

Boxplot Detectives

Complete a data investigation from question to conclusion

GRADE 8 • 8.PS.2

8.PS.2 "Excerpt: The student will apply the data cycle"

NAME _____

DATE _____

Build understanding

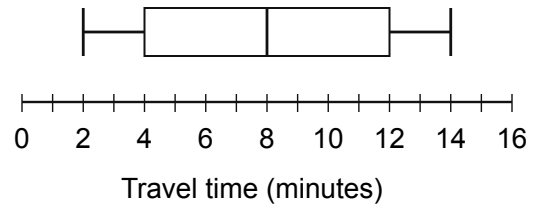
Use a ruler and a device with a boxplot tool. For quartiles, sort the data and find the medians of the two halves, excluding the overall median for odd-sized sets. Here whiskers extend to the minimum and maximum, including outliers. Range = maximum - minimum; IQR = $Q3 - Q1$.

Worked example

Summarize the separate travel times 2, 4, 6, 8, 10, 12, 14 minutes.

The median is 8. Exclude it when finding the median of each half. Draw the box from $Q1 = 4$ to $Q3 = 12$, a median line at 8, and whiskers to 2 and 14. Five-number summary: 2, 4, 8, 12, 14; range 12; IQR 8.

Worked travel times



Work through the numbered tasks. Label every constructed graph with a title and units.

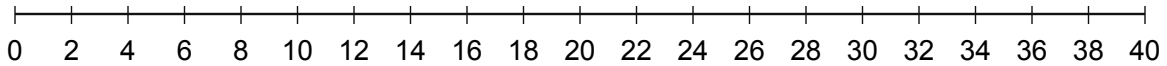
1. Ask and acquire

Formulate a statistical question comparing Route A and Route B travel times. Acquire Route A data by copying its seven values from these simulated logs: A: 12, 18, 14, 24, 20, 16, 22 minutes; B: 14, 22, 18, 30, 24, 20, 26 minutes. Identify the measured variable and unit.

2. Organize and draw

Sort your seven Route A values. Find the five-number summary and construct its boxplot by hand on this axis. Label the title and unit.

Plot title: _____



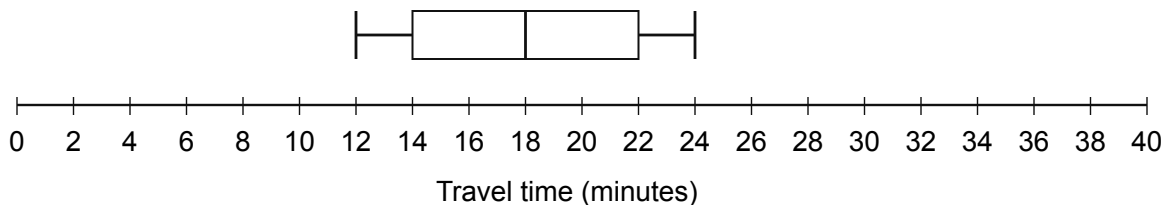
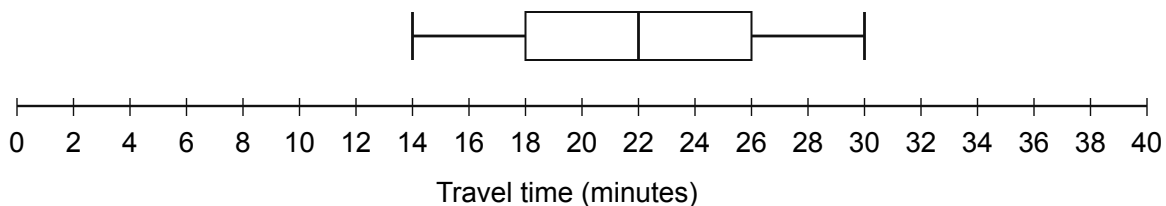
Horizontal axis: _____

3. Represent with technology

Use a device with a boxplot tool to construct a second Route A plot. Enter the seven raw values and choose median-of-halves quartiles excluding the median, or supply your five-number summary to the tool. Title the plot, label minutes and show or save it for your teacher. Record its summary and compare it with your hand plot.

