Comparing Populations with Measures of Center and Variability

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Mean is sum divided by count; MAD is the mean distance from the mean. Order values before finding the median. For $1, 1, 10$, the median is 1 and the range is $10 - 1 = 9$. Use the same units when comparing centers or spreads.

Worked example

Find the mean and MAD of $5, 9, 9, 13$ seconds.

1. Mean: $(5 + 9 + 9 + 13)/4 = 36/4 = 9$ s.
2. The four distances from 9 are $4, 0, 0, 4$ s.
3. MAD: $(4 + 0 + 0 + 4)/4 = 2$ s.
Answer: Mean 9 s; MAD 2 s.

Practice Problems

Show your thinking.

1. Two sets of wait times in minutes are A: $4, 7, 5, 8$ and B: $5, 7, 8, 8$. Find each mean and the difference between them.

2. Machines A and B record cycle times in seconds. A: $9, 11, 9, 11$. B: $6, 9, 11, 14$. Which is more consistent by MAD? Show both MADs.

3. A scores $3, 5, 5, 7$ points and B scores $7, 9, 9, 11$. Express the mean gap in units of their common MAD. Do they share a recorded score?

4. Set A has times $7, 5, 7, 5$ minutes and B has $10, 4, 8, 6$. Find both medians and ranges. Which set has both the lower median and the smaller range?

5. Four times in minutes are $2, 4, 6, 8$. Replace the 8 with an unusually high 20. Find mean and median before and after. Which changed less?

6. Two sets of scores are A: $4, 4, 8, 8$ and B: $4, 6, 6, 8$. Does equal range mean equal MAD? Compute both measures.

Answer Key

1. A: 6 min; B: 7 min; gap 1 min.
2. A: MAD 1 s; B: MAD 2.5 s. A is more consistent.
3. Gap 4 points, or 4 MADs. Both sets include 7 points.
4. A: median 6 min, range 2 min. B: median 7 min, range 6 min. A is lower on both.
5. Mean: 5 to 8 min. Median: 5 min both times; it changed less.
6. Both ranges are 4 points. MAD: A 2 points, B 1 point.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. A: $(4+7+5+8)/4 = 24/4 = 6$ min.
2. B: $(5+7+8+8)/4 = 28/4 = 7$ min.
3. The mean gap is $7-6=1$ min.

Problem 2

1. Both sums are 40 s, so each mean is $40/4 = 10$ s.
2. A distances: $1,1,1,1$. MAD $= (1+1+1+1)/4 = 1$ s.
3. B distances: $4,1,1,4$. MAD $= (4+1+1+4)/4 = 2.5$ s, larger than A.

Problem 3

1. Means: A $(3+5+5+7)/4 = 5$ and B $(7+9+9+11)/4 = 9$ points.
2. Each set has distances $2,0,0,2$ from its own mean, so MAD $= (2+0+0+2)/4 = 1$ point.
3. The gap is $9-5=4$ points, or $4/1 = 4$ MADs. A gap does not rule out overlap: both include 7.

Problem 4

1. A in order: $5,5,7,7$. Average the middle two: $(5+7)/2 = 6$ min. Range: $7-5=2$ min.
2. B in order: $4,6,8,10$. Median: $(6+8)/2 = 7$ min. Range: $10-4=6$ min.
3. A has the lower median $(6<7)$ and smaller range $(2<6)$.

Problem 5

1. Original mean: $(2+4+6+8)/4 = 20/4 = 5$ min.
2. New mean: $(2+4+6+20)/4 = 32/4 = 8$ min.
3. The middle entries stay 4 and 6, so both medians are $(4+6)/2 = 5$ min.
4. The mean rises $8-5=3$ min; the median does not change.

Problem 6

1. The same endpoints give range $8-4=4$ points. Both means are $24/4 = 6$ points.
2. A MAD: $(2+2+2+2)/4 = 2$ points.
3. B MAD: $(2+0+0+2)/4 = 1$ point. Range uses only endpoints; MAD uses all values.

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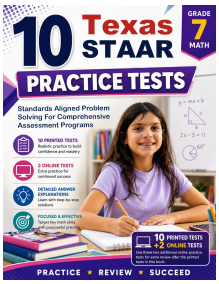

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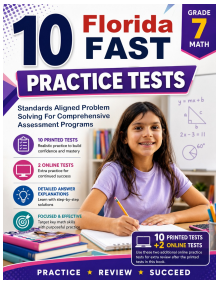

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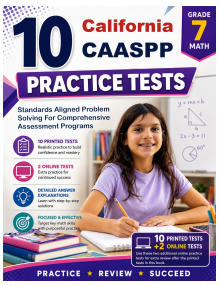

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