Cornwallis Academy
Ambitions for All

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Year 12 Mathematical Studies

Analysis of Data

Learning Objectives

- To understand the data handling cycle and the various types of data. To carry out a random sample.
- To understand and carry out stratified sampling.
- To be able to compare and use all sampling methods including random, stratified, Cluster and quota
- To calculate averages from stem and leaf diagrams and use back-to-back stem and leaf diagrams to compare data
- To calculate averages from tables and grouped frequency tables.
- To calculate the mean, median and mode being able to justify which gives the rest representation.
- Measures of spread – Range, Quartiles and inter quartile ranges
- Measures of spread – Standard deviation
- To construct a box and whisker plot.
- To use a cumulative frequency graph to represent data.
- To compare data sets using both box and whisker and cumulative frequency graphs.
- To construct Histograms.
- To analyse and interpret Histograms.
- Choosing the correct method – advantages and disadvantages of different statistical values and diagrams.

What previous knowledge is required?

Knowledge built upon from GCSE

- Calculating the mean and median of raw data
- Using tally marks to create a grouped frequency table
- Methods of collecting data
- Compiling tables of data
- Constructing and interpreting frequency diagrams
- Calculating the mean, median and mode from a set of data
- Calculating the lower and upper quartiles
- Calculating the range of a set of data
- Constructing a stem-and-leaf diagram, box plot and cumulative frequency diagram
- Drawing box plots and cumulative frequency curves
- Calculating the mean from a grouped frequency table
- Calculating the percentage of an amount
- Calculating with fractions
- Calculating the mean and mode from a set of data
- Constructing a stem-and-leaf diagram

How will this term's content help with future learning?

1. Supports Further Study

Students learn to:

- Interpret tables, charts, and graphs.
- Analyse trends and patterns in data.
- Evaluate statistical claims.
- Understand measures such as averages and spread.
- Judge the reliability of data sources.

These skills are valuable in subjects such as:

- Psychology
- Sociology
- Economics

- Biology
- Geography
- Business Studies

Many university courses require students to interpret research findings and statistical evidence, even when advanced mathematics is not a major part of the course.

2. Develops Critical Thinking

Students learn to question:

- Whether data is representative.
- If graphs are misleading.
- Whether conclusions are justified.
- How sample size affects reliability.

This helps when reading news articles, research reports, surveys, and social media statistics.

3. Improves Workplace Skills

Data analysis is important in careers such as:

- Marketing
- Healthcare
- Business management
- Education
- Public services
- Finance

Employees are often expected to interpret performance data, customer feedback, and trends.

4. Builds Statistical Literacy

The unit develops confidence with:

- Mean, median, and mode.
- Range and measures of spread.
- Correlation and association.
- Sampling techniques.
- Data presentation.

These are essential skills for understanding information encountered in everyday life.

Common Misconceptions

1. Correlation Means Causation

Misconception: If two variables are correlated, one causes the other.

Correction: A correlation only shows a relationship. Other factors may explain the connection.

Example:

- Ice cream sales and sunburn cases both increase in summer.
- Ice cream does not cause sunburn.

2. The Mean Is Always the Best Average

Misconception: The mean should always be used.

Correction: Different situations require different averages.

- Mean: useful for most numerical data.
- Median: better when there are extreme values.
- Mode: useful for categorical or most-common values.

3. Large Samples Are Always Representative

Misconception: A bigger sample automatically gives reliable results.

Correction: A large biased sample can still be misleading. The sampling method matters as much as the sample size.

4. A Graph Always Tells the Truth

Misconception: Graphs provide an unbiased picture.

Correction: Graphs can be misleading through:

- Truncated axes.
- Unequal scales.
- Selective data.

Students should always examine how data is presented.

5. Averages Describe Everyone
Misconception: An average represents all members of a group.
Correction: There can be considerable variation around an average. Measures of spread help describe this variation.

6. A Percentage Increase and Decrease Cancel Out
Misconception: A 20% increase followed by a 20% decrease returns to the original value.
Correction:

- £100 increased by 20% = £120.
- £120 decreased by 20% = £96.

The original value is not restored.

