

VCE VM Numeracy Unit 2

Chapter 3 — Data

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Chapter 3 Data — 3A Collecting and organising data

Theory

About the data in this section. The surveys, tally sheets, record sheets, tables and figures here are **made up** (not real): pretend businesses, pretend people and pretend numbers, built for this book so you can practise the maths. Nothing here is real data about a real business, person or place.

The four jobs in this chapter.

Data is information collected to answer a question. Every workplace, news article, club and shop runs on data, and this chapter splits the work into four jobs — one job per section.

Section	The job
3A (this section)	collect data, then collate and organise it
3B	display data — tables, graphs, axes and simple scales
3C	summarise data — the mean and the range
3D	read data — key facts, patterns and trends

This section is where every data job starts. Before anything can be displayed or summarised, someone has to collect the data and get it into order. In the study design (Unit 2, Area of Study 6), the key knowledge for this section is the simple tools and steps people use to collect data. The key skill is using them yourself: collecting simple, familiar sets of data, then collating and organising them.

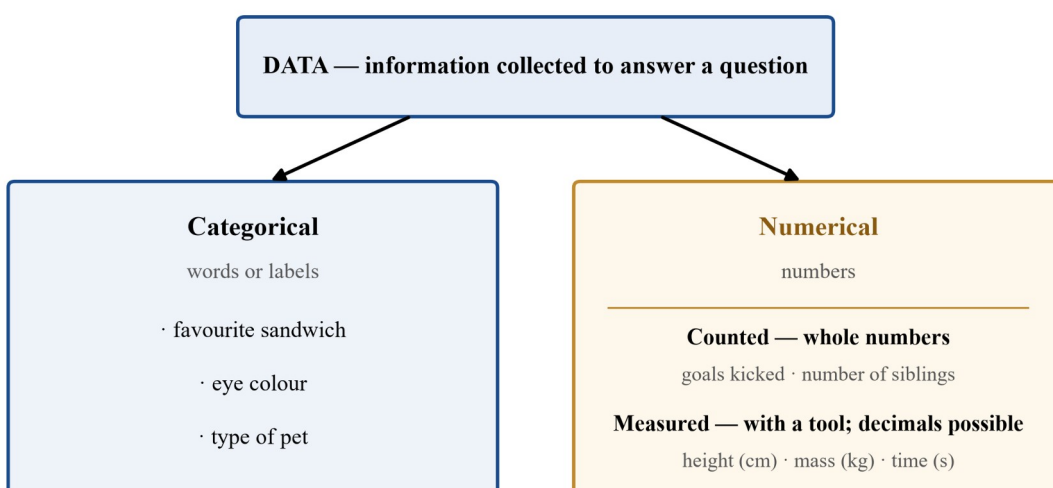
Source: VCAA, VCE Vocational Major Numeracy Study Design, retrieved 2026-10-09.

What is data?

Each single piece of information is one **value**, and the whole collection of values is a **data set**. The question comes first: “Which item sells most at the canteen on Friday?” is a question, and writing down each item sold as it goes over the counter is collecting data to answer it.

Two types of data.

Categorical data is described in words or labels: a favourite sandwich, an eye colour, a type of pet. **Numerical data** is numbers, and numbers arrive in two ways. **Counted** numbers are whole numbers you get by counting — goals kicked, number of siblings, cars past a corner. **Measured** numbers come from a tool — a height off a tape, a mass off scales, a time off a stopwatch — and they can carry decimals.



Type of data	What one value looks like	Examples
Categorical	a word or a label	favourite sandwich, eye colour, type of pet
Numerical — counted	a whole number	goals kicked, number of siblings, cars passing
Numerical — measured	a number from a tool; decimals possible	height in cm, mass in kg, time in s

Why the type matters.

The type of data tells you how to collect it and how to organise it afterwards, so naming the type is the first organising decision you make.

Type of data	How you collect it	How you organise it
Categorical	ask or watch; sort answers into categories	tally each category, then a frequency table
Numerical (counted)	ask or watch; count	tally each value, then a frequency table
Numerical (measured)	measure with a tool	sort smallest to largest, then group if needed

Collecting data yourself — primary data.

Primary data is data you collect yourself, for your own question. There are three ways to collect it: **ask** people (a survey), **watch** and count (observation), or **measure** with a tool.

Surveys. A **survey** is a short set of questions given to a group of people, with everyone asked the same questions in the same order. A good survey question is short and clear, asks **one thing at a time**, and offers **fixed answers to tick** — fixed answers are much faster to collate afterwards than sentences. The form below is a model: two questions, tick-box answers, nothing extra.

Harfield College canteen
student survey

Please tick one box on each question.

1. Which sandwich should the canteen add?

☒ Chicken

☐ Egg

☐ Bean

2. What year level are you in?

☒ Year 11

☐ Year 12

Thank you — one form per person.

Made-up data: the survey form and the questions on it are made up for this section.

Observation. **Observation** means watching and counting events as they happen — cars through an intersection, students through a gate, items over a counter. Nobody is asked anything; you record what you see, usually with tally marks (below), so the running count never gets lost.

Measurement. A measuring tool turns what you measure into a number: scales for mass in kg, a tape measure for length in cm, a stopwatch for time in seconds, a thermometer for temperature in degrees Celsius, a jug for capacity in mL. Always write the **unit** next to the number as you record it — a value with no unit is not data yet.

Refresher — units of measurement.

What you measure	Usual units	Tool
length or height	centimetres (cm) or metres (m)	ruler or tape measure
mass	grams (g) or kilograms (kg)	scales
time	seconds (s) or minutes (min)	stopwatch or clock
temperature	degrees Celsius (°C)	thermometer
capacity	millilitres (mL) or litres (L)	measuring jug

Keep these swaps in your head: 100 cm = 1 m; 1000 g = 1 kg; 1000 mL = 1 L; 60 s = 1 min; 60 min = 1 h. Going from a bigger unit to a smaller one means multiplying (1.2 m = 120 cm); going from a smaller unit to a bigger one means dividing (2500 g = 2.5 kg). Pick the unit that fits the thing: a pencil is measured in cm, not m.

Using data someone else collected — secondary data.

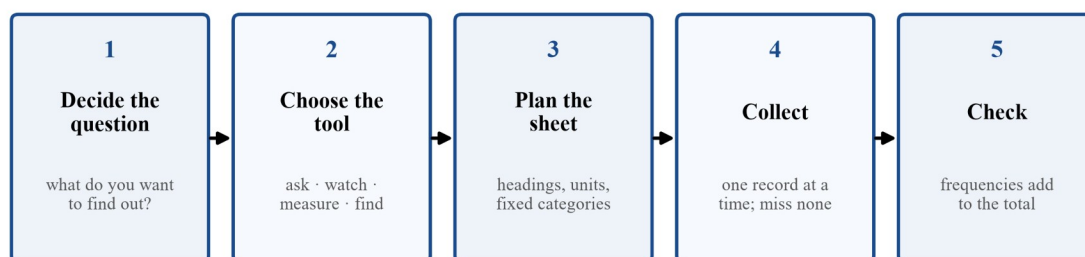
Secondary data is data somebody else already collected: workplace records (a cafe's daily takings sheet), a library's website, a newspaper article, a council report. It is fast and cheap because the collecting is done for you. The habit that keeps it honest is simple: before you use secondary data, note the **source** (who collected it, and where you found it) and the **date**, and check what was actually counted. Example 4 below uses a newspaper article this way.

Technology for collecting.

Data can also be collected on a computer or a phone. A **spreadsheet** keeps values in cells under column headings, with one value per cell, so a whole data set sits in neat columns ready to be counted. An online form can survey a class and tally the tick-box answers by itself, and workplace apps record sales as they happen. These tools are handy but optional: every job in this section can be done with pen, paper and a basic calculator, and the paper methods below are the ones the tools are copying.

The collection process — five steps.

Collecting data is a process, and the same five steps work for a survey, an observation count or a measuring job.



1. **Decide the question.** Write down the question the data must answer. A vague question collects vague data.
2. **Choose the tool.** Ask (survey), watch (observation), measure (a tool), or find (a secondary source).
3. **Plan the recording sheet.** Column headings, units, the fixed categories or groups, and room for tallies — all decided *before* collecting starts.

4. **Collect.** One record at a time, in order, missing none.
5. **Check.** The number of records equals the number of people or things counted, and the frequencies add to that total.

Good recording habits.

- **Label every column.** A heading says what the column holds, including the unit.
- **Fix the categories first.** Categories and groups must not overlap, and together they must cover every possible answer — add an “other” or “none” row if needed.
- **Date the sheet and note the source.** Data with no date or source cannot be checked.
- **Total-check before you finish.** Add the frequency column; the total must match the number of records you collected.

Collating and organising.

To **collate** means gathering all the records into one place. To **organise** means putting them into an order that is easy to read. A page of raw answers in the order they arrived is hard to read; the same data in a frequency table can be read at a glance. Everything from here to the end of the section is about turning raw records into tables.

Tally marks.

A **tally mark** is one short stroke, one per record. Four strokes stand vertical, and the fifth stroke crosses them to close a **gate of five**. Gates exist so that counting up afterwards is counting in fives, not counting in ones.

1 =		7 =		= 5 + 2
2 =		12 =		= 2 × 5 + 2
3 =		17 =		= 3 × 5 + 2
4 =				
5 (a gate) =	/			

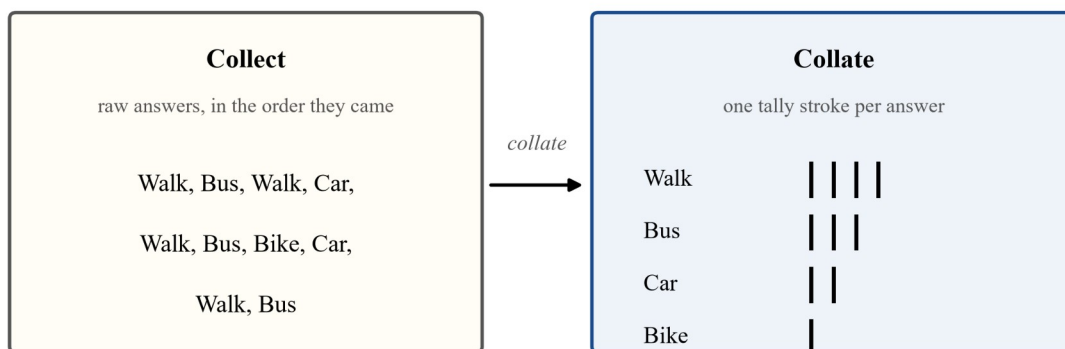
the fifth stroke crosses the gate

Refresher — counting in fives.

Read a tally by counting gates in fives, then adding the loose strokes: three gates and two strokes is $3 \times 5 + 2 = 17$; two gates and four strokes is $2 \times 5 + 4 = 14$. A row with no complete gate is just loose strokes: four strokes is 4.

Frequency tables.

The **frequency** of a category or value is the number of times it appears in the data set. A **frequency table** lists each category in one column and its frequency in the next, with a **total** row at the bottom. The figure below shows the first two moves — collect, then collate — on ten raw answers to the question “How did you get to school today?”.



The frequencies now go into a frequency table (see the table below).

The third move, organise, puts the tallies into a frequency table.

How you get to school	Frequency
Walk	4
Bus	3
Car	2
Bike	1
Total	10

Made-up data: the ten travel answers, the tallies and the table are made up for this section.

Read the check on that table: $4 + 3 + 2 + 1 = 10$, which matches the ten answers collected. A total that does not match means a record was missed or counted twice.

Organising categorical data.

1. **List the categories first**, taken from the fixed answers on the survey or the labels you decided to watch for.
2. **Work through the records one at a time**, adding one tally stroke to that record's category.
3. **Count each row's tally** into the frequency column (count gates in fives).
4. **Add the total row** and check it against the number of records.

Organising numerical data — counted values.

Counted numbers organise exactly like categories: each different value gets its own row. Here are the answers of 15 students to “How many brothers and sisters do you have?”.

Number of siblings	Frequency
0	3
1	5
2	4
3	2
4	1
Total	15

Made-up data: the fifteen students' answers are made up for this section.

If nobody gives some value, its frequency is 0; you may leave that row out or keep it to show you checked.

Organising numerical data — measured values.

Measured values rarely repeat, so one row per value makes a long, useless table. Two moves fix this: **sort** the values, then **group** them.

Refresher — ordering decimals.

Sort decimals by comparing the whole-number parts first: $3.7 < 4.2$ because $3 < 4$. If the whole parts are equal, compare the tenths, then the hundredths. A trailing zero changes nothing, so $8.4 = 8.40$, and $8.40 < 8.45$ — which means 8.4 comes *before* 8.45 when sorting. Sorting 3.7, 3.05 and 4.2 smallest to largest gives 3.05, 3.7, 4.2. To **round to 1 decimal place**, look at the second decimal: if it is 5 or more, the first decimal goes up by one, so 8.45 rounds to 8.5.

Grouping measured values.

A **group** is an equal-size span of values, and a **grouped frequency table** counts how many values fall in each span. Three rules keep groups honest: groups are all the **same size**; groups do **not overlap**, so no value fits two groups; and together the groups **cover every value** in the data set. Here are the heights of 10 students, grouped in spans of 10 cm.

Height (cm)	Frequency
140–149	4
150–159	4
160–169	2
Total	10

Made-up data: the ten heights are made up for this section.

A student who is exactly 149 cm tall goes in the 140–149 group and nowhere else — that is what “no overlap” buys you.

Three checks before you finish.

- Every record was collated **exactly once**.
- The frequencies **add to the number of records** collected.
- Every measured value sits in **exactly one group**.

Where to next.

Organised data is ready to be displayed: section 3B turns tables like these into graphs with axes and simple scales. Section 3C then summarises a data set with the mean and the range, and section 3D reads finished displays for key facts, patterns and trends.

Worked examples

Example 1 — scaffolded

The Harfield College canteen counts every item sold over the counter on Friday lunch with a tally sheet. The finished sheet is shown below.

Harfield College canteen — Friday lunch

tally sheet — items sold over the counter

Item	Tally	Frequency
Chicken roll		
Ham sandwich		
Cheese sandwich		
Salad roll		
Soup		
Total		

Made-up data: the canteen tally sheet and every tally on it are made up for this section.

- Read each tally and complete the frequency column.
- How many items were sold in total?
- How many more chicken rolls than cheese sandwiches were sold?

Working

Comment

Purpose and question(s): turn Friday's tally sheet into a frequency table. Questions: how many of each item? how many in total? how many more chicken rolls than cheese sandwiches?

The tallies already hold the counts; the job is to read them and check.

Chicken roll: two gates and two strokes: $2 \times 5 + 2 = 12$.

Count gates in fives (refresher above).

Ham sandwich: one gate and four strokes: $5 + 4 = 9$.

Same rule on every row.

Cheese sandwich: one gate and two strokes: $5 + 2 = 7$.

Salad roll: four strokes = 4. **Soup:** three strokes = 3.

No complete gate means loose strokes, counted as ones.

Total: $12 + 9 + 7 + 4 + 3 = 35$ items.

The frequency total must match the number of sales recorded — the check passes.

Chicken rolls minus cheese sandwiches: $12 - 7 = 5$.

"How many more" is a subtraction.

The canteen sold 35 items in total — 12 chicken rolls, 9 ham sandwiches, 7 cheese sandwiches, 4 salad rolls and 3 soups — and 5 more chicken rolls than cheese sandwiches.

Example 2 — scaffolded

Ashgrove Market weighs ten bags of potatoes as they are sold. The masses, in kg in the order the bags were weighed, are on the record sheet below.

Ashgrove Market — potato bags

masses weighed in selling order

Bag	Mass (kg)
Bag 1	2.4
Bag 2	2.8
Bag 3	2.1
Bag 4	2.6
Bag 5	2.9

Bag	Mass (kg)
Bag 6	2.3
Bag 7	2.7
Bag 8	2.5
Bag 9	2.2
Bag 10	2.8

Made-up data: the market record sheet and every mass on it are made up for this section.

- Write the masses in order, smallest to largest.
- Count the bags in each group: 2.0–2.4 kg and 2.5–2.9 kg.
- Check that no bag was missed.

Working

Comment

Purpose and question(s): organise ten measured masses. Questions: the masses in order; the count in each of the two groups; a check that no bag is missed.

Measured data: sort first, then group.

Sort: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.8, 2.9 kg.

Compare whole parts first, then tenths (refresher); the two 2.8 bags sit together.

Group 2.0–2.4 kg: 2.1, 2.2, 2.3, 2.4 — that is 4 bags.

A sorted list makes grouping quick: take the values in order.

Group 2.5–2.9 kg: 2.5, 2.6, 2.7, 2.8, 2.8, 2.9 — that is 6 bags.

The two groups do not overlap and together cover every bag.

Check: $4 + 6 = 10$ bags.

The group frequencies add to the number of bags weighed.

In order the masses run from 2.1 kg to 2.9 kg; 4 bags sit in the 2.0–2.4 kg group and 6 in the 2.5–2.9 kg group, and $4 + 6 = 10$ matches the ten bags weighed.

