

One Dataset, Three Views

Construct data displays and examine what each one preserves.

HIGH SCHOOL • HSS-ID.A.1

CCSS.Math.Content.HSS-ID.A.1 "Represent data with plots on the real number line (dot plots, histograms, and box plots)."

NAME _____

DATE _____

Choose a useful representation

A dot plot keeps individual observations. A histogram groups observations into equal-width intervals. A box plot summarizes five positions in ordered data. For quartiles here, split an even-sized ordered list into equal halves and find each half's median; draw whiskers to the minimum and maximum.

Worked example

Four practice wait times are 1, 1, 3, 5 minutes. How can a frequency table help build a dot plot?

1. Count every observation, including repeated values.
2. Place two dots at 1, one at 3, and one at 5 on a number line.

Four dots in total; their frequencies add to four observations.

PRACTICE DATA

Minutes	Frequency
1	2
3	1
5	1

Use the same 20 simulated bus waits for tasks 1-6. These are classroom data, not a survey of a real school. Use a ruler and label each display. Every observation must be represented, including repeats.

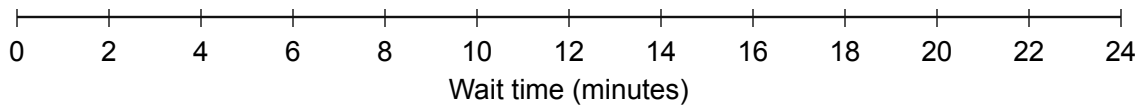
SIMULATED AFTER-SCHOOL BUS WAITS: 20 OBSERVATIONS, IN MINUTES

Observations 1-10	Observations 11-20
2, 4, 4, 6, 6, 6, 8, 8, 8, 10	10, 12, 12, 14, 14, 16, 16, 18, 20, 22

1. Build and compare

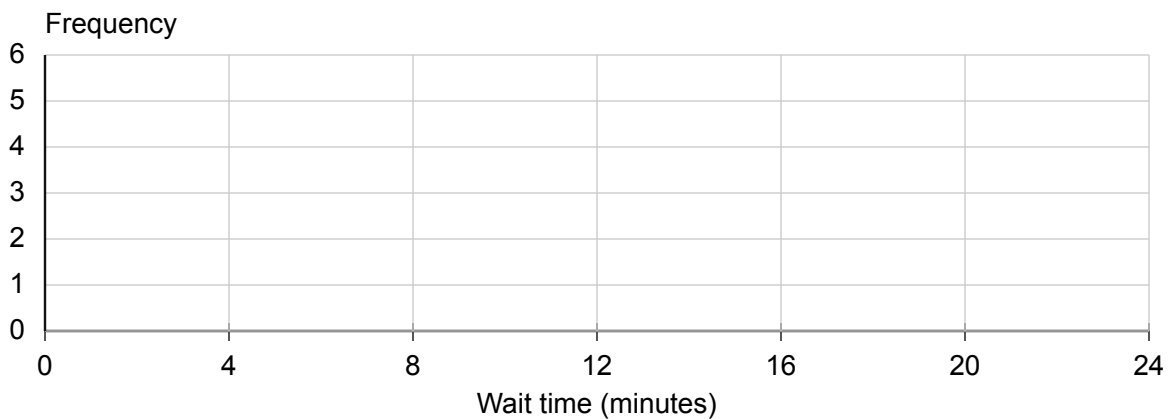
Construct a dot plot of all 20 waits on the axis below. Stack a dot for each repeated observation. Add a title and check your total number of dots.

Title: _____

**2. Build and compare**

Construct a histogram using intervals $0 \leq t < 4$, $4 \leq t < 8$, $8 \leq t < 12$, $12 \leq t < 16$, $16 \leq t < 20$, and $20 \leq t < 24$ minutes. The left boundary is included; the right is excluded. Use touching bars, a title, and the labeled axes.

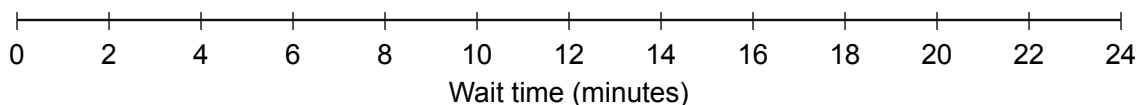
Title: _____



3. Build and compare

Find and label the five-number summary, then construct a box plot on the axis below. Use the median-of-halves convention above. Place quartiles between ticks when needed; label all five values on your plot.

Title: _____

**4. Build and compare**

Which display lets you recover the exact number of 8-minute waits? Which directly shows the middle half's interval? Explain one detail the histogram hides.

5. Apply your reasoning

A planner wants the percentage of waits that lasted at least 16 minutes. Use your histogram to find it, and explain why its boundaries let you answer exactly.

6. Apply your reasoning

A student says, 'Exactly half of the observations must fall between Q1 and Q3, inclusive.' Use your quartiles and the data to check the actual count. Explain how ties can make this claim wrong.

7. Challenge

Create two different datasets of four whole-number waits each. Both must put two values in $0 \leq t < 10$ and two in $10 \leq t < 20$, yet have different medians. Give both datasets and medians. Explain why their identical histograms cannot determine a unique median.

