

YOU WILL NEED

- ruler and metre stick, or measuring tape
- grid paper

GOAL

Plot and interpret experimental data.

INVESTIGATE the Math

A character on a TV crime show predicted the height of a suspect based on hand span. Robin wants to find out what the relationship is.

? How is hand span related to height?



- Measure your hand span.
- Measure your height.
- Gather the data for all members of your class and put it in a table.
- Choose one variable as the independent variable and the other as the dependent variable.
Draw a scatter plot to represent the data.
- Would you say the variables are **continuous** or **discrete**?
- Are there any data points that don't fit the pattern? If so, explain.
- How does the scatter plot suggest how hand span and height are related?

Reflecting

- H. How did making a scatter plot from your data table help you to determine whether hand span and height are related?
- I. Did your choice for the dependent variable in part D affect your conclusion about whether there is a relationship between hand span and height? Explain.

APPLY the Math

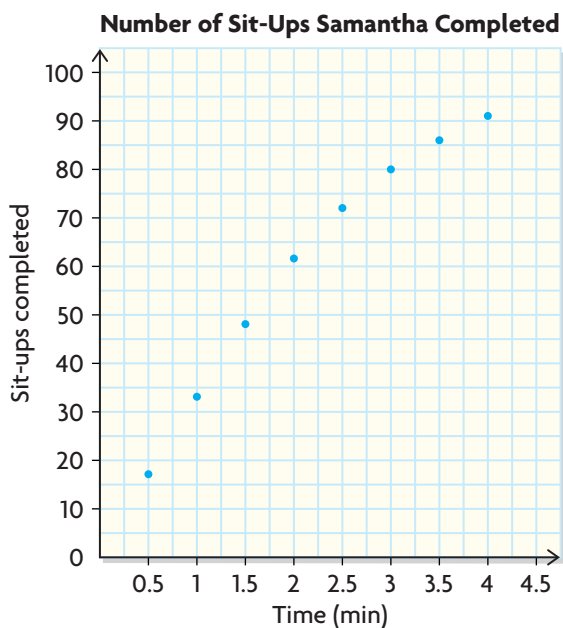
EXAMPLE 1 Representing and interpreting discrete data

The table below shows how many sit-ups Samantha did in gym class.

Time (min)	0.5	1	1.5	2	2.5	3	3.5	4
Sit-Ups Completed	17	33	48	62	72	80	86	91

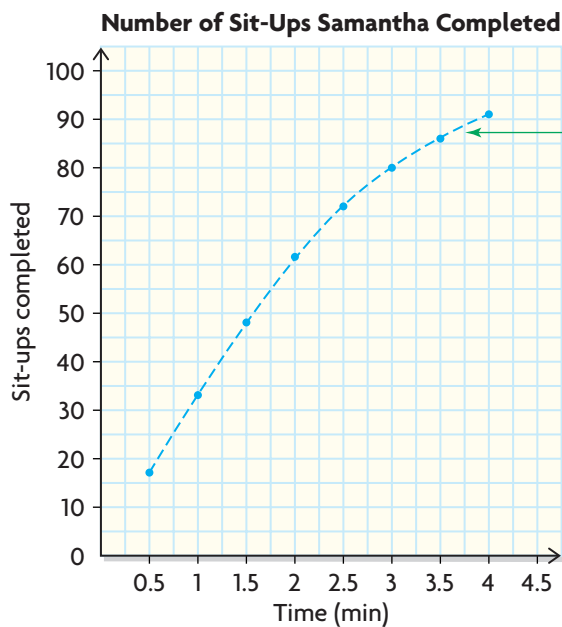
Describe the relationship between completed sit-ups and time.

Hiro's Solution: Reasoning from a hand-drawn scatter plot



I plotted the data on a scatter plot. I chose "sit-ups completed" as the dependent variable, since the number of sit-ups that Samantha does depends on how much time she takes.





I joined the points with a dashed line. The “sit-ups completed” variable is discrete because you can only do a whole number of sit-ups.

At first, the number of sit-ups goes up by almost the same amount in each half minute.

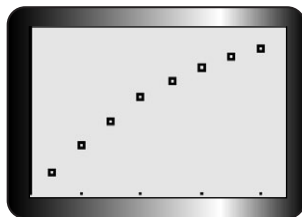
The line is nearly straight at the beginning, but bends at the end.

Toward the end, she must be getting tired because she does fewer sit-ups every half minute.

Nadine’s Solution: Reasoning from a graph drawn using technology

Tech Support

- For help using your calculator to create a scatter plot, see Appendix B-9.



I plotted the data using the Lists in my graphing calculator. I entered “time” into L1 as the independent variable. I entered “sit-ups completed” into L2 as the dependent variable, since the number of sit-ups that Samantha does depends on how much time she takes.

