


9-6

Variability of Data

What You'll Learn

To find and use measures of variability to describe and compare data sets

 **New Vocabulary** measure of center, measure of variability, mean absolute deviation (MAD), interquartile range (IQR)

 **CONTENT STANDARDS**

6.SP.2, 6.SP.3, 6.SP.5.c

Why Learn This?

Farmers can use growth patterns in plants to make predictions about future crop yields.

Big Boy Tomato Plant Yields										
Plant	1	2	3	4	5	6	7	8	9	10
Number of Tomatoes	17	22	16	45	18	24	30	22	27	19

You can describe a data set by studying its center, spread, and overall shape. A value that describes how data is centered is called a **measure of center**. The mean, median, and mode are measures of center.

A value that describes how data is spread out, such as the range, is called a **measure of variability**. One measure of variability is mean absolute deviation. **Mean absolute deviation (MAD)** is the average amount that the data values vary from the mean.

Vocabulary Tip

To *deviate* means to move away from something. You can think of the MAD as average amount by which the data move away from the mean.

$$\begin{aligned} \text{Mean} &= \\ \frac{17 + 22 + 16 + 45 + 18 + 24 + 30 + 22 + 29 + 19}{10} \\ &= 24 \end{aligned}$$

EXAMPLE

Using Variability of Data: Mean Absolute Deviation

- 1 A scientist investigated the yield of his Big Boy tomato plants, displayed above. How can you describe the variability in the yields?

One way to describe the variability is to find the mean absolute deviation (MAD) of the tomato data.

Step 1: Find the mean number of tomatoes over 10 days. Record the mean as shown in the table below.

Big Boy Tomato Yields										
Plant	1	2	3	4	5	6	7	8	9	10
Number of Tomatoes	17	22	16	45	18	24	30	22	27	19
Mean	24	24	24	24	24	24	24	24	24	24
Distance from Mean	7	2	8	21	6	0	6	2	3	5

Step 2: Find the distance between the number of tomatoes on each plant and the mean. Write each distance as a positive number.

Step 3: Calculate the mean of all the distances in the bottom row.

$$\frac{7 + 2 + 8 + 21 + 6 + 0 + 6 + 2 + 3 + 5}{10} = \frac{60}{10} = 6$$

The MAD is 6. So, the average difference between the data values and the mean is 6.

Example

① **Using Variability of Data: Mean Absolute Deviation** The table shows the number of minutes ten students spent talking to their friends on the phone in a day. Find the mean absolute deviation.

Step 1: Find the mean number of minutes for all the students. Record the mean in the table below.

Step 2: Find the distance between each student's number of minutes and the mean. Write each distance as a positive number.

Minutes on the Phone with Friends										
Student	1	2	3	4	5	6	7	8	9	10
Number of Minutes	15	35	55	45	60	20	30	25	45	20
Mean	35	35	35	35	35	35	35	35	35	35
Distance from Mean	20	0	20	10						

Step 3: Calculate the mean of all the distances in the bottom row.

$$20 + 0 + 20 + 10 + 25 + 15 + 5 + 10 + 10 + 15 = 130$$

$$\frac{130}{10} =$$

The MAD is

Another measure of variability is the **interquartile range (IQR)**. This measure gives the spread of the middle half of the data. To find the IQR, subtract the lower quartile of the data from the upper quartile of the data.

The mean absolute deviation and the interquartile range give you information about the variability of a data set using a single number. This is helpful when comparing the variability of two data sets.

Quick Check

1. A scientist investigated the yield of his Big Boy tomato plants. The table shows his data.

Plant	1	2	3	4	5	6	7	8	9	10
Number of Tomatoes	17	22	16	45	18	24	30	22	27	19
Mean	24	24	24	24	24	24	24	24	24	24
Distance from Mean	7	2	8	21	6	0	6	2	3	5

The mean average deviation of the data above is 6.

Suppose that Plant 1 grows 5 more tomatoes for a total of 22 instead of 17.

- a. What is the new mean absolute deviation for the data?
- b. What does the change in MAD for the new data set tell you about the data set? Explain.

2. Suppose that two more Big Boy tomato plants produced 20 and 25 tomatoes.

- a. What is the interquartile range for the 12 data values?

- b. How does this result affect your conclusion about the middle range of the data?

We will work through the guided problem solving worksheet together. Anything we do not finish in class will become homework.

9-6 • Guided Problem Solving

GPS Student Page 338, Exercise 19:

Use the table and information below.

Daily Exercise								
Day	1	2	3	4	5	6	7	8
Talia's Exercise (min)	40	60	55	40	20	32	30	45

The MAD is 7 and the IQR is 14.

Reasoning Using Talia's 8-Day exercise schedule, what effect would it have on the measures of variability if the value for Day 4 changed from 40 to 0? Explain.

Understand

1. What are you being asked to do? _____
2. Cross out and change the number in the table.
3. What statistical name can you call 0 in the new data set? _____

Plan and Carry Out

4. Without calculating, predict the effect of the new data on the mean. Explain.

5. What effect will this have on the MAD? Why?

6. What effect will the new data have on the IQR? Why?

7. Overall, how does the new data affect the variability of the data set? _____

Check

8. How can you check your answer?

9. Is your answer reasonable?

Solve Another Problem

10. Using Talia's original exercise schedule for 8 days, what effect would reducing each value by 10 minutes have on the measures of variability? Explain.

