

7.1

Mean and Mode

Focus Calculate the mean and mode for a set of data.

Questionnaires, experiments, databases, and the Internet are used to collect data. These collected data can be displayed in tables and graphs, which can be used to make predictions. In this lesson, you will learn ways to describe all the numbers in a data set.



Explore



You will need counters.
Three friends compared the time, in hours, they spent on the computer in one particular week.
Ali spent 5 h,
Bryn spent 9 h,
and Lynne spent 10 h.

Use counters to represent the time each person spent on the computer.
Find one number that best represents this time.







Reflect & Share

Share your findings with another pair of classmates.
How did you use counters to help you decide on the number?
Explain to your classmates why your number best represents the data.

Connect

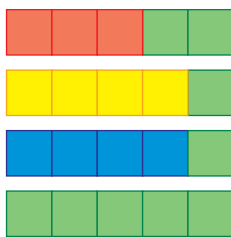
Allira surveyed 4 friends on the number of first cousins each has. To find a number that best represents the number of cousins, Allira used linking cubes.

Kinta		3
Orana		4
Illuka		4
Attunga		9



The **mean** is a number that can represent the centre of a set of numbers.

- One way to find the mean is to rearrange the cubes to make rows of equal length.



There are 5 cubes in each row.

The mean number of first cousins is 5.

When you make equal rows or columns, the total number of cubes does not change.

- You can use the total number of cubes to calculate the mean.

The number of cubes in each row is 3, 4, 4, and 9.

Add these numbers: $3 + 4 + 4 + 9 = 20$

Then divide by the number of rows, 4: $20 \div 4 = 5$

The mean is 5.

The **mode** is the number that occurs most often.

- To find the mode, determine which number occurs most often.

In Allira's data, the number 4 occurs twice.

The mode is 4 cousins.

Two people have 4 cousins.

In a set of data, there may be no mode or there may be more than one mode.

Each of the mean and the mode is a **measure of central tendency**.

We say the word **average** to describe a measure of central tendency.

An average is a number that represents all numbers in a set.

Example

Here are Ira's practice times, in seconds, for the 100-m backstroke:

121, 117, 123, 115, 117, 119, 117, 120, 122

Find the mean and mode of these data.

A Solution

To find the mean practice time, add the practice times:

$$121 + 117 + 123 + 115 + 117 + 119 + 117 + 120 + 122 = 1071$$

Divide by the number of data, 9: $1071 \div 9 = 119$

The mean practice time is 119 s.

The mode is the practice time that occurs most often.

117 occurs three times, so the mode practice time is 117 s.

Practice

- Use linking cubes to find the mean of each set of data.
 - 3, 4, 4, 5
 - 1, 7, 3, 3, 1
 - 2, 2, 6, 1, 3, 4
- Calculate the mean of each set of data.
 - 2, 4, 7, 4, 8, 9, 12, 4, 7, 3
 - 24, 34, 44, 31, 39, 32
- Find the mode of each set of data in question 2.
- Here are the weekly allowances for 10 Grade 7 students:
\$9, \$11, \$13, \$15, \$20, \$10, \$12, \$15, \$10, \$15
 - What is the mean allowance?
 - What is the mode allowance?
 - Suppose two allowances of \$19 and \$25 are added to the list.
What is the new mean? What happens to the mode?
- Here are the ages of video renters at *Movies A Must* during one particular hour: 10, 26, 18, 34, 64, 18, 21, 32, 21, 54, 36, 16, 30, 18, 25, 69, 39, 24, 13, 22
 - What is the mean age? The mode age?
 - During another hour, the mode age of twelve video renters is 36. What might the ages of the renters be?
Explain your answer.



6. Jordin Tootoo is the first Inuk athlete to play in the National Hockey League. On October 9, 2003, he played his first game for the Nashville Predators. This table shows Jordin's statistics when he played junior hockey for the Brandon Wheat Kings.

Jordin Tootoo's Scoring Records 1999-2003				
Year	Games Played	Goals	Assists	Points
1999-2000	45	6	10	16
2000-2001	60	20	28	48
2001-2002	64	32	39	71
2002-2003	51	35	39	74



Find the mean and mode for each set of data.