Example 3 — unscaffolded

Ava surveys 20 classmates with one question: “What is your favourite weekend activity?” The raw answers, in the order they came, are: Sport, Music, Gaming, Sport, Movies, Sport, Art, Gaming, Music, Sport, Movies, Gaming, Sport, Music, Art, Sport, Gaming, Movies, Sport, Music.

Made-up data: Ava’s survey and all twenty answers are made up for this section.

Build a frequency table for Ava’s data, name the most popular activity, and find how many more classmates chose Sport than chose Movies.

Collate first: one tally stroke per answer, category by category, gives Sport seven strokes (a gate and two), Gaming and Music four each, Movies three and Art two. Those tallies are the frequencies: Sport 7, Gaming 4, Music 4, Movies 3, Art 2. The check passes because $7 + 4 + 4 + 3 + 2 = 20$, the number of classmates asked. The biggest frequency is Sport’s 7, so Sport is the most popular activity, and Sport beats Movies by $7 - 3 = 4$ votes.

∴ the frequency table is Sport 7, Music 4, Gaming 4, Movies 3, Art 2 (total 20); Sport is the most popular, with 4 more votes than Movies.

Example 4 — unscaffolded

The Southbrook Mail runs the article below about the Merri Street Cafe.

The Southbrook Mail	
BUSINESS	
Cafe's strong week on Merri Street	
Merri Street Cafe's takings grew through the week, with Saturday the busiest trading day.	
Day	Takings
Thursday	\$420
Friday	\$485
Saturday	\$660

Takings = money taken at the register, in Australian dollars

Made-up data: the newspaper article and every figure in it are made up for this section.

- (a) Which day had the biggest takings?
- (b) Find the total takings over the three days.
- (c) For a reader of the article, is this primary or secondary data? Give a one-sentence reason.

The biggest single number in the table is Saturday's \$660, so Saturday had the biggest takings. The three-day total is $\$420 + \$485 + \$660 = \$1\,565$. For a reader of the article the data is **secondary**: the cafe collected the takings at its register and the newspaper published them, so the reader is using numbers somebody else collected. (A reader would note the source — the Southbrook Mail article — and its date.)

$\therefore$ Saturday had the biggest takings (\$660), the three days total \$1 565, and for a reader of the article the data is secondary.

Practice questions

Scaffolded

Q1. Say whether each data set is categorical or numerical. If it is numerical, say whether the values are counted or measured. (a) The colours of the cars in the staff car park. (b) The number of students in each class of a school. (c) The masses of parcels at a post office, in kg.

Q2. Thirty-five Harfield College students answer the survey question “How do you get to school?”. The finished tally sheet is shown below.

Harfield College survey — how do you get to school?

tally sheet — 35 students answered

Way to school	Tally	Frequency
Walk		
Bike		
Bus		
Car		
Train		
Total		

Made-up data: the travel tally sheet and every tally on it are made up for this section.

- Read each tally and write the frequency for every way to school.
- Check the total: how many students were surveyed?
- How many more students travel by car than by bike?

Q3. Eighteen students answer “What pet do you have at home?”. The raw answers, in the order they came, are: Dog, Cat, None, Dog, Fish, Dog, Cat, None, Dog, Bird, Cat, Dog, None, Cat, Dog, Fish, Cat, Dog.

Pet	Frequency
Dog	?
Cat	?
None	3
Fish	2
Bird	1
Total	?

Made-up data: the eighteen answers and the part-filled table are made up for this section.

- Complete the two missing frequencies and the total.
- Check the total against the number of answers collected.
- Which pet is the most common?

Q4. Name the best collection tool for each job — a survey, observation with a tally sheet, measurement, or an existing record (secondary source) — and say in one sentence why it fits. (a) Finding which podcast is most popular with your class. (b) Finding the mass of each loaf of bread a bakery makes on Monday. (c) Counting the bikes that pass your street corner in 30 minutes.

Q5. Five students time themselves running 50 metres. The times, in seconds, are: 8.45, 8.4, 9.15, 8.9, 10.2. (a) Write the times in order, smallest to largest. (b) How many of the times are under 9 seconds? (c) Write 8.45 correct to 1 decimal place.

Q6. A class plans to record every student's height and mass. The draft recording sheet is shown below.

Class heights — draft recording sheet

Height (cm)	Tally
140–149	
149–158	
158–167	

Nina is exactly 149 cm tall.
Which group does she go in??

Another draft sheet

Name	Mass ?

(what is missing here?)

Made-up data: the draft recording sheet is made up for this section.

- Nina is exactly 149 cm tall. Explain why the height groups on the draft sheet cannot take her measurement.
- Rewrite the three height groups so that every height fits in exactly one group.
- One column heading on the right-hand sheet is missing its unit. Which column is it, and what unit should be added?

Un scaffolded

Q7. A student counts every vehicle passing the corner of Kingsley Road and Trentham Street between 8:00 and 8:15 am on Tuesday. The tally sheet is shown below.

Traffic count — Kingsley Road at Trentham Street

Tuesday 8:00–8:15 am — every vehicle passing the corner

Vehicle	Tally	Frequency
Car		
Ute		
Truck		
Bus		
Motorbike		
Total		

Made-up data: the traffic tally sheet and every tally on it are made up for this section.

- Read each tally and write the frequency for every vehicle type.
- How many vehicles passed the corner in the 15 minutes?
- How many more cars than utes passed the corner?

Q8. Twenty-four students answer “What did you do last weekend?”. The raw answers, in the order they came, are: Sport, Home, Shopping, Sport, Movies, Gaming, Home, Sport, Shopping, Friends, Sport, Movies, Home, Gaming, Sport, Shopping, Friends, Sport, Home, Movies, Gaming, Sport, Shopping, Friends.

Activity	Frequency
Sport	?
Home	?
Shopping	?
Movies	?
Gaming	?
Friends	?
Total	?

Made-up data: the twenty-four answers and the table are made up for this section.

Collate the answers into the frequency table, check the total, and name the most common activity.

Q9. Dunmore Bakery checks the mass of every loaf in one bake, in grams: 812, 795, 808, 791, 823, 804, 798, 815, 787, 809, 796, 821.

Mass (g)	Frequency
785–794	?
795–804	?
805–814	?
815–824	?
Total	?

Made-up data: the twelve loaf masses and the group table are made up for this section.

- Write the masses in order, smallest to largest.
- Complete the grouped frequency table.
- Which group holds the most loaves?

Q10. A netball team’s goals per round over a 12-round season are: 2, 4, 1, 3, 2, 5, 2, 4, 3, 1, 2, 3.

Goals in a round	Frequency
1	?
2	?
3	?
4	?
5	?
Total	?

Made-up data: the twelve rounds and the table are made up for this section.

- Complete the frequency table and check the total.
- Which number of goals happened most often?
- In how many rounds did the team score 3 or more goals?

Q11. The Rosebery Public Library website posts its weekly loans report, shown below.

Rosebery Public Library · roseberylibrary.example	
Weekly loans report	
books borrowed each day, posted on the library website	
Day	Books borrowed
Monday	132
Tuesday	148
Wednesday	205
Thursday	157
Friday	121
Saturday	264
Sunday	96

Made-up data: the library website and every number in the report are made up for this section.

- Which day had the most loans, and how many was it?
- How many books were borrowed on Tuesday and Thursday together?
- For a student who reads this report, is the data primary or secondary? Give a one-sentence reason.

Q12. A class wants to know which hot meal students would most like at the next class barbecue. (a) Write one clear survey question for this, with three fixed tick-box answers. (b) Name the collection tool your question uses. (c) A draft of the question reads: “You love our delicious hot meals, don’t you?” Say what is wrong with it.

Q13. Ted collects 30 survey forms about lunchtime activities and copies his tally sheet into a frequency table. Both are shown below.

Ted's tally sheet

Activity	Tally
Eat	
Play sport	
Go to the library	
Listen to music	
Chat with friends	

Ted's frequency table

Activity	Frequency
Eat	8
Play sport	9
Go to the library	4
Listen to music	7
Chat with friends	3
Total	31

Ted collected 30 forms.

Made-up data: Ted’s tally sheet, his frequency table and the form count are made up for this section.

- Read the tally sheet and write the true frequency for each activity.
- Ted’s total-check goes wrong. Show how adding his frequency column finds the mistake.
- Recount the row with the mistake and write the fixed frequency and the fixed total.

Q14. Riley keeps a weather record in a spreadsheet. One column heading reads “Temp” and the cells below it hold one number per day for 15 days. (a) What is missing from the “Temp” heading? (b) Describe one check Riley can do by hand to make sure the spreadsheet matches the original record. (c) Name two paper tools Riley could have used instead of a spreadsheet.

Q15. Eight friends measure their heights in cm: 158, 165, 172, 161, 155, 170, 167, 175. (a) Write the heights in order, smallest to largest. (b) Count the heights in each group: 150–159 cm, 160–169 cm, 170–179 cm. (c) How many of the friends are 170 cm or taller?

Q16. Harfield College wants to know which gate students use in the morning. A student team watches the gates for the first 15 minutes of school on Monday and tallies what they see. The finished sheet is shown below.

Harfield College — gate count

Monday, first 15 minutes of school — students entering each gate

Gate	Tally	Frequency
Front gate		
Side gate		
Sports-ground gate		
Other		
Total		

Made-up data: the gate tally sheet and every tally on it are made up for this section.

- Name the collection tool the team used and say in one sentence why it fits this job.
- Read each tally and write the frequency for every gate.
- How many students were counted in total, and which gate was used most?

Q17. The manager of Quickfreight Depot keeps a log of deliveries received each day of one week.

Day	Deliveries
Monday	9
Tuesday	14
Wednesday	11
Thursday	16
Friday	21

Made-up data: Quickfreight Depot and every number in the log are made up for this section.

- How many deliveries arrived over the whole week?
- Which day was the busiest, and how many deliveries was it?
- For the depot manager, is this log primary or secondary data? Give a one-sentence reason.

Q18. A student group wants to know how long students wait in the canteen queue at lunch. They time ten students with a stopwatch. The waits, in minutes, are: 4, 7, 5, 9, 6, 4, 8, 5, 7, 4. (a) Name the tool used to collect these values and the unit recorded. (b) How many of the waits are 6 minutes or less? (c) Build a frequency table for the waits (one row per different wait time) and check the total.

Answers

Q1. (a) categorical. (b) numerical — counted. (c) numerical — measured. **Q2.** (a) Walk 9, Bike 6, Bus 7, Car 11, Train 2. (b) 35 students. (c) 5 more students. **Q3.** (a) Dog 7, Cat 5; total 18. (b) 18 answers were collected, so the total checks. (c) Dog. **Q4.** (a) a survey — everyone is asked the same fixed question. (b) measurement — scales turn each loaf's mass into a number in kg. (c) observation with a tally sheet — the bikes are counted as they pass. **Q5.** (a) 8.4, 8.45, 8.9, 9.15, 10.2. (b) 3 times. (c) 8.5 (to 1 decimal place). **Q6.** (a) 149 sits in two of the groups (140–149 and 149–158), so Nina's height fits both — every value must fit exactly one group. (b) 140–149, 150–159, 160–169 (any equal-size groups with no overlap that cover all heights). (c) the Mass column; add kg. **Q7.** (a) Car 14, Ute 6, Truck 3, Bus 2, Motorbike 5. (b) 30 vehicles. (c) 8 more cars. **Q8.** Sport 7, Home 4, Shopping 4, Movies 3, Gaming 3, Friends 3; total 24; most common is Sport. **Q9.** (a) 787, 791, 795, 796, 798, 804, 808, 809, 812, 815, 821, 823. (b) 2, 4, 3, 3; total 12. (c) 795–804 g. **Q10.** (a) 1: 2, 2: 4, 3: 3, 4: 2, 5: 1; total 12. (b) 2 goals. (c) 6 rounds. **Q11.** (a) Saturday, 264 books. (b) 305 books. (c) secondary — the library collected and published the counts, so the student reads data someone else collected. **Q12.** (a) any clear question with three tick-box answers, e.g. "Which hot meal would you most like at the next class barbecue? Tick one: pizza, pasta, burger." (b) a survey. (c) it pushes an answer — "don't you?" tells people to say yes, and a good question pushes no answer. **Q13.** (a) Eat 8, Play sport 9, Go to the library 4, Listen to music 6, Chat with friends 3. (b) his frequencies add to $8 + 9 + 4 + 7 + 3 = 31$, not the 30 forms collected, so the total check fails. (c) Listen to music is 6 (a gate and one stroke), not 7; the fixed total is 30. **Q14.** (a) the unit — the heading should say degrees Celsius ($^{\circ}\text{C}$). (b) any one, e.g. count the rows (15 days) against the 15 days recorded, or recount one day by hand. (c) a tally sheet and a frequency table. **Q15.** (a) 155, 158, 161, 165, 167, 170, 172, 175. (b) 2, 3, 3; total 8. (c) 3 friends. **Q16.** (a) observation with a tally sheet — the team watches and counts students as they enter, and the tally keeps the running count. (b) Front gate 13, Side gate 9, Sports-ground gate 6, Other 2. (c) 30 students; the front gate. **Q17.** (a) 71 deliveries. (b) Friday, 21 deliveries. (c) primary — the depot's own staff recorded their own deliveries as they happened. **Q18.** (a) a stopwatch (timer), in minutes. (b) 6 waits. (c) 4: 3, 5: 2, 6: 1, 7: 2, 8: 1, 9: 1; total 10.

Fully-worked solutions

Q1. (a) Colours are words or labels, so the data is **categorical**. (b) Students per class are whole numbers found by counting, so the data is **numerical — counted**. (c) Masses come off scales and can carry decimals, so the data is **numerical — measured**.

Q2. (a) Count gates in fives then add loose strokes: Walk, a gate and four strokes, is $5 + 4 = 9$; Bike is $5 + 1 = 6$; Bus is $5 + 2 = 7$; Car, two gates and one stroke, is $2 \times 5 + 1 = 11$; Train is 2 loose strokes. (b) Total: $9 + 6 + 7 + 11 + 2 = 35$ students, which matches the 35 students surveyed. (c) Car minus Bike: $11 - 6 = 5$ more students travel by car.

Q3. (a) Tallying the list in order: Dog seven strokes (a gate and two), Cat five (a gate), so Dog 7 and Cat 5. Total: $7 + 5 + 3 + 2 + 1 = 18$. (b) Eighteen answers were collected and the total row is 18, so every answer was collated exactly once. (c) The biggest frequency is Dog's 7, so **Dog** is the most common pet.

Q4. (a) **A survey** — the same fixed question goes to everyone in the class, and tick-box answers collate quickly. (b) **Measurement** — scales turn each loaf's mass into a number in kg. (c) **Observation with a tally sheet** — nobody is asked anything; the bikes are counted as they pass, and the tally keeps the running count for the 30 minutes.

Q5. (a) Compare whole parts first, then tenths and hundredths: 8.4 (that is 8.40), 8.45, 8.9, 9.15, 10.2. (b) Under 9 seconds: 8.4, 8.45 and 8.9 — that is **3 times**. (c) The second decimal of 8.45 is 5, so the first decimal rounds up to **8.5** correct to 1 decimal place.

Q6. (a) The groups 140–149 and 149–158 both contain 149, so Nina's height fits two groups and the sheet cannot say which one takes her tally. (The value 158 has the same problem.) Every value must fit exactly one group. (b) Any equal-size groups with no overlap that cover all heights work, for example **140–149, 150–159, 160–169**: 149 now sits only in the first group and 158 only in the second. (c) The **Mass** column has no unit. Masses of students belong in **kg**, so the heading should read "Mass (kg)".

Q7. (a) Car: two gates and four strokes = $2 \times 5 + 4 = 14$. Ute: $5 + 1 = 6$. Truck: 3. Bus: 2. Motorbike: one gate = 5. (b) Total: $14 + 6 + 3 + 2 + 5 = 30$ vehicles. (c) Cars minus utes: $14 - 6 = 8$ more cars.

Q8. Tallying the 24 answers in order gives Sport 7 (a gate and two strokes), Home 4, Shopping 4, Movies 3, Gaming 3 and Friends 3. Check: $7 + 4 + 4 + 3 + 3 + 3 = 24$, the number of answers collected. The biggest frequency is 7, so the most common activity is **Sport**.

Q9. (a) Sorted smallest to largest: 787, 791, 795, 796, 798, 804, 808, 809, 812, 815, 821, 823 g. (b) From the sorted list: 785–794 holds 787 and 791 (2); 795–804 holds 795, 796, 798 and 804 (4); 805–814 holds 808, 809 and 812 (3); 815–824 holds 815, 821 and 823 (3). Check: $2 + 4 + 3 + 3 = 12$ loaves. (c) The biggest group frequency is 4, so **795–804 g** holds the most loaves.

Q10. (a) Counting the 12 rounds: 1 goal in 2 rounds, 2 goals in 4, 3 goals in 3, 4 goals in 2, 5 goals in 1. Check: $2 + 4 + 3 + 2 + 1 = 12$ rounds. (b) The biggest frequency is 4, on **2 goals**. (c) Rounds with 3 or more goals: $3 + 2 + 1 = 6$ rounds.

Q11. (a) The biggest number in the report is **Saturday's 264 books**. (b) Tuesday plus Thursday: $148 + 157 = 305$ books. (c) **Secondary** — the library collected the loan counts and published them on its website, so a student reading the report is using data someone else collected.

