11-4 Mean Absolute Deviation

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

2.

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

SOLUTION:

Step 1 Find the mean.

$$\frac{640 + 250 + 500 + 640 + 720 + 640 + 250 + 720}{8} = 545$$

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

$|640 - 545| = 95$
$|250 - 545| = 295$
$|500 - 545| = 45$
$|640 - 545| = 95$
$|720 - 545| = 175$
$|640 - 545| = 95$
$|250 - 545| = 295$
$|720 - 545| = 175$

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

$$\frac{95 + 295 + 45 + 95 + 175 + 95 + 295 + 175}{8} = 158.75$$

So, the mean absolute deviation for the data set is 158.75 gigabytes. This means that the average distance each data value is from the mean is 158.75 gigabytes.

ANSWER:

158.75 gigabytes; Sample answer: The average distance each data value is from the mean is 158.75 gigabytes.

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

4. Find the mean absolute deviation. Round to the nearest hundredth.

SOLUTION:

Step 1 Find the mean.

$$\frac{1.5+3.8+1.3+1.6+2.9+1.4+0.9+2.3+8.4+1.3}{10}=2.54$$

Step 2 Find the absolute value of the differences between each value in the data set and the mean.
$|1.5-2.54|=1.04$
$|3.8-2.54|=1.26$
$|1.3-2.54|=1.24$
$|1.6-2.54|=0.94$
$|2.9-2.54|=0.36$
$|1.4-2.54|=1.14$
$|0.9-2.54|=1.64$
$|2.3-2.54|=0.24$
$|8.4-2.54|=5.86$
$|1.3-2.54|=1.24$

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

$$\frac{1.04+1.26+1.24+0.94+0.36+1.14+1.64+0.24+5.86+1.24}{10}=1.496$$

So, rounded to the nearest hundredth, the mean absolute deviation for the data set is 1.50 million people.

ANSWER:
1.50 million

6. Which population is farthest from the mean? How far away from the mean is that population? Round to the nearest hundredth.

SOLUTION:

The mean is 2.54 million people.

Find the absolute value of the differences between each value in the data set and the mean. Make a note of which data value is farthest from the mean.

$|1.5 - 2.54| = 1.04$
$|3.8 - 2.54| = 1.26$
$|1.3 - 2.54| = 1.24$
$|1.6 - 2.54| = 0.94$
$|2.9 - 2.54| = 0.36$
$|1.4 - 2.54| = 1.14$
$|0.9 - 2.54| = 1.64$
$|2.3 - 2.54| = 0.24$
$|8.4 - 2.54| = 5.86$ This data value is farthest from the mean, because 5.86 is greater than the other absolute-value differences.
$|1.3 - 2.54| = 1.24$

The population that is farthest from the mean is 8.40 million. It is 5.86 million from the mean.

ANSWER:

8.40 million; 5.86 million

Be Precise **Look up the word** *deviate* **in a dictionary or online.**
8. What does the word *deviate* mean? How can it help you remember what the mean absolute deviation refers to?

SOLUTION:

to differ from; Sample answer: The mean absolute deviation describes how the data values differ from the mean.

ANSWER:

to differ from; Sample answer: The mean absolute deviation describes how the data values differ from the mean.

10. **Reason Abstractly** 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.

SOLUTION:

Sample answer: Consider the following sets.
Set A: 12, 13, 15, 16, 19
Set B: 4, 8, 10, 15, 23

Find the mean and the mean absolute deviation for each set.

Set A
Find the mean.

$$\frac{12+13+15+16+19}{5} = 15$$

Find the mean absolute deviation.
First, find the absolute value of the differences between each value in the data set and the mean.
$|12 - 15| = 3$
$|13 - 15| = 2$
$|15 - 15| = 0$
$|16 - 15| = 1$
$|19 - 15| = 4$

Next, find the average of the absolute values of the differences between each value in the data set and the mean.

$$\frac{3 + 2 + 0 + 1 + 4}{5} = 2$$

Set B
Find the mean.

$$\frac{4 + 8 + 10 + 15 + 23}{5} = 12$$

Find the mean absolute deviation.
First, find the absolute value of the differences between each value in the data set and the mean.
$|4 - 12| = 8$
$|8 - 12| = 4$
$|10 - 12| = 2$
$|15 - 12| = 3$
$|23 - 12| = 11$

Next, find the average of the absolute values of the differences between each value in the data set and the mean.

$$\frac{8 + 4 + 2 + 3 + 11}{5} = 5.6$$

Notice that the mean of Set A, 15, is greater than the mean of Set B, 12. The mean absolute deviation of Set A, 2, is less than the mean absolute deviation of Set B, 5.6. This means that that data in Set A are closer to their mean than the data in Set B is to their mean, while the mean of Set A is greater than the mean of Set B.

