Name: _____ Date: _____

UNIT 5

3.5.5. Box-and-whisker Plots

Five-number summary • Anatomy of a box plot • Reading values

A. CORE IDEAS

Complete the statements using lesson terminology.

1. A box-and-whisker plot displays the _____, Q_1, median, Q_3, and _____.
2. The **box** runs from _____ to _____ and contains the middle 50% of the data.
3. The line inside the box represents the _____.
4. The whiskers extend from the box to the _____ and _____.

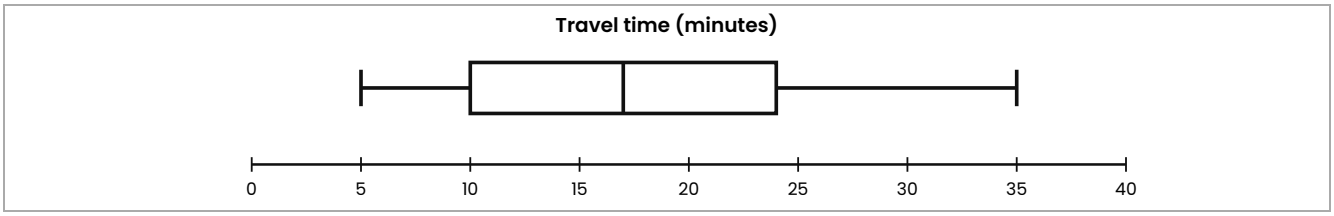
$\text{IQR} = Q_3 - Q_1$ Range = maximum − minimum

B. FIVE-NUMBER SUMMARIES

Write the values in the correct five-number-summary order.

Information	Minimum	Q_1	Median	Q_3	Maximum
Set A: min 4, Q_1 8, median 15, Q_3 23, max 30					
Set B: min 7, Q_1 11, median 18, Q_3 22, max 36					

C. READ A BOX PLOT



1. State the five-number summary.
2. Calculate the range and IQR.
3. What percentage of observations lie between Q_1 and Q_3?

_____

_____

Name: _____ Date: _____

UNIT 5

3.5.5. Box-and-whisker Plots

Construction • Scale • Range and IQR • Accurate plotting

D. RELIABLE CONSTRUCTION METHOD

1. Draw a scale
Include the minimum and maximum.

2. Mark five values
Minimum, Q_1, median, Q_3, maximum.

3. Draw the box
Join Q_1 to Q_3 and place the median inside.

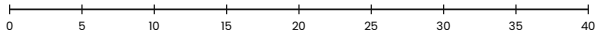
4. Add whiskers
Connect the box to the minimum and maximum.

1. Why must the numerical scale be labelled?
2. Why is the median line not necessarily in the centre of the box?

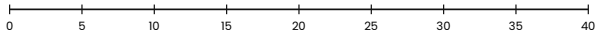
E. CONSTRUCT TWO PLOTS

On each scale, draw the box plot described by its five-number summary.

A: 4, 9, 14, 21, 34



B: 6, 12, 19, 24, 32



F. MEASURE THE SPREAD

Summary	Range	IQR	One interpretation
3, 8, 12, 19, 27			
10, 14, 20, 26, 31			
5, 11, 18, 20, 40			

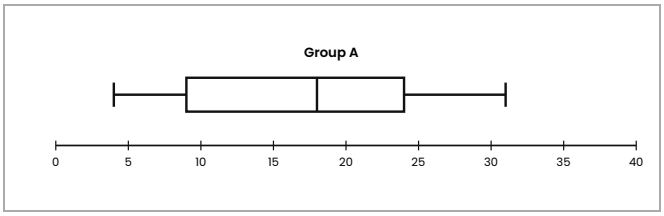
Name: _____ Date: _____

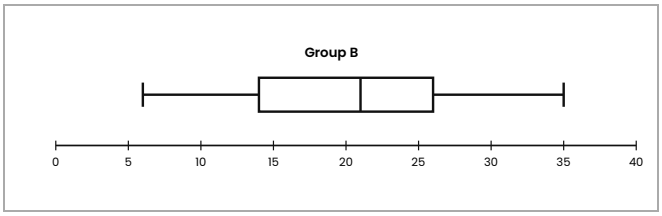
UNIT 5

3.5.5. Box-and-whisker Plots

Comparing distributions • Centre and spread • Context • Error correction

G. COMPARE TWO BOX PLOTS





1. Which group has the higher median?
2. Which group has the smaller IQR?
3. Which group has the greater range?
4. Write one comparison using both **centre** and **spread**.

H. TRAVEL-TIME CONTEXT

Two bus routes have five-number summaries:

Route A	**Route B**
12, 18, 24, 31, 45	10, 20, 25, 29, 34

1. Calculate the median, range and IQR for each route.
2. Which route is more consistent for the middle 50%?
3. Which route has the greater overall spread?
4. Write a two-sentence recommendation to a passenger who values predictability.

