2.9.2: Other Types of Graphs

> **Learning Objectives**
>
> - Read and interpret data from circle graphs (pie charts).
> - Read and interpret data from simple line graphs.

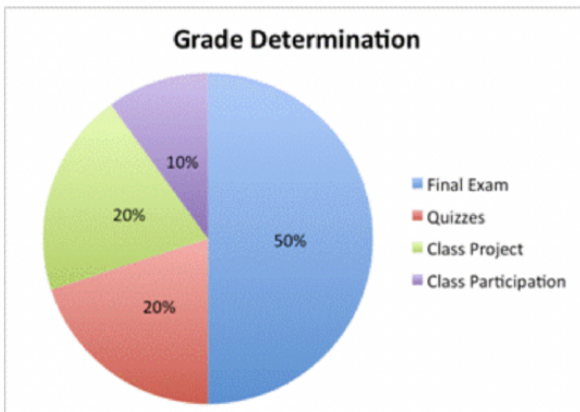
Introduction

Different graphs tell different stories. While a bar graph might be appropriate for comparing some types of data, there are a number of other types of graphs that can present data in a different way. You might see them in news stories or reports, so it's helpful to know how to read and interpret them.

Circle Graphs

Sometimes you will see categorical data presented in a **circle graph**, or pie chart. In these types of graphs, individual pieces of data are represented as sections of the circle (or "pieces of the pie"). Circle graphs are often used to show how a whole set of data is broken down into individual components.

Here's an example. At the beginning of a semester, a teacher talks about how she will determine student grades. She says, "Half your grade will be based on the final exam and 20% will be determined by quizzes. A class project will also be worth 20% and class participation will count for 10%." In addition to telling the class this information, she could also create a circle graph.



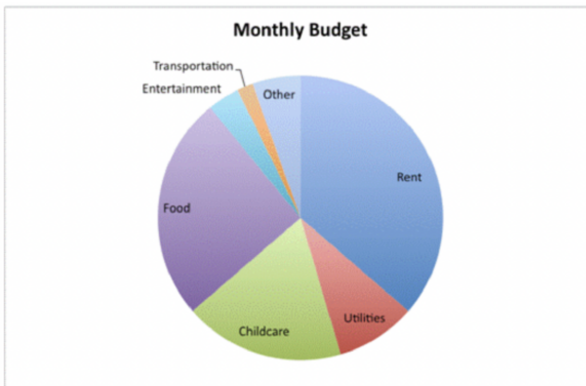
This graph is useful because it relates each part (the final exam, the quizzes, the class project, and the class participation) to the whole. It is easy to see that students in this class had better study for the final exam!

Because circle graphs relate individual parts and a whole, they are often used for budgets and other financial purposes. A sample family budget follows. It has been graphed two ways: first using a bar graph, and then using a circle graph. Each representation illustrates the information a little differently.

The bar graph shows the amounts of money spent on each item during one month. Using this data, you could figure out how much the family needs to earn every month to make this budget work.

The bar graph above focuses on the amount spent for each category. The circle graph below shows how each piece of the budget relates to the other pieces of the budget. This makes it easier to see where the greatest amounts of money are going, and how much of the whole budget these pieces take up. Rent and food are the greatest expenses here, with childcare also taking up a sizeable portion.

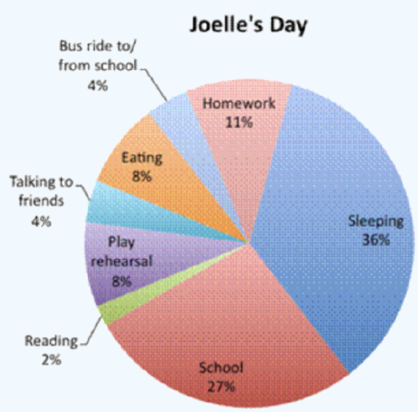
If you look closely at the circle graph, you can see that the sections for food, childcare, and utilities take up almost exactly half of the circle: this means that these three items represent half the budget! This kind of analysis is harder to do with bar graphs because each item is represented as its own entity, and is not part of a larger whole.



Circle graphs often show the relationship of each piece to the whole using percentages, as in the next example.

Example

The circle graph below shows how Joelle spent her day. Did she spend more time sleeping or doing school-related work (school, homework, and play rehearsal)?