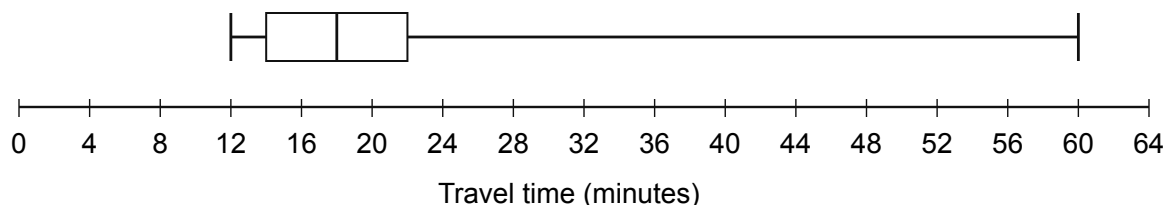
4. Compare distributions

Read both boxplots. Give Route B's five-number summary. Find the range and IQR for each route. Compare their medians and middle-half spreads using numbers.

Route A travel times**Route B travel times**

5. Investigate an extreme value

Replace Route A's 24-minute trip with a 60-minute trip. Use the shown boxplot and original plot in Task 4. Describe changes in shape and spread. Use the upper outlier fence $Q3 + 1.5 \times IQR$ to test 60.

Route A with one delayed trip**6. Choose and critique a display**

An analyst draws A on a 0-40 axis and B on a 0-80 axis, both the same printed width, then compares box widths. Explain what is misleading and how to repair it. For comparing medians and IQRs, choose boxplots or histograms and justify your choice.

7. Communicate and qualify

Write a short answer to your Task 1 question using the medians and IQRs. These logs came only from dry weekdays. Explain why they may not represent all school days, and propose a better sampling plan.

TEACHER NOTES

All logs are simulated instructional data, not observed evidence about actual bus routes. Each set has seven values. Inspect the student-created technology plot in Task 3; software quartile defaults vary, so use the specified convention or enter the five-number summary. Accept other statistical questions and conclusions supported by these small samples.

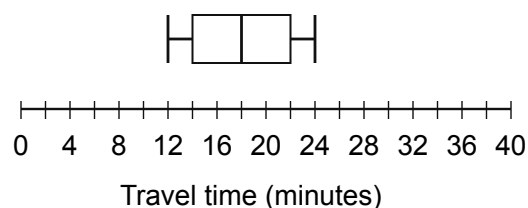
TASK 1

Example: How do typical travel times and their spread compare for Routes A and B? Route A: 12, 18, 14, 24, 20, 16, 22. Variable: travel time in minutes.

TASK 2

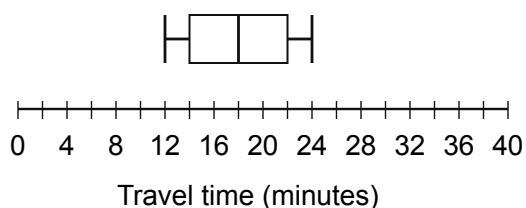
Sorted A: 12, 14, 16, 18, 20, 22, 24. Summary: 12, 14, 18, 22, 24.

Route A travel times

**TASK 3**

The technology plot should match the hand summary 12, 14, 18, 22, 24 and preserve units.

Route A technology reference

**TASK 4**

B summary: 14, 18, 22, 26, 30. A range 12, IQR 8; B range 16, IQR 8. B median is 4 minutes higher; middle-half spreads are equal.

TASK 6

Different scales make equal IQRs look different. Use the same scale. Boxplots directly display medians and quartiles. Histograms show interval frequencies but do not preserve exact quartiles. A 0-80 scale makes the same 8-minute IQR half as wide as a 0-40 scale.

TASK 5

$Q1 = 14$, median = 18, $Q3 = 22$ stay unchanged. Range rises from 12 to 48. The upper whisker is much longer; $60 > 34$, the upper fence. IQR remains 8; upper fence = $22 + 1.5(8) = 34$. These are min-to-max boxplots, so the whisker includes the outlier.

TASK 7

In these logs, B has a higher median (22 vs 18 minutes), with equal IQRs of 8. Dry weekdays may miss delays. Randomly sample school days across weeks and weather conditions; keep the same timing method.