Lesson 8-5
Summarize Data Using Measures of Variability

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I can...
use measures of variability to describe a data set.

MAFS.6.SP.2.5c Summarize numerical data sets in relation to their context, such as by: Giving quantitative measures of... variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. Also 6.SP.2.4

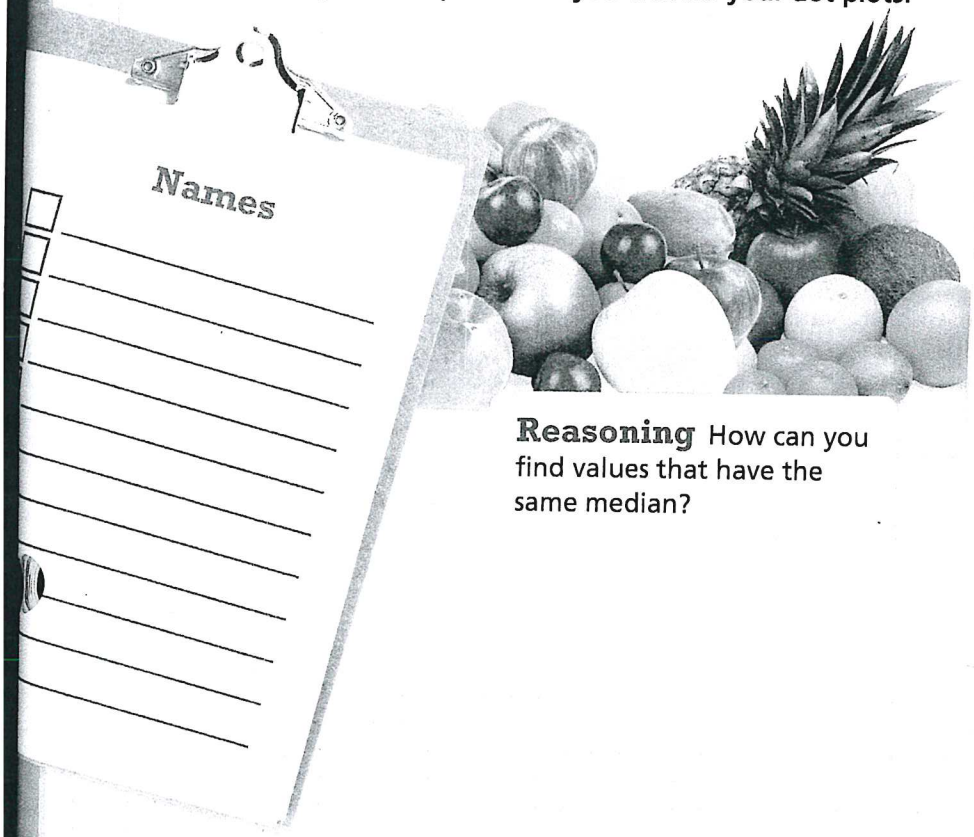
MAFS.K12.MP.2.1, MP.3.1, MP.4.1

Solve & Discuss It!

ACTIVITY

Suppose you collected data from 11 people about the number of pieces of fruit they have eaten in the past week. The median number is 6 pieces of fruit.

Make two possible dot plots that could be used to display the data—one in which the data vary a little and one in which the data vary a lot. Explain how you created your dot plots.



Reasoning How can you find values that have the same median?

Focus on math practices

Critique Reasoning Jackline says that only 3 people surveyed ate more than six pieces of fruit in the past week. Do you agree? Explain why or why not.

Essential Question How can the variability of data be described using a single number?

VISUAL LEARNING

EXAMPLE 1 Find the Mean Absolute Deviation to Describe Variability

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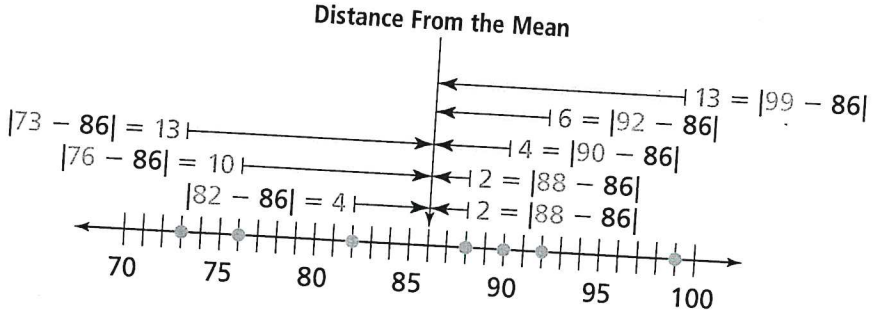
Ann is looking at her math quiz scores for one grading period. She wants to know how much her scores varied. She knows that her average (mean) score is 86%. How can Ann determine how much her scores varied during this grading period?