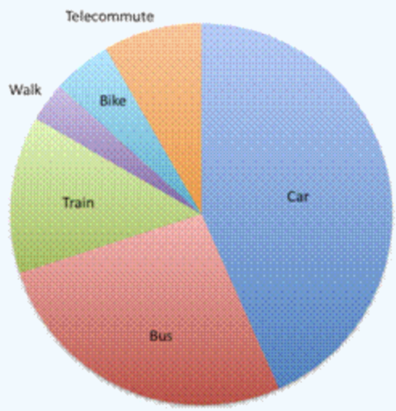
Solution

Sleeping: 36% School-related: $27\% + 8\% + 11\% = 46\%$	Look at the circle graph. The section labeled “Sleeping” is a little larger than the section named “School” (and notice that the percentage of time sleeping is greater than the percentage of time at school!) “Homework” and “Play rehearsal” are both smaller, but when the percentages of time are added to “School,” they add up to a larger portion of the day.

Joelle spent more time doing school-related work.

? Exercise

The graph below shows data about how people in one company commute to work each day.



Which statement is true?

A. Everyone takes a car, bus, or train to work.
B. Taking the bus is more popular than walking or biking.
C. More people take the train than take the bus.
D. Telecommuting is the least popular method of commuting to work.

Answer

A. Incorrect. While most people commute by car, bus, or train, some commute by other means, as shown in the other sections of the graph. The correct answer is that taking the bus is more popular than walking or biking.
B. Correct. The graph shows that about one-fourth of the company takes the bus to work, but only a small portion of people walk or bike.
C. Incorrect. The “Train” section of the circle graph is smaller than the “Bus” section, so the reverse is correct: more people take the bus than take the train. The correct answer is that taking the bus is more popular than walking or biking.
D. Incorrect. The least popular method of transportation is walking, as it has the smallest slice of the pie. The correct answer is that taking the bus is more popular than walking or biking.

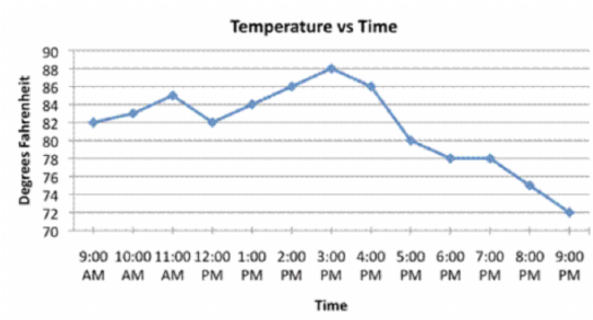
Line Graphs

Unlike circle graphs, **line graphs** are usually used to relate data over a period of time. In a line graph, the data is shown as individual points on a grid; a trend line connects all data points.

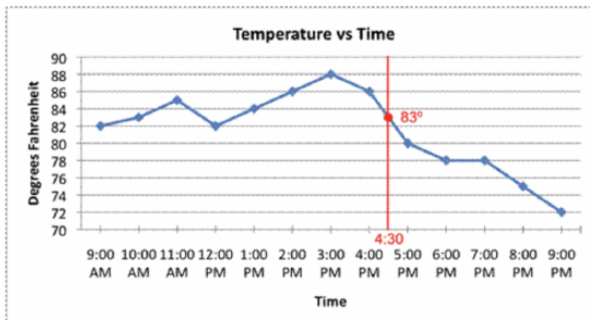
A typical use of a line graph involves the mapping of temperature over time. One example is provided below. Look at how the temperature is mapped on the y-axis and the time is mapped on the x-axis.

Each point on the grid shows a specific relationship between the temperature and the time. At 9AM, the temperature was 82^{o}. It rose to 83^{o} at 10 AM, and then again to 85^{o} at 11AM. It cooled off a bit by noon, as the temperature fell to 82^{o}. What happened the rest of the day?

The data on this graph shows that the temperature peaked at 88^o at 3PM. By 9PM that evening, it was down to 72^o.



