

# Lesson 12

# Mean Absolute Deviation

### Main Idea

Find and interpret the mean absolute deviation for a set of data.

### New Vocabulary

**mean absolute deviation**

Math Online

[glencoe.com](http://glencoe.com)



**CELL PHONES** The table shows the number of contacts eight friends have stored in each of their cell phones.

Number of Contacts Stored			
52	48	60	55
59	54	58	62

1. Find the mean of the data.
2. What is the difference between the data value 52 and the mean?
3. Which value is farthest from the mean?
4. Overall, are the data values close to the mean or far away from the mean? Explain.

You have used the interquartile range which describes the variability of a set of data. Another way to describe the variability of a set of data is to use its mean absolute deviation. The **mean absolute deviation** of a set of data is the average distance between each data value and the mean.

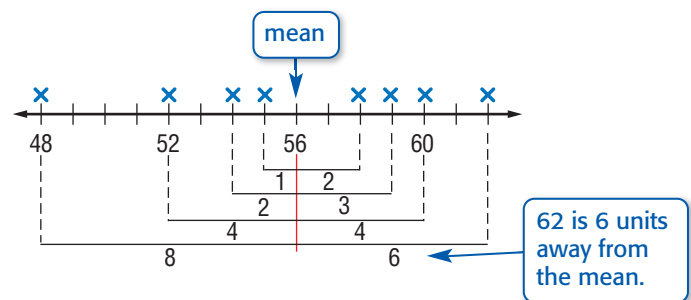
## Key Concept

### Mean Absolute Deviation

The mean absolute deviation of a set of data is the average distance between each data value and the mean.

1. Find the mean.
2. Find the distance between each data value and the mean. That is, find the absolute value of the difference between each data value and the mean.
3. Find the average of those differences.

The mean number of contacts stored and the distance each data value is from the mean is shown below. Each data value is represented by an  $\times$ .



The average of the distances is  $\frac{8 + 4 + 2 + 1 + 2 + 3 + 4 + 6}{8}$ , or 3.75.

So, the mean absolute deviation is 3.75. The average distance between each data value and the mean is 3.75 contacts.

## REAL-WORLD EXAMPLE

## Find Mean Absolute Deviation

- 1 ROLLER COASTERS** The table shows the maximum speeds of eight roller coasters at an amusement park. Find the mean absolute deviation of the set of data. Describe what the mean absolute deviation represents.

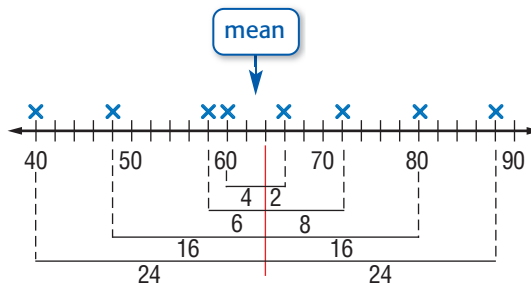
Maximum Speeds of Roller Coasters (mph)			
58	88	40	60
72	66	80	48

- Step 1** Find the mean.

$$\frac{58 + 88 + 40 + 60 + 72 + 66 + 80 + 48}{8} = 64$$

The mean is 64 miles per hour.

- Step 2** Find the absolute value of the differences between each value in the data set and the mean.



- Step 3** Find the average of the absolute values of the differences between each value in the data set and the mean.

$$\frac{24 + 16 + 6 + 4 + 2 + 8 + 16 + 24}{8} = 12.5$$

The mean absolute deviation is 12.5. This means that the average distance each data value is from the mean is 12.5 miles per hour.



### CHECK Your Progress

- a. **BIRDS** The table shows the maximum flying speeds of the ten fastest birds worldwide. Find the mean absolute deviation of the set of data. Round to the nearest hundredth. Describe what the mean absolute deviation represents.