Ann's Math Quiz Scores (%)	
82	99
76	73
92	90
88	88

Model with Math
You can use a number line to show the spread and clustering of data in relation to the mean.

STEP 1 Find the differences between each of Ann's quiz scores and her mean (average) score. Show all differences as positive integers.

The **absolute deviation** is the absolute value of the difference between a value and the mean.



Ann's mean (average) score is 86%.

STEP 2 Find the mean of all of the differences, or absolute deviations. This value is called the **mean absolute deviation (MAD)**.

Add all of the absolute deviations.

$$\frac{13 + 10 + 4 + 2 + 2 + 4 + 6 + 13}{8}$$

$$= \frac{54}{8} \text{ or } 6.75$$

Divide by the number of scores

Ann can find the mean absolute deviation (MAD) to determine how much her math quiz scores varied during this grading period.

Her scores varied by an average of 6.75 points.

Try It!

Ann's vocabulary quiz scores are 75, 81, and 90. The mean score is 82. What is the mean absolute deviation?

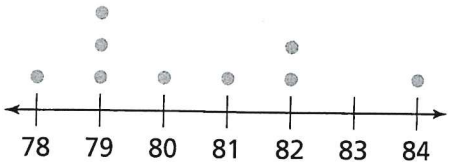
Score	Absolute Deviation
75	$\lvert 82 - 75 \rvert =$
81	$\lvert \quad - \quad \rvert =$
90	$\lvert \quad - \quad \rvert =$

Convince Me! Can the mean absolute deviation ever have a negative value? Explain.

EXAMPLE 2 Find the Interquartile Range (IQR) to Describe Variability

ACTIVITY ASSESS

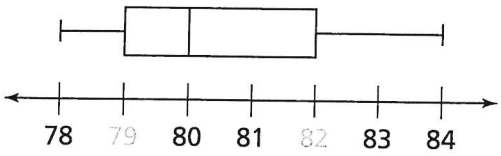
The dot plot shows Ann's science quiz scores. How can Ann determine the variability in her science quiz scores?



Ann's Science Quiz Scores (%)

Draw a box plot to determine the interquartile range.

The **interquartile range (IQR)** is a measure of variability. It represents the difference between the third quartile and the first quartile.

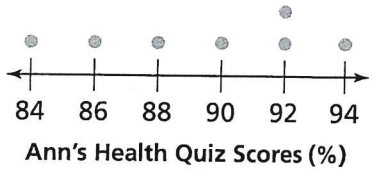


Ann's Science Quiz Scores (%)

The interquartile range is $82 - 79 = 3$.
So, at least half of Ann's science quiz scores were within 3 points.

Try It!

The dot plot shows the distribution of Ann's health quiz scores. How can the IQR describe her scores?



Ann's Health Quiz Scores (%)

EXAMPLE 3 Use the Mean Absolute Deviation (MAD) to Find the Variability of a Data Set

Jonah recorded the points his team scored during its last nine basketball games. The mean number of points scored was 42 and the MAD was $4.\overline{4}$. How can Jonah use these measures to describe the variability of the points his team scored during the last nine games?

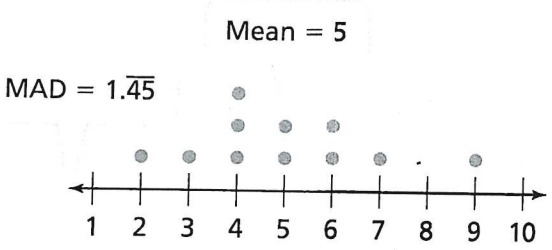
The MAD shows that the scores generally varied greatly from the mean. The scores were mostly less than 38 ($42 - 4.4 = 37.6$) or greater than 46 ($42 + 4.4 = 46.4$).

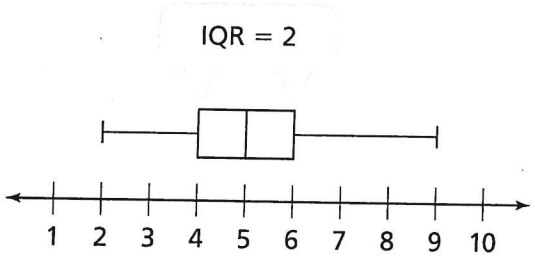
Try It!

