Spread, the IQR and the Standard Deviation

IQR: Q3 minus Q1, with the quartiles found the calculator way. Standard deviation: square each distance from the mean, average, square root. Use the site's statistics tool or a graphing calculator after the one by-hand example.

Name _____ Date _____

Words we use

say the math word, then the plain English

WORD	PLAIN ENGLISH	WHAT YOU DO
Spread (variability)	How far apart the values are.	Two sets with the same center can differ here.
Range	Maximum minus minimum.	Quick, but one extreme value can make it huge.
Quartiles, Q1 and Q3	The values a quarter and three quarters of the way through the ordered data.	The median of each half, leaving out the overall median when n is odd.
Interquartile range, IQR	Q3 minus Q1: the spread of the middle half, the width of the box.	Resists extreme values, like the median.
Mean absolute deviation	The average distance from the mean, from 7th grade.	Drop the signs, then average.
Standard deviation	A typical distance from the mean: square the distances, average, square root.	Bigger means more spread out; 0 means all the same.

Part A Quartiles and the IQR

DATA (IN ORDER)	LOWER HALF	Q1	UPPER HALF	Q3	IQR
4, 5, 6, 7, 8					
1, 3, 6, 9, 11					
3, 6, 9, 11, 15, 20					

Part B The standard deviation by hand

Data: 2, 4, 6, 8, 10. The mean is 6.

VALUE X	X − 6	$(X - 6)^2$
2		
4		
6		

8

Part C Same mean, different spread

Set A: 4, 5, 6, 7, 8. Set B: 1, 3, 6, 9, 11. Use the tool or a calculator.

MEAN IQR Σ sum of the squares

A

1. Divide the sum by n = 5, then take the square root: σ.

B

2. Divide the sum by n – 1 = 4, then take the square root: s.

1. Which set is more spread out? Say what the standard deviation means in words.

3. The mean absolute deviation, for comparison.

Part D Sigma or s?

1. A coach measures all 10 players on her team.

2. A researcher measures 50 trees out of thousands.

3. A data set has a standard deviation of 0. What is true about the values?

Part E Exit ticket

1. Q1, Q3, and IQR of 4, 5, 6, 7, 8.

2. Squared distances add to 40 for 5 values: σ and s.

3. When do you divide by n – 1?

Answer key

Part A. 4, 5; 4.5; 7, 8; 7.5; 3. 1, 3; 2; 9, 11; 10; 8. 3, 6, 9; 6; 11, 15, 20; 15; 9.

Part B. Distances –4, –2, 0, 2, 4; squares 16, 4, 0, 4, 16; sum 40. 1. 40 over 5 = 8; σ = root 8 ≈ 2.83. 2. 40 over 4 = 10; s = root 10 ≈ 3.16. 3. 2.4.

Part C. A: 6, 3, 1.41. B: 6, 8, 3.69. B is more spread out: a typical value in B is about 3.69 from the mean, against 1.41 in A.

Part D. 1. σ (the whole team). 2. s (a sample). 3. Every value is the same.

Part E. 1. 4.5, 7.5, 3. 2. σ ≈ 2.83, s ≈ 3.16. 3. For a sample.