Mean Absolute Deviation

Use MAD to make real-world decisions

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

The mean absolute deviation (MAD) describes the average distance from the mean. First find $\bar{x} = \frac{\text{sum}}{n}$. Find each nonnegative distance $|x - \bar{x}|$. Then divide the sum of those distances by n, not $n - 1$. A larger MAD means more spread. Give exact answers.

Worked example

Find the MAD of $2, 4, 6, 8$.

1. Mean: $\bar{x} = \frac{20}{4} = 5$.
2. Compute $|x - 5|$ for each value: $3, 1, 1, 3$. Their sum is 8.
3. MAD $= \frac{8}{4} = 2$.
Answer: 2

Practice Problems

Show your thinking.

1. A runner records $8, 10, 10, 12$ minutes. Find the average distance from the mean time.

2. Two machines fill bottles. A errors (mL): $9, 10, 11$. B errors: $6, 10, 14$. Find the MADs and name the more consistent machine.

3. A bus arrives after $14, 16, 16, 18$ minutes on four days. Find the MAD in minutes.

4. Four bags weigh $20, 20, 24, 24$ grams. Find the MAD in grams.

5. Two teams score points in three games: A: $4, 5, 6$; B: $3, 5, 7$. Find both MADs and choose the more consistent team.

6. Four books take $2, 4, 6, 8$ days to read. Find the MAD in days.

7. A coach wants four practice times with mean 10 minutes and MAD 1 minute. Design a possible set.

8. Four plants have heights $8, 10, 12, x$ cm with mean 11 cm. Find x and the MAD.

9. Two packing lines have times in minutes: A: $5, 5, 5, 5$; B: $3, 5, 5, 7$. Find both MADs. Explain the zero result.

10. A sensor has MAD 2 meters. All readings are converted to centimeters. Find the new MAD and justify the conversion.

Answer Key

1. 1 minutes
2. A: $\frac{2}{3}$; B: $\frac{8}{3}$. A is more consistent.
3. 1 minutes
4. 2 grams
5. A: $\frac{2}{3}$; B: $\frac{4}{3}$. A is more consistent.
6. 2 days
7. For example, $9, 9, 11, 11$ minutes.
8. $x = 14$ cm; MAD $= 2$ cm.
9. A: 0; B: 1. A is more consistent. A has no variation.
10. 200 cm.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Mean: $\bar{x} = \frac{40}{4} = 10$.
2. Compute $|x - 10|$ for each value: $2, 0, 0, 2$. Their sum is 4.
3. MAD $= \frac{4}{4} = 1$ minutes.

Problem 2

1. A: mean $= 10$; distances $1, 0, 1$; MAD $= 2 \div 3 = \frac{2}{3}$.
2. B: mean $= 10$; distances $4, 0, 4$; MAD $= 8 \div 3 = \frac{8}{3}$.
3. The smaller MAD shows greater consistency: A.

Problem 3

1. Mean: $\bar{x} = \frac{64}{4} = 16$.
2. Compute $|x - 16|$ for each value: $2, 0, 0, 2$. Their sum is 4.
3. MAD $= \frac{4}{4} = 1$ minutes.

Problem 4

1. Mean: $\bar{x} = \frac{88}{4} = 22$.
2. Compute $|x - 22|$ for each value: $2, 2, 2, 2$. Their sum is 8.
3. MAD $= \frac{8}{4} = 2$ grams.

Problem 5

1. A: mean $= 5$; distances $1, 0, 1$; MAD $= 2 \div 3 = \frac{2}{3}$.
2. B: mean $= 5$; distances $2, 0, 2$; MAD $= 4 \div 3 = \frac{4}{3}$.
3. The smaller MAD shows greater consistency: A.

Problem 6

1. Mean: $\bar{x} = \frac{20}{4} = 5$.
2. Compute $|x - 5|$ for each value: $3, 1, 1, 3$. Their sum is 8.
3. MAD $= \frac{8}{4} = 2$ days.

Problem 7

1. Choose two times 1 below 10 and two times 1 above it: $9, 9, 11, 11$.
2. Mean $= 40 \div 4 = 10$; distances are $1, 1, 1, 1$, so MAD $= 4 \div 4 = 1$ minute.

Problem 8

1. Total height must be $4 \times 11 = 44$ cm, so $x = 44 - (8 + 10 + 12) = 14$ cm.
2. Distances from 11 are $3, 1, 1, 3$ cm; their sum is 8 cm.
3. MAD $= 8 \div 4 = 2$ cm.

Problem 9

1. A: mean $= 5$; distances $0, 0, 0, 0$; MAD $= 0 \div 4 = 0$.
2. B: mean $= 5$; distances $2, 0, 0, 2$; MAD $= 4 \div 4 = 1$.
3. The smaller MAD shows greater consistency: A.
4. For line A, every time is 5, so every distance from its mean 5 is 0. That explains its zero MAD.

Problem 10

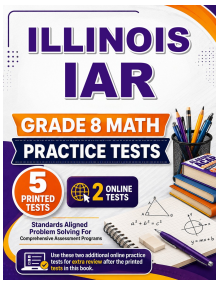
1. Each reading and its mean are multiplied by 100, because 1 meter $= 100$ centimeters.
2. Every absolute distance is also multiplied by 100, so the new MAD is $2 \times 100 = 200$ cm.

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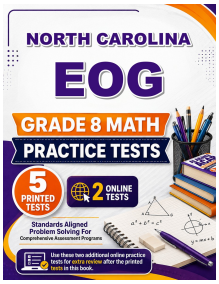
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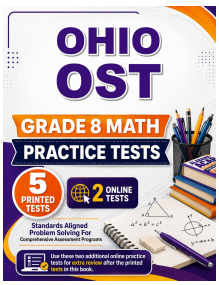
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