These two sample sets satisfy the given conditions.

ANSWER:
Sample answer: Set A: 12, 13, 15, 16, 19; Set B: 4, 8, 10, 15, 23

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Persevere with Problems 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

12. Explain how including the value of 55 affects the mean absolute deviation.

SOLUTION:
Sample answer: When the value of 55 was included, the mean absolute deviation increased. Because the value of 55 is so much greater than the other data values, the larger mean absolute deviation shows that the data are more spread out when the value of 55 is included as opposed to when it is not included.

ANSWER:
Sample answer: When the value of 55 was included, the mean absolute deviation increased. Because the value of 55 is so much greater than the other data values, the larger mean absolute deviation shows that the data are more spread out when the value of 55 is included as opposed to when it is not included.

14. The table shows the high temperature for 6 days.

High Temperature (°F)					
75	58	72	68	69	66

If the high temperature for day 7 is 61°F, how does the mean absolute deviation change?

SOLUTION:
Step 1 Find the mean.
$$\frac{75+58+72+68+69+66}{6} = 68$$

Step 2 Find the absolute value of the differences between each value in the data set and the mean.
$|75 - 68| = 7$
$|58 - 68| = 10$
$|72 - 68| = 4$
$|68 - 68| = 0$
$|69 - 68| = 1$
$|66 - 68| = 2$

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

$$\frac{7+10+4+0+1+2}{6} = 4$$

So, the mean absolute deviation for the data set is 4 degrees Fahrenheit.

Now, add 7°F to the data, and find the mean absolute deviation.

Step 1 Find the mean.

$$\frac{75+58+72+68+69+66+61}{7} = 67$$

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

$|75 - 67| = 8$
$|58 - 67| = 11$
$|72 - 67| = 5$
$|68 - 67| = 1$
$|69 - 67| = 2$
$|66 - 67| = 1$
$|61 - 67| = 6$

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

$$\frac{8+11+5+1+2+1+6}{7} \approx 4.9$$

So, the mean absolute deviation for the new data set is 4.9 degrees Fahrenheit.
The mean absolute deviation increased from 4 to about 4.9.

ANSWER:
The mean absolute deviation increases from 4 to about 4.9.

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Use Math Tools Find the mean absolute deviation for the set of data. Round to the nearest hundredth if necessary. Then describe what the mean absolute deviation represents.

16.

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

SOLUTION:

Step 1 Find the mean.

$$\frac{14+8+7+6+5+10+11+8+8+6}{10} = 8.3$$

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

$|14 - 8.3| = 5.7$
$|8 - 8.3| = 0.3$
$|7 - 8.3| = 1.3$
$|6 - 8.3| = 2.3$
$|5 - 8.3| = 3.3$
$|10 - 8.3| = 1.7$
$|11 - 8.3| = 2.7$
$|8 - 8.3| = 0.3$
$|8 - 8.3| = 0.3$
$|6 - 8.3| = 2.3$

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

$$\frac{5.7+0.3+1.3+2.3+3.3+1.7+2.7+0.3+0.3+2.3}{10} = 2.02$$

So, the mean absolute deviation for the data set is 2.02 Grand Slam titles. This means that the average distance each data value is from the mean is 2.02 Grand Slam titles.

ANSWER:

2.02 Grand Slam titles; The average distance each data value is from the mean is 2.02 Grand Slam titles.

Copy and Solve Find the mean absolute deviation for each set of data. Round to the nearest hundredth. Then write a few sentences comparing their variation.

18. The table shows the number of points scored each game for two different basketball teams.

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

SOLUTION:

Step 1 Find the mean for both data sets.

