use linear regression to determine the equation of the line of best fit for the data.

b) What price should the city expect to pay per litre?

c) What price will be paid in all?

3. The provincial government plans to buy 500 winter parkas with goose down for park rangers. One supplier offers these prices:

- 100 parkas for \$395 each
- 150 parkas for \$380 each
- 200 parkas for \$350 each
- 250 parkas for \$340 each
- 300 parkas for \$320 each
- 350 parkas for \$300 each
- 600 parkas for \$205 each

a) Use linear regression to determine the equation of the line of best fit for the data.

b) What price should the government expect to pay for each of the 500 parkas?

c) How many parkas would the government need to order for each parka to cost less than \$360?

Name: _____

Date: _____

MULTIPLE CHOICE

4. Daniella, a real estate agent, helps businesses move to new offices. If an office does not have enough area, the employees will not be able to work productively. If there is too much area, the business will pay too much rent.

One client is a business with 14 employees. Daniella has made the following table about other businesses in one building.

Number of Employees	4	6	10	12	20	35
Office Space (m ²)	23.2	36.6	75.0	72.0	118.0	245.0

There are two areas for rent in the building.

Area P has 86 m². Area Q has 100 m².

Which area should Daniella show to her client?

- A. Area P only B. Area Q only C. neither P nor Q D. both P and Q

WRITTEN RESPONSE

5. Darcy is planning to build a stable for 15 horses. He has found that other reputable stables in the neighbourhood have the following areas:

Number of Horses	3	5	6	11	17	21
Area (ft ²)	480	750	930	1881	2600	3024

Darcy has decided his stable will have a comparable amount of area. Use linear regression to determine how many square feet the stable should have. Explain what you did.