3.4 Histograms

▶ **GOAL**

Use histograms to describe appropriate data.

Learn about the Math

Rishi's Grade 8 class is planning a trip to Canada's Wonderland. Many of the attractions have minimum or maximum height requirements. The heights (in centimetres) of the students in Rishi's class are given below.

168	173	157	160	165
160	148	160	150	155
155	150	160	163	152
152	163	157	155	157
160	157	152	147	165
155	157	168	160	163

Some students want to use a bar graph to display the heights. Other students want to group the heights to create a **histogram** .
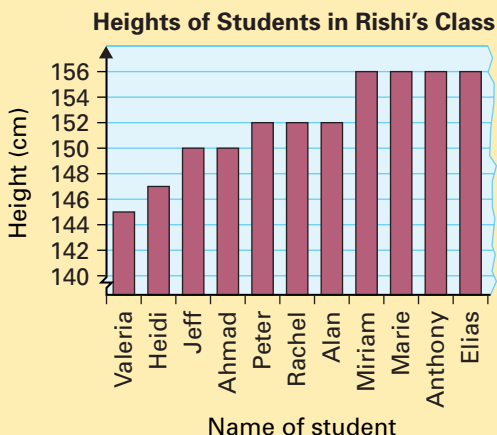
histogram

a graph with bars that show frequencies of data organized into intervals; the intervals line up side by side, without gaps, on the number line

? **How can you use each type of graph to display the heights of the students in Rishi's class?**

Example 1: Displaying data using a bar graph

Create a bar graph to display the heights of the students in Rishi's class.

Kayley's Solution

Heights of Students in Rishi's Class

I used a student name for each category.

My bar graph is very large, but it clearly shows who can go on rides with height restrictions.
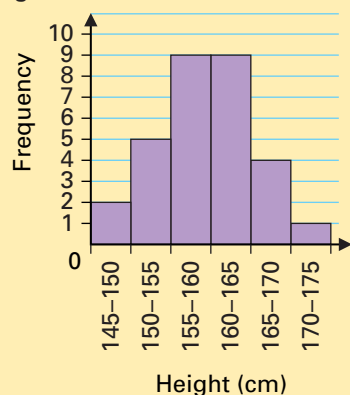
Example 2: Displaying data using a histogram

Create a histogram to display the heights of the students in Rishi's class.

Kito's Solution

Height (cm)	Frequency
145–150	2
150–155	5
155–160	9
160–165	9
165–170	4
170–175	1

First, I organized the heights in a frequency table. I needed intervals to represent heights from 147 cm to 173 cm. This is a range of 26 cm.

If I used multiples of 2 for my intervals, I would have 13 intervals. That's too many.

If I used multiples of 10, I would have three intervals. That's too few.

I chose multiples of 5. This gave me six intervals. I decided to start the first interval at 145 because 145 is a multiple of 5.

Heights of Students in Rishi's Class

My histogram looks a lot like a bar graph. But the bars have no spaces between them since the intervals have no gaps between them.

I can tell how many heights are in each interval, but I don't know what the exact heights are or which students have these heights.

Reflecting

1. How are bar graphs and histograms similar?

2. In what situations would you use a histogram instead of a bar graph? Why?

Communication Tip

Data values that fall at a value where two intervals intersect are usually placed in the higher interval. For example, 155 would usually be placed in the interval 155–160, not in the interval 150–155.

Collecting, Organizing, and Displaying Data

Example 3: Displaying data in a histogram

The students in Brenda's class think that a crossing guard is needed at a nearby intersection before and after school. They decide to research the traffic at the intersection. Their results are shown in the table below.

Number of Vehicles Passing Through Intersection Each Hour							
7:00–8:00 a.m.	253	10:00–11:00 a.m.	199	1:00–2:00 p.m.	143	4:00–5:00 p.m.	370
8:00–9:00 a.m.	364	11:00–12:00 p.m.	175	2:00–3:00 p.m.	137	5:00–6:00 p.m.	441
9:00–10:00 a.m.	217	12:00–1:00 p.m.	220	3:00–4:00 p.m.	150	6:00–7:00 p.m.	289

Create a histogram to display the data. Does your histogram support the need for a crossing guard?

Solution

There are 12 intervals in the table, but 12 intervals would make the graph hard to read. Group the frequencies into 2 h intervals.