Q12. (a) Any one clear question with three fixed answers, for example: “Which hot meal would you most like at the next class barbecue? Tick one: pizza, pasta, burger.” (b) A **survey** — the same question with fixed answers goes to every student. (c) The draft tells people what to answer: “You love our delicious hot meals, don't you?” pushes everyone toward yes. A good survey question pushes no answer, so the counts stay honest.

Q13. (a) Reading the gates in fives: Eat, a gate and three strokes, = 8; Play sport, a gate and four strokes, = 9; Go to the library = 4; Listen to music, a gate and one stroke, = 6; Chat with friends = 3. (b) Ted's column adds to $8 + 9 + 4 + 7 + 3 = 31$, but he collected 30 forms. The total check fails ($31 \neq 30$), so exactly one row must be wrong. (c) Recounting Listen to music: a gate and one stroke is **6**, not 7. Fixed column: $8 + 9 + 4 + 6 + 3 = 30$, which matches the 30 forms.

Q14. (a) The **unit** is missing: “Temp” should read “Temp (°C)” — degrees Celsius — so each number carries its unit. (b) Any one hand check, for example: count the rows in the column and check there are 15 (one per day recorded), or pick one day and recount its value against the original thermometer sheet, or check no cell in the column is empty. (c) A **tally sheet** for collecting and a **frequency table** for organising — both work with pen and paper.

Q15. (a) Sorted smallest to largest: 155, 158, 161, 165, 167, 170, 172, 175 cm. (b) 150–159 holds 155 and 158 (2); 160–169 holds 161, 165 and 167 (3); 170–179 holds 170, 172 and 175 (3). Check: $2 + 3 + 3 = 8$ friends. (c) Heights of 170 cm or more: 170, 172, 175 — that is **3 friends**.

Q16. (a) **Observation with a tally sheet** — the team watches the gates and counts students as they enter, and tally marks keep a running count that cannot get lost. (b) Front gate: two gates and three strokes = $2 \times 5 + 3 = 13$. Side gate: $5 + 4 = 9$. Sports-ground gate: $5 + 1 = 6$. Other: 2. (c) Total: $13 + 9 + 6 + 2 = 30$ students. The biggest frequency is 13, so the **front gate** was used most.

Q17. (a) Week total: $9 + 14 + 11 + 16 + 21 = 71$ deliveries. (b) The biggest daily count is **Friday's 21 deliveries**. (c) **Primary** — the depot's own staff collected the data themselves, recording their own deliveries as they happened.

Q18. (a) A **stopwatch** (or timer), recording each wait in **minutes**. (b) Sorted: 4, 4, 4, 5, 5, 6, 7, 7, 8, 9. Waits of 6 minutes or less: 4, 4, 4, 5, 5, 6 — that is **6 waits**. (c) One row per different wait: 4 min in 3 waits, 5 in 2, 6 in 1, 7 in 2, 8 in 1, 9 in 1. Check: $3 + 2 + 1 + 2 + 1 + 1 = 10$ waits, the number timed.

Chapter 3 Data — 3B Tables and graphs: axes and simple scales

Theory

About the data in this section. The tables and graphs here are **made up** (not real): pretend canteens, a pretend library, a pretend market stall and pretend numbers, built for this book so you can practise the maths. Nothing here is real data about a real business, person or place.

Data is the information you collect — counts, measurements, amounts. A raw list of numbers is hard to read. A **display** puts those numbers into a shape your eye can use: a **table** or a **graph**. This section is about the displays you meet every day, and about the two parts of a graph that make it readable: its **axes** and its **scale**.

The five displays used in this book.

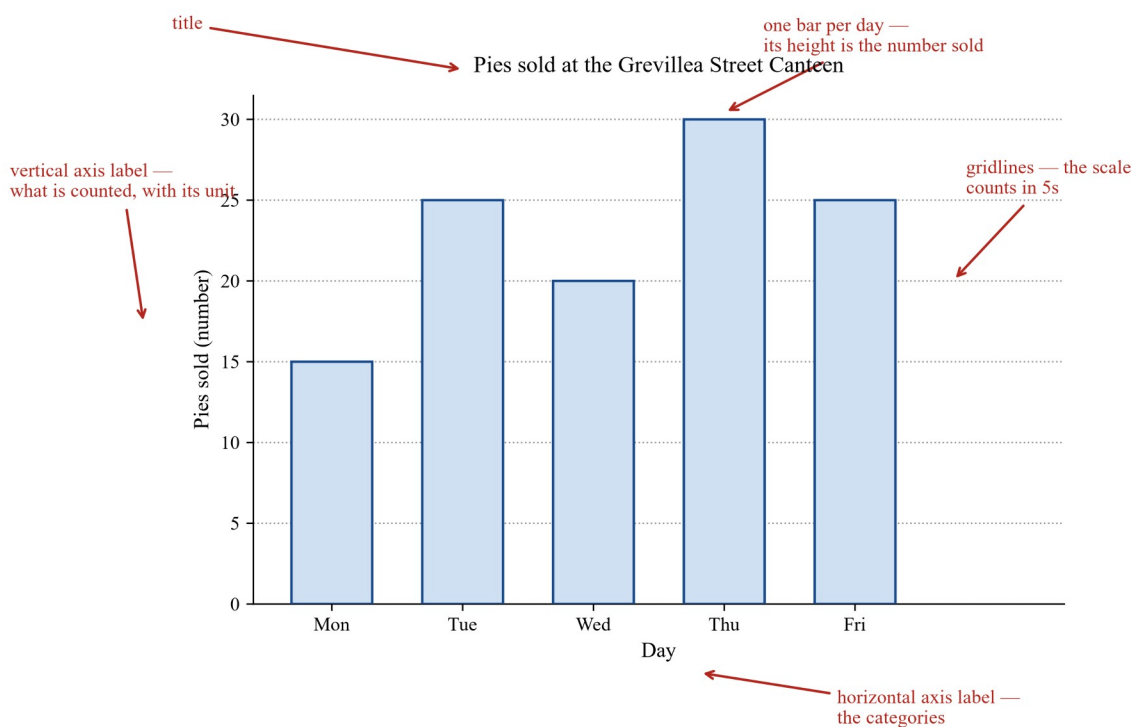
Display	What it looks like	Good for
Table	numbers in rows and columns	exact numbers a reader must look up
Bar chart	one bar per category, bar height is the number	comparing counts across categories
Line graph	points joined by a line	change over time
Dot plot	one dot per value, stacked when a value repeats	a small set of individual values
Pie chart	a circle cut into slices	how one whole splits into shares

A **category** is one group in the data — one day, one drink, one genre, one hen.

Parts of a graph. Every good graph has five parts: a **title**; a **horizontal axis** (the one that runs left–right); a **vertical axis** (the one that runs up–down); a **label on each axis** saying what it holds and in what unit; and a **scale** — the numbers along the axis, counting in even steps. The lines across the chart at each scale number are **gridlines**. Here is one week of pie sales as a table, then as a labelled bar chart.

Day	Pies sold
Monday	15
Tuesday	25
Wednesday	20
Thursday	30
Friday	25

Made-up data: the day names and every number in the table are made up for this section.



Made-up data: this bar chart is drawn for this book.

Read the chart in this order. The title says what was counted. The vertical axis label says it is a count of pies. The horizontal axis label says the categories are days. The scale counts in 5s from 0 to 30. Each bar's height is the number sold that day: Thursday's bar reaches the 30 gridline, so 30 pies sold on Thursday. The whole week is $15 + 25 + 20 + 30 + 25 = 115$ pies.

Refresher — skip counting. A scale counts in one step, over and over. The **step** is the jump from one gridline to the next, and the steps we use are the ones you already skip-count with.

Counting in 2s 0 2 4 6 8 10 good — even steps

Counting in 5s 0 5 10 15 20 good — even steps

Counting in 10s 0 10 20 30 40 50 good — even steps

Uneven steps 0 5 6 20 wrong — the steps jump 5, then 1, then 14

Counting in 2s, 5s and 10s — every jump the same size. The bottom strip is wrong: its jumps are 5, then 1, then 14.

A scale with uneven steps is a broken scale. On the bottom strip the gap from 5 to 6 looks the same size as the gap from 0 to 5, so the strip lies about its own numbers. Every graph in this section counts in even steps.

Choosing a simple scale. Follow these four steps.

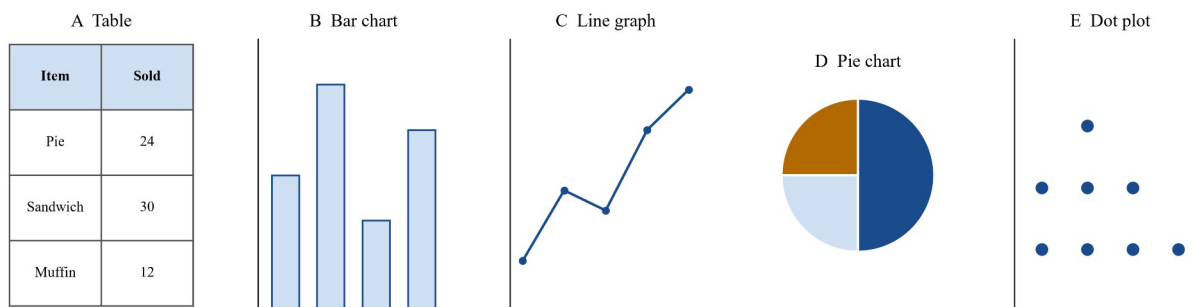
1. Find the largest value in your data.

2. Try steps of 1, 2, 5, 10, 20 or 50. Pick the smallest step where counting from 0 up to the top takes 10 numbers or fewer.
3. The top of the axis is the first number in your step that is at least as big as the largest value.
4. Write every scale number on the axis, in even steps from 0.

Example: the largest value is 42. Counting in 2s up to 42 needs 22 numbers — too many. Counting in 5s up to 45 needs 10 numbers — that fits. So the scale is step 5, top 45: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45.

Reading between the gridlines. A bar or a point can land between two gridlines. Take the halfway number. On a scale counting in 10s, a bar ending halfway between 40 and 50 shows 45. On a scale counting in 2s, a dot halfway between 8 and 10 shows 9.

Choosing the most appropriate format. The skill is matching the display to the data. The five panels below are lettered A to E, and the questions use those letters.



The five displays, drawn small.

If your data is ... the most appropriate display is

exact numbers a reader must look up	A, table
counts for different categories, to compare	B, bar chart
change over time	C, line graph
one whole split into shares	D, pie chart
a small set of individual values	E, dot plot

Refresher — per cent as a share of a whole. Pie charts speak in per cent, and a per cent is a share of 100. Four shares cover nearly every simple pie chart: **50%** is one half, **25%** is one quarter, **10%** is one tenth (divide by 10), and **5%** is half of 10%. For a class of 40 students: 50% of 40 is $40 \div 2 = 20$ students; 25% of 40 is $40 \div 4 = 10$ students; 10% of 40 is $40 \div 10 = 4$ students; 5% of 40 is half of that, 2 students. Question Q13 uses exactly these shares.

Three rules that make a graph honest.

- Even steps: every jump on the scale is the same size.
- Labels with units: every axis says what it holds and in what unit — “Height (cm)”, not just “Height”.
- A title: one line saying what was counted, and over what.

A graph that breaks any of these can mislead a reader, even when the numbers behind it are right. Example 4 and question Q10 show broken graphs to fix.

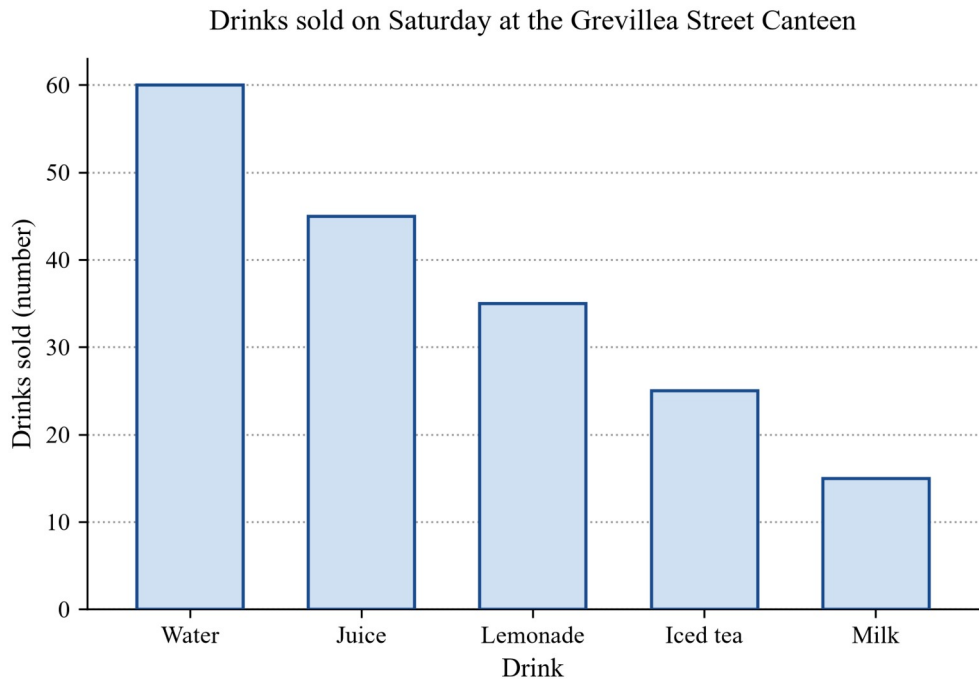
Technology. A spreadsheet or a phone app can turn a table of numbers into a bar chart or a line graph in seconds, and it draws every bar to scale for you. You still make the big choices: which display, what title, what axis labels. Question Q16 looks at a spreadsheet chart. Nothing in this section needs a device — every question can be done with pen, paper, a ruler and a basic calculator.

Units 3 and 4 preview: later units use a wider range of displays and finer scales. This section stays with the five common displays and simple scales.

Worked examples

Example 1 — scaffolded

The bar chart shows drinks sold on Saturday at the Grevillea Street canteen.



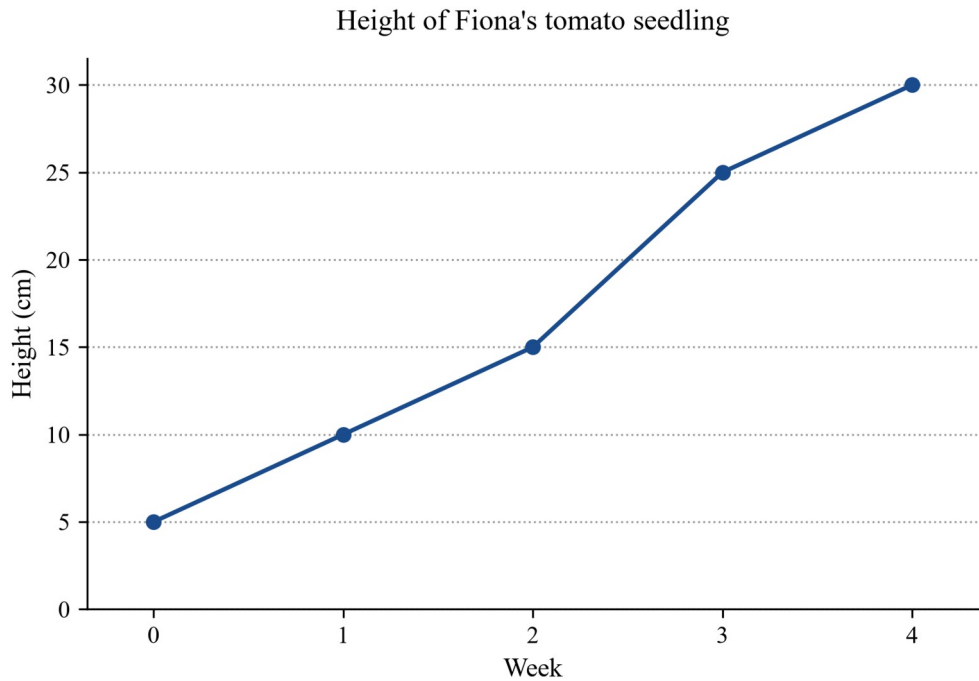
Made-up data: this bar chart is drawn for this book.

- (a) Which drink sold the most?
- (b) How many juices sold? The bar ends between two gridlines.
- (c) What is the step of the scale on the vertical axis, and what is its top number?

Working	Comment
Water, at 60	(a) The tallest bar is Water, ending exactly on the 60 gridline.
Juice ends halfway between 40 and 50	(b) The step is 10, so the halfway number is 45.
45 juices	(b) Read straight off the halfway mark.
Step 10, top 60	(c) The scale counts 0, 10, 20, 30, 40, 50, 60.

Example 2 — scaffolded

Fiona measures her tomato seedling every week. The line graph shows its height.



Made-up data: this line graph is drawn for this book.

- (a) How tall is the seedling at week 3?
- (b) How much does it grow from week 2 to week 3?
- (c) How much does it grow in total, from week 0 to week 4?