Lakeside Panthers:

$$\frac{44 + 38 + 54 + 48 + 26 + 36}{6} = 41$$

Jefferson Eagles:

$$\frac{58 + 42 + 64 + 62 + 70 + 40}{6} = 56$$

Step 2 Find the absolute value of the differences between each value for both data sets and the mean.

Lakeside Panthers:

$|44 - 41| = 3$
$|38 - 41| = 3$
$|54 - 41| = 13$
$|48 - 41| = 7$
$|26 - 41| = 15$
$|36 - 41| = 5$

Jefferson Eagles:

$|58 - 56| = 2$
$|42 - 56| = 14$
$|64 - 56| = 8$
$|62 - 56| = 6$
$|70 - 56| = 14$
$|40 - 56| = 16$

Step 3 Find the average of the absolute values of the differences between each value for both data sets and the mean.

Lakeside Panthers:

$$\frac{3 + 3 + 13 + 7 + 15 + 5}{6} = 7.\overline{6}$$

Rounded to the nearest hundredth, the mean absolute deviation is 7.67 points.

Jefferson Eagles:

$$\frac{2 + 14 + 8 + 6 + 14 + 16}{6} = 10$$

Rounded to the nearest hundredth, the mean absolute deviation is 10 points.

So, the mean absolute deviation for the Lakeside Panthers is 7.67 points. The mean absolute deviation for the Jefferson Eagles is 10 points. The mean absolute deviation of the number of points scored by the Panthers is less than the mean absolute deviation of the number of points scored by the Eagles. The number of points scored by the Panthers is closer to the mean.

ANSWER:

Lakeside Panthers: 7.67 points; Jefferson Eagles: 10 points; Sample answer: The mean absolute deviation of the

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number of points scored by the Panthers is less than the mean absolute deviation of the number of points scored by the Eagles. The number of points scored by the Panthers is closer to the mean.

20. The table shows the prices for parking at 3 different beaches along the the same coastline.

Beach Parking ($)		
2.50	3.75	3.50

Select the correct values to complete the model below to find the mean absolute deviation of the data.

0.25	2.75	1
0.50	3.00	2
0.75	3.25	3
1.00	3.50	4
2.50	3.75	5

Find the mean:

$$\frac{[\quad] + [\quad] + [\quad]}{[\quad]} = [\quad]$$

Find the absolute values of the differences between each data value and the mean:

$$|[\quad] - [\quad]| = [\quad]$$
$$|[\quad] - [\quad]| = [\quad]$$
$$|[\quad] - [\quad]| = [\quad]$$

Find the mean of the absolute values of the differences:

$$\frac{[\quad] + [\quad] + [\quad]}{[\quad]} = [\quad]$$

What is the mean absolute deviation of the data? [\quad]

SOLUTION:

Step 1 Find the mean.
$$\frac{2.50 + 3.75 + 3.50}{3} = 3.25$$

Step 2 Find the absolute value of the differences between each value in the data set and the mean.
$$|2.50 - 3.25| = 0.75$$
$$|3.75 - 3.25| = 0.50$$
$$|3.50 - 3.25| = 0.25$$

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

$$\frac{0.75 + 0.50 + 0.25}{3} = 0.50$$

So, the mean absolute deviation for the data set is $0.50.

ANSWER:

$$\frac{[2.50] + [3.75] + [3.50]}{[3]} = [3.25]$$

$$|[2.50] - [3.25]| = [0.75]$$

$$|[3.75] - [3.25]| = [0.50]$$

$$|[3.50] - [3.25]| = [0.25]$$

$$\frac{[0.75] + [0.50] + [0.25]}{[3]} = [0.50]$$

$0.50

22. The hiking club wanted to cover a different trail each day for a week. On Monday they hiked 2.3 miles, on Tuesday they hiked 1.8 miles, on Wednesday they hiked 3.2 miles, on Thursday they hiked 1.4 miles and on Friday they hiked 2.8 miles. What is the total distance they hiked?

SOLUTION:
Add.

$2.3 + 1.8 + 3.2 + 1.4 + 2.8 = 11.5$

The total distance they hiked was 11.5 miles.

ANSWER:
11.5 miles