GCSE MATHEMATICS

HIGHER TIER
COMPREHENSIVE LESSON NOTEBOOK

UNIT 9 | STATISTICS

TEACH-FROM-SCRATCH • PUBLICATION EDITION

10 detailed chapters • original diagrams • worked examples • guided practice • answers

INDEPENDENT PUBLICATION NOTICE

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COMPREHENSIVE LESSON NOTEBOOK

How to learn from this notebook

Meaning first. Method second. Practice third.

FIVE-PASS ROUTINE

1 Read the key idea without a calculator. 2 Cover each worked solution and reproduce it. 3 Complete practice independently. 4 Mark in a different colour and repair errors. 5 Retest after 2–7 days.

What a complete mathematics answer contains

- A clear model or calculation, not only a calculator display.
- Enough working for another person to follow the reasoning.
- Exact values until approximation is requested.
- Units and sensible rounding in context.
- A final statement when interpretation is required.

Error loop

REPAIR, DO NOT MERELY CORRECT

Label each error: concept, operation, arithmetic, calculator entry, accuracy, unit or interpretation. Write the corrected step and one sentence explaining the change.

Higher statistics requires evidence-led inference

OCR Higher statistics combines representation, estimation, comparison and critique. Strong performance depends on selecting methods and stating limitations.

COMPREHENSIVE LESSON NOTEBOOK

Unit 9 coverage map

OCR J560 Statistics content organised into a teachable sequence.

CH 01	OCR 12.01a	Sampling, bias and inference
CH 02	OCR 12.02a	Data types and frequency tables
CH 03	OCR 12.02a-12.02b	Histograms and frequency density
CH 04	OCR 12.02b; 12.03a	Cumulative frequency and quartiles
CH 05	OCR 12.03a	Grouped estimates and interpolation
CH 06	OCR 12.03a	Box plots and distribution comparison
CH 07	OCR 12.03c-12.03d	Scatter, regression and prediction
CH 08	OCR 12.03b	Misleading graphs and claims
CH 09	OCR 12.01a; 12.03a	Statistical investigation design
CH 10	OCR 12.01-12.03 synthesis	Mixed Higher statistical reasoning

IMPORTANT TIER NOTE

This notebook covers OCR J560 section 12 at Higher Tier: sampling, data representation, summary statistics, misleading data, scatter graphs and outliers. Specification references are identifiers, not copied specification wording.

COMPREHENSIVE LESSON NOTEBOOK

Fast-reference method bank

Understand each relationship before memorising it.

Mean	Σx/n or Σfx/Σf
Range	maximum-minimum
Estimated mean	Σ(midpoint×frequency)/Σfrequency
Pie angle	frequency/total×360°
Frequency density	frequency/class width
Cumulative frequency	running total
Interquartile range	Q3-Q1
Scatter prediction	use best-fit line cautiously
Interpolation	inside observed range
Extrapolation	outside observed range

CURRENT ASSESSMENT NOTE

OCR has announced Foundation and Higher formula sheets for GCSE Mathematics examinations in 2025, 2026 and 2027. Use the current official OCR sheet alongside this learning bank and check OCR for later exam-series arrangements.

COMPREHENSIVE LESSON NOTEBOOK

Sampling, bias and inference

Design representative samples and evaluate the strength and limits of population inferences.

SPECIFICATION FOCUS

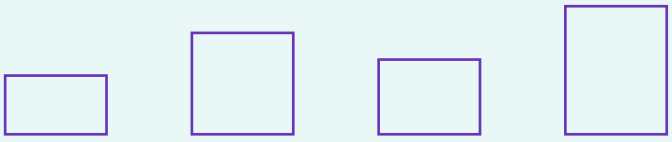
OCR reference OCR 12.01a. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

A sample is evidence about a wider population only when its selection process supports that inference. Randomness reduces systematic selection, while sample size mainly reduces random fluctuation.

KEY VOCABULARY

population • sample • random • bias • inference



Why the method works

- The method preserves the link between observations and conclusions.
- A suitable representation makes the relevant pattern visible without distortion.
- Matched summaries and explicit assumptions make comparisons auditable.

CHECK BEFORE MOVING ON

Answer mentally: A college has 720 Year 12 and 480 Year 13 students. A sample of 90 and 60 is taken. Show it is proportional. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Sampling, bias and inference — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Name the target population.
- Describe how the sample was selected.
- Identify under-coverage, self-selection or leading wording.

WORKED EXAMPLE 1

A college has 720 Year 12 and 480 Year 13 students. A sample of 90 and 60 is taken. Show it is proportional.

SOLUTION

1. 90/720=60/480=1/8.

ANSWER: Both use 1/8 of each year

WORKED EXAMPLE 2

Describe a simple random sample of 120 from 6000 customer IDs.

SOLUTION

1. Every ID has equal chance.

ANSWER: Generate 120 different random integers from 1 to 6000 and select those IDs

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Sampling, bias and inference — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Polling, product research and school surveys depend on representative samples.

Common misconceptions

- Choosing a display before identifying the data type.
- Generalising beyond the sample design.
- Reporting a statistic without context, spread or limitations.

GUIDED TRY

A response rate is 18%. Explain possible non-response bias. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Distinguish population parameter from sample statistic. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Sampling, bias and inference

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **A college has 720 Year 12 and 480 Year 13 students. A sample of 90 and 60 is taken. Show it is proportional.** **[3]**

2. **Describe a simple random sample of 120 from 6000 customer IDs.** **[3]**

3. **A response rate is 18%. Explain possible non-response bias.** **[2]**

4. **A survey estimates 47% support from 40 volunteers. Give three limitations.** **[3]**

5. **Why does increasing a convenience sample from 100 to 10,000 not remove bias?** **[3]**

6. **A stratified sample of 150 from groups 500,300,200 is required. Find allocations.** **[4]**

7. **State one advantage of stratification.** **[2]**

8. **Distinguish population parameter from sample statistic.** **[2]**

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Data types and frequency tables

Classify data and organise raw observations in auditable tables.

