

GCSE MATHEMATICS

FOUNDATION TIER

COMPREHENSIVE LESSON NOTEBOOK

UNIT 6 | STATISTICS

TEACH-FROM-SCRATCH • FREE WEBSITE EDITION

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

Student: _____ Target grade: _____

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START HERE

STUDY ROUTINE

How to learn from this notebook

Meaning first. Method second. Practice third.

THE FIVE-PASS ROUTINE

1 Read the key idea without a calculator. 2 Cover each solution and reproduce it. 3 Complete the 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 sentence when the result must be interpreted.

Error log

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.

Foundation does not mean superficial

Foundation Tier rewards secure fluency and connected reasoning. Grade 4–5 questions often combine several familiar skills, hide the required operation inside a context, or ask whether an answer is reasonable. The notebook therefore explains why methods work as well as how to use them.

SPECIFICATION MAP

PEARSON EDEXCEL 1MA1

Unit 6 coverage map

Statistics content organised into a teachable sequence.

CH 01	S1	Populations, samples and reliable data collection
CH 02	S2, S4	Frequency tables, tally charts and two-way tables
CH 03	S2	Pictograms, bar charts and comparative charts
CH 04	S2	Pie charts and proportional representation
CH 05	S4	Mean, median, mode and range
CH 06	S4, S5	Frequency distributions and weighted means
CH 07	S4, S5	Grouped data and estimated averages
CH 08	S2, S4, S5	Stem-and-leaf diagrams and comparing distributions
CH 09	S2, S6	Scatter graphs, correlation and lines of best fit
CH 10	S2, S5, S6	Time series, misleading graphs and statistical conclusions
CH 11	S2, S4	Data types, chart choice and vertical line charts

IMPORTANT TIER NOTE

This notebook follows the Foundation-assessable content identified in the Pearson Edexcel GCSE Mathematics (1MA1) specification. Higher-only material is excluded from the core lesson sequence unless it is clearly labelled as optional enrichment.

REFERENCE

Fast-reference method bank

STATISTICS FACTS AND METHODS

Understand each formula before memorising it.

Stratified allocation
 $\text{subgroup/total} \times \text{sample size}$
Mean
 $\text{sum of values} \div \text{number of values}$
Frequency-table mean
 $\Sigma fx \div \Sigma f$
Grouped midpoint
 $(\text{lower} + \text{upper}) / 2$
Estimated grouped mean
 $\Sigma (f \times \text{midpoint}) \div \Sigma f$
Range
 $\text{maximum} - \text{minimum}$
Pie-chart angle
 $\text{frequency/total} \times 360^\circ$
Pie-chart frequency
 $\text{angle}/360^\circ \times \text{total}$
Percentage change
 $\text{change/original} \times 100\%$
Best-fit gradient
 $\text{vertical change} \div \text{horizontal change}$

CHAPTER 01 • S1

S1

Populations, samples and reliable data collection

A useful conclusion begins with a well-defined question and representative evidence.

SPECIFICATION FOCUS

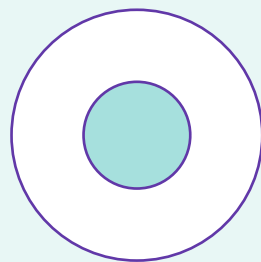
Pearson Edexcel content references S1. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A population is the entire group of interest; a sample is the part actually observed. A census studies every member. Sampling saves time and cost, but a biased method systematically over-represents some responses. Random selection gives each population member a known fair chance, while stratified sampling preserves important subgroup proportions.

KEY VOCABULARY

population • census • sample • sampling frame • random • systematic • stratified • bias • representative



population

sample

representative selection matters

Why the method works

- A large biased sample can be less useful than a smaller representative sample.
- Random sampling reduces selection bias when the sampling frame is complete.
- Stratified allocation = $\text{subgroup size} / \text{total population} \times \text{sample size}$.
- Question wording, non-response and collection time can bias results after selection.

CHECK BEFORE MOVING ON

Answer mentally: 1) State population for survey of Year 11 travel. 2) Name study of every population member. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 01 • S1 • METHODS

S1

Populations, samples and reliable data collection — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Define the target population and the variable to measure.
- Choose a sampling frame covering that population.
- Select a random, systematic or stratified method and justify it.
- Identify practical limitations and avoid leading questions.

WORKED EXAMPLE 1

A school has 480 pupils: 300 lower school and 180 upper school. Stratified sample size 80. Find upper-school allocation.

1. Allocation = $180/480 \times 80$.

ANSWER: 30 pupils

WORKED EXAMPLE 2

Critique asking gym members whether the town exercises enough.

1. Gym members are more likely to exercise than the town population.

ANSWER: Biased sampling frame

SELF-CHECK QUESTION

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

GUIDED TRY

Find 20th item after random start 7, step 13. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 01 • S1 • APPLICATION

S1

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Retailers sample customers to estimate satisfaction. Surveying only customers who made a complaint exaggerates dissatisfaction; surveying only loyalty-card users may omit occasional shoppers.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why sample size alone cannot remove bias. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 01 • S1 • PRACTICE

S1

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. State population for survey of Year 11 travel.

2. Name study of every population member.

3. Find 20th item after random start 7, step 13.

4. Stratify 120 of 600 from subgroup 150.

5. Give one benefit of random sampling.

6. Identify bias in online voluntary poll.

7. Rewrite “Don’t you agree lessons are too long?” neutrally.

8. Explain why sample size alone cannot remove bias.

REFLECTION

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

CHAPTER 02 • S2, S4

S2, S4

Frequency tables, tally charts and two-way tables

Organise raw observations so totals and comparisons become visible.

SPECIFICATION FOCUS

Pearson Edexcel content references S2, S4. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A tally records each observation once; the frequency is the completed count. A frequency table groups identical values or categories. Two-way tables classify the same individuals by two variables and include row, column and grand totals. Missing cells are found by subtraction, but every marginal total must remain consistent.

