

# Measures of Spread

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

**Measures of spread** tell how spread out the data is. The **range** is the largest value minus the smallest. The **interquartile range (IQR)** is the spread of the middle half: split the ordered data into quarters, find  $Q_1$  (median of the lower half) and  $Q_3$  (median of the upper half), then  $IQR = Q_3 - Q_1$ . The **mean absolute deviation (MAD)** is the average distance of the values from the mean: find the mean, take each value's distance from it, and average those distances. A bigger spread means the data is more varied.

◇ **Example:** Find the range, IQR, and MAD of 2, 4, 6, 8, 10.

⇒ The range is easy:  $10 - 2 = 8$ . For the IQR, the median is the middle value 6. The lower half is 2, 4 with  $Q_1 = 3$ , and the upper half is 8, 10 with  $Q_3 = 9$ , so  $IQR = 9 - 3 = 6$ . For the MAD, the mean is  $30 \div 5 = 6$ . The distances from 6 are 4, 2, 0, 2, 4, which add to 12, so  $MAD = 12 \div 5 = 2.4$ .

**Answer:** range = 8, IQR = 6, MAD = 2.4

## PRACTICE

Find the measure of spread asked for in each problem.

- |                                      |       |                                 |       |
|--------------------------------------|-------|---------------------------------|-------|
| 1. Range of 12, 8, 15, 20, 5         | _____ | 11. MAD of 1, 2, 3, 4, 5        | _____ |
| 2. Range of 40, 55, 30, 60, 45       | _____ | 12. MAD of 20, 22, 24, 26, 28   | _____ |
| 3. Range of 7, 7, 7, 7, 7            | _____ | 13. MAD of 2, 4, 6, 8           | _____ |
| 4. Range of 3, 9, 1, 14, 8           | _____ | 14. Range of 6, 8, 10, 12, 14   | _____ |
| 5. Range of 100, 75, 50, 25          | _____ | 15. IQR of 6, 8, 10, 12, 14     | _____ |
| 6. IQR of 2, 4, 6, 8, 10, 12, 14     | _____ | 16. Range of 1, 2, 3, 4, 5      | _____ |
| 7. IQR of 10, 20, 30, 40, 50, 60, 70 | _____ | 17. MAD of 10, 14, 10, 14, 12   | _____ |
| 8. IQR of 1, 3, 5, 7, 9, 11, 13, 15  | _____ | 18. IQR of 20, 22, 24, 26, 28   | _____ |
| 9. Mean of 6, 8, 10, 12, 14          | _____ | 19. Range of 20, 22, 24, 26, 28 | _____ |
| 10. MAD of 6, 8, 10, 12, 14          | _____ | 20. MAD of 5, 15, 5, 15, 10     | _____ |

### ◆ Word Problems

21. The weights of five puppies in pounds are 6, 8, 10, 12, 14. Find the range and the MAD of their weights. \_\_\_\_\_
22. A scientist recorded plant heights in centimeters: 10, 20, 30, 40, 50, 60, 70. Find the IQR of the heights. \_\_\_\_\_
23. Two soccer teams each scored these goals over 5 games. Team A: 2, 3, 3, 3, 4. Team B: 0, 1, 3, 5, 6. Both have the same mean of 3. Which team is more consistent? Use the range to explain. \_\_\_\_\_
24. On a field trip, students' ages were 11, 11, 11, 11, 11, 17. Find the range, then explain why the MAD would also be small compared with the range. \_\_\_\_\_



## Answer Keys

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|--|--|
| <p>1. <input type="text" value="15"/></p> <p>2. <input type="text" value="30"/></p> <p>3. <input type="text" value="0"/></p> <p>4. <input type="text" value="13"/></p> <p>5. <input type="text" value="75"/></p> <p>6. <input type="text" value="8"/></p> <p>7. <input type="text" value="40"/></p> <p>8. <input type="text" value="8"/></p> <p>9. <input type="text" value="10"/></p> <p>10. <input type="text" value="2.4"/></p> <p>11. <input type="text" value="1.2"/></p> <p>12. <input type="text" value="2.4"/></p> | <p>13. <input type="text" value="2"/></p> <p>14. <input type="text" value="8"/></p> <p>15. <input type="text" value="6"/></p> <p>16. <input type="text" value="4"/></p> <p>17. <input type="text" value="1.6"/></p> <p>18. <input type="text" value="6"/></p> <p>19. <input type="text" value="8"/></p> <p>20. <input type="text" value="4"/></p> <p>21. <input type="text" value="range = 8, MAD = 2.4"/></p> <p>22. <input type="text" value="40"/></p> <p>23. <input type="text" value="Team A (range 2 &lt; 6)"/></p> <p>24. <input type="text" value="range = 6; MAD = 2"/></p> |
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### Step-by-Step Explanations