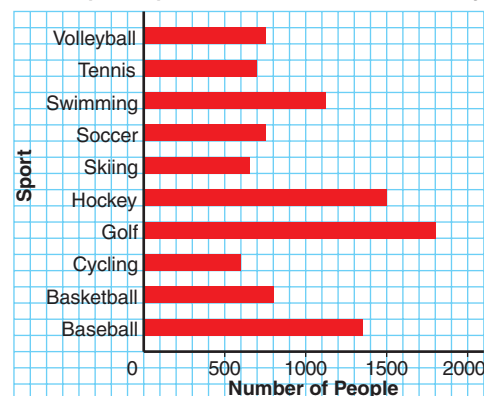
- Games Played
- Goals
- Assists
- Points

7. **Assessment Focus** The graph shows the most popular sports of 13–15-year-olds in Wesley.

- Which sports are equally popular?
- How could you use the bar graph to find the mode?
Explain and show your work.

- Calculate the mean.
Use estimated values from the graph.

Most Popular Sports of 13-15-Year-Olds in Wesley



8. **Take It Further** A data set has 6 numbers. Four of the numbers are: 6, 3, 7, 9. Find the other two numbers in each case.
- The mean is 6.
 - The mode is 3 and the mean is 6.
Find as many different answers as you can.

Reflect

What is the difference between mean and mode?
Create a set of data to explain.

7.2

Median and Range

Focus Find the median and the range of a set of data.

The graph shows the number of tubes of hair gel used by each of 5 students in one particular month.

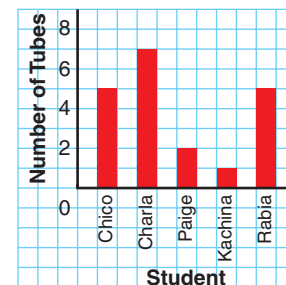
How many tubes of gel did each student use?

What is the mean number of tubes used?

The mode number?

How did you find the mean and the mode?

Number of Tubes of Hair Gel Used in One Particular Month



Explore



Your teacher will give you a bag of Cuisenaire rods.
You will need a ruler.

- Without looking, each person takes 3 rods from the bag.
Work together to arrange the 9 rods from shortest to longest.
Find the middle rod.
How many rods are to its right? To its left?
In what way is the middle rod typical of the rods your group picked?
What do you notice about the rods to the left and right of the middle rod?

- Each of you takes 1 more rod from the bag.
Place them among the ordered rods in the appropriate places.
Is there a middle rod now? Explain.
Sketch the rods.
Below each rod in your sketch, write its length.
How could you use the lengths to find a “middle” length?
How is the middle length typical of the rods in your sketch?



Reflect & Share

Is it possible to have two different sets of rods with the same middle length?
Share your results with other groups to find out.

Connect

The **median** of a data set is the middle number when the data are arranged in order.

- There are 11 Grade 7 students in Ms. Shim's combined Grades 6 and 7 class.
To find the median mark on the last science test, she listed their marks from greatest to least:

95, 92, 87, 85, 80, 78, 76, 73, 70, 66, 54

The middle number is 78.

There are 5 marks greater than 78, and 5 marks less than 78.

The median mark is 78.

- Another Grade 7 student transfers to Ms. Shim's class.
He writes the same test and receives a mark of 72.

To find the new median, the teacher includes his mark in the ordered list:

95, 92, 87, 85, 80, 78, 76, 73, 72, 70, 66, 54

There are two middle numbers, 78 and 76.

There are 5 marks greater than 78, and 5 marks less than 76.

The median is the mean of the 2 middle numbers:

$$(78 + 76) \div 2 = 77$$

The median mark is now 77.

- Now that the marks are arranged in order, we can easily find the range.
The **range** of a data set tells how spread out the data are.
It is the difference between the greatest and least numbers.
To find the range of the marks on the science test, subtract the least mark from the greatest mark:
 $95 - 54 = 41$
The range of the marks is 41.

When there is an odd number of data, the median is the middle number.

When there is an even number of data, the median is the mean of the two middle numbers.

The median is also a measure of central tendency, or an average.

When there is an even number of data, the median might *not* be one of the numbers in the data set.

Example

The hourly wages, in dollars, of 10 workers are: 8, 8, 8, 8, 9, 9, 9, 11, 12, 20

Find:

- a) the mean b) the mode c) the median d) the range

How does each average relate to the data?

A Solution

- a) Mean wage:

Add: $8 + 8 + 8 + 8 + 9 + 9 + 9 + 11 + 12 + 20 = 102$

Divide by the number of workers, 10: $102 \div 10 = 10.2$

The mean wage is \$10.20.

