LESSON MAKER PRO

Measuring the Spread

Two ways to measure distance from the mean

HIGH SCHOOL · GDA.DSP.C.10.a

GDA.DSP.C.10.a "Explain how standard deviation develops from mean absolute deviation."

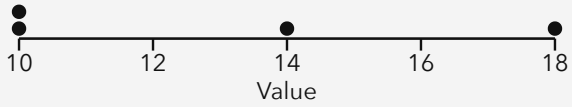
NAME _____ DATE _____

FROM MAD TO SD

Find the mean, then find each value's distance from it. Mean absolute deviation (MAD) averages those distances. Population standard deviation (SD) instead squares each distance, averages the squares, then takes the square root. Squaring gives larger distances more weight.

WORKED EXAMPLE

Find the MAD and population SD for the data shown.



1. Mean: (10 + 10 + 14 + 18)/4 = 13.
2. MAD: (3 + 3 + 1 + 5)/4 = 3.
3. Square the distances, then average: (9 + 9 + 1 + 25)/4 = 11. Take the square root.

Answer: MAD = 3; population SD = sqrt(11).

PRACTICE 4 problems

1 For 2, 2, 6, 6, find the mean and MAD.

ANSWER _____

2 For 0, 0, 4, 4, find the mean squared distance from the mean and the population SD.

ANSWER _____

3 For 0, 0, 0, 4, find the MAD and population SD.

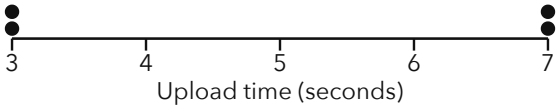
ANSWER _____

4 For 2, 4, 6, 8, find the MAD and population SD.

ANSWER _____

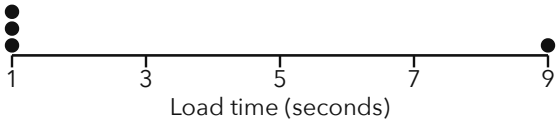
APPLY IT Show your work

1 The plot shows how many seconds four clips took to upload. Find the MAD and population SD.



ANSWER _____

2 The plot shows how many seconds four game levels took to load. Find the MAD and population SD.



ANSWER _____

CHALLENGE One step up

Lists A and B both have a mean of 6. A: 4, 4, 8, 8. B: 2, 6, 6, 10. Find each list's MAD and population SD. Explain why the SDs differ even though the MADs match.

WORK SPACE AND ANSWER

ANSWER KEY

Measuring the Spread

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For 2, 2, 6, 6, find the mean and MAD.	**Mean = 4; MAD = 2.**
2	For 0, 0, 4, 4, find the mean squared distance from the mean and the population SD.	**Mean squared distance = 4; population SD = 2.**
3	For 0, 0, 0, 4, find the MAD and population SD.	**MAD = 3/2; population SD = sqrt(3).**
4	For 2, 4, 6, 8, find the MAD and population SD.	**MAD = 2; population SD = sqrt(5).**

PART 2 · APPLY IT

1. **MAD = 2 seconds; population SD = 2 seconds.** The mean is 5 seconds. Every distance from the mean is 2, so both measures equal 2 seconds.
2. **MAD = 3 seconds; population SD = 2sqrt(3) seconds.** The mean is 3 seconds. The distances are 2, 2, 2, and 6, giving MAD = 12/4 = 3 and SD = sqrt((4 + 4 + 4 + 36)/4) = 2sqrt(3).

CHALLENGE

Both MADs are 2. A has population SD 2; B has population SD 2sqrt(2). In B, the two distances of 4 contribute more after squaring than A's distances of 2, so B has the larger SD.

Accept sqrt(8) for 2sqrt(2) and sqrt(12) for 2sqrt(3). All SD answers use the population formula, which divides by the number of values.