Speeds of Top Ten Fastest Birds (mph)				
88	77	65	70	65
72	95	80	106	68

You can compare the mean absolute deviations for two data sets. A data set with a smaller mean absolute deviation has data values that are closer to the mean than a data set with a greater mean absolute deviation.

- 2 BASEBALL** The top five salaries and the bottom five salaries for the 2010 New York Yankees are shown in the table below. Salaries are in millions of dollars and are rounded to the nearest hundredth.

2010 New York Yankees Salaries (millions of \$)									
Top Five Salaries					Bottom Five Salaries				
33.00	24.29	22.60	20.63	16.50	0.45	0.44	0.43	0.41	0.41

- a. Find the mean absolute deviation for each set of data. Round to the nearest hundredth.

**Top Five Salaries**

Find the mean.

$$\frac{33.00 + 24.29 + 22.60 + 20.63 + 16.50}{5} \approx 23.40$$

The mean is about \$23.40 million.

Find the mean absolute deviation by finding the absolute values of the differences between each data value and the mean. Then average the differences.

$$\frac{9.60 + 0.89 + 0.80 + 2.77 + 6.90}{5} \approx 4.19$$

The mean absolute deviation is about \$4.19 million.

**Bottom Five Salaries**

Find the mean.

$$\frac{0.45 + 0.44 + 0.43 + 0.41 + 0.41}{5} \approx 0.43$$

The mean is about \$0.43 million.

Find the mean absolute deviation by finding the absolute values of the differences between each data value and the mean. Then average the differences.

$$\frac{0.02 + 0.01 + 0 + 0.02 + 0.02}{5} \approx 0.01$$

The mean absolute deviation is about \$0.01 million.

- b. Write a few sentences comparing their variation.

The mean absolute deviation for the bottom five salaries is much less than that for the top five salaries. The data for the bottom five salaries are closer together than the data for the top five salaries.

**Study Tip**

**Mean Absolute Deviation**  
The absolute values of the differences between each data value and the mean for the top five salaries are calculated below.

$$\begin{aligned} |33.00 - 23.40| &= 9.60 \\ |24.29 - 23.40| &= 0.89 \\ |22.60 - 23.40| &= 0.80 \\ |20.63 - 23.40| &= 2.77 \\ |16.50 - 23.40| &= 6.90 \end{aligned}$$

 **CHECK Your Progress**

- b. **MOVIES** The table shows the running time in minutes for two kinds of movies. Find the mean absolute deviation for each set of data. Round to the nearest hundredth. Then write a few sentences comparing their variation.

Running Time for Movies (min)									
Comedy					Drama				
90	95	88	100	98	115	120	150	135	144

 **CHECK Your Understanding**

**Example 1** Find the mean absolute deviation for each set of data. Round to the nearest hundredth if necessary. Then describe what the mean absolute deviation represents.

1. 

Number of Daily Visitors to a Web Site				
112	145	108	160	122

2. 

Zoo Admission Prices (\$)		
9.50	9.00	8.25
9.25	8.00	8.50

**Example 2** 3. **WATER PARKS** The table shows the height of waterslides at two different water parks. Find the mean absolute deviation for each set of data. Round to the nearest hundredth. Then write a few sentences comparing their variation.

Height of Waterslides (ft)									
Splash Lagoon					Wild Water Bay				
75	95	80	110	88	120	108	94	135	126

**Practice and Problem Solving**

**Example 1** Find the mean absolute deviation for each set of data. Round to the nearest hundredth if necessary. Then describe what the mean absolute deviation represents.

4. 

Known Moons of Planets			
0	0	1	2
63	34	27	13

5. 

Hard Drive (gigabytes)			
640	250	500	640
720	640	250	720

6. 

Digital Camera Prices (\$)				
140	125	190	148	156
212	178	188	196	224

7. 

Grand Slam Singles Titles Won				
14	8	7	6	5
10	11	8	8	6

**Example 2****Real-World Link**

New York City is the largest city in the U.S., with a population of about 8.4 million within the city limits. If the surrounding metropolitan areas are included, it is closer to 20 million.