KEY VOCABULARY

tally • frequency • category • discrete • two-way table • row total • column total • grand total

value	frequency	product	running total

Why the method works

- Tally groups of five support accurate counting and checking.
- The sum of frequencies equals the number of observations.
- Rows and columns in a two-way table describe the same grand total.
- A modal category is the category with greatest frequency.

CHECK BEFORE MOVING ON

Answer mentally: 1) Sum frequencies 6,11,8,5. 2) Mode category frequencies A4,B9,C7. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 02 • S2, S4 • METHODS

S2, S4

Frequency tables, tally charts and two-way tables — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Choose non-overlapping categories covering every possible response.
- Tally each raw value once.
- Add frequencies and verify against the data count.
- For a two-way table, complete inner cells before marginal totals.

WORKED EXAMPLE 1

Frequencies 4,7,9,5. Find total and modal position.

- Total= $4+7+9+5=25$.
- Greatest frequency is 9, the third category.

ANSWER: 25; third category

WORKED EXAMPLE 2

60 pupils: 28 boys, 35 bus users, 16 boys use bus. Find girls not using bus.

- Girls= 32 ; girls using bus= $35-16=19$.
- Girls not bus= $32-19$.

ANSWER: 13

SELF-CHECK QUESTION

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

GUIDED TRY

Total 50, male 23: female. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 02 • S2, S4 • APPLICATION

S2, S4

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Transport planners cross-classify travel mode by age group. A complete two-way table distinguishes a large category because the population is large from a high proportion within that category.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

State one check on two-way table. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 02 • S2, S4 • PRACTICE

S2, S4

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Sum frequencies 6,11,8,5.

2. Mode category frequencies A4,B9,C7.

3. Total 50,male 23: female.

4. Total 80,yes 46,male yes 21: female yes.

5. Female total 44,female yes 25: female no.

6. Row entries 12,x,total 31: x.

7. Why must categories not overlap?

8. State one check on two-way table.

REFLECTION

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

CHAPTER 03 • S2

S2

Pictograms, bar charts and comparative charts

Match the display to the data and read the scale before the bar.

SPECIFICATION FOCUS

Pearson Edexcel content references S2. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Pictograms use repeated symbols with a stated key; partial symbols represent corresponding fractions of the key. Bar charts display discrete or categorical data with separated equal-width bars. Comparative bar charts place corresponding groups together using a common scale. Bar height represents frequency, not visual area created by decorative width.

KEY VOCABULARY

pictogram • key • bar chart • discrete • category • comparative • axis • scale



equal scale, equal widths, separated categories

Why the method works

- A pictogram symbol has no numerical meaning without its key.
- Separated bars signal distinct categories rather than continuous intervals.
- Equal vertical scales are essential for honest visual comparison.
- The vertical axis should normally begin at zero for bar-length comparison.

CHECK BEFORE MOVING ON

Answer mentally: 1) Key icon=6; 4 icons. 2) Key icon=10; 2.5 icons. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 03 • S2 • METHODS

S2

Pictograms, bar charts and comparative charts — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Read the title, axes, units and pictogram key.
- Determine the value of one small grid interval.
- Read bar height from the numbered scale, not by appearance.
- Calculate differences or totals only after extracting exact values.

WORKED EXAMPLE 1

A pictogram key says one icon=8 pupils. A row has 3.5 icons. Find frequency.

$$1. 3.5 \times 8 = 28.$$

ANSWER: 28 pupils

WORKED EXAMPLE 2

Bar heights for A and B are 42 and 57. Find percentage increase A to B.

$$1. \text{Increase} = 15.$$

$$2. 15/42 \times 100 = 35.714\ldots\%$$

ANSWER: 35.7%

SELF-CHECK QUESTION

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

GUIDED TRY

Bars 18,25,21: total. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 03 • S2 • APPLICATION

S2

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A company comparing monthly complaints should keep a common scale across branches. A truncated axis may be suitable for locating precise values in a line graph, but can exaggerate bar-length differences.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain danger of vertical axis starting 95 for values 98 and 100. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 03 • S2 • PRACTICE

S2

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Key icon=6; 4 icons.

2. Key icon=10; 2.5 icons.

3. Bars 18,25,21: total.

4. Difference between 46 and 29.

5. Increase 30 to 39: percentage.

6. Why gaps between categorical bars?

7. Name chart for two groups across same categories.

8. Explain danger of vertical axis starting 95 for values 98 and 100.

REFLECTION

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

CHAPTER 04 • S2

S2

Pie charts and proportional representation

Translate between frequency, fraction, percentage and central angle.

SPECIFICATION FOCUS

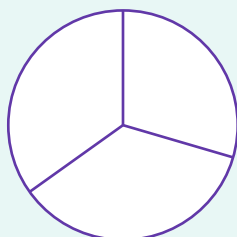
Pearson Edexcel content references S2. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A pie chart represents a whole data set by 360 degrees. Each sector angle is proportional to category frequency. $\text{Sector angle} = \text{frequency} / \text{total} \times 360$; reversing gives $\text{frequency} = \text{angle} / 360 \times \text{total}$. Pie charts compare proportions effectively, but sector sizes alone do not reveal the sample total.

KEY VOCABULARY

sector • angle • proportion • frequency • total • percentage • radius



$\text{sector angle} = \text{frequency} / \text{total} \times 360 \text{ degrees}$

Why the method works

- The complete circle is one whole: 360° and 100%.
- Equal frequencies create equal sector angles.
- A sector fraction $\text{angle} / 360$ equals its data fraction $\text{frequency} / \text{total}$.
- Two equally shaped pie charts may represent very different sample sizes.

CHECK BEFORE MOVING ON

Answer mentally: 1) Frequency 25 of 100: angle. 2) Frequency 14 of 60: angle. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 04 • S2 • METHODS

S2

Pie charts and proportional representation — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Find the total frequency.
- Calculate angle per item as $360 \div \text{total}$ when convenient.
- Multiply by category frequency and check sector angles total 360° .
- Use a protractor from a common centre and label sectors clearly.