Working	Comment
25 cm	(a) The week-3 point sits on the 25 gridline.
$25 - 15 = 10$ cm	(b) Week 3 height minus week 2 height.
$30 - 5 = 25$ cm	(c) Week 4 height minus week 0 height.

Example 3 — unscaffolded

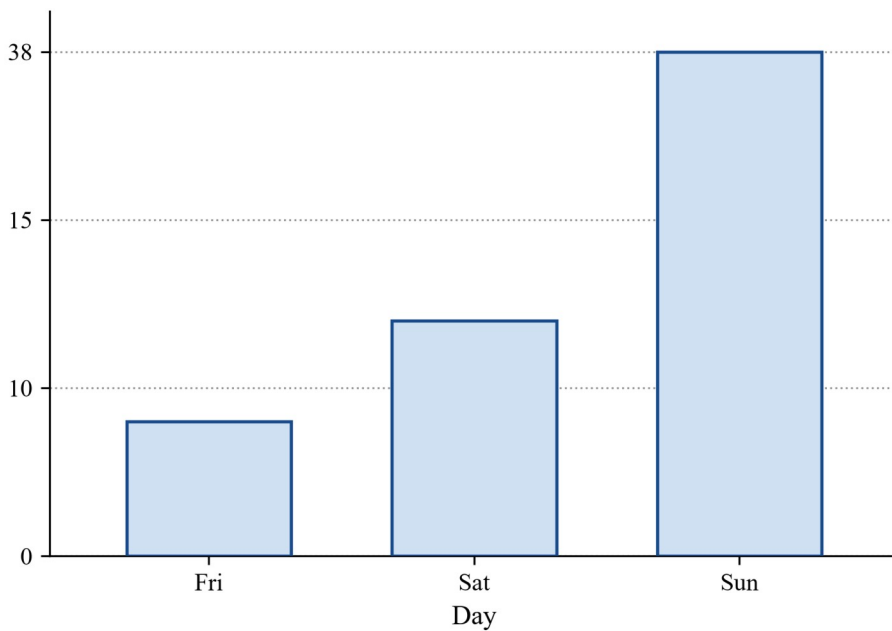
Match each of these four data sets to the most appropriate display, and give one reason each time.

- (i) The maximum temperature each day for two weeks.
- (ii) The price of each sandwich filling at a canteen, for a reader who must look prices up exactly.
- (iii) The number of first-aid kits in each of five school buildings.
- (iv) How one week’s pay splits between rent, food, savings and everything else.
- (v) C, line graph — the data is change over time.
- (vi) A, table — the reader needs exact numbers to look up.
- (vii) B, bar chart — counts across five categories, set side by side to compare.
- (viii) D, pie chart — one whole (the week’s pay) split into shares.

∴ Time data goes on a line graph, look-up numbers go in a table, category counts go on a bar chart, and shares of one whole go on a pie chart.

Example 4 — unscaffolded

Lachie draws this bar chart of the dogs he washed on Friday, Saturday and Sunday at his dog wash. The chart has faults.



Made-up data: this hand-drawn chart is drawn for this book, faults and all.

- (a) Find two faults in the chart.
- (b) The largest value is 38 dogs. Using the four steps for choosing a scale, give the step and the top number Lachie should use.
- (c) On that new scale, between which two gridlines will Sunday's bar end?

Faults: the gridlines are not evenly spaced — the jumps are 10, then 5, then 23 — and the chart has no title and no label on the vertical axis, so a reader cannot tell what is being counted.

New scale: counting in 5s up to 40 takes 9 numbers, which fits step 2 of the rule, so the step is 5 and the top is 40.

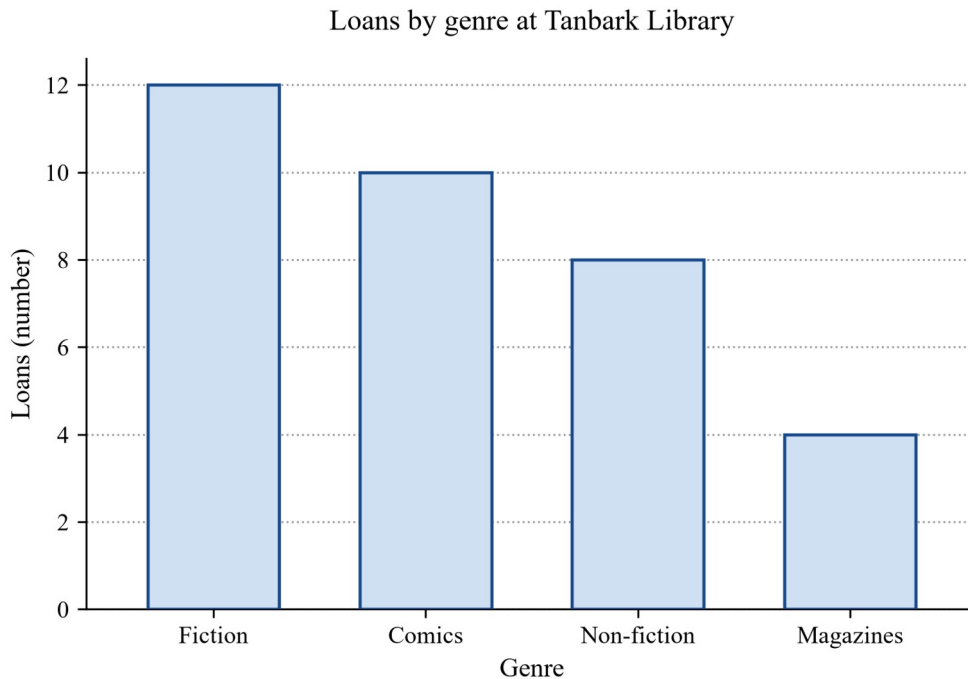
Sunday's bar: 38 sits between the 35 and 40 gridlines.

∴ The chart needs even steps (step 5, top 40), a title and a labelled vertical axis; Sunday's 38 dogs then read between the 35 and 40 gridlines.

Practice questions

Scaffolded

Q1. Use the bar chart of loans by genre at Tanbark Library.



Made-up data: this bar chart is drawn for this book.

- (a) How many comics were loaned?
- (b) What is the step of the scale on the vertical axis?
- (c) Which genre was loaned the least?

Q2. Skip counting and halfway marks.

- (a) Fill the gaps, counting in 5s: 0, 5, , **15**, .
- (b) Fill the gaps, counting in 10s: 20, , , 50.
- (c) On a scale counting in 2s, what number is halfway between 8 and 10?

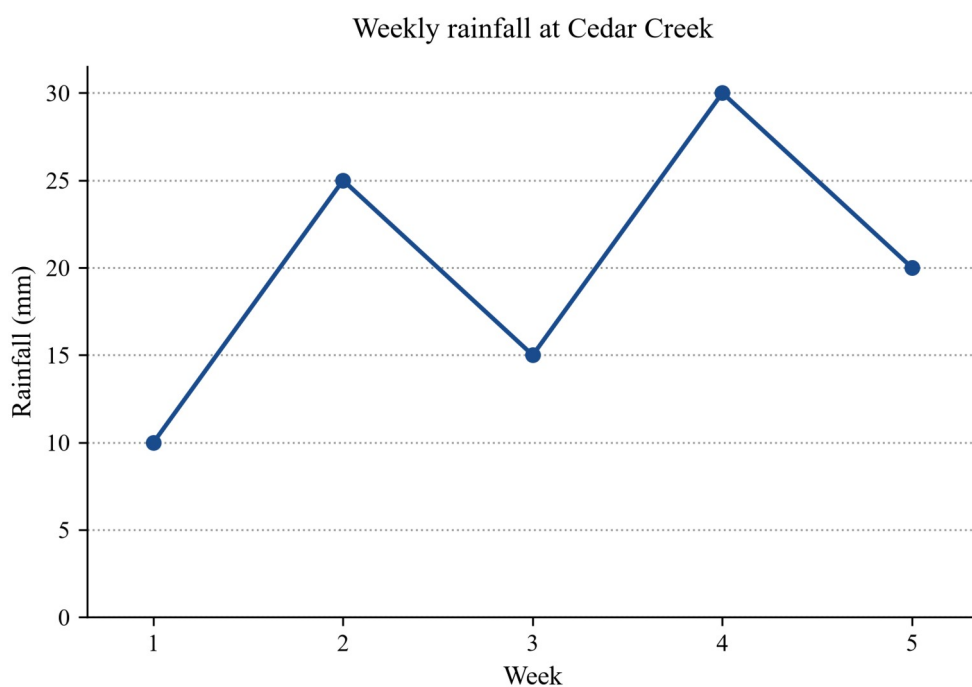
Q3. The table shows items sold at the Cedar Creek milk bar one lunchtime.

Item	Number sold
Pie	24
Sausage roll	18
Sandwich	30
Muffin	12
Fruit	6

Made-up data: the items and every number in the table are made up for this section.

- (a) Which item sold the most?
- (b) How many more sandwiches than muffins sold?
- (c) How many items sold in total?

Q4. Use the line graph of weekly rainfall at Cedar Creek.



Made-up data: this line graph is drawn for this book.

- (a) How much rain fell in week 2?
- (b) Which week was the wettest?
- (c) How much rain fell over the five weeks in total?

Q5. Choose a scale. For each largest value below, give the step and the top number using the four steps in the Theory.

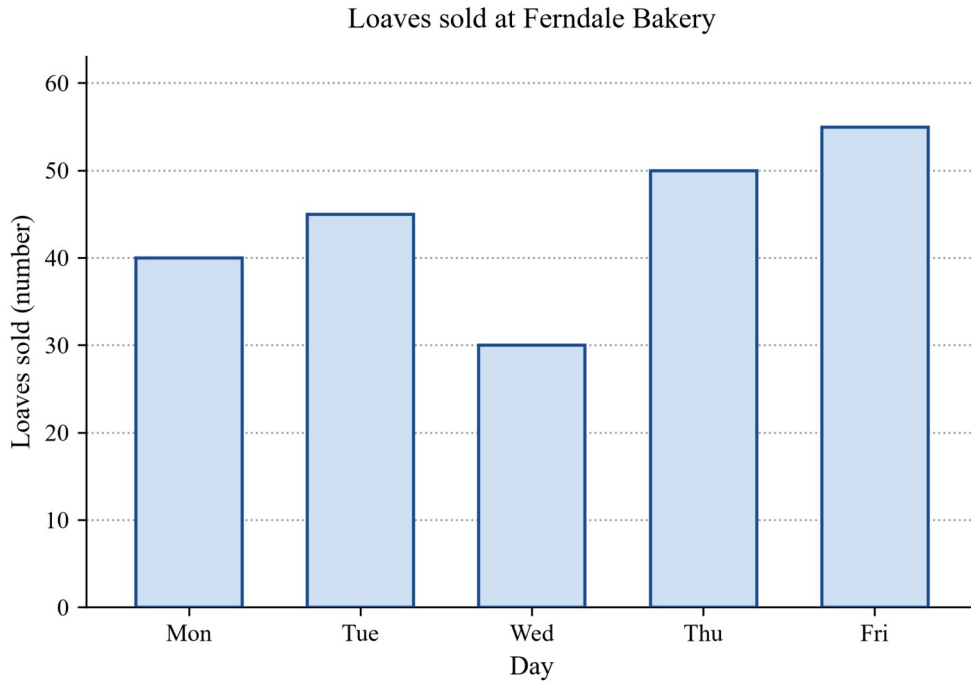
- (a) Largest value 28.
- (b) Largest value 90.
- (c) Largest value 7.

Q6. Use the five display panels A to E in the Theory. Match each data set to the most appropriate display.

- (a) The number of members in each of six clubs.
- (b) How one day's 24 hours splits between sleep, school, sport and other.
- (c) The exact departure times of five buses, for a reader catching a bus.

Unscaffolded

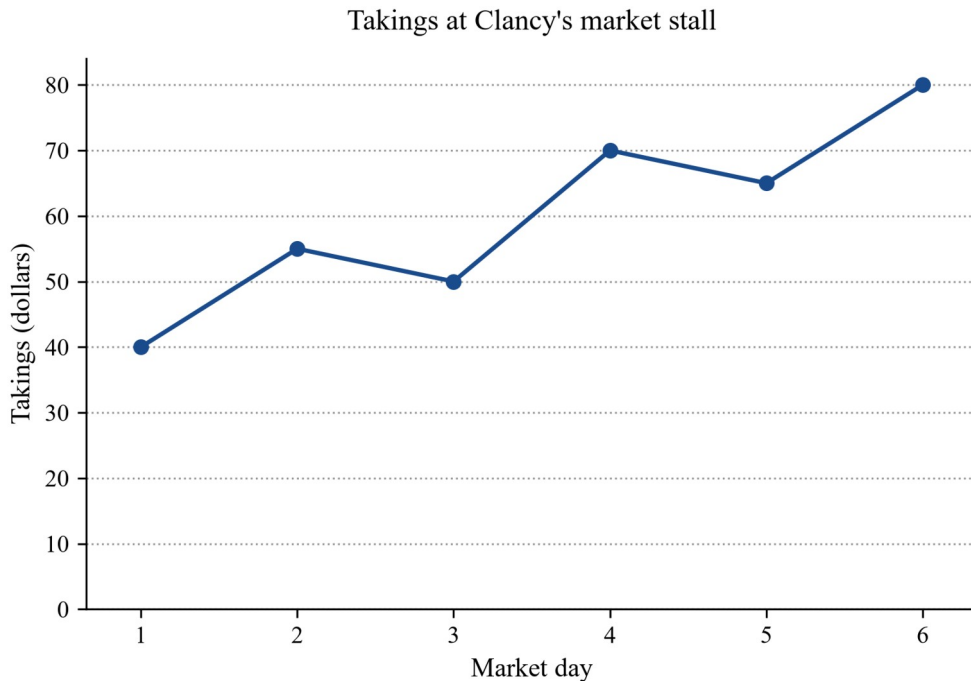
Q7. Use the bar chart of loaves sold at Ferndale Bakery.



Made-up data: this bar chart is drawn for this book.

- (a) How many loaves sold on Tuesday? The bar ends between two gridlines.
- (b) How many more loaves sold on Friday than on Wednesday?
- (c) Show that the five-day total is 220 loaves.

Q8. Clancy keeps a stall at the Cedar Creek market. The line graph shows his takings for six market days.



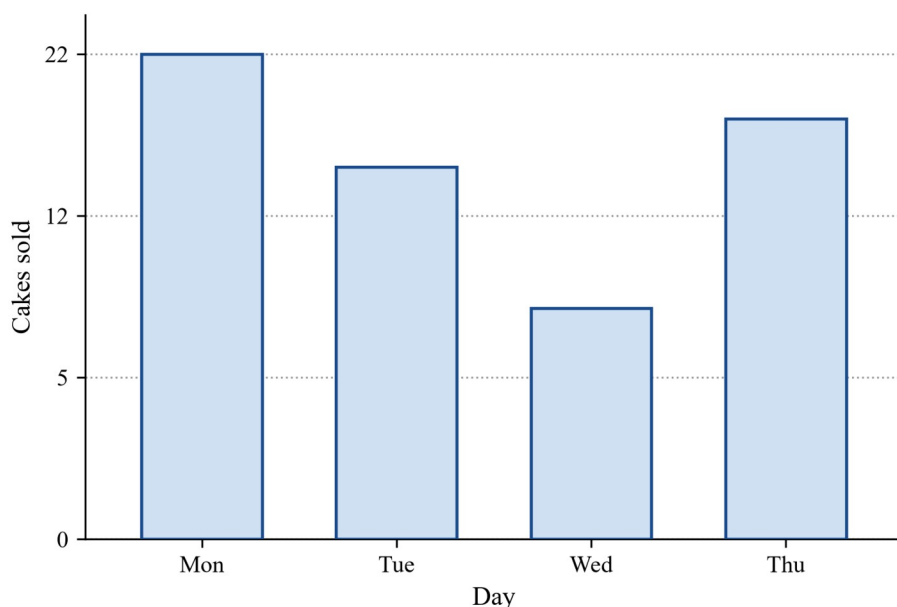
Made-up data: this line graph is drawn for this book.

- (a) What were the takings on day 2?
- (b) Show that the takings fell by \$5 from day 2 to day 3.
- (c) Between which two days did the takings rise the most, and by how much?

Q9. Match each data set to the most appropriate display (A table, B bar chart, C line graph, D pie chart, E dot plot). Give one reason for (i).

- (i) The height of a street tree measured at the end of each month for six months.
- (ii) The number of eggs laid by each of five hens in one month.
- (iii) How a club's \$200 fundraiser was spent, as shares of the whole.
- (iv) Every score in one small game of darts.
- (v) The exact prices on a canteen menu.

Q10. Viv draws this bar chart of cakes sold at her cake stall, Monday to Thursday. The chart has faults.



Made-up data: this hand-drawn chart is drawn for this book, faults and all. The data is Mon 22, Tue 15, Wed 8, Thu 18 cakes.

- (a) Find two faults in the chart.
- (b) The largest value is 22 cakes. Using a step of 5, what should the top number on the vertical axis be?
- (c) Say why a scale must count in even steps.