Jonah's team scored 36, 37, 38, 38, 41, 46, 47, 47, and 48 points in the last nine games. Find the IQR and range of the points Jonah's team scored in its last nine games. Are these good measures for describing the points scored?

KEY CONCEPT

The mean absolute deviation and the interquartile range each use a single number to describe the variability, or spread, of a data set. The **mean absolute deviation (MAD)** tells you how far the data are spread out from the mean. The **interquartile range (IQR)** tells you how far the middle of the data is spread out from the median.





Do You Understand?

1. **Essential Question** How can the variability of data be described using a single number?

2. What does the IQR show that the range does not show?

3. **Reasoning** Two data sets have the same mean, 8. However, the MAD of Data Set A is 2 and the MAD of Data Set B is 4. What does this indicate about the variability of the data sets?

Do You Know How?

In 4–7, use these data.

Davita works at a shoe store. She measured the feet of nine customers and found that their shoe sizes were 4, 5, 5, 6, 7, 8, 8, 10, and 10.

4. Find the mean.

5. Find the sum of the absolute deviations from the mean.

6. Find the mean absolute deviation. Explain how you found the MAD.

7. Find the range and IQR. How is each calculated?

Name:

PRACTICE TUT

Practice & Problem Solving

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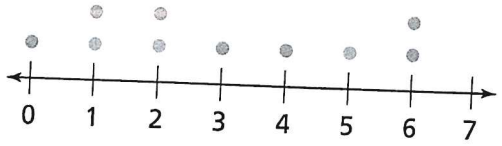
8. **Leveled Practice** The mean of the data set is 3. Find the absolute deviation of each of the green values.



a. The absolute deviation of 1 is .

b. The absolute deviation of 2 is .

c. The absolute deviation of 5 is .

In 9 and 10, use the data table showing the number of miles that Jill biked on 9 days.

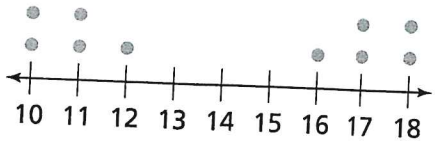
9. Find the mean.

Miles Biked		
5	9	11
10	8	6
7	12	4

10. Find the MAD of this data set. What does this tell you about the number of miles that Jill biked?

In 11 and 12, use the data shown in the dot plot.

11. What are the mean and the MAD?

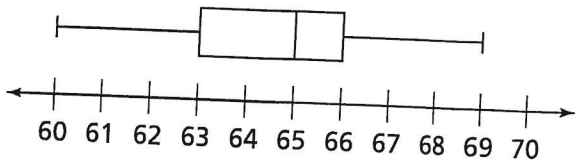


Ages of Park Volunteers

12. Describe the variability of the data.

In 13 and 14, use the data shown in the box plot.

13. What are the range and the IQR?



Heights of Volleyball Players (in.)

14. Describe the variability of the data.

15. The data set shows prices for concert tickets in 10 different cities in Florida.

City	Price ($)	City	Price ($)
Q	45	V	36
R	50	W	24
S	35	X	25
T	37	Y	27
U	29	Z	43

a. Find the IQR of the data set.

b. How do prices vary within the middle 50%?

16. **Reasoning** The MAD of the data set in the table is about 6.7. Does the value 4 deviate more or less than most of the values in the table? Explain.

4	28	25
19	7	13
16	22	10

In 17–19, use the data set shown in the table.

Temperatures (°C)			
11	17	20	16
19	16	15	22

17. **Vocabulary** What is the term used to describe the range of the middle half of the data set? Find that value for this data.

18. **Critique Reasoning** Dina said that the greatest absolute deviation will be found from the highest temperature because it has to be the farthest from the mean. Is she correct? Explain.

19. **Higher Order Thinking** What is the MAD for the data and what does it tell you about the temperatures?

Assessment Practice

20. Harlo recorded the tide, in feet, every hour during an 8-hour period as shown in the table. 6.SP.2.5c

Tide (ft)
3, 7, 11, 15, 20, 31, 39, 42

PART A

What is the MAD for the data set?

PART B

Select all the statements that best describe the IQR, MAD, and variability of the data set.

- ☐ The middle 50% of the data is spread out more than the average variation.
- ☐ The IQR is greater than the MAD.
- ☐ The middle 25% of the data is spread out more than the average variation.
- ☐ The IQR is less than the MAD.
- ☐ The MAD shows that the tides generally varied greatly from the mean.