WORKED EXAMPLE 1

In 120 responses, 35 choose A. Find sector angle.

- Angle = $35/120 \times 360$.

ANSWER: 105°

WORKED EXAMPLE 2

A 72° sector represents 18 people. Find total.

- $72/360 = 1/5$ of total.
- Total = 18×5 .

ANSWER: 90

SELF-CHECK QUESTION

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

GUIDED TRY

90° sector: percentage. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 04 • S2 • APPLICATION

S2

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Election reports use pie charts to show vote share. Comparing the number of voters requires both sector proportion and total turnout; a larger angle in a smaller sample can still represent fewer people.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why sector angles total 360° . Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 04 • S2 • PRACTICE

S2

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Frequency 25 of 100: angle.

2. Frequency 14 of 60: angle.

3. 90° sector: percentage.

4. 144° sector of total 250: frequency.

5. Angles $80^\circ, 120^\circ, x$: find x .

6. Total 72: angle per person.

7. Can two equal pie sectors prove equal frequencies across different charts?

8. Explain why sector angles total 360° .

REFLECTION

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

CHAPTER 05 • S4

S4

Mean, median, mode and range

Choose an average for the question, then pair it with a measure of spread.

SPECIFICATION FOCUS

Pearson Edexcel content references S4. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

The mean shares the total equally across all values. The median is the central value after ordering, the mode is the most frequent value, and the range measures total spread from minimum to maximum. Each summary loses detail. Extreme values strongly affect mean and range but may leave median and mode unchanged.

KEY VOCABULARY

mean • median • mode • range • outlier • average • spread

3

5

5

7

20

median 5 | mode 5 | mean 8 | range 17

Why the method works

- Mean = $\text{sum of values} \div \text{number of values}$.
- Median requires ordered data and uses the mean of two middle values when the count is even.
- Mode may be absent or have more than one value.
- Range = $\text{maximum} - \text{minimum}$ and describes spread, not typical value.

CHECK BEFORE MOVING ON

Answer mentally: 1) Mean of 4, 7, 9, 10. 2) Median of 2, 5, 8, 11, 14. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 05 • S4 • METHODS

S4

Mean, median, mode and range — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Order the data before finding median, mode or range.
- Count observations carefully.
- For mean, calculate the total then divide by count.
- Interpret average and spread together in the original units.

WORKED EXAMPLE 1

Find summaries for 3,5,5,7,20.

1. Sum=40, count=5, mean=8.
2. Median=5, mode=5, range=17.

ANSWER: mean 8; median 5; mode 5; range 17

WORKED EXAMPLE 2

Five values have mean 12. Four total 43. Find fifth.

1. Required total= $5 \times 12 = 60$.
2. Missing= $60 - 43$.

ANSWER: 17

SELF-CHECK QUESTION

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

GUIDED TRY

Median of 3,6,9,12. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 05 • S4 • APPLICATION

S4

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

For salaries with one extremely high value, median may better describe a typical worker. Mean remains valuable when every value should contribute, such as total resource use per person.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain outlier effect on mean. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 05 • S4 • PRACTICE

S4

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Mean of 4,7,9,10.

2. Median of 2,5,8,11,14.

3. Median of 3,6,9,12.

4. Mode of 1,2,2,3,3.

5. Range of -4,3,11.

6. Six values mean 8: total.

7. Mean 10 for 5 values; four sum 37: missing.

8. Explain outlier effect on mean.

REFLECTION

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

CHAPTER 06 • S4-S5

S4, S5

Frequency distributions and weighted means

Multiply each value by its frequency before sharing the complete total.

SPECIFICATION FOCUS

Pearson Edexcel content references S4, S5. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

In a frequency table, each value occurs several times. The data total is Σfx and the number of observations is Σf , so $\text{mean} = \Sigma fx / \Sigma f$. This is a weighted mean: values with larger frequencies contribute more. Median position is located using cumulative frequency through the table, while mode is the value with greatest frequency.

KEY VOCABULARY

frequency distribution • weighted mean • Σfx • cumulative frequency • median position

value	frequency	product	running total

Why the method works

- Multiplying x by f reconstructs the contribution of repeated values.
- Σf counts observations, not distinct table rows.
- Median positions refer to ordered observations and are located by running totals.
- The modal value corresponds to maximum frequency.

CHECK BEFORE MOVING ON

Answer mentally: 1) x 1,2,3; f 4,3,3: mean. 2) x 2,4,6; f 1,5,4: Σfx . 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 06 • S4-S5 • METHODS

S4, S5

Frequency distributions and weighted means — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Create columns for x , f and fx .
- Add Σf and Σfx independently.
- Divide Σfx by Σf for the mean.
- Use cumulative frequency to locate middle observation(s).

WORKED EXAMPLE 1

Values 1,2,3 with frequencies 2,5,3. Find mean.

1. $\Sigma f = 10$.
2. $\Sigma fx = 2 + 10 + 9 = 21$.
3. Mean = $21/10$.

ANSWER: 2.1

WORKED EXAMPLE 2

Scores 0,1,2,3 have frequencies 1,4,6,3. Find mode and median.

1. Mode = 2.
2. There are 14 values; 7th and 8th both lie in score 2.

ANSWER: mode 2; median 2

SELF-CHECK QUESTION

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

GUIDED TRY

Previous table: mean. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 06 • S4-S5 • APPLICATION

S4, S5

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A star-rating average is weighted: one-star and five-star ratings contribute according to their frequencies. Averaging the category labels without frequencies would answer a different question.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

State check for calculated mean. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 06 • S4-S5 • PRACTICE

S4, S5

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. x 1,2,3; f 4,3,3: mean.

2. x 2,4,6; f 1,5,4: Σfx .

3. Previous table: mean.

4. Frequencies 2,7,5: modal position.

5. Total frequency 25: median observation position.

6. Eight values mean 6.5: Σfx .

7. Why not divide Σfx by number of rows?

8. State check for calculated mean.

REFLECTION

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

CHAPTER 07 • S4-S5

S4, S5

Grouped data and estimated averages

A class interval hides individual values, so use midpoints and label the result an estimate.

