

# 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.

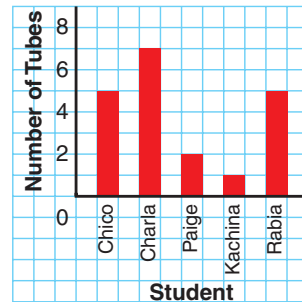
How many tubes of gel did each student use?

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:

$$\text{Add: } 8 + 8 + 8 + 8 + 9 + 9 + 9 + 11 + 12 + 20 = 102$$

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

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**

$$\text{Subtract the least wage from the greatest wage: } 20 - 8 = 12$$

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?