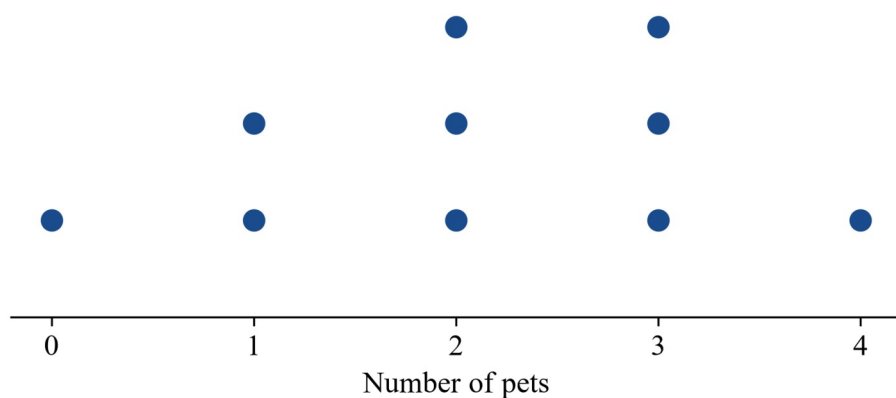
Q11. The table shows recycling collected at the Cedar Creek Community Garden in one month.

Material	Mass collected (kg)
Paper	45
Glass	30
Plastic	20
Metal	10
Green waste	25

Made-up data: the materials and every number in the table are made up for this section.

- (a) Which material was collected the most?
- (b) What total mass was collected?
- (c) On a bar chart counting in 10s, between which two gridlines would the paper bar end?

Q12. Bianca asks everyone in her class how many pets they have. The dot plot shows the answers.

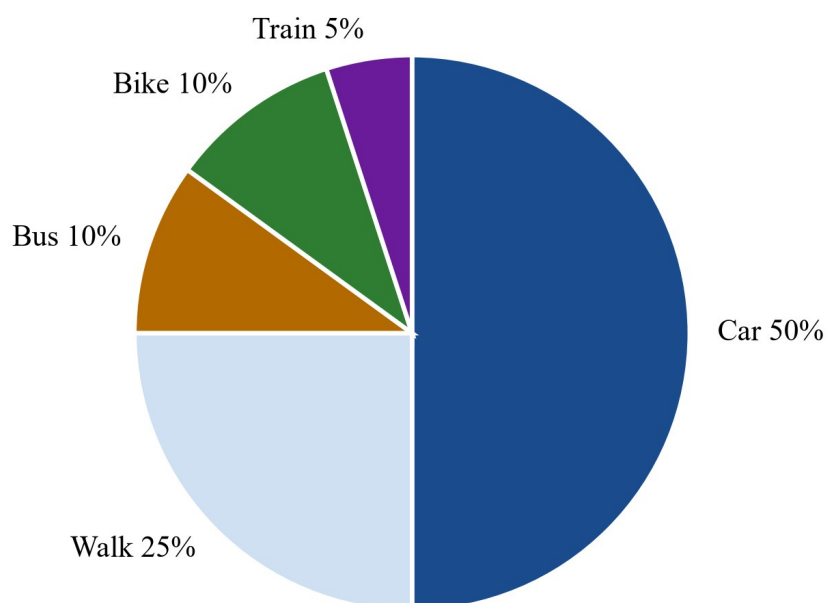


Made-up data: this dot plot is drawn for this book.

- (a) How many people did Bianca ask?
- (b) How many people have exactly 2 pets?
- (c) How many people have 3 or more pets?

Q13. The pie chart shows how the 40 students in a class travel to school.

How the 40 students in a class travel to school



Made-up data: this pie chart is drawn for this book.

- (a) Which way of travelling has the biggest share?
- (b) How many students walk?
- (c) How many students travel by car or bus?

Q14. Rhys counts his skips per minute in five jump-rope trials: 78, 85, 92, 88, 95.

- (a) What is the largest value?
- (b) Using the four steps in the Theory, give the step and the top number for the vertical axis of a bar chart of the trials.
- (c) Write the two axis labels Rhys should use, including the unit where one is needed.

Q15. The table shows seedlings sold by the Cedar Creek Community Garden in one weekend.

Seedling	Number sold
Tomato	35
Herb	42
Flower	28
Veggie	15

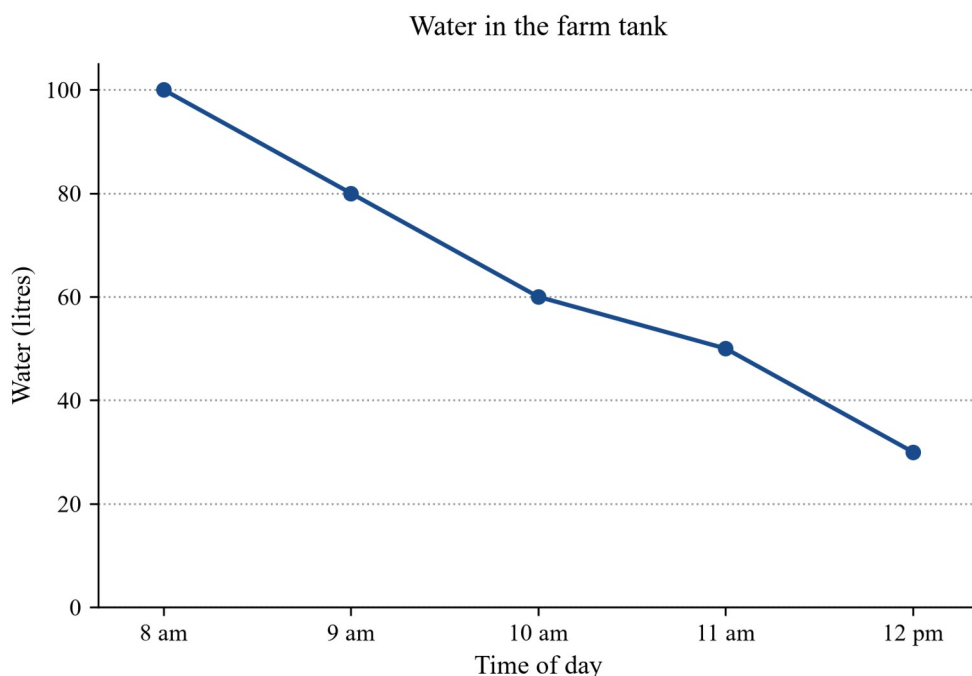
Made-up data: the seedling types and every number in the table are made up for this section.

- (a) Show that the total number of seedlings sold is 120.
- (b) Which seedling sold the most?
- (c) On a bar chart counting in 10s, between which two gridlines would the herb bar end?

Q16. Elsa types her club's fundraising numbers into a spreadsheet and lets it draw a bar chart.

- (a) Name two things the spreadsheet does for her that are slow by hand.
- (b) Name two choices the spreadsheet cannot make for her.
- (c) Elsa's laptop battery dies on market day. Can she still make a bar chart of the day's numbers? Say how.

Q17. A farm tank holds water for the animals. The line graph shows the water in the tank through one morning.



Made-up data: this line graph is drawn for this book.

- (a) How many litres were in the tank at 10 am?
- (b) At 11 am the point sits halfway between two gridlines. How many litres were in the tank?
- (c) How many litres were used between 8 am and 12 pm?

Q18. Fiona counts the birds in her garden each morning for a week: Monday 6, Tuesday 9, Wednesday 12, Thursday 8, Friday 14, Saturday 10, Sunday 11.

- (a) Which display is most appropriate for these numbers, and why?
- (b) Using the four steps in the Theory, give the step and the top number for the vertical axis.
- (c) Which morning had the most birds?

Answers

- Q1.** (a) 10 (b) 2 (c) Magazines
- Q2.** (a) 10 and 20 (b) 30 and 40 (c) 9
- Q3.** (a) Sandwich (b) 18 (c) 90 items
- Q4.** (a) 25 mm (b) Week 4 (c) 100 mm
- Q5.** (a) Step 5, top 30 (b) Step 10, top 90 (c) Step 1, top 7
- Q6.** (a) B, bar chart (b) D, pie chart (c) A, table
- Q7.** (a) 45 (b) 25 (c) 220 loaves
- Q8.** (a) \$55 (b) \$5 (c) From day 3 to day 4, by \$20
- Q9.** (i) C, line graph (ii) B, bar chart (iii) D, pie chart (iv) E, dot plot (v) A, table
- Q10.** (a) No title; gridlines not evenly spaced (b) 25 (c) So every height reads and compares truly
- Q11.** (a) Paper (b) 130 kg (c) Between 40 and 50
- Q12.** (a) 10 (b) 3 (c) 4
- Q13.** (a) Car (b) 10 (c) 24
- Q14.** (a) 95 (b) Step 20, top 100 (c) Horizontal axis “Trial”; vertical axis “Skips per minute (number)”
- Q15.** (a) 120 seedlings (b) Herb (c) Between 40 and 50
- Q16.** (a) Any two: draws every bar exactly to scale; redraws the chart when a number changes; totals or sorts a column (b) Any two: which display suits the data; the title; the axis labels and units (c) Yes — by hand on grid paper with an even scale
- Q17.** (a) 60 litres (b) 50 litres (c) 70 litres
- Q18.** (a) Bar chart (or line graph), with a matching reason (b) Step 2, top 14 (c) Friday

Fully-worked solutions

- Q1.** (a) The comics bar ends on the 10 gridline: **10 comics**. (b) The scale numbers run 0, 2, 4, 6, 8, 10, 12, so the step is **2**. (c) The shortest bar is Magazines at 4: **Magazines**.
- Q2.** (a) Counting in 5s: 0, 5, **10**, 15, **20**. (b) Counting in 10s: 20, **30**, **40**, 50. (c) Halfway between 8 and 10 on a step of 2 is **9**.
- Q3.** (a) The largest number in the table is 30, so **sandwiches** sold the most. (b) $30 - 12 = 18$, so **18 more sandwiches** than muffins. (c) $24 + 18 = 42$; $42 + 30 = 72$; $72 + 12 = 84$; $84 + 6 = 90$. **90 items**.
- Q4.** (a) The week-2 point sits on the 25 gridline: **25 mm**. (b) The highest point is week 4 at 30 mm: **week 4**. (c) $10 + 25 = 35$; $35 + 15 = 50$; $50 + 30 = 80$; $80 + 20 = 100$. **100 mm**.
- Q5.** (a) Step 2 would need 15 numbers; step 5 counts 0, 5, 10, ..., 30 in 7 numbers. **Step 5, top 30**. (b) Step 5 would need 19 numbers; step 10 counts 0, 10, 20, ..., 90 in 10 numbers. **Step 10, top 90**. (c) Step 1 counts 0 to 7 in 8 numbers, which fits. **Step 1, top 7**.
- Q6.** (a) Counts for six clubs are category counts to compare: **B, bar chart**. (b) One day split into shares of the whole: **D, pie chart**. (c) Exact times a reader must look up: **A, table**.

Q7. (a) Tuesday's bar ends halfway between 40 and 50: **45 loaves**. (b) $55 - 30 = 25$: **25 more loaves**. (c) One step per line:

$$40 + 45 = 85$$

$$85 + 30 = 115$$

$$115 + 50 = 165$$

$$165 + 55 = 220$$

so the five-day total is **220 loaves**, as required.

Q8. (a) The day-2 point sits halfway between 50 and 60: **\$55**. (b) Day 2 is \$55 and day 3 is \$50:

$$\$55 - \$50 = \$5$$

so the takings fell by **\$5**, as required. (c) The day-to-day changes are +15, -5, +20, -5, +15 dollars. The biggest rise is +\$20, **from day 3 to day 4**.

Q9. (i) **C, line graph** — the tree's height is change over time. (ii) **B, bar chart** — counts for five hens, set side by side to compare. (iii) **D, pie chart** — one whole (\$200) split into shares. (iv) **E, dot plot** — a small set of individual scores. (v) **A, table** — exact prices a reader must look up.

Q10. (a) The chart has **no title**, and its **gridlines are not evenly spaced** — the numbers jump 5, then 7, then 10 while every gap looks the same size. (b) Counting in 5s past 22 gives a top of **25**. (c) If the steps are uneven, two bars of the same height can stand for different numbers and no height can be trusted. Even steps keep every reading and every comparison true.

Q11. (a) The largest mass is 45 kg, so **paper** was collected the most. (b) $45 + 30 = 75$; $75 + 20 = 95$; $95 + 10 = 105$; $105 + 25 = 130$. **130 kg**. (c) 45 sits halfway between the 40 and 50 gridlines: **between 40 and 50**.

Q12. (a) One dot per answer; counting all the dots gives **10 people**. (b) The stack above 2 has 3 dots: **3 people**. (c) The stacks above 3 and 4 hold $3 + 1 = 4$ dots: **4 people**.

Q13. (a) The biggest slice is **car**, at 50%. (b) 25% of 40 is $40 \div 4 = 10$: **10 students**. (c) Car is 50% of 40, which is 20 students, and bus is 10% of 40, which is 4 students: $20 + 4 = 24$. **24 students**.

Q14. (a) The largest count is **95 skips**. (b) Step 10 would count 0, 10, ..., 100 in 11 numbers — too many; step 20 counts 0, 20, ..., 100 in 6 numbers: **step 20, top 100**. (c) Horizontal axis: "Trial". Vertical axis: "Skips per minute (number)".

Q15. (a) One step per line:

$$35 + 42 = 77$$

$$77 + 28 = 105$$

$$105 + 15 = 120$$

so the total is **120 seedlings**, as required. (b) The largest number is 42, for **herb** seedlings. (c) 42 sits between the 40 and 50 gridlines: **between 40 and 50**.

Q16. (a) Any two of: it draws every bar exactly to scale; it redraws the whole chart the moment a number changes; it totals or sorts a column in one click. (b) Any two of: which display suits the data; the chart title; the axis labels and their units. (c) Yes. A bar chart is only bars drawn to an even scale, so Elsa can rule one on grid paper with pen and a ruler, using the four scale steps from the Theory. The spreadsheet is a shortcut, never a requirement.

Q17. (a) The 10 am point sits on the 60 gridline: **60 litres**. (b) Halfway between 40 and 60 on a step of 20 is **50 litres**. (c) $100 - 30 = 70$: **70 litres used**.

Q18. (a) A **bar chart** (a line graph also earns the mark): the numbers are counts for seven separate mornings, and bars set them side by side to compare. (b) Step 1 would need 15 numbers; step 2 counts 0, 2, 4, ..., 14 in 8 numbers: **step 2, top 14**. (c) The biggest count is 14, on **Friday**.

Example checks. Example 1: water 60 is the tallest bar; juice 45 reads halfway between 40 and 50; the scale is step 10, top 60. Example 2: week 3 is 25 cm; $25 - 15 = 10$ cm; $30 - 5 = 25$ cm. Example 3: (i) C, (ii) A, (iii) B, (iv) D. Example 4: the faults are uneven gridlines plus a missing title and missing vertical axis label; the new scale is step 5, top 40; 38 sits between 35 and 40.

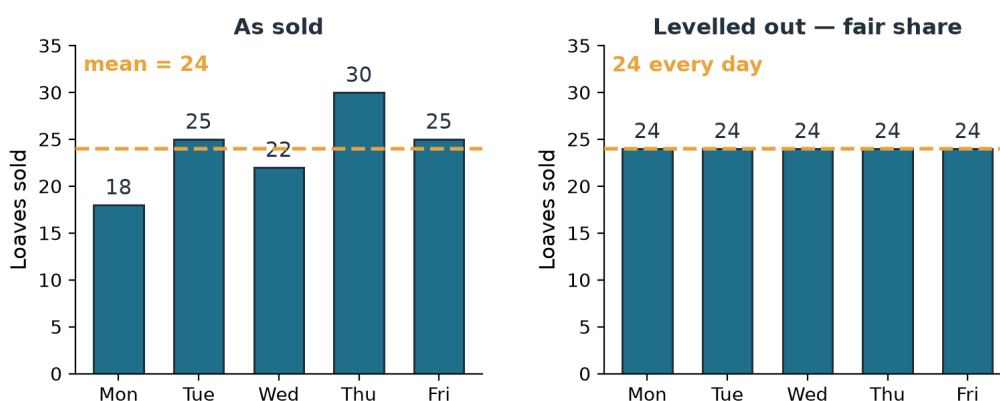
Theory

The two numbers in this section. A *data set* is a list of numbers collected about the one thing — loaves sold each morning, lap times, wages for each week. A long list is hard to talk about, so we sum it up with two numbers. The **mean** says how much is typical. The **range** says how much the values spread out. Those two numbers, mean and range, are everything this section teaches.

The mean: share it out equally. The mean is the number most people call the *average*. Picture putting every value into one pool, then sharing the pool out equally between the values. Each equal share is the mean.

$$\text{mean} = \frac{\text{total of all the values}}{\text{how many values there are}}$$

Some books and some calculators write the mean as $\bar{x}$, said “x-bar”. It means the same thing as the word *mean*.



Same total both ways: $18 + 25 + 22 + 30 + 25 = 120$ loaves, shared equally over 5 days = 24 a day (made-up data)

Bar chart of loaves sold each morning as sold, next to the same total levelled out to 24 loaves every day

The bakery’s mean is 24 loaves a day. Notice two things. First, the mean did not need any day to actually be 24 — the mean does not have to be one of the values in the data. Second, the mean is a fair share: on the good days the shop sells more than 24, on the quiet days less, and it all balances out.