SPECIFICATION FOCUS

Pearson Edexcel content references S4, S5. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Grouped data record how many observations lie inside intervals. The exact values are unavailable. The modal class has greatest frequency. An estimated mean replaces every observation in a class by its midpoint, then calculates $\Sigma(f \times \text{midpoint}) / \Sigma f$. The estimate may differ from the true mean because values need not cluster at midpoints.

KEY VOCABULARY

class interval • boundary • midpoint • grouped frequency • modal class • estimated mean

value	frequency	product	running total

Why the method works

- Class midpoint = $(\text{lower boundary} + \text{upper boundary}) / 2$.
- Midpoint multiplication estimates a class total.
- The modal class is an interval, not necessarily a single mode.
- Non-overlapping intervals must assign boundary values unambiguously.

CHECK BEFORE MOVING ON

Answer mentally: 1) Midpoint of $20 < x \leq 30$. 2) Midpoint of $1.5 \leq x < 2.5$. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 07 • S4-S5 • METHODS

S4, S5

Grouped data and estimated averages — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- List each class midpoint.
- Multiply midpoint by class frequency.
- Add estimated totals and divide by total frequency.
- Write “estimated mean” and appropriate units.

WORKED EXAMPLE 1

Classes 0-10,10-20,20-30 have frequencies 3,5,2. Estimate mean using midpoints 5,15,25.

1. $\Sigma fm = 15 + 75 + 50 = 140$; $\Sigma f = 10$.
2. Estimate = $140/10$.

ANSWER: 14

WORKED EXAMPLE 2

Frequencies 4,9,7 across increasing classes. State modal class position.

1. Greatest frequency is 9.

ANSWER: second class

SELF-CHECK QUESTION

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

GUIDED TRY

Class frequencies 3,8,6: modal position. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 07 • S4-S5 • APPLICATION

S4, S5

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Travel times grouped into 10-minute intervals support quick summaries, but midpoint estimates can hide clustering near one boundary. Retaining raw data gives more precise statistics.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Give one requirement for class intervals. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 07 • S4-S5 • PRACTICE

S4, S5

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Midpoint of $20 < x \leq 30$.

2. Midpoint of $1.5 \leq x < 2.5$.

3. Class frequencies 3,8,6: modal position.

4. Midpoints 5,15; frequencies 4,6: estimated mean.

5. Midpoints 10,30,50; f 2,5,3: Σfm .

6. Previous: estimated mean.

7. Why is grouped mean estimated?

8. Give one requirement for class intervals.

REFLECTION

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

CHAPTER 08 • S2, S4-S5

S2, S4, S5

Stem-and-leaf diagrams and comparing distributions

Preserve individual values while displaying shape, centre and spread.

SPECIFICATION FOCUS

Pearson Edexcel content references S2, S4, S5. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A stem-and-leaf diagram splits each ordered value into a stem and leaf while retaining the original data. A key defines place value. Back-to-back diagrams compare two groups using a shared stem. Meaningful comparison needs both location, such as median, and spread, such as range, stated in context.

KEY VOCABULARY

stem • leaf • key • ordered • back-to-back • distribution • consistency



key: 1 | 2 means 12

Why the method works

- Every leaf represents one observation, including repeated values.
- A key such as 2|7=27 defines the scale.
- Leaves are ordered away from the stem as specified.
- Comparing only medians ignores consistency; comparing only ranges ignores typical size.

CHECK BEFORE MOVING ON

Answer mentally: 1) Read 3|7 if key 3|7=37. 2) Leaves 1,4,4,9: frequency. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 08 • S2, S4-S5 • METHODS

S2, S4, S5

Stem-and-leaf diagrams and comparing distributions — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Write a key before entering data.
- Place each value on its correct stem.
- Order leaves and count against the original data.
- Calculate and compare a typical value and spread.

WORKED EXAMPLE 1

Data 12,15,15,21,24. Write stems.

1. Stem 1 leaves 2,5,5; stem 2 leaves 1,4.

ANSWER: 1|255 and 2|14

WORKED EXAMPLE 2

Group A median 18 range 7; B median 21 range 14. Compare.

1. B has higher typical value; A has smaller spread.

ANSWER: B higher; A more consistent

SELF-CHECK QUESTION

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

GUIDED TRY

Data 8,11,13: range. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 08 • S2, S4-S5 • APPLICATION

S2, S4, S5

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Sports performance is compared using centre and spread. A player with higher median but much larger range may perform better typically yet less consistently.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Write a complete comparison sentence using median and range. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 08 • S2, S4-S5 • PRACTICE

S2, S4, S5

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Read 3|7 if key 3|7=37.

2. Leaves 1,4,4,9: frequency.

3. Data 8,11,13: range.

4. Ordered 12,15,17,20,22: median.

5. A median 50,B 46: typical comparison.

6. A range 9,B 15: consistency.

7. Why include a key?

8. Write a complete comparison sentence using median and range.

REFLECTION

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

CHAPTER 09 • S2, S6

S2, S6

Scatter graphs, correlation and lines of best fit

Describe association without claiming that one variable causes the other.

SPECIFICATION FOCUS

Pearson Edexcel content references S2, S6. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A scatter graph plots paired values for two variables. Positive correlation trends upward, negative correlation downward, and no correlation shows no clear direction. A line of best fit passes through the centre of the pattern with roughly balanced points and supports approximate predictions. Interpolation is within the observed range; extrapolation is less reliable.

KEY VOCABULARY

bivariate • scatter graph • positive • negative • correlation • outlier • line of best fit • interpolation



Why the method works

- Each point represents one paired observation.
- Correlation describes direction and strength of association.
- A line of best fit models the overall pattern rather than joining points.
- Correlation does not prove causation because other variables or coincidence may explain it.

