Understanding the Mean

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10.9 Understanding the Mean

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[Figure 1]

The school track team is heading to regionals. Mackenzie wants to figure out the team standings in order to set goals to improve. Mackenzie began to figure out his standing. He is a high-jumper at his school. He has 8 teammates whose records are 172 cm, 174 cm, 175 cm, 179 cm, 181 cm, 181 cm, 182 cm, and 185 cm. If Mackenzie's record is 176 cm, how does he compare to the rest of the team?

In this concept, you will learn to understand the mean.

Mean

Statistical measures help to generalize a group of data, make inferences about it, and compare it with other groups of data. Depending on the situation, certain measures may be more helpful than others in interpreting data.

The **mean, median**, and **mode** are three common measures of central tendency; they are three mathematical tools frequently used to analyze data.

The **mean** is the sum of all the data items divided by the number of data items.

The **median** is the middle number in a set of data that is ordered from lowest to highest. If there is an even number of data, you take the average of the middle two numbers to find the median.

The **mode** is the number that occurs most often.

When you look for the **deviation from the mean**, you are looking for the difference between an average and a value.

Let's look at an example that shows what happens when the difference between the mean and another value is determined.

At a restaurant, the food servers report how much money in tips they earn each night. One Saturday, the food servers reported the following tips: $45, $37.50, $51, $69, $47, and $55. Greg is the newest food server and wants to know how the tips compare to each other. One way to do this is to find the deviation from the mean. This tells you how far away from the mean, or average, each food server was.

First, find the mean.

$$\begin{aligned} \text{mean} &= \frac{45+37.50+51+69+47+55}{6} \\ &= \frac{304.50}{6} \\ &= 50.75 \end{aligned}$$

Next, find the difference of each food server tip from the mean. This is the deviation from the mean. Notice that Greg's value is always used because you are looking for the deviation between the tips of the other waiters and Greg.

When subtracting, place the larger of the two numbers first so that the difference is positive.

Difference from mean	Deviation from the mean
50.75 - 37.5	13.25
50.75 - 45	5.75
50.75 - 47	3.75
51 - 50.75	0.25
55 - 50.75	4.25
69 - 50.75	18.25

Then, find the mean of these deviations. The deviation from the mean can let each food server know how far he or she was from the average tips that night.

$$\begin{aligned} \text{mean} &= \frac{13.25+5.75+3.75+0.25+4.25+18.25}{6} \\ &= \frac{45.5}{6} \\ &= 7.58 \end{aligned}$$

The answer is 7.58. Therefore the tips received by each of the servers are on average $7.58 from the mean amount of tips ($50.75).

Another statistical measure that can be useful is the **mean absolute deviation**. The deviation from the mean, which is how far an individual item is from the mean, has already been calculated. When only the positive difference is found, the **mean absolute deviation** is found.

The **range** is found by subtracting the smallest number from the largest number. This gives an idea of the span or the breadth of the data.

For instance, if a new car buyer has just entered the work force, it may help for the buyer to know that the mean price of new cars is $22,300. This may be too high, but the mean doesn't really supply enough information. If the buyer knows that new car prices vary from $10,500 to $89,900, then he may have a better idea about what a car might cost at the lower end, easier for his income level. The range of car prices, in this example is $\$89,900 - \$10,500 = \$79,400$. It is a broad range that should allow him to purchase a car.

Let's look at another example.

A city surveyor took elevation measurements around a coastal city that has a reported mean elevation of 35 feet above sea level. He went to various homes and gathered the following data: 152, 316, 26, 64, 20, 506, 210, and 89. Find the range and mean absolute deviation.

First, find the range. Subtract the smallest number from the largest.

$$506 - 20 = 486$$

Next, knowing the mean is 35 feet (given); find the deviations from the mean.

Difference from mean	Deviation from the mean
35 - 20	15
35 - 26	9
64 - 35	29
89 - 35	54
152 - 35	117
210 - 35	175
316 - 35	281
506 - 35	471

Then, find the mean of these deviations.

$$\begin{aligned} \text{mean} &= \frac{15+9+29+54+117+175+281+471}{8} \\ &= \frac{1151}{8} \\ &= 143.875 \end{aligned}$$

The answer is 143.875.

Therefore, the mean absolute deviation is 143.9 feet.

Examples

Example 1

Earlier, you were given a problem about Mackenzie the high-jumper at his school. He has 8 teammates whose records are 172 cm, 174 cm, 175 cm, 179 cm, 181 cm, 181 cm, 182 cm, and 185 cm.

If Mackenzie's record is 176 cm, how does he compare to the rest of the team?

In this case, finding the deviation from the mean would be most useful in answering the question because he wants to compare his individual record to that of the team.