SPECIFICATION FOCUS

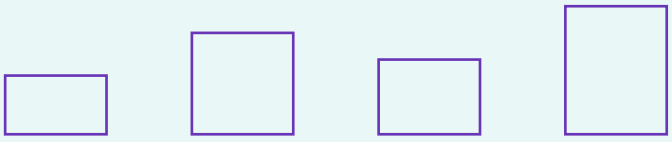
OCR reference OCR 12.02a. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

Data type determines which tables, scales and calculations are meaningful. A well-designed frequency table preserves every observation once.

KEY VOCABULARY

categorical • discrete • continuous • tally • frequency



Why the method works

- The method preserves the link between observations and conclusions.
- A suitable representation makes the relevant pattern visible without distortion.
- Matched summaries and explicit assumptions make comparisons auditable.

CHECK BEFORE MOVING ON

Answer mentally: Classify shoe size as categorical, discrete numerical or continuous numerical. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Data types and frequency tables — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Decide categorical or numerical.
- For numerical data, decide discrete or continuous.
- Check frequencies total the sample size.

WORKED EXAMPLE 1

Classify shoe size as categorical, discrete numerical or continuous numerical.

SOLUTION

1. It takes separated allowed values.

ANSWER: Discrete numerical

WORKED EXAMPLE 2

Classify journey time.

SOLUTION

1. It can take any value in an interval.

ANSWER: Continuous numerical

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Data types and frequency tables — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Databases and surveys begin with consistent classification.

Common misconceptions

- Choosing a display before identifying the data type.
- Generalising beyond the sample design.
- Reporting a statistic without context, spread or limitations.

GUIDED TRY

Values 2,3,2,5,4,3,2. Complete frequencies for 2,3,4,5. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State two checks for a data table. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Data types and frequency tables

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **Classify shoe size as categorical, discrete numerical or continuous numerical.** [1]

2. **Classify journey time.** [1]

3. **Values 2,3,2,5,4,3,2. Complete frequencies for 2,3,4,5.** [2]

4. **A frequency table totals 48 but the survey had 52 responses. What does this show?** [2]

5. **Give one suitable response category set for travel-to-school method.** [2]

6. **Why is height not best recorded in categories “short” and “tall” without boundaries?** [2]

7. **A table has frequencies 6,9,x,4 and total 31. Find x.** [2]

8. **State two checks for a data table.** [2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Histograms and frequency density

Construct and interpret histograms with unequal class widths.

SPECIFICATION FOCUS

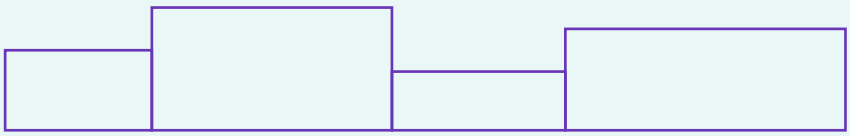
OCR reference OCR 12.02a-12.02b. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

A histogram represents continuous grouped data. Class width is shown horizontally and frequency density vertically, so each rectangle area - not merely its height - is proportional to frequency.

KEY VOCABULARY

class boundary • class width • frequency density • area • histogram



bar area represents frequency

Why the method works

- Density corrects for unequal class widths.
- Frequency equals class width multiplied by density.
- Touching bars express continuous intervals.

CHECK BEFORE MOVING ON

Answer mentally: Class 0–5 has frequency 20. Find frequency density. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Histograms and frequency density — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Frequency density=frequency/class width.
- Histogram area represents frequency.
- Read frequency from area, not height alone.

WORKED EXAMPLE 1

Class 0–5 has frequency 20. Find frequency density.

SOLUTION

1. 20/5=4.

ANSWER: 4

WORKED EXAMPLE 2

Class 5–15 has frequency 30. Find density.

SOLUTION

1. 30/10=3.

ANSWER: 3

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Histograms and frequency density — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Histograms compare distributions when measurements are grouped into unequal intervals.

Common misconceptions

- Plotting frequency as height when widths differ.
- Leaving gaps between continuous classes.
- Reading frequency from height alone.

GUIDED TRY

A histogram bar width 8 and density 2.5. Find frequency. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State three histogram checks. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Histograms and frequency density

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **Class 0–5 has frequency 20. Find frequency density.** [2]

2. **Class 5–15 has frequency 30. Find density.** [2]

3. **A histogram bar width 8 and density 2.5. Find frequency.** [2]

4. **Classes 0–4,4–10 have frequencies 12,15. Find densities.** [3]

5. **A bar has twice the height but half the width of another. Compare frequencies.** [3]

6. **A density scale shows 1 cm height represents density 4. A bar is 3.5 cm. Find density.** [2]

7. **Why may ordinary frequency bars mislead for unequal widths?** [2]

8. **State three histogram checks.** [3]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Cumulative frequency and quartiles

Construct cumulative-frequency graphs and estimate median, quartiles and percentiles.

SPECIFICATION FOCUS

OCR reference OCR 12.02b; 12.03a. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

Cumulative frequency is a running total plotted against upper class boundaries. Horizontal readings at fixed proportions of the total estimate the median, quartiles and other percentiles.

KEY VOCABULARY

cumulative frequency • upper boundary • median • quartile • percentile

Why the method works

- Every new class adds a non-negative frequency.
- N/2 locates the median and N/4, 3N/4 locate quartiles.
- Subtracting cumulative totals recovers interval frequencies.