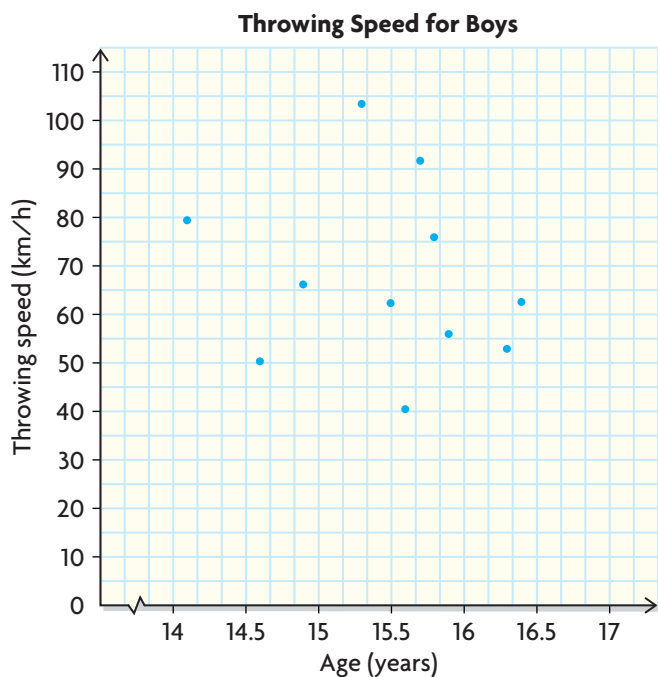
The screen shows the same relationship that Hiro found plotting the data by hand.

EXAMPLE 2 Representing and interpreting continuous data

Students in Grade 9 and Grade 10 are trying out for the junior boys' baseball team at their school. The speeds of their pitches were measured with a hand-held radar gun and are shown in the table below. Determine if there is a relationship between throwing speed and age.



Age (years)	14.1	14.6	14.9	15.3	15.5	15.6	15.7	15.8	15.9	16.3	16.4
Throwing Speed (km/h)	79.3	50.2	66.1	103.3	62.3	40.4	91.6	75.8	55.9	52.7	62.4

Jay's Solution


I didn't know which variable to choose as the independent variable. I remembered that time is usually on the horizontal axis, so I chose "age" as the independent variable.

The data are continuous. I know because any speed and any age between the ones in my data set are valid.

I plotted the data.

There doesn't seem to be any relationship between age and throwing speed for this set of data.

The data points are really scattered. I couldn't see a simple pattern and didn't even try to join data points.

In Summary

Key Ideas

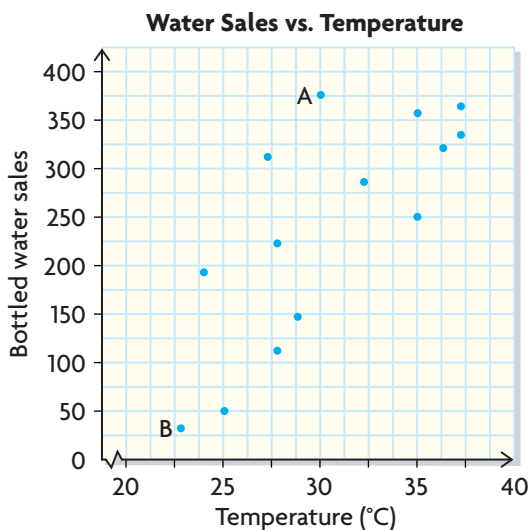
- You can use a table of values to organize numerical data collected from an experiment.
- If the data points on the scatter plot seem to follow a predictable pattern, you might suggest that there is a relationship between the variables.
- Often, the purpose of an experiment is to determine whether the values of the dependent variable actually do depend on the values of the independent variable.

Need to Know

- In some cases, either variable could be chosen as the independent variable, depending on your point of view.
- Sometimes, the points in a scatter plot are approximated by a line or smooth curve. The line or curve may help you see if there is a relationship between the variables.