CHECK BEFORE MOVING ON

Answer mentally: 1) Name correlation for points rising left to right. 2) Name correlation falling left to right. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because ...” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 09 • S2, S6 • METHODS

S2, S6

Scatter graphs, correlation and lines of best fit — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Label both axes with variable and units.
- Plot every coordinate accurately.
- Describe direction and strength and mention outliers.
- Use the best-fit line only across a sensible data range.

WORKED EXAMPLE 1

A best-fit line passes through (2,15) and (8,39). Find gradient.

1. $\text{Gradient} = (39 - 15) / (8 - 2) = 24/6$.

ANSWER: 4

WORKED EXAMPLE 2

Ice-cream sales and temperature show positive correlation. Does heat cause every sale?

1. Association alone cannot prove causation.

ANSWER: No

SELF-CHECK QUESTION

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

GUIDED TRY

What is an outlier? First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 09 • S2, S6 • APPLICATION

S2, S6

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Health studies often report correlations. Age, income or behaviour may be confounding variables, so evidence beyond a scatter plot is needed to support a causal claim.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Explain why correlation does not prove causation. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 09 • S2, S6 • PRACTICE

S2, S6

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Name correlation for points rising left to right.

2. Name correlation falling left to right.

3. What is an outlier?

4. Prediction inside data range is called?

5. Prediction outside range is called?

6. Why not join every scatter point?

7. Gradient from (1,6),(5,18).

8. Explain why correlation does not prove causation.

REFLECTION

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

CHAPTER 10 • S2, S5-S6

S2, S5, S6

Time series, misleading graphs and statistical conclusions

Read trends critically and connect every conclusion to the evidence.

SPECIFICATION FOCUS

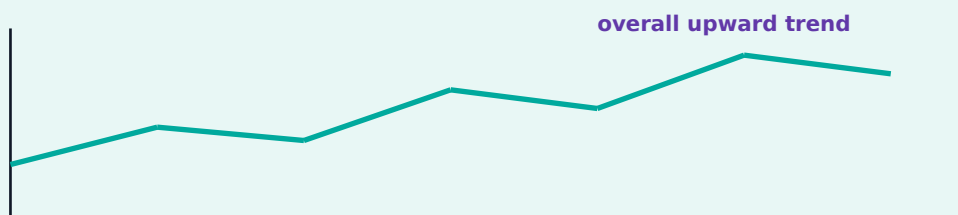
Pearson Edexcel content references S2, S5, S6. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

A time series plots a variable in chronological order. A trend is the overall direction; seasonal or cyclic effects repeat; random fluctuations are shorter irregular changes. Graph design affects perception: truncated axes, unequal intervals, pictorial area and selective time windows can distort comparisons. A responsible conclusion considers source, sample, scale and uncertainty.

KEY VOCABULARY

time series • trend • seasonal • fluctuation • axis break • misleading • inference • reliability



Why the method works

- Joining time-series points shows chronological change, unlike a scatter graph.
- Trend concerns overall movement, not every local rise or fall.
- Equal horizontal distances must represent equal time intervals.
- Statistical evidence supports qualified conclusions rather than certainty about individuals.

CHECK BEFORE MOVING ON

Answer mentally: 1) Values 80 to 92: absolute increase. 2) Same values: percentage increase. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: “The method works because ...” Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 10 • S2, S5-S6 • METHODS

S2, S5, S6

Time series, misleading graphs and statistical conclusions — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Read title, source, axes, units and interval.
- Describe overall trend, repeated pattern and unusual points separately.
- Calculate absolute or percentage change when comparison is required.
- Evaluate sampling, display choices and whether the conclusion overreaches.

WORKED EXAMPLE 1

Sales rise from 240 to 300. Find percentage increase.

1. Increase=60.
2. $60/240 \times 100$.

ANSWER: 25%

WORKED EXAMPLE 2

A bar axis begins at 980 and compares 990 with 1000. Explain risk.

1. The 10-unit difference occupies a large visual fraction.

ANSWER: Difference is exaggerated

SELF-CHECK QUESTION

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

GUIDED TRY

Name overall long-term direction. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 10 • S2, S5-S6 • APPLICATION

S2, S5, S6

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

Energy demand data show seasonal peaks in winter. Planning should use several years because one unusual winter may not represent the repeating pattern.

Common mistakes and how to repair them

MISTAKE 1

Reading a graph before checking its scale and units. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Giving a calculation without interpreting it in context. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Treating a sample result as certain for the whole population. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

Write cautious conclusion for sample mean higher than another. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 10 • S2, S5-S6 • PRACTICE

S2, S5, S6

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Values 80 to 92: absolute increase.

2. Same values: percentage increase.

3. Name overall long-term direction.

4. Name repeating annual pattern.

5. Why equal time spacing?

6. State issue with 3D pictogram doubled in height and width.

7. Give one question about data source.

8. Write cautious conclusion for sample mean higher than another.

REFLECTION

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

CHAPTER 11 • S2, S4

S2, S4

Data types, chart choice and vertical line charts

The variable type determines which display communicates it honestly.

SPECIFICATION FOCUS

Pearson Edexcel content references S2, S4. This lesson develops representation, accurate calculation and interpretation within Foundation Tier problem solving.

Understand the idea

Categorical data use labels; numerical data use numbers. Discrete numerical data take separate countable values, while continuous data can take any value within a measurement interval. A vertical line chart represents ungrouped discrete data with a thin line above each value. Continuous or grouped data require intervals and should not be shown as isolated categories.

KEY VOCABULARY

categorical • numerical • discrete • continuous • grouped • vertical line chart • frequency



Why the method works

- A count such as number of siblings is discrete.
- A measurement such as height is continuous even if recorded to the nearest unit.
- Vertical line charts preserve the numerical spacing between discrete values.
- A chart is appropriate only when its axis structure matches the data type.

CHECK BEFORE MOVING ON

Answer mentally: 1) Classify eye colour. 2) Classify number of pets. 3) State one definition or rule from this page in your own words.