The traffic is greater between 7:00 and 9:00 a.m., and between 3:00 and 5:00 p.m., than it is at most other times during the day. Therefore, the histogram supports the need for a crossing guard because these are the same times that students are travelling to and from school.

Number of Vehicles Passing Through Intersection
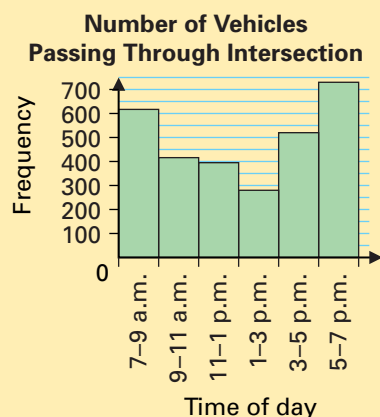
A Checking

3. a) How many intervals are in this histogram? What is the size of each interval?

Time Spent on Homework in Grade 8
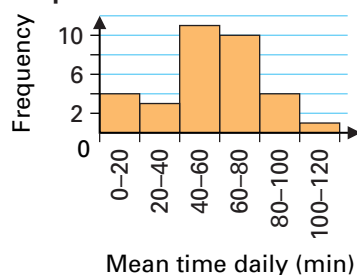
b) Todd spends 35 min on homework per day, on average. In which interval does his daily time belong?

c) About how much time do you spend doing homework each day, on average? In which interval does it belong?

4. Organize these temperatures (°C) into a frequency table. Then use your table to construct a histogram.

1.1	8.7	30	23.5	33.9	40.1
27.2	31.4	19.6	6.7	14.8	33.3
7.1	39.4	22.9	29.1	16.6	9.7
43.5	48.4	46.8	11.2	33.1	45

B Practising

5. Display the following information in a histogram.

Time Spent on Computer by Students

Time spent on a computer daily (min)	Number of students
0–30	24
30–60	40
60–90	57
90–120	23
over 120	8

6. These are Ravi's mean bowling scores for the past 24 weeks.

110.7 120.4 115.2 106.2 107.1 122.6
130.0 129.5 119.2 113.4 100.2   95.4
103.0 129.9 105.7 125.0 122.6 111.5
112.4 114.7 101.8 129.0 103.1 140.9

a) Organize the scores in a frequency table. Explain your choice of intervals.

b) Display the scores in a histogram.

c) Display the scores in a stem-and-leaf plot.

7. a) How many intervals are in this histogram? What is the size of the intervals?

Time Needed to Get to School

Time (min)
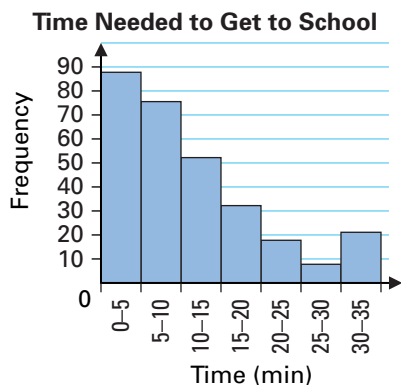
b) James takes 25 min to walk to school. Which interval does his time belong in?

c) What percent of the students needs 30 min or more to get to school?

8. Manon and Juan recorded the running time for 100 movies. Manon displayed the data in a bar graph that listed each movie individually. Juan combined the data to create seven intervals and displayed the intervals in a histogram.

a) Could Juan have used Manon's bar graph to create his histogram? How?

b) Could Manon have used Juan's histogram to create her bar graph? How?

c) What was the benefit of using a histogram?

9. The following times, in seconds, were recorded for a 100 m race.

13.9   14.3   14.4   13.7   15.2   15.4 13.9
13.9   14.5   14.7   14.4   13.8   13.1 13.8
12.4   13.8   12.7   13.4   13.9   14.0 14.4
14.3   14.5   11.8   12.9   12.3   12.8 13.7
13.1   15.0   14.8   14.2   14.4   14.8

a) Explain how you would sort the data into
i) three intervals   **ii)** five intervals

b) Which number of intervals in part (a) would be the most appropriate? Explain.

c) Use this number of intervals to construct a histogram.

C Extending

10. Two students drew histograms that showed the ages of 40 people. The students used different numbers of intervals. Figure out a possible distribution of the 40 ages that makes both histograms accurate.

Anna's Histogram

Age (years)

Ben's Histogram

Age (years)

Collecting, Organizing, and Displaying Data **107**