

Quantitative Literacy: Thinking Between the Lines

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Chapter 2: Analysis of Growth

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Lesson Plan

- ▶ Measurements of growth: How fast is it changing?
- ▶ Graphs: Picturing growth
- ▶ Misleading graphs: Should I believe my eyes?

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2.2 Graphs: Picturing growth

Learning Objectives:

- ▶ Study various types of graphs: bar graphs, scatterplots, and line graphs
- ▶ Learn how to interpret the patterns
- ▶ Analyze the graphs critically
- ▶ Determine advantages and disadvantages of each type of graph

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2.2 Graphs: Picturing growth

- ▶ **Graphs** allow us to visualize information, which helps see patterns that may not be readily apparent from a table.
- ▶ **Example:** A graph reveals visually where the function is increasing or decreasing and how rapid the change is.
- ▶ A **scatterplot** is a graph consisting of isolated points, with each dot corresponding to a data point.
- ▶ To make a **line graph**, we begin with a scatterplot and join the adjacent points with straight line segments.

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2.2 Graphs: Picturing growth

- ▶ **Example:** The running speed of ants varies with the ambient temperature. Here are data collected at various temperatures:

Temperature (degrees Celsius)	Speed (centimeters per second)
25.6	2.62
27.5	3.03
30.4	3.56
33.0	4.17

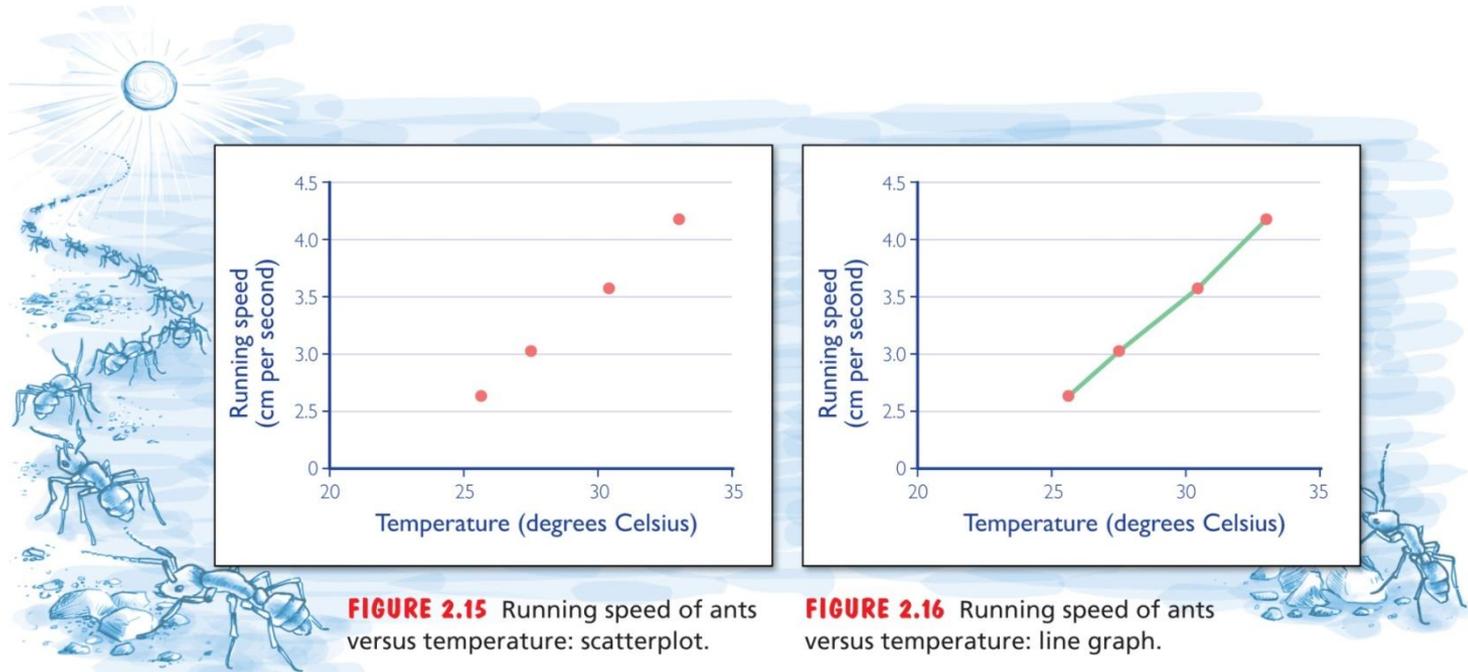
First make a scatterplot of the data showing the speed as the function and the temperature as the independent variable, then make a line graph using these data.

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2.2 Graphs: Picturing growth

- ▶ Solution: To make a scatterplot, we plot the data points on the graph: $(25.6, 2.62), \dots, (33.0, 4.17)$.

We join the points with line segments to get the line graph.



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2.2 Graphs: Picturing growth

▶ **Interpreting line graphs: Growth rates and graphs**

1. The growth rate of data is reflected in the steepness of the graph. Steeper graphs indicate a growth rate of greater magnitude.
2. An increasing graph indicates a positive growth rate, and a decreasing graph indicates a negative growth rate.