EXPLAIN IT

Complete this sentence: "The method works because ..." Use the key vocabulary above and refer to the representation in the diagram.

CHAPTER 11 • S2, S4 • METHODS

S2, S4

Data types, chart choice and vertical line charts — method and examples

Follow the reasoning; do not copy steps mechanically.

Reliable method

- Identify the variable and its data type.
- Choose categories, separate numerical values or intervals.
- Label axes with variable, frequency and units.
- Check that spacing and total frequency are accurate.

WORKED EXAMPLE 1

Classify number of goals in a match.

1. Only whole-number counts are possible.

ANSWER: discrete numerical

WORKED EXAMPLE 2

Values 0,1,2,3 have frequencies 2,5,7,4. What is plotted above $x=2$?

1. The vertical line height equals its frequency.

ANSWER: 7

SELF-CHECK QUESTION

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

GUIDED TRY

Classify exact mass. First predict the form or approximate size of the answer; then show a complete method.

CHAPTER 11 • S2, S4 • APPLICATION

S2, S4

Apply and reason

Connect the method to a context and communicate the conclusion.

Real-world model

CONTEXT

A transport survey may record categorical travel mode, discrete number of journeys and continuous journey time. Each requires a different display.

Common mistakes and how to repair them

MISTAKE 1

Using joined line segments for unrelated categories. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 2

Calling rounded height discrete because the record is a whole number. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

MISTAKE 3

Spacing numerical values equally when their actual gaps differ. Repair: return to the definition, write one complete mathematical line, then check the size or sign of the result.

Exam communication

- Write the operation or equation before the answer.
- Preserve exact values unless the question asks for rounding.
- Attach units and interpret the final value in the context.

REASONING PROMPT

State one essential axis label. Write one sentence explaining why your calculation or conclusion is valid.

CHAPTER 11 • S2, S4 • PRACTICE

S2, S4

Independent practice

Complete without notes, then use the answer section to diagnose errors.

1. Classify eye colour.

2. Classify number of pets.

3. Classify exact mass.

4. Best display for ungrouped discrete frequencies.

5. At $x=4$ frequency 9: line height.

6. Should bars touch for categorical data?

7. Why is measured time continuous?

8. State one essential axis label.

REFLECTION

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

PRACTICE ANSWERS

CHAPTER 01

Practice answers and repair notes

Populations, samples and reliable data collection

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. State population for survey of Year 11 travel.

ANSWER: all Year 11 pupils

Method cue: Define the target population and the variable to measure. Then check the sign, size, accuracy and units of the result.

2. Name study of every population member.

ANSWER: census

Method cue: Choose a sampling frame covering that population. Then check the sign, size, accuracy and units of the result.

3. Find 20th item after random start 7, step 13.

ANSWER: 254

Method cue: Select a random, systematic or stratified method and justify it. Then check the sign, size, accuracy and units of the result.

4. Stratify 120 of 600 from subgroup 150.

ANSWER: 30

Method cue: Identify practical limitations and avoid leading questions. Then check the sign, size, accuracy and units of the result.

5. Give one benefit of random sampling.

ANSWER: reduces selection bias

Method cue: Define the target population and the variable to measure. Then check the sign, size, accuracy and units of the result.

6. Identify bias in online voluntary poll.

ANSWER: self-selection bias

Method cue: Choose a sampling frame covering that population. Then check the sign, size, accuracy and units of the result.

7. Rewrite “Don’t you agree lessons are too long?” neutrally.

ANSWER: What do you think of lesson length?

Method cue: Select a random, systematic or stratified method and justify it. Then check the sign, size, accuracy and units of the result.

8. Explain why sample size alone cannot remove bias.

ANSWER: method may systematically exclude groups

Method cue: Identify practical limitations and avoid leading questions. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 02

Practice answers and repair notes

Frequency tables, tally charts and two-way tables

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Sum frequencies 6,11,8,5.

ANSWER: 30

Method cue: Choose non-overlapping categories covering every possible response. Then check the sign, size, accuracy and units of the result.

2. Mode category frequencies A4,B9,C7.

ANSWER: B

Method cue: Tally each raw value once. Then check the sign, size, accuracy and units of the result.

3. Total 50,male 23: female.

ANSWER: 27

Method cue: Add frequencies and verify against the data count. Then check the sign, size, accuracy and units of the result.

4. Total 80,yes 46,male yes 21: female yes.

ANSWER: 25

Method cue: For a two-way table, complete inner cells before marginal totals. Then check the sign, size, accuracy and units of the result.

5. Female total 44,female yes 25: female no.

ANSWER: 19

Method cue: Choose non-overlapping categories covering every possible response. Then check the sign, size, accuracy and units of the result.

6. Row entries 12,x,total 31: x.

ANSWER: 19

Method cue: Tally each raw value once. Then check the sign, size, accuracy and units of the result.

7. Why must categories not overlap?

ANSWER: each observation counted once

Method cue: Add frequencies and verify against the data count. Then check the sign, size, accuracy and units of the result.

8. State one check on two-way table.

ANSWER: row and column totals give same grand total

Method cue: For a two-way table, complete inner cells before marginal totals. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 03

Practice answers and repair notes

Pictograms, bar charts and comparative charts

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Key icon=6; 4 icons.

ANSWER: 24

Method cue: Read the title, axes, units and pictogram key. Then check the sign, size, accuracy and units of the result.

2. Key icon=10; 2.5 icons.

ANSWER: 25

Method cue: Determine the value of one small grid interval. Then check the sign, size, accuracy and units of the result.

3. Bars 18,25,21: total.

ANSWER: 64

Method cue: Read bar height from the numbered scale, not by appearance. Then check the sign, size, accuracy and units of the result.

4. Difference between 46 and 29.

ANSWER: 17

Method cue: Calculate differences or totals only after extracting exact values. Then check the sign, size, accuracy and units of the result.

5. Increase 30 to 39: percentage.

ANSWER: 30%

Method cue: Read the title, axes, units and pictogram key. Then check the sign, size, accuracy and units of the result.