CHECK BEFORE MOVING ON

Answer mentally: Frequencies 5,9,12,4. Write cumulative frequencies. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Cumulative frequency and quartiles — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Accumulate frequencies at upper class boundaries.
- Median is at N/2; quartiles at N/4 and 3N/4.
- Read values with sensible graph precision.

WORKED EXAMPLE 1

Frequencies 5,9,12,4. Write cumulative frequencies.

SOLUTION

1. Running totals.

ANSWER: 5,14,26,30

WORKED EXAMPLE 2

For N=80, state positions for Q1, median and Q3.

SOLUTION

1. Use N/4,N/2,3N/4.

ANSWER: 20th, 40th and 60th

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Cumulative frequency and quartiles — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Cumulative curves summarise waiting times, marks and other grouped measurements.

Common misconceptions

- Plotting at class midpoints.
- Allowing the curve to decrease.
- Claiming more precision than the graph scale supports.

GUIDED TRY

A graph gives Q1=18 and Q3=42. Find IQR. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State how to estimate number above value x from a cumulative graph. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Cumulative frequency and quartiles

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **Frequencies 5,9,12,4. Write cumulative frequencies.** **[2]**

2. **For N=80, state positions for Q1, median and Q3.** **[2]**

3. **A graph gives Q1=18 and Q3=42. Find IQR.** **[1]**

4. **The 90th percentile of 200 values is required. State position.** **[1]**

5. **Cumulative frequency reaches 64 at x=30 and total is 80. Estimate percentage ≤30.** **[2]**

6. **Why must a cumulative-frequency curve never decrease?** **[2]**

7. **A median read is 27.4 from a graph marked every 2 units. Give sensible accuracy.** **[2]**

8. **State how to estimate number above value x from a cumulative graph.** **[2]**

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Grouped estimates and interpolation

Estimate means, medians and spread from grouped data while communicating assumptions.

SPECIFICATION FOCUS

OCR reference OCR 12.03a. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

Grouped estimates replace unknown values by class midpoints or assume observations are evenly distributed inside a class. These are explicit modelling assumptions, so answers must be labelled estimates.

KEY VOCABULARY

midpoint • weighted total • estimated mean • interpolation • uniformity

Why the method works

- Midpoint times frequency approximates a class total.
- Linear interpolation allocates a fraction of a class width.
- Narrower classes usually lose less information.

CHECK BEFORE MOVING ON

Answer mentally: Classes 0–10,10–20,20–40 have frequencies 4,10,6. Estimate mean. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Grouped estimates and interpolation — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Use class midpoints to estimate the mean.
- Modal class has greatest frequency.
- Estimate median from cumulative frequency and class position.

WORKED EXAMPLE 1

Classes 0–10,10–20,20–40 have frequencies 4,10,6. Estimate mean.

SOLUTION

1. Midpoints are 5,15,30.
2. Weighted sum=20+150+180=350.
3. Divide by 20 to obtain 17.5.

ANSWER: 17.5

WORKED EXAMPLE 2

Why can two raw data sets share the same grouped table but have different means?

SOLUTION

1. Midpoint estimation hides within-class detail.

ANSWER: Values may occupy different positions inside each class

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Grouped estimates and interpolation — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Grouped tables make large data sets manageable while preserving approximate structure.

Common misconceptions

- Using class boundaries as midpoint values.
- Dividing by number of classes instead of total frequency.
- Presenting an interpolated value as exact.

GUIDED TRY

A class 20–30 has cumulative frequency rising from 18 to 42. Estimate median for N=60 by linear interpolation. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State two sources of uncertainty in a grouped median. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Grouped estimates and interpolation

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **Classes 0–10,10–20,20–40 have frequencies 4,10,6. Estimate mean.** **[4]**

2. **Why can two raw data sets share the same grouped table but have different means?** **[3]**

3. **A class 20–30 has cumulative frequency rising from 18 to 42. Estimate median for N=60 by linear interpolation.** **[4]**

4. **Class 50–70 contains 16 values. Estimate how many are below 65 assuming uniformity.** **[3]**

5. **Grouped data have Q1≈14,Q3≈39. Find IQR.** **[1]**

6. **Explain the uniform-distribution assumption in interpolation.** **[2]**

7. **Midpoints 5,15,25 with frequencies 2,x,4 give estimated mean 17 and total 10. Find x.** **[3]**

8. **State two sources of uncertainty in a grouped median.** **[2]**

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Box plots and distribution comparison

Interpret five-number summaries and compare centre, spread, skew and outliers.

SPECIFICATION FOCUS

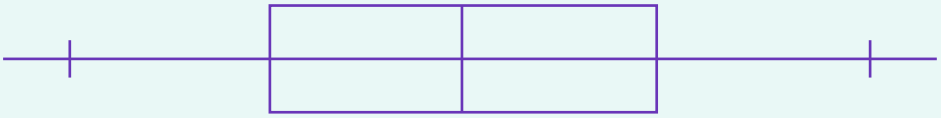
OCR reference OCR 12.03a. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

A box plot displays a five-number summary. The median compares typical values; the box width is the interquartile range and compares the spread of the middle half of each distribution.

KEY VOCABULARY

minimum • lower quartile • median • upper quartile • maximum • IQR



minimum • quartiles • median • maximum

Why the method works

- Quartiles divide ordered data into four equal parts.
- IQR=Q3-Q1 measures the central 50%.
- Matched median/IQR comparisons resist extreme values.

CHECK BEFORE MOVING ON

Answer mentally: A box plot has Q1=12,median=19,Q3=31. Find IQR. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Box plots and distribution comparison — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Read minimum,Q1,median,Q3,maximum.
- IQR=Q3-Q1.
- Compare matched measures and state context.

