

## 7.4

## Applications of Averages

**Focus** Understand which average best describes a set of data.

## Explore

Record on the board how many siblings you have.

Use the class data.

Find the mean, the median, and the mode.

Find the range.

## Reflect &amp; Share

With a classmate, discuss which measure best describes the average number of siblings.



## Connect

A clothing store sold jeans in these sizes in one day:

28 30 28 26 30 32 28 32 26 28 34 38 36 30 34 32 30

To calculate the mean jeans size sold, add the sizes, then divide by the number of jeans sold.

$$\begin{aligned} \text{Mean} &= \frac{28 + 30 + 28 + 26 + 30 + 32 + 28 + 32 + 26 + 28 + 34 + 38 + 36 + 30 + 34 + 32 + 30}{17} \\ &= \frac{522}{17} \\ &\doteq 30.7 \end{aligned}$$

The mean size is approximately 30.7.

To calculate the median, order the jeans sold from least size to greatest size. There are 17 numbers.

The middle number is the median. The middle number is the 9th.

26, 26, 28, 28, 28, 28, 30, 30, **30**, 30, 32, 32, 32, 34, 34, 36, 38

The median size is 30.

The mode is the number that occurs most often.

But, there are two numbers that occur most often.

So, there are two modes.

They are 28 and 30.

So, the mode sizes are 28 and 30.



When there is an odd number of data, to find the middle number: Add 1 to the number of data, then divide by 2. This gives the position of the middle number. For example:  $\frac{17 + 1}{2} = \frac{18}{2} = 9$ ; the middle number is the 9th.

In this situation, the mean, 30.7, is of little use.  
The mean does not represent a size.

The median, 30, shows about one-half of the customers bought jeans of size 30 or smaller, and about one-half of the customers bought jeans of size 30 or larger.

The modes, 28 and 30, tell which sizes are purchased more often.  
The mode is most useful to the storeowner.

He may use the mode to order extra stock of the most popular sizes.

### Example

A bookstore has 15 books in its young adult section.

There are 5 different prices.

This table shows the number of books at each price.

- Find the mean, median, and mode prices.
- Which measure best represents the average price of a young adult book?
- What is the range of the prices?

Young Adult Books	
Price (\$)	Number of Books
8.99	3
9.99	5
13.99	5
32.99	1
37.99	1

### A Solution

Make a list of the prices, in dollars:

8.99, 8.99, 8.99, 9.99, 9.99, 9.99, 9.99, 9.99, 13.99,  
13.99, 13.99, 13.99, 13.99, 32.99, 37.99

a) Mean price:

- Multiply each price by the total number of books at that price, then add the prices.  
 $(8.99 \times 3) + (9.99 \times 5) + (13.99 \times 5) + 32.99 + 37.99 = 217.85$
- Divide the total price by the total number of books: 15  
 $\frac{217.85}{15} \doteq 14.52$ , to two decimal places

The mean price is approximately \$14.52.

Median price:

There are 15 books.

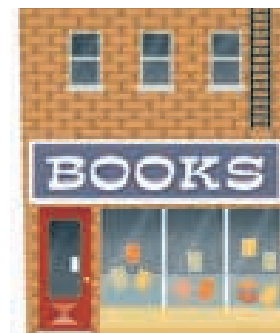
The list shows the books in order from least price to greatest price.

The median price is the 8th price. The 8th price is \$9.99.

The median price is \$9.99.

Mode price:

There are two mode prices. They are \$9.99 and \$13.99.



- b) The mean price is not charged for any of the books.  
Only two books cost more than the mean of \$14.52.  
There are two mode prices.  
One mode, \$9.99, is the same as the median price.  
One-half the books cost the median price or less.  
One-half cost more. So, the median price, \$9.99, best represents the average price of a young adult book at the store.
- c) For the range, subtract the lowest price from the highest price:  
 $37.99 - 8.99 = 29.00$   
The range of prices is \$29.00.

The mean is usually the best average when no numbers in the data set are significantly different from the other numbers.

The median is usually the best average when there are numbers in the data set that are significantly different.