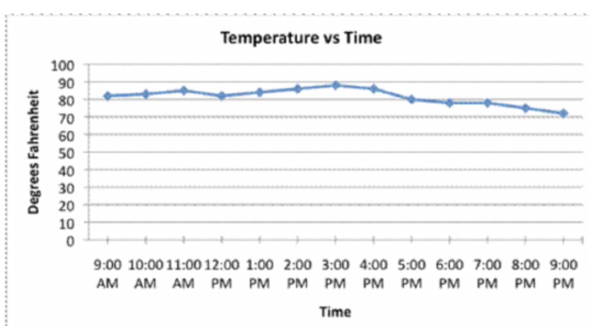
The line segments connecting each data point are important to consider, too. While this graph only provides data points for each hour, you could track the temperature each minute (or second!) if you wanted. The line segments connecting the data points indicate that the temperature vs. time relationship is continuous, meaning it can be read at any point. The line segments also provide an estimate for what the temperature would be if the temperature were measured at any point between two existing readings. For example, if you wanted to estimate the temperature at 4:30, you could find 4:30 on the x-axis and draw a vertical line that passes through the trend line; the place where it intersects the graph will be the temperature estimate at that time.



Note that this is just an estimate based on the data. There are many different possible temperature fluctuations between 4PM and 5PM. For example, the temperature could have held steady at 86^o for most of the hour, and then dropped sharply to 80^o just before 5PM. Alternatively, the temperature could have dropped to 76^o due to a sudden storm, and then climbed back up to 80^o once the storm passed. In either of these cases, our estimate of 83^o would be incorrect! Based on the data, though, 83^o seems like a reasonable prediction for 4:30PM.

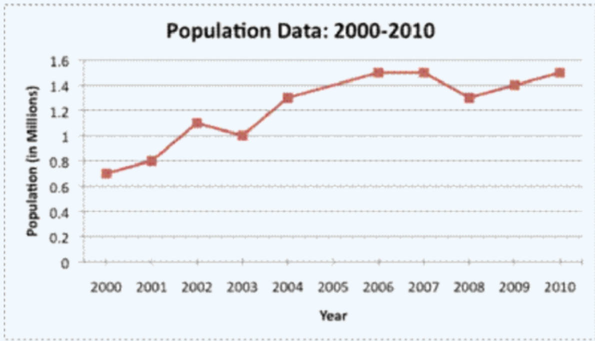
Finally, a quick word about the scale in this graph. Notice the y-axis, which is the vertical line where the Degrees Fahrenheit are listed. Notice that it starts at 70^o, and then increases in increments of 2^o each time. Since the scale is small and the graph begins at 70^o, the temperature data looks pretty volatile, as if the temperature went from being warm to hot to very cold! Look at the same data set when plotted on a line graph that begins at 0^o and has a scale of 10^o.

As you can see, changing the scale of the graph can affect how a viewer perceives the data within the graph.



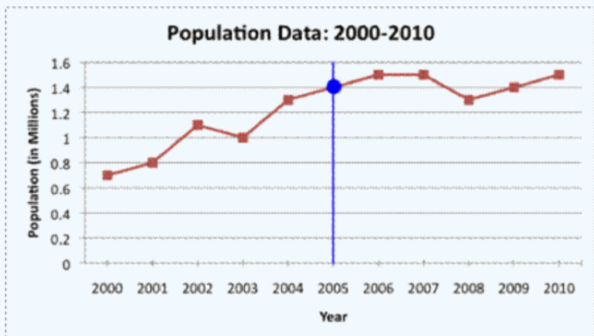
Example

Population data for a fictional city is given below. Estimate the city's population in 2005.



Solution

Look at the line graph. The population starts at about 0.7 million (or 700,000) in 2000, rises to 0.8 million in 2001, and then again to 1.1 million in 2002. To find the population in 2005, find 2005 on the x-axis and draw a vertical line that intersects the trend line.



The lines intersect at 1.4, so million (or 1,400,000) would be a good estimate.

The population in 2005 was about 1.4 million.

Summary

Bar graphs are only the beginning of the story when it comes to visualizing data sets. Circle graphs show how a set of data is divided up into sections, and they help the viewer visualize how each section relates to the whole. By contrast, line graphs are usually used to relate continuous data over a period of time. A third type of graph, the stem-and-leaf plot, provides another way to organize quantitative data. Stem-and-leaf plots are useful for getting a quick picture of the smallest and largest values, clusters, and gaps of the data within a set.