WORKED EXAMPLE 1

A box plot has Q1=12,median=19,Q3=31. Find IQR.

SOLUTION

1. 31-12.

ANSWER: 19

WORKED EXAMPLE 2

Two medians are 42 and 47. Interpret.

SOLUTION

1. Use context.

ANSWER: The second distribution has a typical value 5 units higher

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Box plots and distribution comparison — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Box plots compare performance, reliability and waiting-time distributions compactly.

Common misconceptions

- Reading box width as frequency.
- Comparing a median with another range.
- Inferring a mode from a box plot.

GUIDED TRY

A has IQR 8; B has IQR 15. Which is more consistent? First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State one limitation of comparing only ranges. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Box plots and distribution comparison

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **A box plot has Q1=12,median=19,Q3=31. Find IQR.** [1]

2. **Two medians are 42 and 47. Interpret.** [2]

3. **A has IQR 8; B has IQR 15. Which is more consistent?** [1]

4. **Minimum 4,Q1=9,median=11,Q3=18,max=30. Which side suggests greater spread?** [2]

5. **Can a box plot show the mode?** [1]

6. **A value lies beyond a plotted outlier fence. Must it be deleted?** [2]

7. **Compare A median 20,IQR 6 with B median 17,IQR 4.** [3]

8. **State one limitation of comparing only ranges.** [2]

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Scatter, regression and prediction

Interpret correlation and assess interpolation, extrapolation and outlier influence.

SPECIFICATION FOCUS

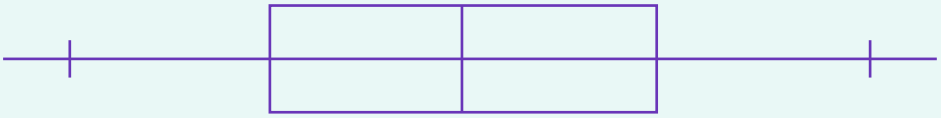
OCR reference OCR 12.03c-12.03d. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

A scatter graph plots paired observations. A trend line models average association, while residuals and outliers show departures from that model. Association alone does not establish cause.

KEY VOCABULARY

paired data • correlation • line of best fit • residual • leverage



minimum • quartiles • median • maximum

Why the method works

- Each point must preserve its original pair.
- A balanced trend line represents the centre of the cloud.
- Prediction is most defensible inside the observed x-range.

CHECK BEFORE MOVING ON

Answer mentally: A correlation coefficient-like description is close to -1. Describe the scatter. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Scatter, regression and prediction — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Describe direction and strength.
- A line of best fit follows the centre of the cloud.
- Correlation does not prove causation.

WORKED EXAMPLE 1

A correlation coefficient-like description is close to -1. Describe the scatter.

SOLUTION

1. Points cluster near a falling line.

ANSWER: Strong negative linear association

WORKED EXAMPLE 2

A best-fit line is y=2.4x+7. Estimate y at x=15.

SOLUTION

1. 2.4×15+7.

ANSWER: 43

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Scatter, regression and prediction — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Regression-style reasoning supports cautious prediction in science, business and social research.

Common misconceptions

- Joining points in observation order.
- Forcing the line through the origin.
- Treating correlation as proof of causation.

GUIDED TRY

Observed x-range is 4–18. Classify prediction at x=12. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

State three cautions when using a trend line. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Scatter, regression and prediction

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **A correlation coefficient-like description is close to -1. Describe the scatter.** **[2]**

2. **A best-fit line is y=2.4x+7. Estimate y at x=15.** **[2]**

3. **Observed x-range is 4–18. Classify prediction at x=12.** **[1]**

4. **Why can an extreme outlier rotate a line of best fit?** **[2]**

5. **Ice-cream sales correlate with sunburn cases. Give a plausible lurking variable.** **[2]**

6. **A line predicts 80 but actual value is 74. Find residual actual-predicted.** **[2]**

7. **Why should a causal claim require more than correlation?** **[3]**

8. **State three cautions when using a trend line.** **[3]**

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Misleading graphs and claims

Recognise distorted scales, areas and selective summaries.

SPECIFICATION FOCUS

OCR reference OCR 12.03b. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

A technically drawn graph can still mislead through truncated scales, unequal intervals, area symbols or selective data.

KEY VOCABULARY

scale • baseline • area • distortion • claim

Why the method works

- The method preserves the link between observations and conclusions.
- A suitable representation makes the relevant pattern visible without distortion.
- Matched summaries and explicit assumptions make comparisons auditable.

CHECK BEFORE MOVING ON

Answer mentally: A bar chart axis starts at 95 and bars are 98 and 100. Why may it mislead? Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Misleading graphs and claims — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Check whether axes start at zero and use equal intervals.
- Distinguish bar height from area or volume.
- Test whether the statistic supports the wording.

WORKED EXAMPLE 1

A bar chart axis starts at 95 and bars are 98 and 100. Why may it mislead?

SOLUTION

1. The actual difference is 2.

ANSWER: The truncated axis exaggerates the small difference

WORKED EXAMPLE 2

A pictogram doubles both height and width of a symbol. By what factor does its area grow?

SOLUTION

1. Area scales in two dimensions.

ANSWER: 4

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Misleading graphs and claims — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

News and advertising require critical graph reading.

Common misconceptions

- Choosing a display before identifying the data type.
- Generalising beyond the sample design.
- Reporting a statistic without context, spread or limitations.

