LESSON MAKER PRO

Measure the Spread

Find and compare population standard deviations.

HIGH SCHOOL · MT.CORE.DATA.INT.3

MT.CORE.DATA.INT.3 "Understand that standard deviation measures the variability of a data distribution, and calculate standard deviation using technology."

NAME _____ DATE _____

HOW SPREAD OUT?

Population standard deviation measures how spread out values are around their mean. Subtract the mean from each value, square the differences, divide their sum by the number of values, then take the square root. A larger standard deviation means more spread.

WORKED EXAMPLE

Find the population standard deviation of 21, 21, 27, 27.

1. Find the mean: (21 + 21 + 27 + 27) / 4 = 24.
2. Subtract 24 from each value and square: $(-3)^2$, $(-3)^2$, 3^2, 3^2 are all 9.
3. Average the squares: (9 + 9 + 9 + 9) / 4 = 9. Take the square root: sqrt(9) = 3.

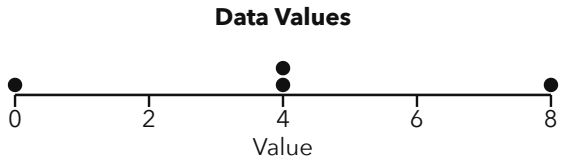
Answer: The population standard deviation is 3.

PRACTICE 6 problems

1 Find the population standard deviation of 1, 1, 7, 7.

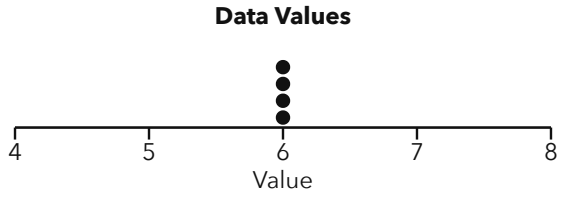
ANSWER _____

2 Find the population standard deviation of the values in the dot plot. Give an exact answer.



ANSWER _____

3 Find the population standard deviation of the values in the dot plot. What does your answer tell you about the values?



ANSWER _____

_____

4 Find the population standard deviation of each set. Which set is more variable?

TWO DATA SETS

Set A	Set B
3	1
3	1
7	9
7	9

ANSWER _____

_____

5 Find the population standard deviation of 1, 3, 3, 5. Give an exact answer.

ANSWER _____

6 The values 0, 0, 4, 4 each increase by 7. What is the population standard deviation of the new values?

ANSWER _____

APPLY IT Show your work

1 A runner records sprint times of 12, 12, 16, and 16 seconds. Find the population standard deviation of the times.

WORK SPACE

ANSWER _____

2 A streamer tracks lag spikes in four matches of each game. Use the table to find the population standard deviation for each game. Which game has more consistent lag-spike counts?

LAG SPIKES PER MATCH

Game A	Game B
0	1
0	1
6	3
6	3

ANSWER _____

CHALLENGE One step up

The four values 2, 2, 8, x have a mean of 5. Find x and the population standard deviation. Explain why adding 4 to every value would not change the standard deviation.

WORK SPACE AND ANSWER

Measure the Spread

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the population standard deviation of 1, 1, 7, 7.	**3**
2	Find the population standard deviation of the values in the dot plot. Give an exact answer.	**2 × sqrt(2)**
3	Find the population standard deviation of the values in the dot plot. What does your answer tell you about the values?	**0; all the values are equal, so there is no spread.**
4	Find the population standard deviation of each set. Which set is more variable?	**Set A: 2; Set B: 4. Set B is more variable.**
5	Find the population standard deviation of 1, 3, 3, 5. Give an exact answer.	**sqrt(2)**
6	The values 0, 0, 4, 4 each increase by 7. What is the population standard deviation of the new values?	**2**

PART 2 · APPLY IT

1. **2 seconds** The mean is 14 seconds. Each time is 2 seconds from the mean, so the average squared difference is 4 and the standard deviation is 2 seconds.
2. **Game A: 3 lag spikes; Game B: 1 lag spike. Game B is more consistent.** Game A has a mean of 3 and an average squared difference of 9. Game B has a mean of 2 and an average squared difference of 1, so its standard deviation is smaller.

CHALLENGE

x = 8, and the population standard deviation is 3. Adding 4 raises both the values and their mean by 4, so each value stays the same distance from the mean.

Accept sqrt(8) as equivalent to 2 × sqrt(2) in problem 2. Standard deviations use the number of data values, not one less, as the divisor.