Three workers have a wage greater than the mean and 7 workers have a wage less than the mean.

- b) Mode wage:

8, 8, 8, 8, 9, 9, 9, 11, 12, 20

The mode wage is \$8. It occurs 4 times.

This is the least wage; that is, 6 workers have a wage greater than the mode.

- c) Median wage:

List the 10 wages in order from least to greatest:

8, 8, 8, 8, **9, 9, 9, 11, 12, 20**

The median wage is the mean of the 5th and 6th wages.

Both the 5th and 6th wages are 9.

The median wage is \$9.

There are 3 wages above the median and 4 wages below the median.

- d) Range:

8, 8, 8, 8, 9, 9, 9, 11, 12, 20

Subtract the least wage from the greatest wage: $20 - 8 = 12$

The range of the wages is \$12.

Practice

- Find the median and the range of each set of data.
 - 85, 80, 100, 90, 85, 95, 90
 - 12 kg, 61 kg, 85 kg, 52 kg, 19 kg, 15 kg, 21 kg, 30 kg

2. The Grade 7 students in two combined Grades 6 and 7 classes wrote the same quiz, marked out of 15.

Here are the results:

Class A: 8, 9, 9, 12, 12, 13, 13, 14, 15, 15

Class B: 10, 10, 11, 11, 12, 12, 13, 13, 14, 14

- a) Find the median mark for each class.
b) Find the range of each set of marks.
c) Which class do you think is doing better? Explain.
3. a) Find the mean, median, and mode for each data set.
i) 4, 5, 7, 8, 11 ii) 50, 55, 65, 70, 70, 50
iii) 7, 63, 71, 68, 71 iv) 6, 13, 13, 13, 20

b) Which data sets have:

- the same values for the mean and median?
What do you notice about the numbers in each set?
- the same values for the mean, median, and mode?
What do you notice about the numbers in each set?
- different values for the mean, median, and mode?
What do you notice about the numbers in each set?

4. **Assessment Focus** Write two different data sets with 6 numbers, so that:

- a) The mode is 100. The median and the mean are equal.
b) The mode is 100. The mean is less than the median.

Show your work.

5. a) The median height of ten 12-year-old girls is 158 cm.
What might the heights be? How do you know?
b) The mode height of ten 12-year-old boys is 163 cm.
What might the heights be? How do you know?

6. Jamal was training for a 400-m race. His times, in seconds, for the first five races were: 120, 118, 138, 124, 118
- a) Find the median and mode times.
b) Jamal wants his median time after 6 races to be 121 s.
What time must he get in his 6th race? Show your work.
c) Suppose Jamal fell during one race and recorded a time of 210 s.
Which of the mean, median, and mode would be most affected? Explain.



7. In 2005, the Edmonton Miners hosted The Minto Cup Junior A Lacrosse Championship. Here are the 2005 statistics, as of June 30, 2005, for 10 players on the team.

Player	Games	Goals	Assists	Points	Penalty Minutes
Jeremy Boyd	13	2	8	10	54
Dan Claffey	11	3	11	14	33
Dalen Crouse	11	10	10	20	6
Andrew Dixon	15	4	5	10	47
Dan Hartzell	11	5	21	26	8
Cole Howell	12	21	13	34	0
Aiden Inglis	12	3	4	7	23
Ryan Polny	17	7	14	21	2
Chris Schmidt	5	8	4	12	2
Neil Tichkowsky	17	34	19	53	8

- a) Calculate the mean, the median, and the mode of each set of data.
- b) Make up a question about the mean, the median, or the mode that can be answered using these data. Answer your question.



8. **Take It Further** This is how Edward calculated the mean of these data.

48, 49, 50, 50, 51, 53, 57, 58

Estimated mean is 51.

Score	48	49	50	50	51	53	57	58
Deviation	-3	-2	-1	-1	0	+2	+6	+7

$$\begin{aligned} \text{Mean} &= 51 + \frac{(-3) + (-2) + (-1) + (-1) + 0 + 2 + 6 + 7}{8} \\ &= 52 \end{aligned}$$

Check that Edward's answer is correct. How does his method work?

Reflect

A median is the strip of land or concrete barrier separating lanes of highway traffic travelling in opposite directions. How is this meaning similar to its meaning in math?