Refresher: adding and subtracting decimals. Means need a good total, and totals need careful adding. Line the decimal points up in columns, and fill empty places with zeros so every number has the same number of decimal places. Then add or subtract as if they were whole numbers, and put the decimal point in the same place in the answer: $4.5 + 3.25 + 6 = 4.50 + 3.25 + 6.00 = 13.75$, and $9.25 - 4.50 = 4.75$.

Refresher: division that gives a decimal answer. A mean rarely lands on a whole number, so the division often leaves a decimal answer. Keep going past the decimal point, adding zeros to the number being divided until the division finishes or you have one extra digit than you need: $63 \div 5 = 12.6$. Check by going backwards: $12.6 \times 5 = 63$. A calculator does this division for you if you prefer.

Refresher: rounding to decimal places. One decimal place (1 d.p.) means one digit after the decimal point; two decimal places (2 d.p.) means two. Look at the digit one place further out than you want. If it is 5 or more, round the last kept digit up. If it is 4 or less, leave the last kept digit alone and drop the rest: 12.648 is 12.6 to 1 d.p. and 12.65 to 2 d.p. Exactly halfway rounds up, the same rule as §1C: 9.75 is 9.8 to 1 d.p., and 7.5 is 8 to the nearest whole number. Whenever this section asks for a rounded answer, it tells you the place to round to.

A quick check on any mean. The mean is a share of the values, so it can never sit below the lowest value or above the highest value. It always lands somewhere in between. After you find a mean, glance at your lowest and highest values: if the mean is not between them, the total or the count went wrong somewhere, so re-do it. For the bakery, $18 \leq 24 \leq 30$ — the mean passes the check.

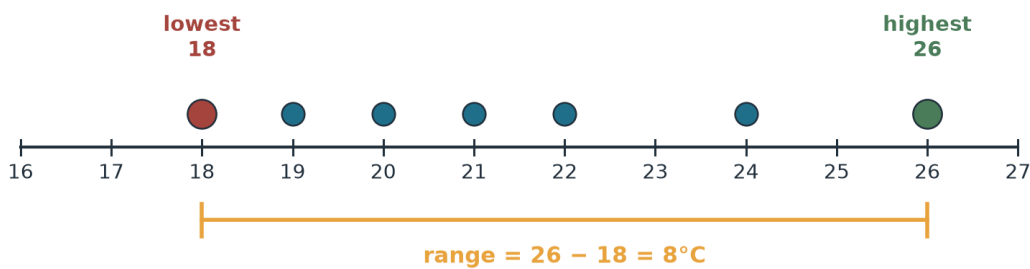
The range: how spread out. The **range** is the gap from the lowest value to the highest value. The highest value is also called the *maximum* and the lowest value is also called the *minimum*. Sort the values from lowest to highest first, so the two ends are easy to see.

$$\text{range} = \text{highest value} - \text{lowest value}$$

The range measures *spread* — how far apart the values are. A small range means the values sit close together. A large range means they are spread out a long way. The range carries the same units as the data: if the data is in dollars, the range is in dollars.

Refresher: ordering decimals, to find the highest and lowest. Compare decimals digit by digit from the left. If one number runs out of digits, fill the empty places with zeros first, so 12.5 becomes 12.50 and you can see that $12.45 < 12.50$. Sorting a whole list works the same way: pick the lowest, then the next lowest, and so on. For example 4.07, 4.7 and 3.98 sort to 3.98, 4.07, 4.70 — so the lowest is 3.98 and the highest is 4.70.

Highest temperature each day of one week (°C) — made-up data

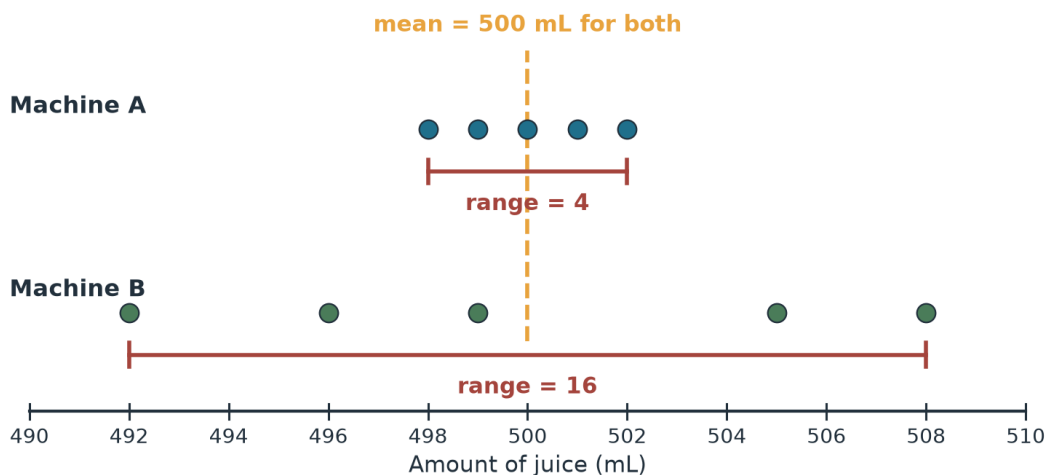


Number line of the highest temperature each day of one week, from 18 to 26 degrees, with the range marked as the gap from lowest to highest

For this week of temperatures, the range is $26 - 18 = 8^{\circ}\text{C}$. The week moved across 8 degrees from its coolest day to its hottest day. That is all the range is telling you: the size of that gap.

The mean and the range work as a pair. On their own, each number hides half the story. The mean says nothing about spread, and the range says nothing about what is typical. Report them together and the data set starts to make sense.

Two juice-filling machines — amount in each 500 mL bottle (made-up data)



Two dot plots, Machine A and Machine B, both centred on a mean of 500 mL, with Machine A's values close together (range 4) and Machine B's values spread out (range 16)

Both juice machines put in a mean of 500 mL, so the mean cannot tell them apart. The range can. Machine A's range is 4 mL: every bottle is close to the label. Machine B's range is 16 mL: some bottles are well over and some well under. We say Machine A is more **consistent** — it keeps closer to the same result every time. When two data sets have similar means, the one with the smaller range is the more consistent one.

Question you want to answer	Measure to use
How much, or how many, in a typical case?	the mean
How much do the values change, from lowest to highest?	the range
Which of two data sets is more consistent?	the range, after checking the means

Two numbers that sum up any data set

Find the mean

1. Add up all the values.
2. Count the values.
3. mean = total ÷ count

“How much, typically?”

Find the range

1. Sort the values, lowest → highest.
2. range = highest – lowest

“How spread out?”

Check: the mean always sits between the lowest value and the highest value — if it doesn't, re-do the sum.

Two step cards: find the mean (add, count, divide) and find the range (sort, subtract), with a check that the mean sits between the lowest and highest value

The mean from a frequency table. Data often arrives already counted up in a table. The *frequency* of a value is how many times that value came up. A frequency table has one row per value, so the total is not just adding the value column — each value has to be counted as many times as its frequency says.

Refresher: multiplication as repeated addition. Adding the same number again and again is multiplication: $4 + 4 + 4 = 3 \times 4 = 12$. In a frequency table, value $\times$ frequency gives the row total in one step.

A team's goals in 10 games of one season:

Goals in a game	Frequency (games)	Row total (goals)
0	2	$0 \times 2 = 0$
1	3	$1 \times 3 = 3$
2	3	$2 \times 3 = 6$
3	1	$3 \times 1 = 3$
4	1	$4 \times 1 = 4$
Total	10	16

Made-up data: the games and every number in this table are made up for this section.

The count of values is the frequency total, 10 games. The total of all the values is the row-total column added up, 16 goals. So the mean is $16 \div 10 = 1.6$ goals a game. For the range, use the *value* column only — the goals actually scored — never the row totals: highest 4, lowest 0, range $4 - 0 = 4$ goals.

Technology. A calculator finds a mean in two presses: add the values, then divide by the count. A spreadsheet does it in one cell each: `=AVERAGE (B2 : B6)` gives the mean of the cells B2 to B6, `=MAX (B2 : B6)` gives the highest value and `=MIN (B2 : B6)` the lowest, so `=MAX (B2 : B6) - MIN (B2 : B6)` gives the range. Worth knowing, and worth checking a spreadsheet's answer against your own working now and then. Nothing in this section needs a device — pen, paper and the two formulas are enough.

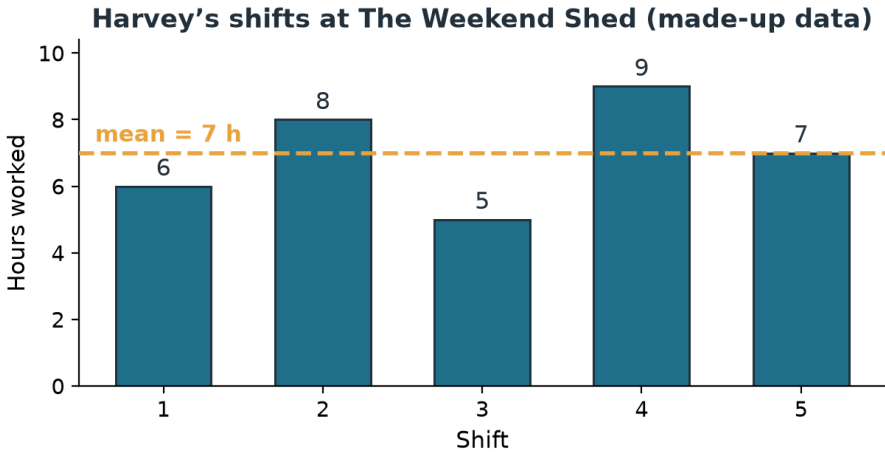
About the data in this section. The sales, times, wages, temperatures and scores here are **made up** (not real): pretend businesses, pretend people and pretend numbers, built for this book so you can practise the maths. Nothing here is real data about a real business, person or place.

Worked examples

Example 1 — scaffolded

Harvey writes down the hours he worked on his last 5 shifts at The Weekend Shed: 6, 8, 5, 9 and 7 hours. Find the mean and the range of his shift lengths.

Working	Comment
Total: $6 + 8 + 5 + 9 + 7 = 35$ h	Add up all the values.
Count: 5 shifts	Count how many values there are.
Mean: $35 \div 5 = 7$ h	mean = total $\div$ count.
Sorted: 5, 6, 7, 8, 9	Sort lowest to highest to see the ends.
Range: $9 - 5 = 4$ h	range = highest – lowest.
Check: $5 \leq 7 \leq 9$ ✓	The mean sits between lowest and highest.



Bar chart of Harvey's five shifts in hours with the mean line at 7 hours

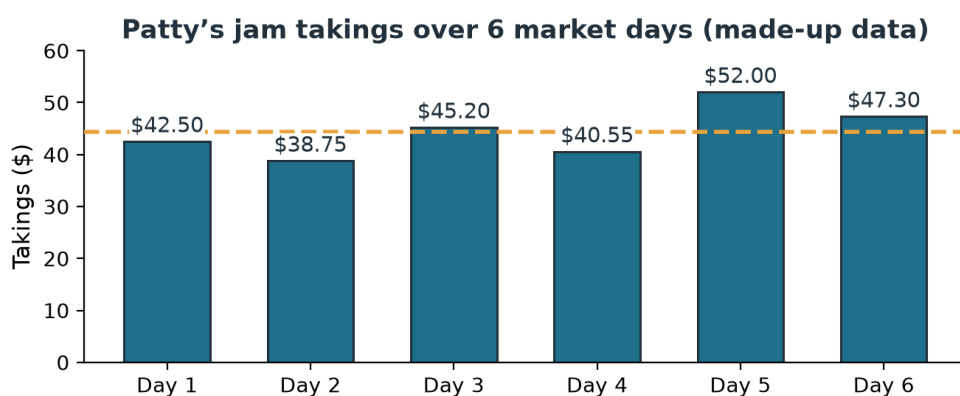
Harvey's shifts average 7 hours, and they vary by up to 4 hours from his shortest shift to his longest.

Example 2 — scaffolded

Patty sells jam at the Corner Crate market stall. Her takings over 6 market days were \$ 42.50, \$ 38.75, \$ 45.20, \$ 40.55, \$ 52.00 and \$ 47.30. Find the mean daily takings to the nearest cent, and the range of the takings.

Working	Comment
Total: $42.50 + 38.75 + 45.20 + 40.55 + 52.00 + 47.30 = \$ 266.3$	Decimal points lined up in columns.
Count: 6 market days	Count the values.
Mean: $266.30 \div 6 = 44.3833 \dots$	This one does not finish neatly.
Mean $\approx \$ 44.38$	Round to the nearest cent, as the question asks.
Sorted: 38.75, 40.55, 42.50, 45.20, 47.30, 52.00	Sort to find the two ends.
Range: $52.00 - 38.75 = \$ 13.25$	range = highest – lowest.
Check: $38.75 \leq 44.38 \leq 52.00$ ✓	The mean sits between lowest and highest.

dashed line = mean = \$44.38 (to the nearest cent)



Bar chart of Patty's takings over six market days with the mean line at 44 dollars 38

Patty's mean takings are \$44.38 a market day (to the nearest cent), and the takings range across \$13.25 from her quietest day to her best day.

Example 3 — unscaffolded

Colm collects the eggs from his hens each morning for 14 days. The table shows how many mornings each count came up. Find the mean number of eggs per day to 1 decimal place, and the range.

Eggs in a day	Frequency (days)
4	3
5	5
6	4
7	2

Made-up data: the days and every number in this table are made up for this section.

Row totals: $4 \times 3 = 12$, $5 \times 5 = 25$, $6 \times 4 = 24$, $7 \times 2 = 14$.

Total eggs: $12 + 25 + 24 + 14 = 75$. Count of days: $3 + 5 + 4 + 2 = 14$.

Mean: $75 \div 14 = 5.357 \dots \approx 5.4$ eggs a day, to 1 decimal place.

Range: highest 7, lowest 4, so $7 - 4 = 3$ eggs.

$\therefore$ the mean is 5.4 eggs per day (to 1 d.p.) and the range is 3 eggs. No day produced 5.4 eggs — a mean can be a decimal even when every value in the data is a whole number.

Example 4 — unscaffolded

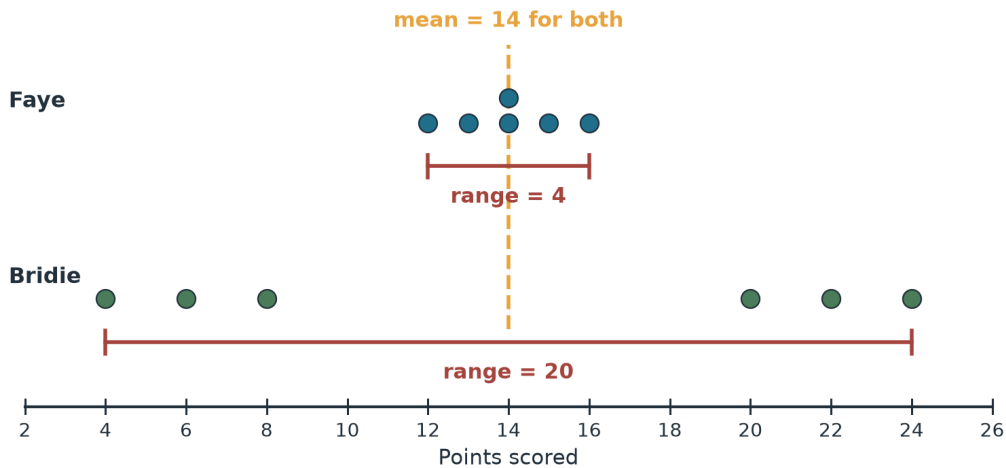
Faye and Bridie each play 6 rounds of netball. Faye scores 12, 16, 14, 13, 15 and 14 points. Bridie scores 4, 22, 8, 20, 6 and 24 points. Each claims to be the more consistent scorer. Use the mean and the range to comment on their claims.

Faye: total $12 + 16 + 14 + 13 + 15 + 14 = 84$, so mean $84 \div 6 = 14$ points a round. Sorted: 12, 13, 14, 14, 15, 16, so range $16 - 12 = 4$ points.

Bridie: total $4 + 22 + 8 + 20 + 6 + 24 = 84$, so mean $84 \div 6 = 14$ points a round. Sorted: 4, 6, 8, 20, 22, 24, so range $24 - 4 = 20$ points.

$\therefore$ both players average 14 points a round, but Faye's range is 4 points against Bridie's 20 points, so Faye is the more consistent scorer: her scores stay close to 14 every round while Bridie's swing from 4 to 24.

Faye and Bridie — points scored in each of 6 netball rounds (made-up data)



Two dot plots of Faye's and Bridie's points per round, both with mean 14, Faye's values close together (range 4) and Bridie's spread out (range 20)

Practice questions

Scaffolded

Q1. Find the mean of each data set.

- (a) 4, 7, 9, 8, 2
- (b) 12, 15, 18
- (c) 5, 9, 11, 13, 7, 9

Q2. For each data set, write down the lowest value, the highest value and the range.