First, find the mean.

$$\begin{aligned} \text{mean} &= \frac{172+174+179+181+181+182+185+176}{8} \\ &= \frac{1430}{8} \\ &= 178.75 \end{aligned}$$

Next, calculate Mackenzie's deviation from the mean.

$$178.75 - 176 = 2.75$$

The answer is 2.75.

Therefore Mackenzie's record is 2.75 cm lower than the mean.

Example 2

The town keeps statistics on its local races. Here are the times from a recent 5 km race. The average time was 23 minutes. The times are: 21, 21, 22, 18, 19, 23, 25, 27, 30.

What are the range and the mean absolute deviation?

First, find the range. Subtract the smallest number from the largest.

$$30 - 18 = 12$$

Next, knowing the mean is 23 minutes (given); find the deviations from the mean.

Difference from mean	Deviation from the mean
23 - 18	5
23 - 19	4
23 - 21	2
23 - 21	2
23 - 22	1
23 - 23	0
25 - 23	2
27 - 23	4
30 - 23	7

Then, find the mean of these deviations.

$$\begin{aligned} \text{mean} &= \frac{5+4+2+2+1+0+2+4+7}{9} \\ &= \frac{27}{9} \\ &= 3 \end{aligned}$$

The answer is 3.

The mean absolute deviation of the race times is 3 minutes.

The following scores were earned on a math test: 65, 70, 82, 83, 50, 90 and 88. Use this information to answer each question below.

Example 3

What is the mean of the scores?

$$\begin{aligned} \text{mean} &= \frac{65+70+82+83+50+90+88}{7} \\ &= \frac{528}{7} \\ &= 75.43 \end{aligned}$$

The answer is 75.43.

The mean score on the math test is 75.4.

Example 4

Find the absolute mean deviation from the mean for each score.

Difference from mean	Deviation from the mean
75.4 - 50	25.4
75.4 - 65	10.4
75.4 - 70	5.4
82 - 75.4	6.6
83 - 75.4	7.6
88 - 75.4	12.6
90 - 75.4	14.6

$$\begin{aligned} \text{mean} &= \frac{25.4+10.4+5.4+6.6+7.6+12.6+14.6}{7} \\ &= \frac{82.6}{7} \\ &= 11.8 \end{aligned}$$

The answer is 11.8.

The absolute mean deviation is 11.8.

Example 5

How did Kara's score of 82 compare to the others?

Kara's score is 82%.

The mean score on the math test is 75.4%.

Therefore, Kara's score is 6.6 points above the mean.

Review

Define each term.

1. Mean

2. Median

3. Mode

4. Deviation from the mean

5. Range

Use this data to complete the following questions.

Two groups of adult female harbor seals were weighed from different parts of the globe, one from the Pacific Ocean and one from the Atlantic Ocean.

The Pacific Ocean group had weights of: 126 kg, 130 kg, 135 kg, 136 kg, 137 kg, 140 kg, 148 kg, and 150 kg. The Atlantic Ocean group had weights of 117 kg, 119 kg, 122 kg, 123 kg, 130 kg, 131 kg, 141 kg, 149 kg, and 152 kg. A marine biologist decided to gather data to compare the two groups.

Beginning with the Pacific Ocean Group.

6. What is the mean of the data set?

7. What is the median?

8. What is the mode?

9. What is the range?

10. If a new seal was weighed with a weight of 137 kg, what would be the deviation from the mean?

Now with the Atlantic Ocean Group.

11. What is the mean of the data set?

12. What is the median?

13. What is the mode?

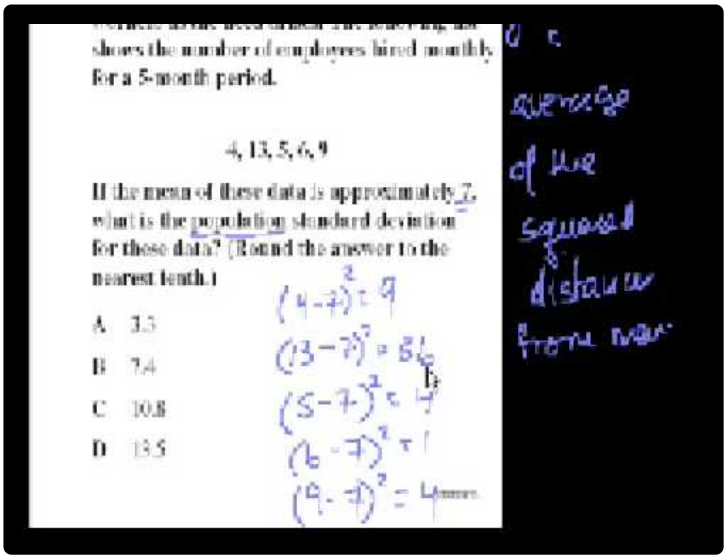
14. What is the range?

15. If a new seal was weighed with a weight of 137 kgs, what would be the deviation from the mean?

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

Resources



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