6. Why gaps between categorical bars?

ANSWER: categories are separate

Method cue: Determine the value of one small grid interval. Then check the sign, size, accuracy and units of the result.

7. Name chart for two groups across same categories.

ANSWER: comparative bar chart

Method cue: Read bar height from the numbered scale, not by appearance. Then check the sign, size, accuracy and units of the result.

8. Explain danger of vertical axis starting 95 for values 98 and 100.

ANSWER: exaggerates small difference

Method cue: Calculate differences or totals only after extracting exact values. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 04

Practice answers and repair notes

Pie charts and proportional representation

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Frequency 25 of 100: angle.

ANSWER: 90°

Method cue: Find the total frequency. Then check the sign, size, accuracy and units of the result.

2. Frequency 14 of 60: angle.

ANSWER: 84°

Method cue: Calculate angle per item as $360 \div \text{total}$ when convenient. Then check the sign, size, accuracy and units of the result.

3. 90° sector: percentage.

ANSWER: 25%

Method cue: Multiply by category frequency and check sector angles total 360°. Then check the sign, size, accuracy and units of the result.

4. 144° sector of total 250: frequency.

ANSWER: 100

Method cue: Use a protractor from a common centre and label sectors clearly. Then check the sign, size, accuracy and units of the result.

5. Angles 80°, 120°, x: find x.

ANSWER: 160°

Method cue: Find the total frequency. Then check the sign, size, accuracy and units of the result.

6. Total 72: angle per person.

ANSWER: 5°

Method cue: Calculate angle per item as $360 \div \text{total}$ when convenient. Then check the sign, size, accuracy and units of the result.

7. Can two equal pie sectors prove equal frequencies across different charts?

ANSWER: no, totals may differ

Method cue: Multiply by category frequency and check sector angles total 360°. Then check the sign, size, accuracy and units of the result.

8. Explain why sector angles total 360°.

ANSWER: complete circle

Method cue: Use a protractor from a common centre and label sectors clearly. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 05

Practice answers and repair notes

Mean, median, mode and range

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Mean of 4,7,9,10.

ANSWER: 7.5

Method cue: Order the data before finding median, mode or range. Then check the sign, size, accuracy and units of the result.

2. Median of 2,5,8,11,14.

ANSWER: 8

Method cue: Count observations carefully. Then check the sign, size, accuracy and units of the result.

3. Median of 3,6,9,12.

ANSWER: 7.5

Method cue: For mean, calculate the total then divide by count. Then check the sign, size, accuracy and units of the result.

4. Mode of 1,2,2,3,3.

ANSWER: 2 and 3

Method cue: Interpret average and spread together in the original units. Then check the sign, size, accuracy and units of the result.

5. Range of -4,3,11.

ANSWER: 15

Method cue: Order the data before finding median, mode or range. Then check the sign, size, accuracy and units of the result.

6. Six values mean 8: total.

ANSWER: 48

Method cue: Count observations carefully. Then check the sign, size, accuracy and units of the result.

7. Mean 10 for 5 values; four sum 37: missing.

ANSWER: 13

Method cue: For mean, calculate the total then divide by count. Then check the sign, size, accuracy and units of the result.

8. Explain outlier effect on mean.

ANSWER: pulls mean toward extreme

Method cue: Interpret average and spread together in the original units. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 06

Practice answers and repair notes

Frequency distributions and weighted means

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. x 1,2,3; f 4,3,3: mean.

ANSWER: 1.9

Method cue: Create columns for x , f and fx . Then check the sign, size, accuracy and units of the result.

2. x 2,4,6; f 1,5,4: Σfx .

ANSWER: 46

Method cue: Add Σf and Σfx independently. Then check the sign, size, accuracy and units of the result.

3. Previous table: mean.

ANSWER: 4.6

Method cue: Divide Σfx by Σf for the mean. Then check the sign, size, accuracy and units of the result.

4. Frequencies 2,7,5: modal position.

ANSWER: second category

Method cue: Use cumulative frequency to locate middle observation(s). Then check the sign, size, accuracy and units of the result.

5. Total frequency 25: median observation position.

ANSWER: 13th

Method cue: Create columns for x , f and fx . Then check the sign, size, accuracy and units of the result.

6. Eight values mean 6.5: Σfx .

ANSWER: 52

Method cue: Add Σf and Σfx independently. Then check the sign, size, accuracy and units of the result.

7. Why not divide Σfx by number of rows?

ANSWER: rows are not observations

Method cue: Divide Σfx by Σf for the mean. Then check the sign, size, accuracy and units of the result.

8. State check for calculated mean.

ANSWER: between minimum and maximum

Method cue: Use cumulative frequency to locate middle observation(s). Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 07

Practice answers and repair notes

Grouped data and estimated averages

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Midpoint of $20 < x \leq 30$.

ANSWER: 25

Method cue: List each class midpoint. Then check the sign, size, accuracy and units of the result.

2. Midpoint of $1.5 \leq x < 2.5$.

ANSWER: 2

Method cue: Multiply midpoint by class frequency. Then check the sign, size, accuracy and units of the result.

3. Class frequencies 3,8,6: modal position.

ANSWER: second class

Method cue: Add estimated totals and divide by total frequency. Then check the sign, size, accuracy and units of the result.

4. Midpoints 5,15; frequencies 4,6: estimated mean.

ANSWER: 11

Method cue: Write "estimated mean" and appropriate units. Then check the sign, size, accuracy and units of the result.

5. Midpoints 10,30,50; f 2,5,3: Σfm .

ANSWER: 320

Method cue: List each class midpoint. Then check the sign, size, accuracy and units of the result.

6. Previous: estimated mean.

ANSWER: 32

Method cue: Multiply midpoint by class frequency. Then check the sign, size, accuracy and units of the result.

7. Why is grouped mean estimated?

ANSWER: exact values unknown

Method cue: Add estimated totals and divide by total frequency. Then check the sign, size, accuracy and units of the result.

