Determine the mean of the following set of grades on a quiz for a math quiz:

90, 95, 80, 89, 90, 85, 93, 90

The mean is used as a guide to make a prediction. Using the example above, if I were to guess the average grade on the math quiz, the mean would be a good guess.

If the numbers are all spread apart, the mean might not be a good measure of predicting outcomes. For example, if someone in the class gets a 0 on the quiz, but everyone else in the class gets a B or an A, the mean of the test grades would probably be somewhere close to 70.

Would it make sense for me to guess that on average, students got a 70% on the quiz?

That is why we find the mean absolute deviation because it helps us determine if the mean is useful.

The mean absolute deviation is the average amount that each number is away from the mean of the data set. (You may hear it referred to as the average mean deviation)

To find the mean absolute deviation, use the following formula for \( n \) data entries:

\[
\frac{\sum_{i=1}^{N} |x_i - \bar{x}|}{N} = \frac{|entry_1 - mean| + |entry_2 - mean| + |entry_3 - mean| + \ldots + |entry_n - mean|}{\text{total number of entries, } n}
\]

Example 1: The following are scores on a Math test. Find the mean absolute deviation.

80, 85, 81, 0, 85, 90, 87, 92

Step 1: find the mean of the data: \( \frac{80 + 85 + 81 + 0 + 85 + 90 + 87 + 92}{8} = 75 \)

Step 2: find the deviations of the data from the mean:

80 – 75 = 5  
82 – 75 = 7  
81 – 75 = 6  
0 – 75 = -75  
85 – 75 = 10  
90 – 75 = 15  
87 – 75 = 12  
92 – 75 = 17

Step 3: take the absolute value of each deviation and find the average:

\[
\frac{5 + 7 + 6 + 75 + 10 + 15 + 12 + 17}{8} = 18.375 \quad \text{The mean absolute deviation for this test is 18.375.}
\]

What does this tell us? Is the mean relevant for this data?

When the mean absolute deviation is large, that means that the mean is not relevant. This is because there is an outlier.
Follow these steps to find mean deviation:

1) Find the mean of the data.
2) Subtract the mean from each data entry.
3) Take all of the subtractions, make them positive, and find their average.

Example 2:

Emma and Sara play 5 games on a handheld video game and record their scores in this table.

<table>
<thead>
<tr>
<th>Game</th>
<th>Emma</th>
<th>Sara</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>17</td>
</tr>
</tbody>
</table>

Which girl had the greater mean deviation for her scores?

First look at Emma’s scores:

Step 1: \(\frac{30+20+10+20+20}{5} = \frac{100}{5} = 20\)

Step 2: \(30 - 20 = 10\)  \(10 - 20 = -10\)  \(20 - 20 = 0\)

Step 3: \(\frac{10+0+10+0+0}{5} = \frac{20}{5} = 4\)

Then look at Sara’s scores:

Step 1: \(\frac{15+21+20+22+17}{5} = \frac{95}{5} = 19\)

Step 2: \(15 - 19 = -4\)  \(20 - 19 = 1\)  \(17 - 19 = -2\)

Step 3: \(\frac{4+2+1+3+2}{5} = \frac{12}{5} = 2.4\)

Who has the greater mean deviation? What does this mean?

Emma has the greater mean absolute deviation. This means that her mean is less relevant. Sara has a more relevant mean score when it comes to playing the game.
You try to find the mean absolute deviation of the following problems:

1. On five different tanks full of gas a pickup got 12, 15, 16, 12, and 15 miles per gallon. Determine the mean absolute deviation for the miles per gallon.

Step 1: \[ \frac{12+15+16+12+15}{5} = \frac{70}{5} = 14 \]

Step 2: 
- \[ 12 - 14 = -2 \]
- \[ 16 - 14 = 2 \]
- \[ 15 - 14 = 1 \]
- \[ 12 - 14 = -2 \]

Step 3: 
\[ \frac{2+1+2+2+1}{5} = \frac{8}{5} = 1.6 \]

What does this MAD tell us?

2. The following scores were given to a gymnast for her floor routine. Find the average mean deviation for her scores.

8.4, 7.9, 9.1, 8.7, 9.1, 8.6

\[ \frac{8.4+7.9+9.1+8.7+9.1+8.6}{6} = \frac{51.8}{6} = 8.6 \]

8.4 – 8.6 = -0.2
7.9 – 8.6 = -0.7
9.1 – 8.6 = 0.5
8.6 – 8.6 = 0

\[ \frac{2+.7+.5+.1+.5+0}{6} = \frac{2}{6} = \frac{1}{3} \text{ or } 0.33 \]

What does this MAD tell us?

3. The following is a list of the amount of times people have flown on an airplane. Find the mean absolute deviation of the flights.

7, 4, 6, 77, 8, 6, 5, 7

\[ \frac{7+4+6+77+8+6+5+7}{8} = \frac{120}{8} = 15 \]

7 – 15 = -8
4 – 15 = -11
6 – 15 = -9
5 – 15 = -10
77 – 15 = 62
7 – 15 = -8

\[ \frac{8+11+9+62+7+9+10+8}{8} = \frac{124}{8} = 15.5 \]

What does this MAD tell us?