- (a) 3, 11, 7, 15, 9
- (b) 20, 14, 27, 18
- (c) 6, 6, 9, 3, 12, 8

Q3. Alec delivers flyers on foot. Over 5 days he covers 8, 11, 9, 12 and 10 streets.

- (a) Find the total number of streets covered.
- (b) Find the mean number of streets per day.
- (c) Find the range of the number of streets.

Q4. Franky times himself on a practice circuit, in seconds: 46.2, 45.8, 47.5, 46.9 and 45.3.

- (a) Sort the times from fastest (lowest) to slowest (highest).
- (b) Find the range of the times, in seconds.
- (c) Find the mean lap time, in seconds.

Q5. Wanda's ice-cream van takes \$86.40, \$91.25 and \$78.90 on its first 3 days of a weekend festival.

- (a) Find the total takings for the 3 days.
- (b) Find the mean daily takings, to the nearest cent.
- (c) Find the range of the daily takings.

Q6. Patty counts the dogs she passes on her walk, every day for 10 days.

Dogs passed	Frequency (days)
1	2
2	3
3	3
4	2

Made-up data: the days and every number in this table are made up for this section.

- How many days are in the data set?
- Find the total number of dogs passed, using $\text{value} \times \text{frequency}$ for each row.
- Find the mean number of dogs per walk, and the range.

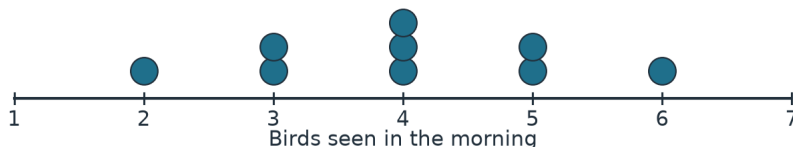
Unscaffolded

Q7. Sunnyhill Soccer Club scores 2, 0, 3, 1, 2, 4, 1 and 3 goals in its first 8 games of the season. Find the mean number of goals per game, and the range.

Q8. Colm's apprentice wage over 6 weeks is \$612.40, \$589.25, \$634.80, \$601.55, \$578.90 and \$625.35. Find his mean weekly wage, to the nearest cent, and the range of the weekly wages.

Q9. Bridie counts the birds at her birdbath each morning for 9 mornings. The dot plot shows her counts. Find the mean and the range of birds per morning.

Birds at Bridie's birdbath, counted each morning (made-up data)



Dot plot of birds seen at Bridie's birdbath each morning: values 2, 3, 3, 4, 4, 4, 5, 5, 6

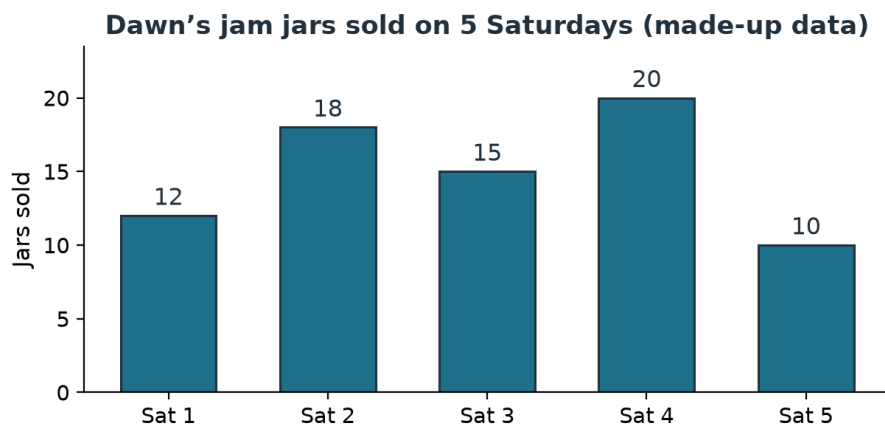
Q10. Harvey counts the customers who come in per hour at The Weekend Shed, over 15 hours.

Customers in the hour	Frequency (hours)
0	1
1	2
2	4
3	5
4	2
5	1

Made-up data: the hours and every number in this table are made up for this section.

Find the mean number of customers per hour, to 1 decimal place, and the range.

Q11. Dawn sells her jam at the Saturday market. The bar chart shows the jars she sold on 5 Saturdays. Find the mean number of jars per Saturday, and the range.

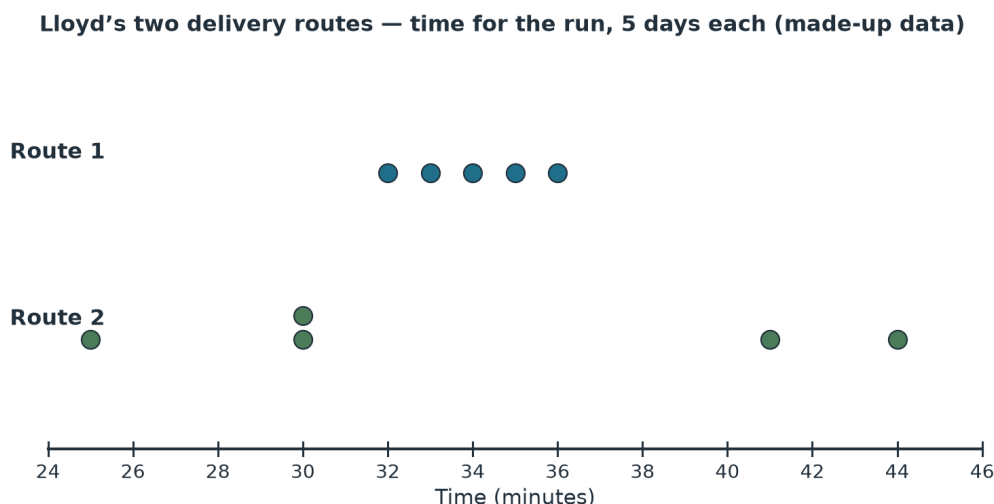


Bar chart of jars of jam Dawn sold on five Saturdays: 12, 18, 15, 20, 10

Q12. The Corner Crate shop is open for 7 hours one day, and the mean number of customers per hour for the day is 12.

- Find the total number of customers for the day.
- The counts for the first six hours are 9, 14, 11, 13, 10 and 15. Find the count for the seventh hour.

Q13. Lloyd drives two different delivery routes, and times himself on each for 5 days. The dot plots show his times in minutes.



Two dot plots of Lloyd's delivery times in minutes: Route 1 values 32, 33, 34, 35, 36 and Route 2 values 25, 30, 30, 41, 44

- Find the mean time for each route.
- Find the range of the times for each route.
- Lloyd wants the route with the more predictable times. Which route should he choose? Use your answers to give a reason.

Q14. Two plots at the Sunnyhill community garden grow tomatoes. The kilograms picked each week for 5 weeks are: Plot 1: 3.2, 4.1, 3.8, 4.5, 3.9; Plot 2: 2.6, 5.0, 3.1, 4.7, 2.1.

- Find the mean weekly pick for each plot, in kilograms.
- Which plot grew more on average?
- Find the range for each plot, and say which plot was the more consistent grower.

Q15. Say whether the **mean** or the **range** best answers each question, and explain in half a sentence.

- (a) What is a typical shift length at the café?
- (b) How much did the daily takings change across the week?
- (c) Of two netball shooters, which one is more consistent?
- (d) A café sells a mean of 40 coffees a day. About how many coffees does it sell in 6 days? Find the number.

Q16. For homework, Colm finds the mean of the quiz scores 5, 8, 4, 7 and 6, and writes down a mean of 30.

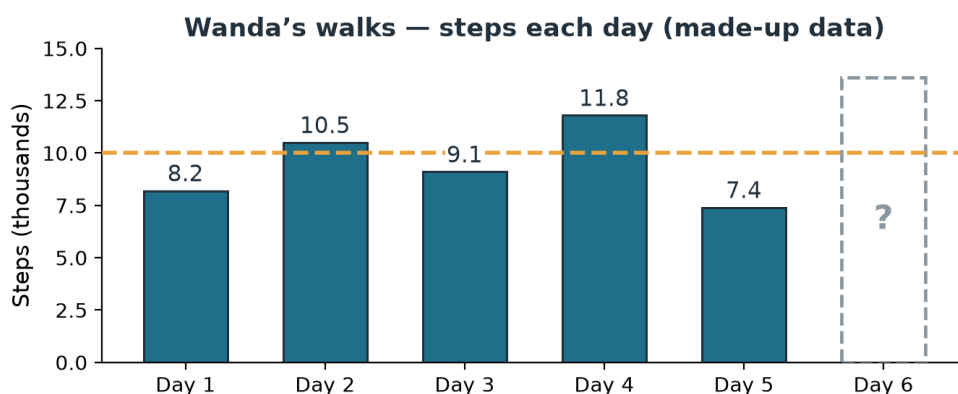
- (a) Without calculating the mean, explain how you can see that 30 cannot be right.
- (b) Find the correct mean.
- (c) Suggest the slip Colm most likely made.

Q17. Dawn records the highest temperature in her greenhouse each day for 7 days, in °C: 19.4, 21.8, 24.3, 26.1, 18.9, 22.5 and 23.6.

- (a) Find the mean of the temperatures, to the nearest whole number of degrees.
- (b) Find the range of the temperatures.
- (c) Check that your rounded mean sits between the lowest and the highest temperature.

Q18. Wanda's phone counts her steps each day, in thousands: 8.2, 10.5, 9.1, 11.8 and 7.4 over 5 days.

dashed line = Wanda's goal: a mean of 10 thousand steps a day



Bar chart of Wanda's steps each day in thousands for five days, with an empty dashed bar marked with a question mark for day 6 and a goal line at 10

- (a) Find the mean number of steps per day, in thousands.
- (b) Find the range of the daily steps, in thousands.
- (c) Wanda wants a mean of 10 thousand steps a day over 6 days. How many thousand steps does she need on day 6?

Answers

Q1. (a) 6 (b) 15 (c) 9

Q2. (a) lowest 3, highest 15, range 12 (b) lowest 14, highest 27, range 13 (c) lowest 3, highest 12, range 9

Q3. (a) 50 streets (b) 10 streets per day (c) 4 streets

Q4. (a) 45.3, 45.8, 46.2, 46.9, 47.5 (b) 2.2 s (c) 46.34 s

Q5. (a) \$256.55 (b) \$85.52 (to the nearest cent) (c) \$12.35

Q6. (a) 10 days (b) 25 dogs (c) mean 2.5 dogs per walk, range 3 dogs

Q7. mean 2 goals per game, range 4 goals

Q8. mean \$607.04 per week (to the nearest cent), range \$55.90

Q9. mean 4 birds per morning, range 4 birds

Q10. mean 2.5 customers per hour (to 1 d.p.), range 5 customers

Q11. mean 15 jars per Saturday, range 10 jars

Q12. (a) 84 customers (b) 12 customers

Q13. (a) Route 1: 34 min; Route 2: 34 min (b) Route 1: 4 min; Route 2: 19 min (c) Route 1 — the means are equal and Route 1's range is much smaller, so its times are more predictable

Q14. (a) Plot 1: 3.9 kg; Plot 2: 3.5 kg (b) Plot 1 (c) Plot 1: 1.3 kg; Plot 2: 2.9 kg; Plot 1 is the more consistent grower

Q15. (a) mean (b) range (c) range (d) mean; $40 \times 6 = 240$ coffees

Q16. (a) a mean must sit between the lowest score (4) and the highest score (8), and 30 is above every score (b) 6 (c) he wrote down the total ($5 + 8 + 4 + 7 + 6 = 30$) and forgot to divide by the count of 5

Q17. (a) 22°C (to the nearest whole number) (b) 7.2°C (c) yes: $18.9 \leq 22 \leq 26.1$

Q18. (a) 9.4 thousand steps (b) 4.4 thousand steps (c) 13.0 thousand steps

Fully-worked solutions

Q1. (a) Total $4 + 7 + 9 + 8 + 2 = 30$; count 5; mean $30 \div 5 = 6$. (b) Total $12 + 15 + 18 = 45$; count 3; mean $45 \div 3 = 15$. (c) Total $5 + 9 + 11 + 13 + 7 + 9 = 54$; count 6; mean $54 \div 6 = 9$.

Q2. Sort each set, then subtract lowest from highest. (a) 3, 7, 9, 11, 15: range $15 - 3 = 12$. (b) 14, 18, 20, 27: range $27 - 14 = 13$. (c) 3, 6, 6, 8, 9, 12: range $12 - 3 = 9$.

Q3. (a) $8 + 11 + 9 + 12 + 10 = 50$ streets. (b) Mean $50 \div 5 = 10$ streets per day. (c) Sorted: 8, 9, 10, 11, 12; range $12 - 8 = 4$ streets. Check: $8 \leq 10 \leq 12$ ✓.

Q4. (a) 45.3, 45.8, 46.2, 46.9, 47.5 s. (b) Range $47.5 - 45.3 = 2.2$ s. (c) Total $46.2 + 45.8 + 47.5 + 46.9 + 45.3 = 231.7$ s; mean $231.7 \div 5 = 46.34$ s (this division finishes exactly, so no rounding is needed).

Q5. (a) $86.40 + 91.25 + 78.90 = \$256.55$. (b) Mean $256.55 \div 3 = 85.5166... \approx \$85.52$ to the nearest cent. (c) Range $91.25 - 78.90 = \$12.35$. Check: $78.90 \leq 85.52 \leq 91.25$ ✓.

Q6. (a) Frequency total: $2 + 3 + 3 + 2 = 10$ days. (b) Row totals $1 \times 2 = 2$, $2 \times 3 = 6$, $3 \times 3 = 9$, $4 \times 2 = 8$; total $2 + 6 + 9 + 8 = 25$ dogs. (c) Mean $25 \div 10 = 2.5$ dogs per walk; range from the value column: $4 - 1 = 3$ dogs.

Q7. Total $2+0+3+1+2+4+1+3=16$ goals; count 8 games; mean $16 \div 8 = 2$ goals a game. Sorted: 0, 1, 1, 2, 2, 3, 3, 4; range $4 - 0 = 4$ goals.

Q8. Total $612.40 + 589.25 + 634.80 + 601.55 + 578.90 + 625.35 = \$3642.25$. Mean $3642.25 \div 6 = 607.0416... \approx \$607.04$ to the nearest cent. Sorted ends: lowest \$578.90, highest \$634.80; range $634.80 - 578.90 = \$55.90$. Check: $578.90 \leq 607.04 \leq 634.80$ ✓.

Q9. Read the dots: 2, 3, 3, 4, 4, 4, 5, 5, 6. Total 36; count 9 mornings; mean $36 \div 9 = 4$ birds a morning. Range $6 - 2 = 4$ birds.

Q10. Count of hours: $1+2+4+5+2+1=15$. Row totals: 0, 2, 8, 15, 8, 5; total customers $0+2+8+15+8+5=38$. Mean $38 \div 15 = 2.5333... \approx 2.5$ customers an hour to 1 d.p. Range from the value column: $5 - 0 = 5$ customers.

Q11. Read the bars: 12, 18, 15, 20, 10 jars. Total 75; count 5 Saturdays; mean $75 \div 5 = 15$ jars a Saturday. Range $20 - 10 = 10$ jars.

Q12. (a) mean $\times$ count = total: $12 \times 7 = 84$ customers. (b) First six hours total $9 + 14 + 11 + 13 + 10 + 15 = 72$; seventh hour $84 - 72 = 12$ customers.

Q13. (a) Route 1 total $32 + 35 + 33 + 34 + 36 = 170$; mean $170 \div 5 = 34$ min. Route 2 total $25 + 44 + 30 + 41 + 30 = 170$; mean $170 \div 5 = 34$ min. (b) Route 1 sorted 32, 33, 34, 35, 36: range $36 - 32 = 4$ min. Route 2 sorted 25, 30, 30, 41, 44: range $44 - 25 = 19$ min. (c) Route 1. Both routes average 34 min, but Route 1's range of 4 min is far smaller than Route 2's 19 min, so Route 1's times stay close to the mean and are the more predictable.

Q14. (a) Plot 1 total $3.2 + 4.1 + 3.8 + 4.5 + 3.9 = 19.5$ kg; mean $19.5 \div 5 = 3.9$ kg. Plot 2 total $2.6 + 5.0 + 3.1 + 4.7 + 2.1 = 17.5$ kg; mean $17.5 \div 5 = 3.5$ kg. (b) Plot 1, because $3.9 > 3.5$. (c) Plot 1 sorted 3.2, 3.8, 3.9, 4.1, 4.5: range $4.5 - 3.2 = 1.3$ kg. Plot 2 sorted 2.1, 2.6, 3.1, 4.7, 5.0: range $5.0 - 2.1 = 2.9$ kg. Plot 1 is the more consistent grower — the smaller range means its weekly pick stays closer to the same amount.

Q15. (a) The mean — “typical” is exactly what the mean measures. (b) The range — change from lowest to highest is the range. (c) The range — consistency is about spread, and the smaller range is the more consistent shooter. (d) The mean — total = mean $\times$ count: $40 \times 6 = 240$ coffees.

Q16. (a) A mean is a share of the values, so it must sit between the lowest score (4) and the highest score (8). 30 is bigger than every score in the set, so it cannot be the mean. (b) Total $5 + 8 + 4 + 7 + 6 = 30$; count 5; mean $30 \div 5 = 6$. Check: $4 \leq 6 \leq 8$ ✓. (c) Colm stopped at the total. His 30 is the sum of the scores — he forgot the divide-by-the-count step.