GUIDED TRY

A graph has unequal numerical intervals drawn at equal spacing. What is wrong? First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Give three checks for a statistical claim. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Misleading graphs and claims

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **A bar chart axis starts at 95 and bars are 98 and 100. Why may it mislead?** **[2]**

2. **A pictogram doubles both height and width of a symbol. By what factor does its area grow?** **[2]**

3. **A graph has unequal numerical intervals drawn at equal spacing. What is wrong?** **[2]**

4. **A headline says “average doubled” using mean 2 to 4. What extra information is needed?** **[2]**

5. **Why can omitting a category mislead?** **[1]**

6. **A 3D cylinder icon doubles in every dimension. By what factor does volume grow?** **[2]**

7. **A company selects only its best month. Name the problem.** **[1]**

8. **Give three checks for a statistical claim.** **[3]**

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Statistical investigation design

Plan questions, variables, sampling and analysis before collecting data.

SPECIFICATION FOCUS

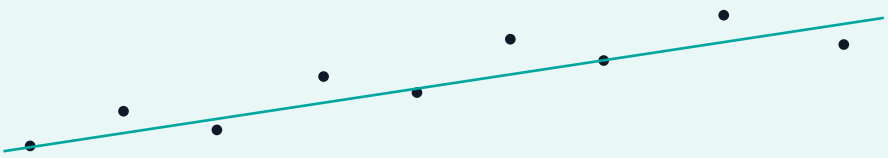
OCR reference OCR 12.01a; 12.03a. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

A statistical investigation is designed before data collection. The question, population, variables, sampling process, measurement method and intended analysis must fit together.

KEY VOCABULARY

research question • operational definition • explanatory variable • response • control



Why the method works

- Operational definitions make measurements reproducible.
- Controls reduce alternative explanations.
- A planned analysis reduces selective reporting.

CHECK BEFORE MOVING ON

Answer mentally: Suggest a measurable variable for “fitness”. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Statistical investigation design — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- State a testable question and target population.
- Define variables and a representative sampling method.
- Plan suitable displays and summaries.

WORKED EXAMPLE 1

Suggest a measurable variable for “fitness”.

SOLUTION

1. Operationally define method and units.

ANSWER: For example recovery heart rate after a standard exercise

WORKED EXAMPLE 2

Why should a questionnaire pilot be used?

SOLUTION

1. Revise before full collection.

ANSWER: To identify ambiguous questions and response problems

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Statistical investigation design — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Good experimental and survey design makes later conclusions credible and auditable.

Common misconceptions

- Collecting convenient data before defining the population.
- Changing categories after seeing results without disclosure.
- Ignoring units or measurement reliability.

GUIDED TRY

A study compares revision time with score. Identify explanatory and response variables. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Write a five-stage investigation plan. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Statistical investigation design

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **Suggest a measurable variable for “fitness”.** [2]

2. **Why should a questionnaire pilot be used?** [2]

3. **A study compares revision time with score. Identify explanatory and response variables.** [2]

4. **Give one control variable for comparing paper-aircraft designs.** [1]

5. **Why record units in the data table?** [1]

6. **Choose summaries for skewed waiting times.** [2]

7. **Explain why repeating measurements can improve reliability.** [2]

8. **Write a five-stage investigation plan.** [5]

SHOW ALL WORKING

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Mixed Higher statistical reasoning

Select and critique methods in unfamiliar statistical investigations.

SPECIFICATION FOCUS

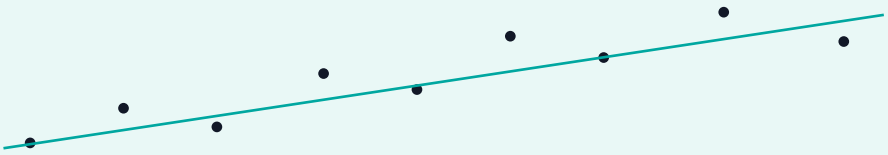
OCR reference OCR 12.01-12.03 synthesis. This lesson develops representation, accurate calculation, reasoning and interpretation within Higher Tier.

Understand the idea

Mixed Higher problems require a complete evidence chain: representative data, faithful display, correct calculation, contextual comparison and a conclusion no stronger than the design permits.

KEY VOCABULARY

evidence • uncertainty • representation • comparison • inference



Why the method works

- Sampling controls who the conclusion can describe.
- Representation controls which patterns are visible.
- Limitations distinguish evidence from certainty.

CHECK BEFORE MOVING ON

Answer mentally: Group A: median 52,IQR 8; B: median 48,IQR 14. Compare. Then define one key word from this page in your own words.

COMPREHENSIVE LESSON NOTEBOOK

Mixed Higher statistical reasoning — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Connect sampling, representation and analysis.
- Quantify centre and spread before concluding.
- State uncertainty and limitations.

WORKED EXAMPLE 1

Group A: median 52,IQR 8; B: median 48,IQR 14. Compare.

SOLUTION

1. Use median and IQR.

ANSWER: A is typically higher and more consistent

WORKED EXAMPLE 2

A histogram class 20–35 has density 1.6. Find frequency.

SOLUTION

1. Width 15×1.6.

ANSWER: 24

SELF-CHECK QUESTION

Which step carries the mathematical reason, and which step carries only arithmetic? Being able to distinguish them makes a solution easier to repair.

COMPREHENSIVE LESSON NOTEBOOK

Mixed Higher statistical reasoning — apply and reason

Connect the method to decisions and common errors.

Where this mathematics appears

Publication-quality statistical conclusions integrate design, calculation and critical interpretation.

Common misconceptions

- Using precise arithmetic to disguise weak sampling.
- Choosing only the summary that supports a claim.
- Extrapolating or claiming causation without justification.

GUIDED TRY

N=120, Q1=18,Q3=42. Find number in middle 50% and IQR. First predict the form or approximate size of the answer. Then show the complete method.