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| <p>1. Largest minus smallest: <math>20 - 5 = 15</math>.</p> <p>2. The biggest is 60, the smallest is 30: <math>60 - 30 = 30</math>.</p> <p>3. All values match, so the range is 0.</p> <p>4. The largest is 14 and the smallest is 1: <math>14 - 1 = 13</math>.</p> <p>5. Subtract: <math>100 - 25 = 75</math>.</p> <p>6. The median is 8. The lower half 2, 4, 6 gives <math>Q_1 = 4</math> and the upper half 10, 12, 14 gives <math>Q_3 = 12</math>, so <math>12 - 4 = 8</math>.</p> <p>7. The median is 40. Then <math>Q_1 = 20</math> and <math>Q_3 = 60</math>, so the IQR is <math>60 - 20 = 40</math>.</p> <p>8. With 8 values, the lower half is 1, 3, 5, 7 so <math>Q_1 = 4</math>, and the upper half gives <math>Q_3 = 12</math>. The IQR is <math>12 - 4 = 8</math>.</p> <p>9. The sum is 50, so the mean is <math>50 \div 5 = 10</math> — a useful first step before finding the MAD.</p> <p>10. The mean is 10. Distances are 4, 2, 0, 2, 4, which add to 12, so <math>MAD = 12 \div 5 = 2.4</math>.</p> <p>11. The mean is 3. Distances are 2, 1, 0, 1, 2, summing to 6, so <math>MAD = 6 \div 5 = 1.2</math>.</p> <p>12. The mean is 24. Distances are 4, 2, 0, 2, 4, summing to 12, so <math>MAD = 12 \div 5 = 2.4</math>.</p> <p>13. The mean is 5. Distances are 3, 1, 1, 3, summing to 8, so <math>MAD = 8 \div 4 = 2</math>.</p> | <p>14. Largest minus smallest: <math>14 - 6 = 8</math>.</p> <p>15. The median is 10. The lower half 6, 8 gives <math>Q_1 = 7</math> and the upper half 12, 14 gives <math>Q_3 = 13</math>, so <math>13 - 7 = 6</math>.</p> <p>16. Subtract the smallest from the largest: <math>5 - 1 = 4</math>.</p> <p>17. The mean is <math>60 \div 5 = 12</math>. Distances are 2, 2, 2, 2, 0, summing to 8, so <math>MAD = 8 \div 5 = 1.6</math>.</p> <p>18. The median is 24. Then <math>Q_1 = 21</math> and <math>Q_3 = 27</math>, so the IQR is <math>27 - 21 = 6</math>.</p> <p>19. The biggest is 28 and the smallest is 20: <math>28 - 20 = 8</math>.</p> <p>20. The mean is <math>50 \div 5 = 10</math>. Distances are 5, 5, 5, 5, 0, summing to 20, so <math>MAD = 20 \div 5 = 4</math>.</p> <p>21. The range is <math>14 - 6 = 8</math> pounds. The mean is <math>50 \div 5 = 10</math>, and the distances from 10 are 4, 2, 0, 2, 4, which add to 12. So the MAD is <math>12 \div 5 = 2.4</math> pounds.</p> <p>22. The median is 40. The lower half is 10, 20, 30 so <math>Q_1 = 20</math>, and the upper half is 50, 60, 70 so <math>Q_3 = 60</math>. The IQR is <math>60 - 20 = 40</math> centimeters.</p> <p>23. Team A's range is <math>4 - 2 = 2</math>, while Team B's range is <math>6 - 0 = 6</math>. A smaller range means the scores stay closer together, so Team A is more consistent.</p> <p>24. The range is <math>17 - 11 = 6</math>. The mean is <math>72 \div 6 = 12</math>, and the distances are 1, 1, 1, 1, 5, which add to 10, so the MAD is <math>10 \div 6 \approx 1.7</math> — small because most ages sit close to the mean.</p> |
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