I. ERROR CORRECTION

1. A student draws the box from the minimum to the maximum. Explain the error.
2. A student places the median exactly halfway between Q_1 and Q_3 without checking its value. Explain why this can be wrong.
3. A plot has Q_1=12 and Q_3=20. A student says IQR = 12-20. Correct the calculation.

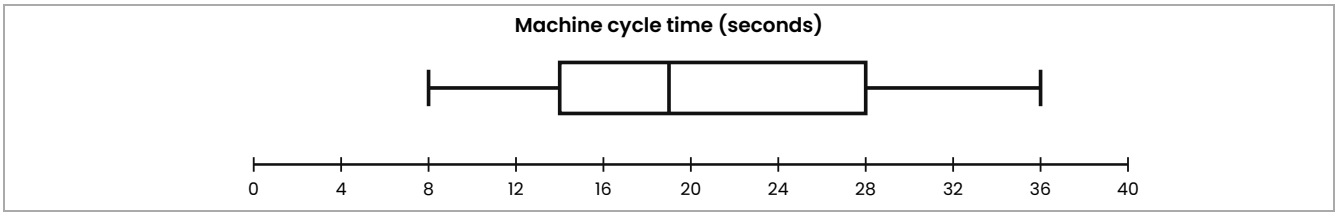
Name: _____ Date: _____

UNIT 5

3.5.5. Box-and-whisker Plots

Reverse reading • Missing values • Modelling • Harder reasoning

J. REVERSE-READ THE PLOT



1. State the median and IQR.
2. Find the distance from the minimum to Q_1.
3. Find the distance from Q_3 to the maximum.
4. Which quarter of the data is most spread out on the number scale? Justify.

K. REVERSE-ENGINEER MISSING VALUES

1. Q_1=11 and IQR=13. Find Q_3.
2. Q_3=29 and IQR=8. Find Q_1.
3. A box plot has range 32, minimum 7 and maximum *M*. Find *M*.
4. A five-number summary has minimum 4, Q_1=10, median 16, Q_3=24 and range 31. Find the maximum.

L. EXTENDED MODELLING: DELIVERY TEAMS

Team A: 18, 24, 29, 34, 47. Team B: 20, 23, 30, 31, 39. Times are in minutes.

1. Find the range and IQR for each team.
2. Which team has the higher typical delivery time?
3. Which team is more consistent in the middle 50%?
4. Explain why a manager could reasonably prefer Team B even if the medians are close.

Name: _____ Date: _____

UNIT 5

3.5.5. Box-and-whisker Plots

Validity • Transformations • Extended comparison • Final review

M. ALWAYS, SOMETIMES OR NEVER?

Give a reason or counterexample for each.

1. The longer box always means the larger overall range.
2. The group with the higher median always has the larger IQR.
3. The box contains 50% of the data.
4. If every value increases by 5, the box plot shifts right by 5 but keeps the same range and IQR.
5. If every value is multiplied by 2, the range and IQR both double.
6. A longer right whisker means the maximum is greater than the median.

N. TRANSFORMATION CHALLENGE

A five-number summary is 6, 10, 15, 21, 30.

1. Write the five-number summary after adding 4 to every value.
2. Write the five-number summary after multiplying every value by 3.
3. Describe what happens to the median, range and IQR under each transformation.

O. EXTENDED COMPARISON FROM CLUES

Plot A has median 24, IQR 8 and range 28. Plot B has median 22, IQR 5 and range 35.

1. Which plot has the higher typical value?
2. Which plot has the more consistent middle 50%?
3. Which plot has the greater overall spread?
4. Explain why the answers to parts 2 and 3 can refer to different plots.

P. FINAL REVIEW

1. Name the five values used to construct a box plot.
2. What does the box represent?
3. What does the line inside the box represent?
4. How do you calculate range and IQR?
5. When comparing two box plots, which two ideas should normally appear in a conclusion?

ANSWER KEY

Name: _____ Date: _____

UNIT 5

3.5.5. Box-and-whisker Plots

ANSWER KEY • Core ideas • Reading • Construction • Spread

A. CORE IDEAS

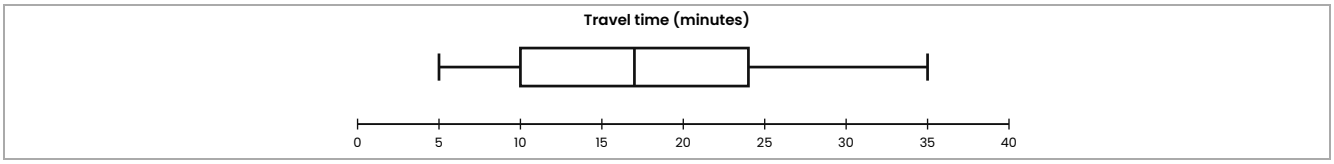
1. Minimum and maximum.
2. Q_1 to Q_3.
3. Median (Q_2).
4. Minimum and maximum.