REASONING PROMPT

Give a complete release check for a statistical conclusion. Explain why each condition or operation you use is valid.

EXAM COMMUNICATION

Use one mathematical statement per line. Label units and restrictions. If the result is approximate, show the unrounded value before the final rounded answer.

COMPREHENSIVE LESSON NOTEBOOK

Independent practice

Mixed Higher statistical reasoning

Complete without notes. Show all working, then use the answer section to diagnose and repair errors.

1. **Group A: median 52,IQR 8; B: median 48,IQR 14. Compare.** **[3]**

2. **A histogram class 20–35 has density 1.6. Find frequency.** **[2]**

3. **N=120, Q1=18,Q3=42. Find number in middle 50% and IQR.** **[2]**

4. **A sample mean rises from 32 to 36 after correcting one error. Total frequency 25. Find change in total.** **[2]**

5. **A line y=5.2x-3 predicts at x=9. Find prediction.** **[2]**

6. **Explain why a graph with a zero-suppressed axis can still be acceptable.** **[2]**

7. **A survey is random but only 35% respond. Is it necessarily representative?** **[2]**

8. **Give a complete release check for a statistical conclusion.** **[4]**

REFLECTION

Circle one: secure / almost / reteach. Record the question number of your most useful error and the rule that repairs it.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Sampling, bias and inference

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A college has 720 Year 12 and 480 Year 13 students. A sample of 90 and 60 is taken. Show...

ANSWER: Both use 1/8 of each year

Method cue: 90/720=60/480=1/8. Check sign, size, accuracy and units.

2. Describe a simple random sample of 120 from 6000 customer IDs.

ANSWER: Generate 120 different random integers from 1 to 6000 and select those IDs

Method cue: Every ID has equal chance. Check sign, size, accuracy and units.

3. A response rate is 18%. Explain possible non-response bias.

ANSWER: Respondents may systematically differ from non-respondents

Method cue: The replies may not represent all invited people. Check sign, size, accuracy and units.

4. A survey estimates 47% support from 40 volunteers. Give three limitations.

ANSWER: Small sample, self-selection and unknown population coverage

Method cue: Each weakens inference. Check sign, size, accuracy and units.

5. Why does increasing a convenience sample from 100 to 10,000 not remove bias?

ANSWER: It reduces random fluctuation but preserves systematic selection error

Method cue: Size cannot repair a biased sampling frame. Check sign, size, accuracy and units.

6. A stratified sample of 150 from groups 500,300,200 is required. Find allocations.

ANSWER: 75,45,30

Method cue: Total=1000. Check sign, size, accuracy and units.

7. State one advantage of stratification.

ANSWER: Important subgroups are represented in population proportions

Method cue: It can improve representativeness. Check sign, size, accuracy and units.

8. Distinguish population parameter from sample statistic.

ANSWER: A parameter describes the whole population; a statistic is calculated from a sample

Method cue: The statistic estimates the parameter. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Data types and frequency tables

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Classify shoe size as categorical, discrete numerical or continuous numerical.

ANSWER: Discrete numerical

Method cue: It takes separated allowed values. Check sign, size, accuracy and units.

2. Classify journey time.

ANSWER: Continuous numerical

Method cue: It can take any value in an interval. Check sign, size, accuracy and units.

3. Values 2,3,2,5,4,3,2. Complete frequencies for 2,3,4,5.

ANSWER: 3,2,1,1

Method cue: Tally each value. Check sign, size, accuracy and units.

4. A frequency table totals 48 but the survey had 52 responses. What does this show?

ANSWER: Four responses are missing or misclassified

Method cue: Frequencies should total 52. Check sign, size, accuracy and units.

5. Give one suitable response category set for travel-to-school method.

ANSWER: Walk, cycle, bus, car, train, other

Method cue: Categories should be exhaustive and non-overlapping. Check sign, size, accuracy and units.

6. Why is height not best recorded in categories “short” and “tall” without boundaries?

ANSWER: The categories are subjective and not reproducible

Method cue: Numerical boundaries are needed. Check sign, size, accuracy and units.

7. A table has frequencies 6,9,x,4 and total 31. Find x.

ANSWER: 12

Method cue: x=31-6-9-4. Check sign, size, accuracy and units.

8. State two checks for a data table.

ANSWER: Clear heading/units and exhaustive non-overlapping categories

Method cue: Also check total frequency. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Histograms and frequency density

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Class 0–5 has frequency 20. Find frequency density.

ANSWER: 4

Method cue: 20/5=4. Check sign, size, accuracy and units.

2. Class 5–15 has frequency 30. Find density.

ANSWER: 3

Method cue: 30/10=3. Check sign, size, accuracy and units.

3. A histogram bar width 8 and density 2.5. Find frequency.

ANSWER: 20

Method cue: Area=8×2.5. Check sign, size, accuracy and units.

4. Classes 0–4,4–10 have frequencies 12,15. Find densities.

ANSWER: 3 and 2.5

Method cue: Divide each frequency by class width. Check sign, size, accuracy and units.

5. A bar has twice the height but half the width of another. Compare frequencies.

ANSWER: They are equal

Method cue: Area products are equal. Check sign, size, accuracy and units.

6. A density scale shows 1 cm height represents density 4. A bar is 3.5 cm. Find density.

ANSWER: 14

Method cue: 3.5×4. Check sign, size, accuracy and units.

7. Why may ordinary frequency bars mislead for unequal widths?

ANSWER: Wider classes would appear larger even when frequency density is lower

Method cue: Histogram area must encode frequency. Check sign, size, accuracy and units.

