Outliers and What They Do

Students apply the 1.5 IQR rule to find fences and outliers, read modified box plots, run before-and-after experiments to see which statistics an outlier pulls, and decide what to do about an outlier.

TIME	45 minutes (one student with a parent or tutor, or a small group)
WHO	Math 1 (algebra readiness), about age 12. Follows Unit 12, Lesson 3.
MATERIALS	Student worksheet (PDF), the Deep Dive 5 interactive page for this lesson (fences and the add-a-value experiment), pencil, calculator
PRIOR KNOWLEDGE	Quartiles and the IQR (Lesson 3). The mean and median, and resistance (Lesson 2). Box plots (Lesson 1).
STANDARDS	NC.M1.S-ID.3, NC.M1.S-ID.1.
KEEP OUT	Other outlier rules (z-scores). Formal tests.

Learning goals

1. Build the two fences from Q1, Q3, and the IQR, and name every outlier.
2. Read and sketch a modified box plot.
3. Predict and verify what an added outlier does to the mean, median, IQR, and standard deviation.
4. Explain what to do about an outlier: fix a mistake, keep a real value, and use resistant statistics.

Vocabulary: say both, every time

The rule for the whole lesson: whenever the adult or the student says a math word, they follow it with the plain-English version. Proper term first, plain English second, until the student does it without being asked.

TERM	LOOKS LIKE	PLAIN ENGLISH
Outlier	past a fence	The 1.5 IQR rule.
Fence	Q1 – 1.5 IQR, Q3 + 1.5 IQR	Build both.
Modified box plot	outliers as dots	Whiskers stop inside the fences.
Resistant	median, IQR	Not pulled.

> THE ONE SENTENCE TO SAY OUT LOUD
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> IQR, times 1.5, subtract and add. Past the fence is an outlier. Outliers pull the mean; the median resists.

Lesson timeline (45 minutes)

0:00 to 0:05	Warm-up: does 88 belong? The songs dot plot. Ask: is 88 unusual? How would you decide without guessing?
0:05 to 0:15	The rule. The four steps on the songs data: fences –10.75 and 35.25. The modified box plot with the whisker at 32.
0:15 to 0:30	What an outlier does. The basketball team in the experiment tool: add 74, read the before-and-after table. Then the class periods and the 100. State the carry-away rule, then what to do about an outlier.
0:30 to 0:41	Practice. The practice problems or Worksheet Parts A to C. Same buttons: Hint, Show next step, Reveal answer, Hide help.
0:41 to 0:45	Exit ticket. Worksheet Part E. Success looks like the two fences, pulls-versus-resists, and fixing the 740.

Misconceptions to listen for

- **1.5 times Q3.** It is 1.5 times the IQR.
- **Only an upper fence.** Low values can be outliers too.
- **Delete outliers.** Ask first; keep real values.
- **The median should move a lot.** It resists.

Support and stretch

Support

Give a four-box template for the rule. Let the student predict each statistic's direction before pressing Add it, then compare.

Stretch

Ask how tall a new player would have to be to NOT be an outlier (72.5 inches or less). Ask whether a value exactly on a fence is an outlier (no: it must be past the fence).

Where this goes next

Lesson 5: comparing data sets. Same scale, shape first, the statistics that fit, then sentences in context.

> THE HABIT TO BUILD
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> Fences first, then judge. When an outlier shows up, reach for the median and the IQR.