7. An Outlier Should Always Be Removed
Misconception: Unusual values are mistakes.
Correction: Some outliers are genuine and may provide important information. They should be investigated before removal.

National Curriculum / Specification

AQA Specification reference
D1.1 , D1.2 , D1.3
D2.1 , D2.2
D3.1 , D3.2
D4.1

Personal Finance

Learning Objectives

- Percentages
- Percentages 2
- Introduction to personal finance. To effectively budget.
- To analyse the key parts of a payslip.
- Introduction to TAX
- To calculate TAX
- Calculating National Insurance
- To understand methods of controlling debt including credit cards and various types of loan.
- To calculate annual percentage rate (APR)
- To understand some of the key aspects of how a mortgage is calculated.
- To calculate Interest rates including AER for savings and investments.
- To calculate VAT and other percentages.
- To use exchange rates.
- To calculate inflation.

What previous knowledge is required?

Knowledge built upon from GCSE

- Calculating with percentages
- Calculating percentages
- Rounding to 2dp
- Substituting values into formulae
- Rearranging equations
- Calculating with percentages
- Using spreadsheet formulae
- Drawing and interpreting line graphs
- Calculating simple and compound interest
- Substituting into formulae
- Solving equations
- Calculating percentages of an amount
- Recognising that 100% represents a whole
- Calculating percentages of amounts
- Converting percentages to decimals
- Finding one quantity as a percentage of another
- Drawing and interpreting line graphs
- Finding the mean
- Using conversion graphs
- Calculating percentages
- Substituting numerical values into algebraic expressions and formulae
- Entering formulae into a spreadsheet
- Recognising that 100% represents a whole

How will this term's content help with future learning?

Studying this unit helps learners to:

- Understand income, taxation, and deductions from earnings.
- Create and analyse budgets.
- Compare financial products such as savings accounts and loans.
- Calculate and interpret simple and compound interest.
- Evaluate financial risks and rewards.
- Make informed decisions about borrowing and saving.

These skills support future learning in subjects such as:

- Business Studies
- Economics
- Accounting
- Geography

The unit also develops problem-solving, reasoning, and decision-making skills that are useful in higher education and many careers.

Common Misconceptions

1. "A higher salary means I keep all of the extra money."
Misconception: If earnings increase by £1,000, take-home pay also increases by £1,000.
Correction: Tax, National Insurance, pension contributions, and other deductions reduce the amount received.

2. "Simple interest and compound interest give similar results."
Misconception: Both types of interest grow money at the same rate.
Correction: Compound interest earns interest on previously earned interest, causing growth to accelerate over time.

3. "The cheapest monthly payment is the best deal."

Misconception: Lower monthly repayments always save money.
Correction: A longer repayment period often means paying more interest overall.

4. "Credit cards provide free money."
Misconception: Borrowed money does not have consequences.
Correction: Unpaid balances may incur interest and increase debt.

5. "Percentage increases and decreases cancel each other out."
Misconception: A 10% increase followed by a 10% decrease returns to the original amount.
Correction: The final amount will be lower than the starting amount because the percentages are calculated from different values.

6. "Insurance is pointless if I never claim."
Misconception: Insurance only has value when a claim is made.
Correction: Insurance provides financial protection against potentially expensive risks.

7. "All loans with the same interest rate cost the same."
Misconception: Interest rate is the only factor that matters.
Correction: Loan length, fees, and repayment structure also affect the total cost.

National Curriculum / Specification

AQA Specification reference:
F 1.1, F1.2, F1.3, F1.4
F2.1, F2.2, F2.3, F2.4 F2.5
F3.1, F3.2,
F4.1,
F5.1
F6.1
F7.1, F7.2, F7.3, F7.4

Modelling and Estimation

Learning Objectives

- Useful facts and formulae – To calculate the volume and surface area of prisms and spheres.
- Useful facts and formulae – Calculating speed, distance time and Mass, density, volume.
- Introduction to mathematical modelling and what it is.
- Modelling the Gulf Stream
- To write numbers in standard form and calculate with them.
- Rounding to d.p. and s.f. in order to make estimations.
- To use the scaling method of estimation.
- To use the subdividing method of estimation.
- To be able to state assumptions in order to make estimations. (fermi problems)
- To evaluate the effectiveness of a mathematical model.