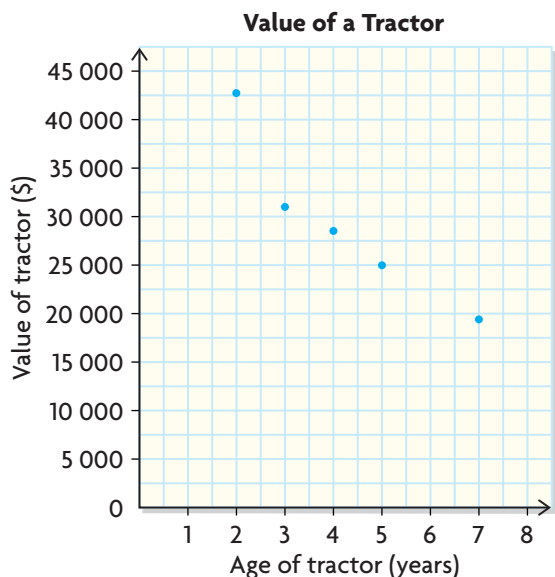
CHECK Your Understanding

1. Suppose you were to survey your classmates to see if there is a relationship between math marks and the number of hours spent watching TV.
 - a) What column headings would you use in a table of values designed to organize the data from your survey?
 - b) Which variable would you choose as the independent variable? Explain.
 - c) How would you interpret the ordered pair (2, 65) if it were to appear on a scatter plot of your data?
2. The scatter plot shows the sales of bottled water at a refreshment booth at the Canadian National Exhibition in Toronto for different days during a heat wave one summer.
 - a) What information does point A represent? What does point B represent?
 - b) What does the scatter plot show about the relationship between water sales and temperature?



PRACTISING

3. The scatter plot shows the ages of some tractors and their values.



- Identify the independent variable and the dependent variable.
 - Would you consider the variables to be discrete or continuous?
Would you use a dashed line or a solid line to join the points?
 - Does the scatter plot suggest a relationship between the age of a tractor and its value? Explain.
4. These data show the heights of some Grade 9 boys and their fathers.

K

Height of Grade 9 Boy (cm)	164	168	150	162	159	165	187	152	180	166	148	159
Height of Father (cm)	171	186	164	180	176	177	192	167	189	180	165	172

- Identify the independent variable and the dependent variable.
- Would you consider the variables to be discrete or continuous?
- Would you use a dashed line or a solid line to join the points?
- Construct a scatter plot for the data.
- Does the scatter plot suggest a relationship between a boy's height and his father's height? Explain.
- Is there is a relationship between the variables? Suggest reasons for this.

Use the data below for questions 5 and 6.

Countries and Films Represented at the Toronto International Film Festival

Year	2006	2005	2004	2003	2002	2001	2000
Countries	61	52	55	50	50	54	56
Films	352	335	336	339	345	326	329

5.
 - a) Draw a scatter plot of the number of countries represented each year.
 - b) Describe any patterns you see in the scatter plot of part a).
 - c) Draw a scatter plot of the number of films shown each year.
 - d) Describe any patterns you see in the scatter plot of part c).
 - e) For each scatter plot, would you consider the variables to be discrete or continuous? Would you use a dashed line or a solid line for the graph?

6.
 - a) Draw a scatter plot using the number of countries and the number of films.
 - b) Explain how you chose the independent and dependent variables.
 - c) Describe any patterns you see in the scatter plot.

7. The amount of fuel a hybrid car uses is measured at various speeds as **A** shown in the table below.

Speed (km/h)	3	8	11	16	21	26	32	40	50	60	64	67	71	80	90	100	110
Fuel Consumption (L/100 km)	14.9	5.3	4.7	3.8	3.5	3.3	3.2	3.1	3.1	3.1	3.1	3.8	3.9	4.1	4.4	4.9	5.3

- a) Draw a scatter plot of the data.
- b) Describe any pattern you see.
- c) Does the pattern you described in part b) seem reasonable? Explain.
- d) Does the pattern you described in part b) suggest how you should drive in order to minimize fuel consumption?
- e) Who would want this information? Why?
- f) Are the variables discrete or continuous?
- g) Which variable did you choose for the independent variable? Explain.

8. This table shows the birth rates in four provinces over the last few years.

T Number of Births per 1000 People

Year	Alberta	British Columbia	Newfoundland and Labrador	Ontario
2001	12.4	9.8	8.8	10.9
2002	12.8	9.9	8.8	10.8
2003	12.9	9.7	8.9	10.9
2004	12.9	9.7	8.6	10.8
2005	12.7	9.6	8.6	10.6

- a) Draw a scatter plot of the number of births for this five-year period for each province on a single grid.
- b) Do any provincial data show a strong pattern?
9. Suppose that you have plotted some data on a scatter plot.
- C** a) How could you tell whether there is a relationship between the variables?
- b) How could you decide whether to use a solid or dashed line?

Extending

10. The data on the right show the number of car accidents in a year for different age groups.
- a) Choose an independent variable and a dependent variable. Explain how you chose.
- b) Draw a scatter plot of the data. Use the median age for each age group.
- c) Describe any trends you see in the scatter plot.
- d) Is it appropriate to connect the plotted points with a line? If so, should the line be solid or broken? Explain.
- e) Veera says that young people have more car accidents than old people. Are there sufficient data to support this claim? If not, what further information would be helpful? Explain.

Age Group	Number of Accidents
16–19	6 382
20–24	7 183
25–34	11 733
35–44	8 990
45–54	5 517
55–64	3 307
65–74	2 308