The mode is usually the best average when the data represent measures, such as shoe sizes or clothing sizes.

A store needs to restock the sizes that sell most often.

## Practice

- The daily high temperatures for one week at Clearwater Harbour were: 27°C, 31°C, 23°C, 25°C, 28°C, 23°C, 28°C
  - Find the mean, median, and mode for these data.
  - Which average do you think best describes the daily high temperature at Clearwater Harbour that week? Explain.
  - The weather channel reported the average temperature for Clearwater Harbour that week was 23°C. Is this correct? Explain.
- Caitlin received these test marks in each subject.
  - Find the mean, median, and mode mark for each subject.
  - Explain what information each average gives.
  - Which subject do you think Caitlin is best at? Worst at? Explain your reasoning.



Caitlin's Marks							
Math	85	69	92	55	68	75	78
Music	72	81	50	69	81	96	92
French	68	74	82	80	76	67	74

3. The table shows the tips earned by five waiters and waitresses during two weeks in December.
- Calculate the mean, median, and mode tips for each week.
  - Calculate the mean, median, and mode tips for the two-week period.
  - Compare your answers in parts a and b. Which are the same? Which are different? Explain why.
  - Explain which average best represents the tips earned during the two weeks.

Weekly Tips Earned (\$)		
Waiter	Week 1	Week 2
James	1150	600
Kyrra	700	725
Tamara	800	775
Jacob	875	860
George	600	1165

4. A small engineering company has an owner and 5 employees. This table shows their salaries.
- Calculate the mean, median, and mode annual salaries.
  - What is the range of the annual salaries?
  - Which measure would you use to describe the average annual salary in each case? Explain.
    - You want to attract a new employee.
    - You want to suggest the company does not pay its employees well.

Company Salaries	
Position	Annual Salary (\$)
Owner	130 000
Manager	90 000
2 Engineers	50 000
Receptionist	28 000
Secretary	28 000

5. Is each conclusion correct? Explain your reasoning.
- The mean cost of a medium pizza is \$10.  
So, the prices of three medium pizzas could be \$9, \$10, and \$11.
  - The number of raisins in each of 30 cookies was counted.  
The mean number of raisins was 15.  
So, in 10 cookies, there would be a total of 150 raisins.

6. **Assessment Focus** In each case, which average do you think is most useful: the mean, median, or mode? Justify your answer.
- A storeowner wants to know which sweater sizes she should order.  
Last week she sold 5 small, 15 medium, 6 large, and 2 X-large sweaters.
  - Five of Robbie's friends said their weekly allowances are: \$10, \$13, \$15, \$11, and \$10.  
Robbie wants to convince his parents to increase his allowance.
  - Tina wants to know if her math mark was in the top half or bottom half of the class.

7. A quality control inspector randomly selects boxes of crackers from the production line. She measures their masses.

On one day she selects 15 boxes, and records these data:

- 6 boxes: 405 g each
- 2 boxes: 395 g each
- 4 boxes: 390 g each
- 2 boxes: 385 g each
- 1 box: 380 g

- a) Calculate the mean, median, and mode masses.
- b) What is the range of the masses?
- c) For the shipment of crackers to be acceptable, the average mass must be at least 398 g. Which average would you use to describe this shipment to make it acceptable? Explain.



8. **Take It Further** Andrew has these marks:

English 82%, French 75%, Art 78%, Science 80%

- a) What mark will Andrew need in math if he wants his mean mark in these 5 subjects to be each percent?

i) 80%                      ii) 81%                      iii) 82%

- b) Is it possible for Andrew to get a mean mark of 84% or higher? Justify your answer.

9. **Take It Further** Celia received a mean mark of 80% in her first three exams.

She then had 94% on her next exam.

Celia stated that her overall mean mark was 87% because the mean of 80 and 94 is 87.

Is Celia's reasoning correct? Explain.



## Reflect

Use your answers from *Practice*. Describe a situation for each case.

- a) The mean is the best average.
- b) The median is the best average.
- c) The mode is the best average.

Justify your choices.