8. State three histogram checks.

ANSWER: Continuous boundaries, correct densities and area-frequency consistency

Method cue: Also label axes. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Cumulative frequency and quartiles

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Frequencies 5,9,12,4. Write cumulative frequencies.

ANSWER: 5,14,26,30

Method cue: Running totals. Check sign, size, accuracy and units.

2. For N=80, state positions for Q1, median and Q3.

ANSWER: 20th, 40th and 60th

Method cue: Use N/4,N/2,3N/4. Check sign, size, accuracy and units.

3. A graph gives Q1=18 and Q3=42. Find IQR.

ANSWER: 24

Method cue: 42-18. Check sign, size, accuracy and units.

4. The 90th percentile of 200 values is required. State position.

ANSWER: 180th

Method cue: 0.9×200. Check sign, size, accuracy and units.

5. Cumulative frequency reaches 64 at x=30 and total is 80. Estimate percentage ≤30.

ANSWER: 80%

Method cue: 64/80×100. Check sign, size, accuracy and units.

6. Why must a cumulative-frequency curve never decrease?

ANSWER: Running totals cannot fall as the upper boundary increases

Method cue: Each class adds a non-negative frequency. Check sign, size, accuracy and units.

7. A median read is 27.4 from a graph marked every 2 units. Give sensible accuracy.

ANSWER: About 27 (or 27.4 only if interpolation supports it)

Method cue: Do not claim unjustified precision. Check sign, size, accuracy and units.

8. State how to estimate number above value x from a cumulative graph.

ANSWER: Total minus cumulative frequency at x

Method cue: The curve counts values at or below x. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Grouped estimates and interpolation

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Classes 0–10,10–20,20–40 have frequencies 4,10,6. Estimate mean.

ANSWER: 17.5

Method cue: Midpoints are 5,15,30. Check sign, size, accuracy and units.

2. Why can two raw data sets share the same grouped table but have different means?

ANSWER: Values may occupy different positions inside each class

Method cue: Midpoint estimation hides within-class detail. Check sign, size, accuracy and units.

3. A class 20–30 has cumulative frequency rising from 18 to 42. Estimate median for N=60 by...

ANSWER: 25

Method cue: Median position=30. Check sign, size, accuracy and units.

4. Class 50–70 contains 16 values. Estimate how many are below 65 assuming uniformity.

ANSWER: 12

Method cue: 65 is 15/20 through class. Check sign, size, accuracy and units.

5. Grouped data have Q1≈14,Q3≈39. Find IQR.

ANSWER: 25

Method cue: 39-14. Check sign, size, accuracy and units.

6. Explain the uniform-distribution assumption in interpolation.

ANSWER: Values are treated as evenly spread within the class interval

Method cue: It may not match actual clustering. Check sign, size, accuracy and units.

7. Midpoints 5,15,25 with frequencies 2,x,4 give estimated mean 17 and total 10. Find x.

ANSWER: 4

Method cue: Total gives x=4; check weighted mean=(10+60+100)/10=17. Check sign, size, accuracy and units.

8. State two sources of uncertainty in a grouped median.

ANSWER: Class grouping and graph/linear interpolation

Method cue: Exact positions inside the median class are unknown. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Box plots and distribution comparison

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A box plot has Q1=12,median=19,Q3=31. Find IQR.

ANSWER: 19

Method cue: 31-12. Check sign, size, accuracy and units.

2. Two medians are 42 and 47. Interpret.

ANSWER: The second distribution has a typical value 5 units higher

Method cue: Use context. Check sign, size, accuracy and units.

3. A has IQR 8; B has IQR 15. Which is more consistent?

ANSWER: A

Method cue: Smaller IQR. Check sign, size, accuracy and units.

4. Minimum 4,Q1=9,median=11,Q3=18,max=30. Which side suggests greater spread?

ANSWER: Upper side

Method cue: Distances above median and upper whisker are larger. Check sign, size, accuracy and units.

5. Can a box plot show the mode?

ANSWER: No

Method cue: Individual frequencies are not displayed. Check sign, size, accuracy and units.

6. A value lies beyond a plotted outlier fence. Must it be deleted?

ANSWER: No

Method cue: Investigate whether it is genuine or erroneous. Check sign, size, accuracy and units.

7. Compare A median 20,IQR 6 with B median 17,IQR 4.

ANSWER: A is typically higher; B is more consistent

Method cue: Use median and IQR. Check sign, size, accuracy and units.

8. State one limitation of comparing only ranges.

ANSWER: Range depends on extremes and ignores the middle 50%

Method cue: IQR is more resistant to outliers. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Scatter, regression and prediction

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A correlation coefficient-like description is close to -1. Describe the scatter.

ANSWER: Strong negative linear association

Method cue: Points cluster near a falling line. Check sign, size, accuracy and units.

2. A best-fit line is y=2.4x+7. Estimate y at x=15.

ANSWER: 43

Method cue: 2.4×15+7. Check sign, size, accuracy and units.

3. Observed x-range is 4–18. Classify prediction at x=12.

ANSWER: Interpolation

Method cue: Inside the range. Check sign, size, accuracy and units.

4. Why can an extreme outlier rotate a line of best fit?

ANSWER: It has high leverage and can strongly affect the trend

Method cue: Check sensitivity with and without it. Check sign, size, accuracy and units.

5. Ice-cream sales correlate with sunburn cases. Give a plausible lurking variable.

ANSWER: Hot/sunny weather

Method cue: It influences both. Check sign, size, accuracy and units.

6. A line predicts 80 but actual value is 74. Find residual actual-predicted.

ANSWER: -6

Method cue: 74-80. Check sign, size, accuracy and units.

7. Why should a causal claim require more than correlation?

ANSWER: Confounding, reverse causation and chance remain possible

Method cue: Controlled evidence or stronger design is needed. Check sign, size, accuracy and units.