- 8. FUNDRAISING** The table shows the amount of money raised by the homerooms for two grade levels at a middle school. Find the mean absolute deviation for each set of data. Round to the nearest hundredth. Then write a few sentences comparing their variation.

Money Raised (\$)											
Sixth Grade						Seventh Grade					
88	116	94	108	112	124	144	91	97	122	128	132

- 9. BRIDGES** The table shows the lengths of the longest bridges in the United States and in Europe. Find the mean absolute deviation for each set of data. Round to the nearest hundredth if necessary. Then write a few sentences comparing their variation.

Longest Bridges (kilometers)									
United States					Europe				
38.4	36.7	29.3	24.1	17.7	17.2	11.7	7.8	6.8	6.6
12.9	11.3	10.9	8.9	8.9	6.1	5.1	5.0	4.3	3.9

- 10. BASKETBALL** The table shows the number of points scored each game for two different basketball teams. Find the mean absolute deviation for each set of data. Round to the nearest hundredth if necessary. Then write a few sentences comparing their variation.

Number of Points Scored											
Lakeside Panthers					Jefferson Eagles						
44	38	54	48	26	36	58	42	64	62	70	40

- POPULATION** For Exercises 11–14, refer to the table that shows the recent population, in millions, of the ten largest U.S. cities.

Population of Largest U.S. Cities (millions)				
1.5	3.8	1.3	1.6	2.9
1.4	0.9	2.3	8.4	1.3

- Find the mean absolute deviation. Round to the nearest hundredth.
- How many data values are closer than one mean absolute deviation away from the mean?
- Which population is farthest from the mean? How far away from the mean is that population? Round to the nearest hundredth.
- Are there any populations that are more than twice the mean absolute deviation from the mean? Explain.

**VOCABULARY** For Exercises 15 and 16, look up the word *deviate* in a dictionary or online.

- What does the word *deviate* mean? How can it help you remember what the mean absolute deviation refers to?
- How does the word *absolute* help you to remember how to calculate the mean absolute deviation?

**NUTRITION** For Exercises 17 and 18, refer to the table that shows the number of Calories in several sandwiches at two restaurants.

Number of Calories per Sandwich											
Susan's Sub Shop						The Picnic Basket					
490	380	270	430	510	410	550	320	470	430	610	290

- Find the mean absolute deviation for each set of data. Round to the nearest hundredth.
- For either data set, are there any data values that are more than twice the mean absolute deviation from the mean? Explain.

### H.O.T. Problems

- OPEN ENDED** Create two sets of data, each with five values, that satisfy the following conditions.

*The mean absolute deviation of Set A is less than the mean absolute deviation of Set B.*

*The mean of Set A is greater than the mean of Set B.*

**CHALLENGE** For Exercises 20 and 21, refer to the table that shows the recorded speeds of several cars on a busy street.

Recorded Speeds (mph)					
35	38	41	35	36	55

- Calculate the mean absolute deviation both with and without the data value of 55. Round to the nearest hundredth if necessary.
- Explain how including the value of 55 affects the mean absolute deviation.
- REASONING** Explain why the mean absolute deviation is calculated using absolute value.
- WRITE MATH** Write a letter to a classmate explaining how to find the mean absolute deviation and what it tells you about a set of data.

### Test Practice

- The table shows the prices for parking at various beaches along the same coastline.

Beach Parking (\$)				
2.50	3.75	1.25	2.25	3.00

Which of the following is the mean absolute deviation for the set of data?

- \$0.25
  - \$0.66
  - \$2.50
  - \$2.55
- Which of the following is true concerning the mean absolute deviation of a set of data?
    - It describes the variation of the data values around the median.
    - It describes the absolute value of the mean.
    - It describes the average distance between each data value and the mean.
    - It describes the variation of the data values around the mode.