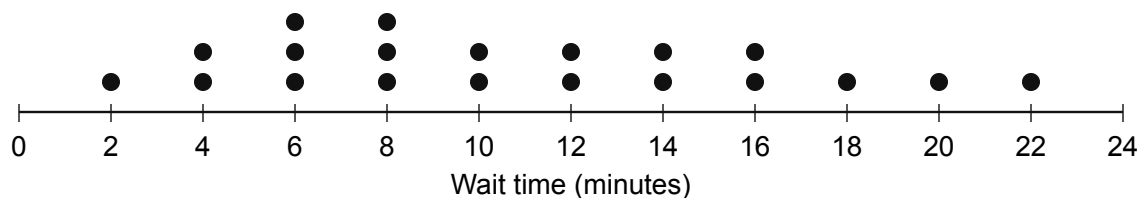
TEACHER NOTES

Accept equivalent titles and accurate constructions. Dot plots require 20 separate dots; histograms require equal-width touching bars and consistent interval boundaries. The box plot uses median-of-halves quartiles and min/max whiskers, as stated for students. These displays use the same simulated observations, so they do not establish population-wide waiting patterns. Tasks 5-6 correspond to the two applied questions.

TASK 1

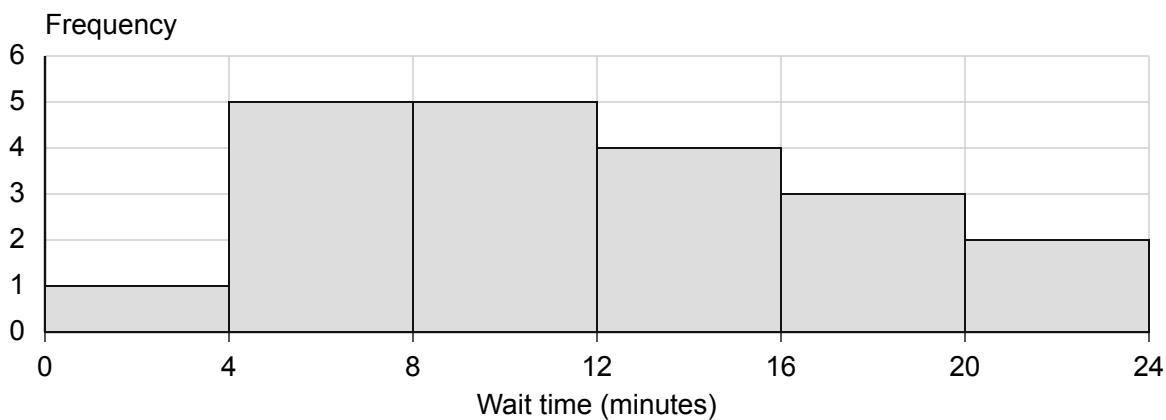
There are 20 dots: 2(1), 4(2), 6(3), 8(3), 10(2), 12(2), 14(2), 16(2), 18(1), 20(1), 22(1). Parentheses show frequency.

Simulated bus waits

**TASK 2**

Frequencies from left to right: 1, 5, 5, 4, 3, 2. Their sum is 20. A wait of 8 goes in $8 \leq t < 12$, not the preceding interval.

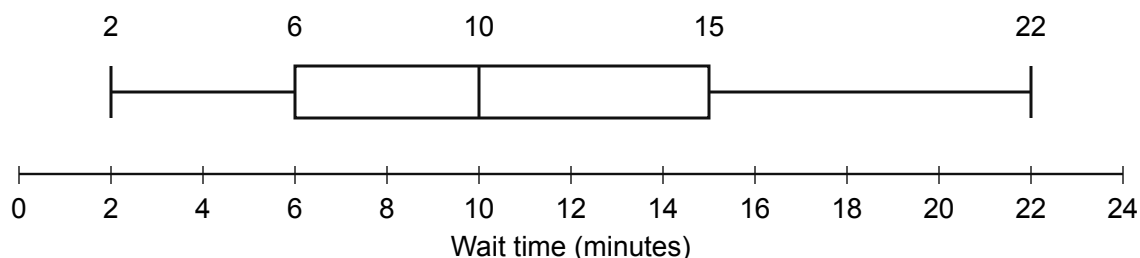
Simulated bus waits



TASK 3

Minimum 2, Q1 6, median 10, Q3 15, maximum 22. Median = $(10 + 10)/2$; Q1 = $(6 + 6)/2$; Q3 = $(14 + 16)/2$.

Simulated bus waits

**TASK 4**

The dot plot shows three 8-minute waits. The box plot directly marks the middle half from Q1 = 6 to Q3 = 15 minutes. The histogram combines 8- and 10-minute waits, so it does not reveal their separate frequencies.

TASK 5

25% of the observations. The final two bins contain $3 + 2 = 5$ of 20 waits; $5/20 = 25\%$. The 16-minute threshold is a bin boundary, so no partly included bin is needed.

TASK 6

The inclusive count is 12 of 20, so the claim is false. Count three 6s, three 8s, two 10s, two 12s and two 14s. Quartiles locate the middle half in the ordered list; including every observation tied at a boundary can include more than half of all observations.

TASK 7

Example A: 1, 2, 10, 11, median 6. Example B: 8, 9, 18, 19, median 13.5. Both histograms have bin frequencies 2 and 2, but the exact observations within each interval differ, including the two central observations used to find the median.