

Outlier Plot Effects

See how one extreme value changes a boxplot.

GRADE 8 • 8.PS.2.f

8.PS.2.f "Describe how the presence of an extreme data point (outlier) affects the shape and spread of the data distribution of a boxplot."

NAME _____

DATE _____

THE BIG IDEA

A high outlier stretches a boxplot to the right, and a low outlier stretches it to the left. An outlier increases the full range, but the box and IQR can stay the same when the middle 50% of the data does not change.

WORKED EXAMPLE

The values are 12, 14, 15, 16, 18, 19, 20, and 45. Describe the effect of 45.

1. Without 45, the range is $20 - 12 = 8$.
2. With 45, the range is $45 - 12 = 33$.
3. The value 45 is far above the other values.
4. The boxplot has an extreme point on the right.

Answer: The outlier increases the range from 8 to 33 and stretches the distribution to the right.

PRACTICE 5 problems

- 1** A boxplot's regular values go from 31 to 40. A high outlier at 70 is added. What is the range before and after the outlier?

ANSWER _____

- 2** A boxplot has regular values from 53 to 69 and a separate low outlier at 9. Describe the effect on the range and shape.

ANSWER _____

- 3** A boxplot has $Q1 = 101$ and $Q3 = 110$. A high outlier is added, but the middle half stays the same. What is the IQR?

ANSWER _____

- 4** The data are 4, 5, 6, 7, 8, 9, 10, and 30. Find the range with and without 30. Then describe the shape.

ANSWER _____

- 5** Boxplot C has values from 62 to 75. Boxplot D has regular values from 63 to 72 and a high outlier at 97. Which boxplot has the greater full range?

ANSWER _____

APPLY IT Show your work

- 1** A music app records playlist counts for eight days: 21, 22, 23, 24, 25, 26, 27, and 60. On the boxplot, 60 is marked as a high outlier. How does 60 affect the range and shape?

WORK SPACE

ANSWER _____

- 2** A gaming club's regular practice times run from 73 to 82 minutes. Its boxplot has $Q1 = 75$ and $Q3 = 80$, and it marks 2 minutes as a low outlier. What are the full range and IQR, and how does the outlier affect the plot?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

A boxplot has a non-outlier minimum of 29, $Q1 = 34$, $Q3 = 41$, and a non-outlier maximum of 46. It also shows low and high outliers at 5 and 83. Describe the effect of the two outliers on the shape and spread.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A boxplot's regular values go from 31 to 40. A high outlier at 70 is added. What is the range before and after the outlier?	Before: 9. After: 39. The outlier stretches the plot to the right.
2	A boxplot has regular values from 53 to 69 and a separate low outlier at 9. Describe the effect on the range and shape.	The range changes from 16 to 60. The outlier stretches the plot to the left.
3	A boxplot has $Q1 = 101$ and $Q3 = 110$. A high outlier is added, but the middle half stays the same. What is the IQR?	9. The IQR stays 9 because the box does not change.
4	The data are 4, 5, 6, 7, 8, 9, 10, and 30. Find the range with and without 30. Then describe the shape.	Without 30, the range is 6. With 30, the range is 26. The high outlier makes the plot stretch right.
5	Boxplot C has values from 62 to 75. Boxplot D has regular values from 63 to 72 and a high outlier at 97. Which boxplot has the greater full range?	Boxplot D. Its full range is 34, compared with 13 for Boxplot C. The outlier stretches D to the right.

PART 2 • APPLY IT

- Without 60, the range is 6. With 60, the range is 39. The outlier stretches the boxplot to the right.** Subtract 21 from 27 for the regular range, then subtract 21 from 60 for the full range. The isolated high value creates a right-side extreme.
- The full range is 80, and the IQR is 5. The low outlier stretches the plot left, while the box and IQR stay the same.** Use $82 - 2$ for the full range and $80 - 75$ for the IQR. The outlier changes the overall spread, not the middle half.

CHALLENGE

The IQR is 7 and stays based on the box. The non-outlier range is 17, but the full range is 78. The plot has extreme points on both the left and right, so the overall spread is much larger.

Accept equivalent descriptions such as "longer on the right" for a high outlier and "longer on the left" for a low outlier. Full range includes outliers, while IQR is unchanged only when the middle 50% remains unchanged.