8. State three cautions when using a trend line.

ANSWER: Use within range, recognise scatter, and avoid causal interpretation

Method cue: Also consider sample design and outliers. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Misleading graphs and claims

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. A bar chart axis starts at 95 and bars are 98 and 100. Why may it mislead?

ANSWER: The truncated axis exaggerates the small difference

Method cue: The actual difference is 2. Check sign, size, accuracy and units.

2. A pictogram doubles both height and width of a symbol. By what factor does its area grow...

ANSWER: 4

Method cue: Area scales in two dimensions. Check sign, size, accuracy and units.

3. A graph has unequal numerical intervals drawn at equal spacing. What is wrong?

ANSWER: The scale is non-linear but appears linear

Method cue: Distances do not represent equal changes. Check sign, size, accuracy and units.

4. A headline says “average doubled” using mean 2 to 4. What extra information is needed?

ANSWER: Sample sizes, spread, context and how samples were selected

Method cue: A mean alone is incomplete. Check sign, size, accuracy and units.

5. Why can omitting a category mislead?

ANSWER: The displayed proportions no longer represent the whole data set

Method cue: Check exhaustiveness. Check sign, size, accuracy and units.

6. A 3D cylinder icon doubles in every dimension. By what factor does volume grow?

ANSWER: 8

Method cue: Volume scale factor=2^3. Check sign, size, accuracy and units.

7. A company selects only its best month. Name the problem.

ANSWER: Cherry-picking

Method cue: The time period is unrepresentative. Check sign, size, accuracy and units.

8. Give three checks for a statistical claim.

ANSWER: Source/sample, scale/graph construction, and appropriate summary/context

Method cue: Also inspect missing data and uncertainty. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Statistical investigation design

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Suggest a measurable variable for “fitness”.

ANSWER: For example recovery heart rate after a standard exercise

Method cue: Operationally define method and units. Check sign, size, accuracy and units.

2. Why should a questionnaire pilot be used?

ANSWER: To identify ambiguous questions and response problems

Method cue: Revise before full collection. Check sign, size, accuracy and units.

3. A study compares revision time with score. Identify explanatory and response variables.

ANSWER: Revision time explanatory; score response

Method cue: The direction does not prove causation. Check sign, size, accuracy and units.

4. Give one control variable for comparing paper-aircraft designs.

ANSWER: For example same paper, thrower or launch force

Method cue: Hold other conditions constant. Check sign, size, accuracy and units.

5. Why record units in the data table?

ANSWER: Values are otherwise ambiguous and may be incomparable

Method cue: Units define measurement. Check sign, size, accuracy and units.

6. Choose summaries for skewed waiting times.

ANSWER: Median and IQR

Method cue: They resist extreme waits. Check sign, size, accuracy and units.

7. Explain why repeating measurements can improve reliability.

ANSWER: Random measurement variation can be assessed and averaged

Method cue: It does not automatically remove systematic error. Check sign, size, accuracy and units.

8. Write a five-stage investigation plan.

ANSWER: Question; population/sample; collect; represent/analyse; conclude with limitations

Method cue: Each stage should be defined before reporting. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Practice answers and repair notes

Mixed Higher statistical reasoning

Use only after a genuine attempt. Rework incorrect questions from a blank line rather than copying the final value.

1. Group A: median 52,IQR 8; B: median 48,IQR 14. Compare.

ANSWER: A is typically higher and more consistent

Method cue: Use median and IQR. Check sign, size, accuracy and units.

2. A histogram class 20–35 has density 1.6. Find frequency.

ANSWER: 24

Method cue: Width 15×1.6. Check sign, size, accuracy and units.

3. N=120, Q1=18,Q3=42. Find number in middle 50% and IQR.

ANSWER: 60 values; IQR 24

Method cue: Half of 120 lies between quartiles. Check sign, size, accuracy and units.

4. A sample mean rises from 32 to 36 after correcting one error. Total frequency 25. Find c...

ANSWER: 100

Method cue: Mean change 4×25. Check sign, size, accuracy and units.

5. A line y=5.2x-3 predicts at x=9. Find prediction.

ANSWER: 43.8

Method cue: 5.2×9-3. Check sign, size, accuracy and units.

6. Explain why a graph with a zero-suppressed axis can still be acceptable.

ANSWER: If clearly labelled and used to show small changes without deceptive claims

Method cue: Context and transparent scale matter. Check sign, size, accuracy and units.

7. A survey is random but only 35% respond. Is it necessarily representative?

ANSWER: No

Method cue: Non-response can introduce systematic bias. Check sign, size, accuracy and units.

8. Give a complete release check for a statistical conclusion.

ANSWER: Representative sample; accurate display; suitable matched summaries; uncertainty and causation limits stated

Method cue: Verify calculations and data provenance. Check sign, size, accuracy and units.

COMPREHENSIVE LESSON NOTEBOOK

Independent authorship and release check

OCR Foundation Mathematics • Unit 9 Statistics

ORIGINAL-CONTENT STATEMENT

This publication contains independently written teaching explanations, examples, practice questions, numerical data, diagrams and solutions. OCR is referenced solely to identify the J560 qualification. No OCR logo, official assessment question, mark scheme, examiner-report text or protected assessment layout is reproduced.

Release checklist

- 10 publisher-organised chapters mapped to OCR J560 section 12.
- Every chapter begins on a new page and contains conceptual explanation.
- Original vector diagrams and two worked examples appear in every chapter.
- Applications, misconceptions, guided reasoning and independent practice are included.
- Answers are collected at the end with method cues.
- Copyright, trademark and non-endorsement wording included.

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