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2.2 Graphs: Picturing growth

- ▶ **Example:** The line graph in Figure 2.18 shows the yearly gross income in thousands of dollars for a small business from 2002 through 2011. Explain what this graph says about the rate of growth of yearly income.

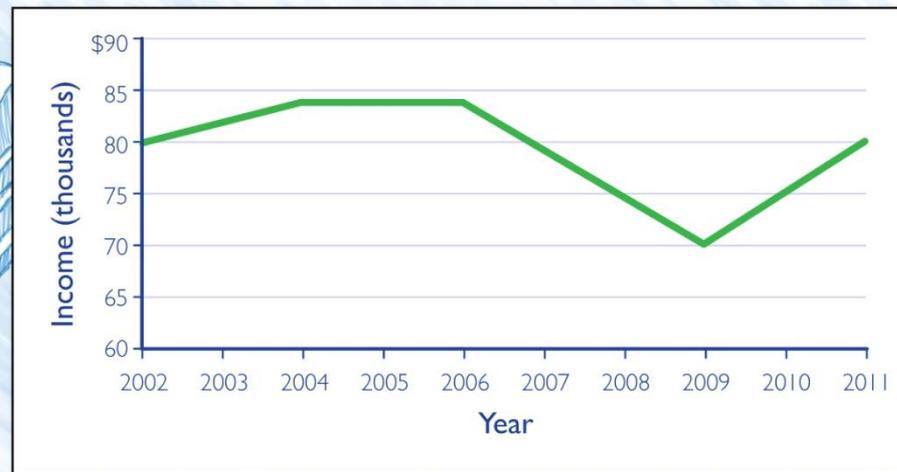


FIGURE 2.18 Small business income.

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2.2 Graphs: Picturing growth

- ▶ A **smooth line graph** is made from a scatterplot by joining data points smoothly with curves instead of line segments.
- ▶ **Example:** The graph of the amount of toxic waste remaining as a function of time is decreasing at a decreasing rate. Sketch an appropriate graph for the amount of toxic waste remaining as a function of time.
- ▶ **Solution:**

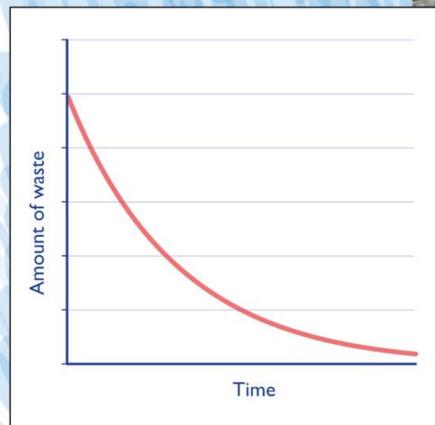


FIGURE 2.23 Toxic waste disposal from a meth lab site.

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2.2 Graphs: Picturing growth

- ▶ In **practical settings**, the **growth rate** has a familiar meaning.
- ▶ **Example:** The graph in Figure 2.24 shows a population that increases from a time and then begins to decrease. The growth rate in this context is the rate of population growth. The growth rate is positive in Year 0. It remains positive until we reach Year 3, where the growth rate is 0. Beyond Year 3 the growth rate gets negative through Year 5.

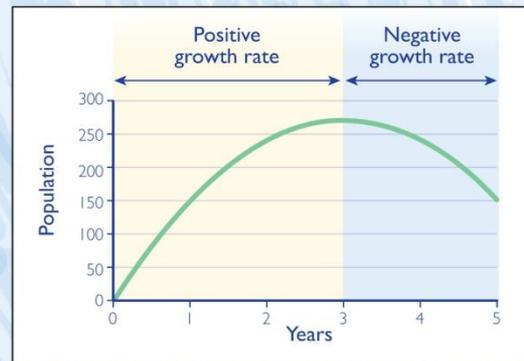


FIGURE 2.24 A population graph.

Chapter 2 Analysis of Growth: **Chapter Summary**

- ▶ **Measurements of graphs: How fast is it changing?**
 - ▶ Use growth rates to analyze quantitative information
 - ▶ Tables and percentage change:
 - A data table, a bar graph
 - the Percentage change formula
 - ▶ Interpolation and Extrapolation:
 - the Average growth formula
 - Estimate by interpolation or extrapolation from a function value

Chapter 2 Analysis of Growth: **Chapter Summary**

▶ **Graphs: Picturing growth**

- ▶ Understand various types of graphs: bar graphs, scatterplots, line graphs, and smoothed line graphs.

- ▶ Growth rates and graphs:

The growth rate of data is reflected in the steepness of the graph.

An increasing graph indicates a positive growth rate.

A decreasing graph indicates a negative growth rate.



Chapter 2 Analysis of Growth: **Chapter Summary**

- ▶ **Misleading graphs: Should I believe my eyes?**
 - ▶ By choice of axis scale
 - ▶ Default ranges on graphs generated by calculators and computers
 - ▶ By misrepresentation of data: Inflation
 - Adjusting for inflation
 - ▶ By using insufficient data
 - ▶ Pictorial representations: Pie chart