

Ma4 Handling data

1 Using and Applying Handling Data

Students should be taught to:

Problem solving

- a carry out each of the four aspects of the handling data cycle to solve problems:
 - i specify the problem and plan: formulate questions in terms of the data needed, and consider what inferences can be drawn from the data

decide what data to collect (including sample size and data format) and what statistical analysis is needed
 - ii collect data from a variety of suitable sources, including experiments and surveys, and primary and secondary sources
 - iii process and represent the data: turn the raw data into usable information that gives insight into the problem
 - iv interpret and discuss the data: answer the initial question by drawing conclusions from the data
- b identify what further information is needed to pursue a particular line of enquiry
- b* select the problem-solving strategies to use in statistical work, and monitor their effectiveness (these strategies should address the scale and manageability of the tasks, and should consider whether the mathematics and approach used are delivering the most appropriate solutions)
- c select and organise the appropriate mathematics and resources to use for a task
- d review progress while working

check and evaluate solutions

Communicating

- e interpret, discuss and synthesise information presented in a variety of forms
- f communicate mathematically, including using ICT, making use of diagrams and related explanatory text
- g examine critically, and justify, their choices of mathematical presentation of problems involving data

Reasoning

- h apply mathematical reasoning, explaining and justifying inferences and deductions
 - e identify exceptional or unexpected cases when solving statistical problems
 - i explore connections in mathematics and look for relationships between variables when analysing data
 - j recognise the limitations of any assumptions and the effects that varying the assumptions could have on the conclusions drawn from data analysis
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2 Specifying the Problem and Planning

Students should be taught to:

- a see that random processes are unpredictable
 - b identify key questions that can be addressed by statistical methods
 - c discuss how data relate to a problem, identify possible sources of bias and plan to minimise it
 - d identify which primary data they need to collect and in what format, including grouped data, considering appropriate equal class intervals
 - e design an experiment or survey
decide what primary and secondary data to use
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3 Collecting Data

Students should be taught to:

- a design and use data-collection sheets for grouped discrete and continuous data
collect data using various methods, including observation, controlled experiment, data logging, questionnaires and surveys
 - b gather data from secondary sources, including printed tables and lists from ICT-based sources
 - c design and use two-way tables for discrete and grouped data
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4 Processing and Representing Data

Students should be taught to:

- a draw and produce, using paper and ICT, pie charts for categorical data, and diagrams for continuous data, including line graphs for time series, scatter graphs, frequency diagrams and stem-and-leaf diagrams

Example: pictograms and bar charts
frequency polygons, histograms with equal class intervals
and frequency diagrams for grouped discrete data

- b calculate mean, range and median of small data sets with discrete then continuous data

Example: the mode

identify the modal class for grouped data

- c understand and use the probability scale

- d understand and use estimates or measures of probability from theoretical models (including equally likely outcomes), or from relative frequency

Example: addition of simple probabilities

- e list all outcomes for single events, and for two successive events, in a systematic way

- f identify different mutually exclusive outcomes and know that the sum of the probabilities of all these outcomes is 1

- g find the median for large data sets and calculate an estimate of the mean for large data sets with grouped data

- h draw lines of best fit by eye, understanding what these represent

Example: using a line of best fit

- j use relevant statistical functions on a calculator or spreadsheet
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5 Interpreting and Discussing Results

Students should be taught to:

- a relate summarised data to the initial questions
- b interpret a wide range of graphs and diagrams and draw conclusions

Example: interpreting a stem-and-leaf diagram

- c look at data to find patterns and exceptions
- d compare distributions and make inferences, using the shapes of distributions and measures of average and range
- e consider and check results and modify their approach if necessary
- f appreciate that correlation is a measure of the strength of the association between two variables

distinguish between positive, negative and zero correlation using lines of best fit

appreciate that zero correlation does not necessarily imply 'no relationship' but merely 'no linear relationship'

- g use the vocabulary of probability to interpret results involving uncertainty and prediction

Example: 'there is some evidence from this sample that ...'

- h compare experimental data and theoretical probabilities
- i understand that if they repeat an experiment, they may — and usually will — get different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics
- j discuss implications of findings in the context of the problem
- k interpret social statistics including index numbers

Example: the General Index of Retail Prices

time series

Example: population growth

and survey data

Example: the National Census