$\text{IQR} = Q_3 - Q_1$ Range = maximum − minimum

B. FIVE-NUMBER SUMMARIES

Set A: **4, 8, 15, 23, 30**. Set B: **7, 11, 18, 22, 36**.

C. READ A BOX PLOT

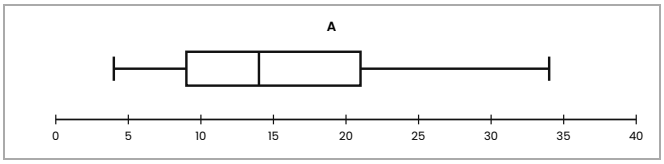


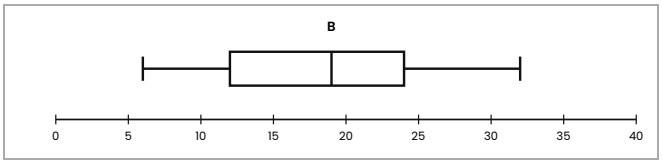
Five-number summary: **5, 10, 17, 24, 35**. Range = **30**. IQR = **14**. The interval Q_1 to Q_3 contains **50%** of observations.

D. RELIABLE CONSTRUCTION METHOD

The scale is required so numerical positions can be read accurately. The median need not be centred because its value need not be halfway between Q_1 and Q_3.

E. CONSTRUCT TWO PLOTS





F. MEASURE THE SPREAD

3,8,12,19,27: range **24**, IQR **11**. 10,14,20,26,31: range **21**, IQR **12**. 5,11,18,20,40: range **35**, IQR **9**. The third set has the greatest overall spread but the smallest middle spread.

Name: _____ Date: _____

UNIT 5

3.5.5. Box-and-whisker Plots

ANSWER KEY • Comparisons • Context • Error correction • Reverse reasoning

G. COMPARE TWO BOX PLOTS

Group B has the higher median (**21** vs 18). Group B has the smaller IQR: A = **15**, B = **12**. Ranges: A = **27**; B = **29**. A valid comparison: B has a higher median and a smaller IQR, so its typical value is higher and its middle 50% is more consistent.

H. TRAVEL-TIME CONTEXT

Route A: median **24**, range **33**, IQR **13**. Route B: median **25**, range **24**, IQR **9**. Route B is more consistent in the middle 50% and has less overall spread, so it is the stronger choice for predictability.

I. ERROR CORRECTION

1. The box must run from Q_1 to Q_3; minimum and maximum are whisker endpoints.
2. The median must be plotted at its actual scale value, not visually centred.
3. IQR = Q_3-Q_1 = 20-12 = **8**.

J. REVERSE-READ THE PLOT

Median **19**, IQR = 28-14 = **14**. Minimum to Q_1 = **6**. Q_3 to maximum = **8**. The widest quarter on the number scale is Q_2 to Q_3, width **9**.

K. REVERSE-ENGINEER MISSING VALUES

1. Q_3=11+13=**24**.
2. Q_1=29-8=**21**.
3. M=7+32=**39**.
4. Maximum = 4+31 = **35**.

L. DELIVERY TEAMS

Team A: range **29**, IQR **10**, median 29. Team B: range **19**, IQR **8**, median 30. Team B has the slightly higher median but is more consistent both overall and in the middle 50%.

Name: _____ Date: _____

UNIT 5

3.5.5. Box-and-whisker Plots

ANSWER KEY • Validity • Transformations • Extended comparison • Final review

M. ALWAYS, SOMETIMES OR NEVER?

1. **Sometimes.** Box length is IQR, not range.
2. **Sometimes.** Centre and middle spread are separate features.
3. **Always** under the standard quartile interpretation used in this lesson.
4. **Always.** Translation preserves differences.
5. **Always** for multiplication by positive 2.
6. **Always.** A right whisker requires maximum > Q_3 ≥ median; its length does not alone tell how large that difference is.

N. TRANSFORMATION CHALLENGE

After +4: **10, 14, 19, 25, 34**. The median increases by 4; range and IQR stay unchanged. After ×3: **18, 30, 45, 63, 90**. Median, range and IQR are all multiplied by 3.

O. EXTENDED COMPARISON FROM CLUES

Plot A has the higher median (**24** vs 22). Plot B has the smaller IQR (**5** vs 8), so B is more consistent in the middle 50%. Plot B also has the greater overall range (**35** vs 28). This is possible because range depends on the extremes while IQR depends only on Q_1 and Q_3.

P. FINAL REVIEW

1. Minimum, Q_1, median, Q_3, maximum.
2. The middle 50%, from Q_1 to Q_3.
3. The median.
4. Range = maximum−minimum; IQR = Q_3−Q_1.
5. Centre (usually median) and spread (usually IQR/range).

$$\text{minimum} \leq Q_1 \leq Q_2 \leq Q_3 \leq \text{maximum}$$