What previous knowledge is required?

Knowledge built upon from GCSE:

- Working with large numbers
- Estimating amounts
- Substituting values into a given formula
- Converting between metric units
- Calculating percentage error

- Calculating with powers of 10
- Calculating volumes
- Comparing lengths

How will this term's content help with future learning?

Studying this unit helps learners to:

- Estimate quantities when exact values are unavailable.
- Check whether answers are reasonable.
- Make assumptions and evaluate their impact.
- Construct and interpret mathematical models.
- Analyse real-world situations using mathematics.
- Develop problem-solving and critical-thinking skills.

These skills support future learning in subjects such as:

- Physics
- Engineering
- Economics
- Geography
- Business Studies

The unit also prepares students for situations where decisions must be made using incomplete information, a common requirement in higher education and the workplace.

Common Misconceptions

1. "An estimate must be exact."
Misconception: An estimate is incorrect unless it is very close to the actual value.
Correction: Estimates are approximations designed to provide a reasonable answer, not an exact one.

2. "Models always give the correct answer."
Misconception: Mathematical models perfectly represent reality.
Correction: Models simplify reality and depend on assumptions. Their predictions may not always match real outcomes.

3. "Assumptions do not affect results."
Misconception: Any assumptions made in a model have little impact.
Correction: Different assumptions can significantly change conclusions and predictions.

4. "More complex models are always better."
Misconception: The most detailed model produces the most useful answer.
Correction: Simpler models can often provide sufficient accuracy while being easier to understand and use.

5. "Rounding does not matter."
Misconception: Rounding values during calculations has no effect on the final answer.
Correction: Repeated rounding can introduce errors, especially in multi-step calculations.

6. "A reasonable-looking answer must be correct."
Misconception: If an answer seems sensible, it does not need checking.
Correction: Estimates should be used to test whether answers are reasonable, but calculations and assumptions should still be verified.

National Curriculum / Specification

AQA Specification reference:
E1.1 , E1.2, E1.3 , E1.4,
E2.1

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Critical Analysis

Learning Objectives

- To understand what is meant by critical analysis and to analyse the clarity of statements focusing on the use of language.
- To analyse the clarity of statements based on figures which must have calculations to back them up
- To critically analyse statements focusing on various assumptions and understand what assumptions are acceptable.
- To understand how the selectivity and sampling methods can obscure results

What previous knowledge is required?

Knowledge built upon from GCSE:

- Calculating index numbers
- Interpreting graphs

How will this term's content help with future learning?

Studying this unit helps learners to:

- Interpret information presented in reports, graphs, and statistics.
- Assess the reliability of data sources.
- Identify bias and misleading presentations of data.
- Evaluate the assumptions behind mathematical arguments.
- Judge whether conclusions are supported by evidence.
- Develop logical reasoning and communication skills.

These skills support future learning in subjects such as:

- Economics
- Psychology
- Sociology
- Business Studies
- Geography
- Politics

The unit is particularly valuable in higher education, where students are expected to evaluate evidence, challenge assumptions, and justify conclusions.

Common Misconceptions

1. "If statistics are presented, the conclusion must be true."
Misconception: Numbers automatically make an argument reliable.
Correction: Statistics can be misinterpreted, selectively chosen, or presented in a misleading way. The source and methodology should always be examined.

2. "Correlation means causation."
Misconception: If two variables are related, one must cause the other.
Correction: A relationship between variables does not prove that one causes the other. Other factors may be involved.

3. "Large samples are always reliable."
Misconception: A large sample guarantees accurate conclusions.
Correction: Reliability depends on how the sample was selected as well as its size. A large biased sample can still be misleading.

4. "Graphs always present information fairly."
Misconception: Graphical representations are objective.

Correction: Choices of scale, axis range, and presentation style can exaggerate or hide patterns in data.

5. "Average values describe everyone in a group."
Misconception: The mean or median represents all individuals equally.
Correction: Measures of spread and variation must also be considered because individuals may differ greatly from the average.

National Curriculum / Specification

AQA Specification reference:
C1.1 , C2.1, C3.1 , C3.2