8. Give one requirement for class intervals.

ANSWER: no overlap and full coverage

Method cue: Write "estimated mean" and appropriate units. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 08

Practice answers and repair notes

Stem-and-leaf diagrams and comparing distributions

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Read 3|7 if key 3|7=37.

ANSWER: 37

Method cue: Write a key before entering data. Then check the sign, size, accuracy and units of the result.

2. Leaves 1,4,4,9: frequency.

ANSWER: 4

Method cue: Place each value on its correct stem. Then check the sign, size, accuracy and units of the result.

3. Data 8,11,13: range.

ANSWER: 5

Method cue: Order leaves and count against the original data. Then check the sign, size, accuracy and units of the result.

4. Ordered 12,15,17,20,22: median.

ANSWER: 17

Method cue: Calculate and compare a typical value and spread. Then check the sign, size, accuracy and units of the result.

5. A median 50,B 46: typical comparison.

ANSWER: A higher

Method cue: Write a key before entering data. Then check the sign, size, accuracy and units of the result.

6. A range 9,B 15: consistency.

ANSWER: A more consistent

Method cue: Place each value on its correct stem. Then check the sign, size, accuracy and units of the result.

7. Why include a key?

ANSWER: defines place value

Method cue: Order leaves and count against the original data. Then check the sign, size, accuracy and units of the result.

8. Write a complete comparison sentence using median and range. ANSWER: context-dependent: compare centre and spread

Method cue: Calculate and compare a typical value and spread. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 09

Practice answers and repair notes

Scatter graphs, correlation and lines of best fit

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Name correlation for points rising left to right.

ANSWER: positive

Method cue: Label both axes with variable and units. Then check the sign, size, accuracy and units of the result.

2. Name correlation falling left to right.

ANSWER: negative

Method cue: Plot every coordinate accurately. Then check the sign, size, accuracy and units of the result.

3. What is an outlier?

ANSWER: point away from pattern

Method cue: Describe direction and strength and mention outliers. Then check the sign, size, accuracy and units of the result.

4. Prediction inside data range is called?

ANSWER: interpolation

Method cue: Use the best-fit line only across a sensible data range. Then check the sign, size, accuracy and units of the result.

5. Prediction outside range is called?

ANSWER: extrapolation

Method cue: Label both axes with variable and units. Then check the sign, size, accuracy and units of the result.

6. Why not join every scatter point?

ANSWER: points are not a sequence

Method cue: Plot every coordinate accurately. Then check the sign, size, accuracy and units of the result.

7. Gradient from (1,6),(5,18).

ANSWER: 3

Method cue: Describe direction and strength and mention outliers. Then check the sign, size, accuracy and units of the result.

8. Explain why correlation does not prove causation.

ANSWER: third variables/chance possible

Method cue: Use the best-fit line only across a sensible data range. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 10

Practice answers and repair notes

Time series, misleading graphs and statistical conclusions

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Values 80 to 92: absolute increase.

ANSWER: 12

Method cue: Read title, source, axes, units and interval. Then check the sign, size, accuracy and units of the result.

2. Same values: percentage increase.

ANSWER: 15%

Method cue: Describe overall trend, repeated pattern and unusual points separately. Then check the sign, size, accuracy and units of the result.

3. Name overall long-term direction.

ANSWER: trend

Method cue: Calculate absolute or percentage change when comparison is required. Then check the sign, size, accuracy and units of the result.

4. Name repeating annual pattern.

ANSWER: seasonal pattern

Method cue: Evaluate sampling, display choices and whether the conclusion overreaches. Then check the sign, size, accuracy and units of the result.

5. Why equal time spacing?

ANSWER: distance represents equal intervals

Method cue: Read title, source, axes, units and interval. Then check the sign, size, accuracy and units of the result.

6. State issue with 3D pictogram doubled in height and width.

ANSWER: area quadruples, exaggerating

Method cue: Describe overall trend, repeated pattern and unusual points separately. Then check the sign, size, accuracy and units of the result.

7. Give one question about data source.

ANSWER: who collected/how sampled

Method cue: Calculate absolute or percentage change when comparison is required. Then check the sign, size, accuracy and units of the result.

8. Write cautious conclusion for sample mean higher than population mean. **ANSWER: sample suggests, not proves, higher population value**

Method cue: Evaluate sampling, display choices and whether the conclusion overreaches. Then check the sign, size, accuracy and units of the result.

PRACTICE ANSWERS

CHAPTER 11

Practice answers and repair notes

Data types, chart choice and vertical line charts

Use these only after making a genuine attempt. Rework any incorrect question from a blank line rather than copying the final value.

1. Classify eye colour.

ANSWER: categorical

Method cue: Identify the variable and its data type. Then check the sign, size, accuracy and units of the result.

2. Classify number of pets.

ANSWER: discrete numerical

Method cue: Choose categories, separate numerical values or intervals. Then check the sign, size, accuracy and units of the result.

3. Classify exact mass.

ANSWER: continuous numerical

Method cue: Label axes with variable, frequency and units. Then check the sign, size, accuracy and units of the result.

4. Best display for ungrouped discrete frequencies.

ANSWER: vertical line chart

Method cue: Check that spacing and total frequency are accurate. Then check the sign, size, accuracy and units of the result.

5. At $x=4$ frequency 9: line height.

ANSWER: 9

Method cue: Identify the variable and its data type. Then check the sign, size, accuracy and units of the result.

6. Should bars touch for categorical data?

ANSWER: no

Method cue: Choose categories, separate numerical values or intervals. Then check the sign, size, accuracy and units of the result.

7. Why is measured time continuous?

ANSWER: any value in an interval is possible

Method cue: Label axes with variable, frequency and units. Then check the sign, size, accuracy and units of the result.

8. State one essential axis label.

ANSWER: variable/frequency/units

Method cue: Check that spacing and total frequency are accurate. Then check the sign, size, accuracy and units of the result.

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Unit 6: Statistics • Foundation Tier

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