Q17. (a) Total $19.4 + 21.8 + 24.3 + 26.1 + 18.9 + 22.5 + 23.6 = 156.6$; mean $156.6 \div 7 = 22.3714... \approx 22^\circ\text{C}$ to the nearest whole number. (b) Sorted ends: lowest 18.9, highest 26.1; range $26.1 - 18.9 = 7.2^\circ\text{C}$. (c) $18.9 \leq 22 \leq 26.1$, so the rounded mean passes the check.

Q18. (a) Total $8.2 + 10.5 + 9.1 + 11.8 + 7.4 = 47.0$ thousand; mean $47.0 \div 5 = 9.4$ thousand steps a day. (b) Range $11.8 - 7.4 = 4.4$ thousand steps. (c) A mean of 10 thousand over 6 days needs a total of $10 \times 6 = 60.0$ thousand; the first 5 days give 47.0 thousand, so day 6 needs $60.0 - 47.0 = 13.0$ thousand steps.

Chapter 3 Data — 3D Reading data: key facts, patterns and trends

Theory

About the data in this section. The tables, graphs and numbers here are **made up** (not real): pretend shops, pretend people and pretend numbers, built for this book so you can practise the maths. Nothing here is real data about a real business, person or place.

The last job with data. Section 3A collected data, 3B displayed it, and 3C summed it up with the mean and the range. This section does the job all of that was for: **reading** the data. In the study design (Unit 2, Area of Study 6), the key knowledge for this section is how to interpret and describe simple, familiar data and the tables and graphs that show it. The key skills are picking out the key facts from a table or a graph, reading what the results say, and describing the overall patterns and trends.

Source: VCAA, VCE Vocational Major Numeracy Study Design, retrieved 2026-10-09.

To **interpret** data means to say what the numbers show about the real situation — not just “saturday is 52”, but “Saturday is the busiest day, so the shop needs extra staff then”. To **describe** a data set means to tell its story in one or two sentences. Both skills start with the same thing: pulling out the **key facts**.

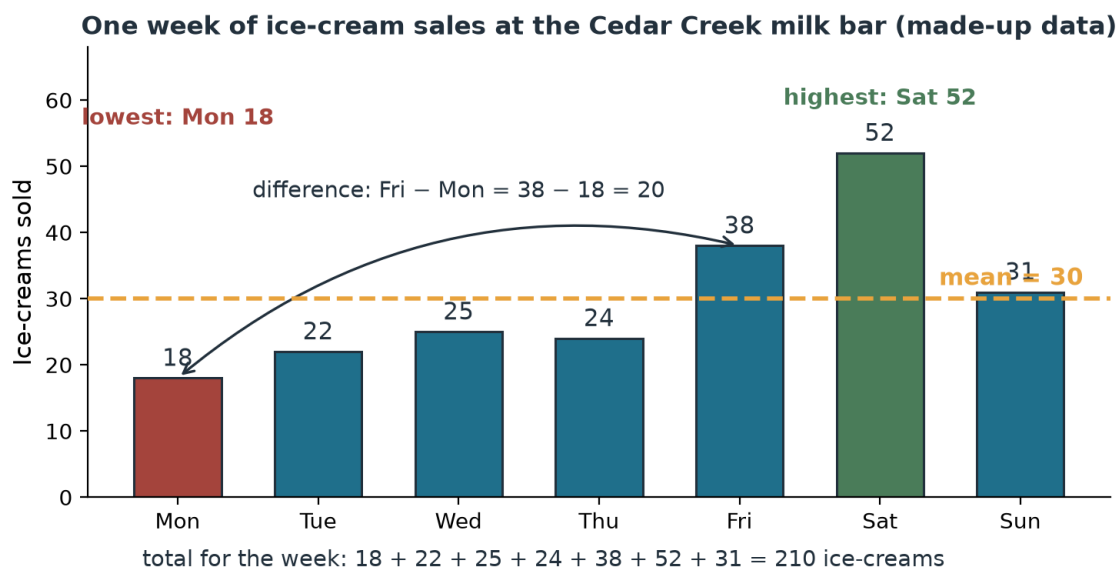
The five key facts. Almost every question about a table or a graph asks for one of these five facts.

Key fact	The question it answers	Words that signal it
Highest value	What is the most, the biggest, the best day?	most, highest, maximum, peak
Lowest value	What is the least, the smallest, the quietest day?	least, lowest, minimum, quietest
Total	How many altogether?	total, altogether, in all
Difference	How many more (or fewer, or less)?	how many more, gap, compared with
Look-up	What is the value for this one day, person or item?	on Tuesday, for juice, in week 3

Here is one week of ice-cream sales at the Cedar Creek milk bar, with the key facts marked.

Day	Ice-creams sold
Monday	18
Tuesday	22
Wednesday	25
Thursday	24
Friday	38
Saturday	52
Sunday	31

Made-up data: the days and every number in this table are made up for this section.



Bar chart of ice-creams sold each day at the Cedar Creek milk bar, with the highest bar (Saturday 52), the lowest bar (Monday 18) and the mean line at 30 marked

The key facts for this week: the **highest** is Saturday with 52 ice-creams; the **lowest** is Monday with 18; the **total** is 210 ice-creams for the week; the **difference** between Friday and Monday is $38 - 18 = 20$ ice-creams; and a **look-up** says Thursday sold 24.

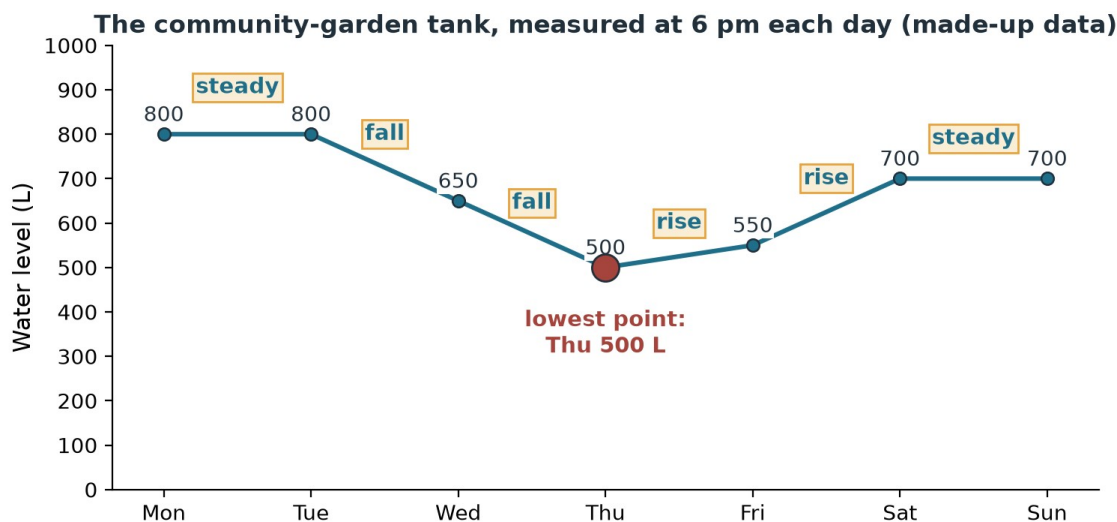
Refresher: mean and range. Reading a data set often uses the two numbers from §3C. The **mean** is the typical value: $\text{mean} = \text{total} \div \text{count}$. The **range** is the spread: $\text{range} = \text{highest value} - \text{lowest value}$. Quick demo on the list 4, 6, 5, 9, 6: total $4 + 6 + 5 + 9 + 6 = 30$, count 5, so the mean is $30 \div 5 = 6$; highest 9, lowest 4, so the range is $9 - 4 = 5$. For the milk bar week: mean $210 \div 7 = 30$ ice-creams a day, range $52 - 18 = 34$ ice-creams. On the chart, the dashed line at 30 is the mean: Friday (38), Saturday (52) and Sunday (31) sit **above the mean** — 3 days of the 7 — and the other 4 days sit below it.

Reading a table. A table hides its facts in cells, so read it with two moves: find the right **row** (run your finger down the row labels), then find the right **column** (run your finger across the column labels). The cell where they meet is your value. When a table has a column for each of two shops, two weeks or two days, you compare by reading the same row twice, then subtracting.

Patterns and trends on a line graph. A line graph joins points in time order, so its shape tells you how the values moved. A **trend** is the general direction of the values; a **pattern** is the whole story of the shape, dips and all. The words you need:

What the line does	What the values do	Words to use
goes up	the values get bigger	rise, increase, grow
goes down	the values get smaller	fall, decrease, drop
stays flat	the values stay the same	steady, no change, flat
reaches its top point	the biggest value	the peak
reaches its bottom point	the smallest value	the lowest point

The tank at the Cedar Creek community garden is measured at 6 pm every day. The line graph shows the water level through one week.



Line graph of the water level in the Cedar Creek community garden tank over one week, with each section labelled rise, fall or steady, and the lowest point marked at 500 litres on Thursday

Read the shape section by section: Monday to Tuesday the level is **steady** at 800 L; Tuesday to Thursday it **falls** to the **lowest point**, 500 L on Thursday; then it **rises** back to 700 L and is **steady** again over the weekend. The story makes sense in the real world: the garden used water on the hot middle days, and rain refilled the tank on Friday and Saturday.

Refresher: rises, falls and the minus sign. The change between two values is later value – earlier value. A positive answer means a rise; an answer with a minus sign in front means a fall. The minus sign, –, is read “negative”: $90 - 95 = -5$ is read “negative five” and means *a fall of 5*. For the tank, Thursday to Friday is $550 - 500 = +50$ L (a rise of 50 L), and Wednesday to Thursday is $500 - 650 = -150$ L (a fall of 150 L). Notice that a fall does not mean the values went negative — the tank still held 500 L. The *change* carries the minus sign, not the level.

Refresher: per cent shares of a whole. A pie chart splits one whole into shares, and each share is a **per cent** — a number out of 100. The whole circle is always 100 %. Four shares do most of the work: **50%** is one half, **25%** is one quarter, **10%** is the total divided by 10, and **5%** is half of 10 %. Build the others from these: $15\% = 10\% + 5\%$, and $60\% = 6 \times 10\%$. To turn a share into a count, find that share of the total. For 200 loans: 10 % of 200 is $200 \div 10 = 20$ loans; 25 % of 200 is $200 \div 4 = 50$ loans; 15 % of 200 is $20 + 10 = 30$ loans.

Describing a data set in two sentences. This is the skill the key skills ask for. A good description fits in two sentences and uses numbers from the data itself.

Sentence	Say this	Using these facts
1	what is typical, and how much the values spread	the mean and the range
2	what stands out	the highest, the lowest, or the trend

Model description for the milk bar week: *The milk bar sells a mean of 30 ice-creams a day, with a range of 34. Sales are highest on Saturday (52) and lowest on Monday (18), and the weekend is clearly the busy time.* Two sentences, four numbers, the whole story.

Three checks before you read any graph. They take ten seconds and stop most mistakes.

1. Read the **title** — what was counted, and over what?
2. Read the **axis labels** — what does each axis hold, and in what unit?
3. Read the **scale** — what is the step from one gridline to the next? A point between two gridlines takes the halfway number (§3B).

Technology. Phone apps and spreadsheets draw these graphs for you in seconds, and a spreadsheet finds the mean with `=AVERAGE ( . . . )`. The machine draws; **you** read. The key facts, the trend and the two-sentence description are

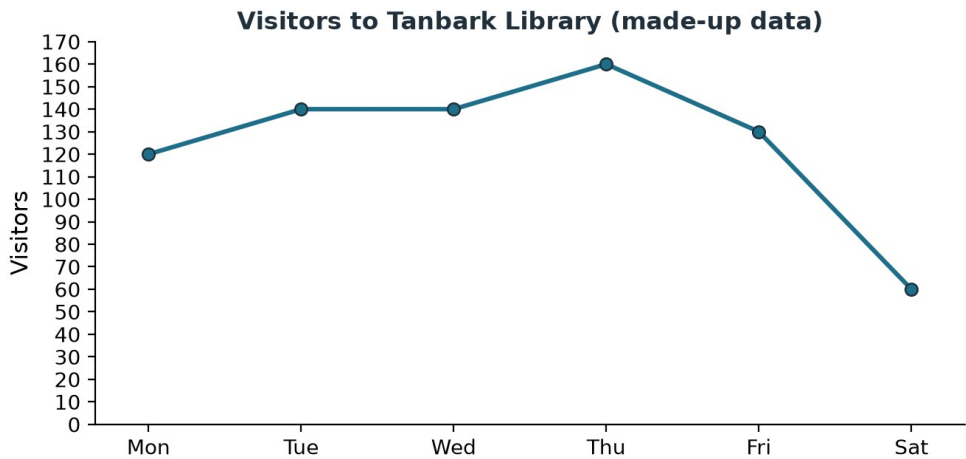
the parts no app writes for you — and every question in this section can be done with pen, paper and a basic calculator.

Units 3 and 4 preview: later units describe data with more statistics and finer graphs. This section stays with key facts, patterns and trends using the mean and the range.

Worked examples

Example 1 — scaffolded

The line graph shows the visitors to Tanbark Library on each of six days.



Line graph of visitors to Tanbark Library from Monday to Saturday: 120, 140, 140, 160, 130, 60

Made-up data: this line graph is drawn for this book.

- (a) How many visitors came on Thursday? Which day was the quietest?
- (b) Find the change in visitors from Thursday to Friday. Did they rise or fall?
- (c) Describe the trend from Monday to Wednesday.
- (d) Find the mean number of visitors per day.

Working

Thursday: 160 visitors

Quietest: Saturday, 60 visitors

$130 - 160 = -30$

Visitors fell by 30

Monday to Tuesday: $140 - 120 = +20$, a rise

Tuesday to Wednesday: $140 - 140 = 0$, steady

Trend: rose by 20, then stayed steady

Total: $120 + 140 + 140 + 160 + 130 + 60 = 750$

Mean: $750 \div 6 = 125$ visitors a day

Comment

(a) Look-up: find Thursday on the bottom axis, read the point.

(a) The lowest point on the line.

(b) change = later – earlier.

(b) The minus sign means a fall.

(c) Check each section of the line.

(c) The flat section is “steady”.

(c) Say it in words, with the number.

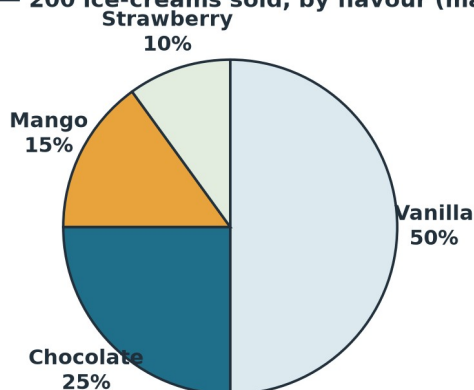
(d) Add all six values.

(d) mean = total $\div$ count.

Example 2 — scaffolded

Wanda's ice-cream van sold 200 ice-creams last month. The pie chart shows the split by flavour.

Wanda's van — 200 ice-creams sold, by flavour (made-up data)



Pie chart of Wanda's 200 ice-creams by flavour: vanilla 50 per cent, chocolate 25 per cent, mango 15 per cent, strawberry 10 per cent

Made-up data: this pie chart is drawn for this book.

- (a) Which flavour has the biggest share?
- (b) How many strawberry ice-creams sold?
- (c) How many mango ice-creams sold?

Working

Vanilla, at 50 %
Strawberry is 10 % of 200
 $200 \div 10 = 20$ ice-creams
Mango is 15 % = 10 % + 5 %
10 % of 200 is 20; 5 % is half of that, 10
 $20 + 10 = 30$ ice-creams
Check: $100 + 50 + 30 + 20 = 200$ ✓

Comment

(a) The biggest slice is half the circle.
(b) 10 % means “divide by 10”.
(b) Share to count: find 10 % of the total.
(c) Build 15 % from shares you know.
(c) Find each part.
(c) Add the parts.
The counts must add back to the total.

The check line uses 50 % of 200 = 100 vanilla and 25 % of 200 = 50 chocolate. Every count adds back to 200, so the reading is right.

Example 3 — unscaffolded

The table shows the pies the Cedar Creek milk bar sold at lunchtime in two different weeks.

Day	Week 1	Week 2
Monday	20	24
Tuesday	25	26
Wednesday	18	21
Thursday	30	28
Friday	22	26

Made-up data: the days and every number in this table are made up for this section.

- (a) Show that the week 1 total is 115 pies and the week 2 total is 125 pies.
- (b) Find the mean number of pies per day for each week.

(c) Describe the pattern between the two weeks, and say which week was the more consistent seller.

Week 1 total, one step per line:

$$20 + 25 = 45$$

$$45 + 18 = 63$$

$$63 + 30 = 93$$

$$93 + 22 = 115$$

Week 2 total, one step per line:

$$24 + 26 = 50$$

$$50 + 21 = 71$$

$$71 + 28 = 99$$

$$99 + 26 = 125$$

∴ the totals are 115 pies and 125 pies, as required.

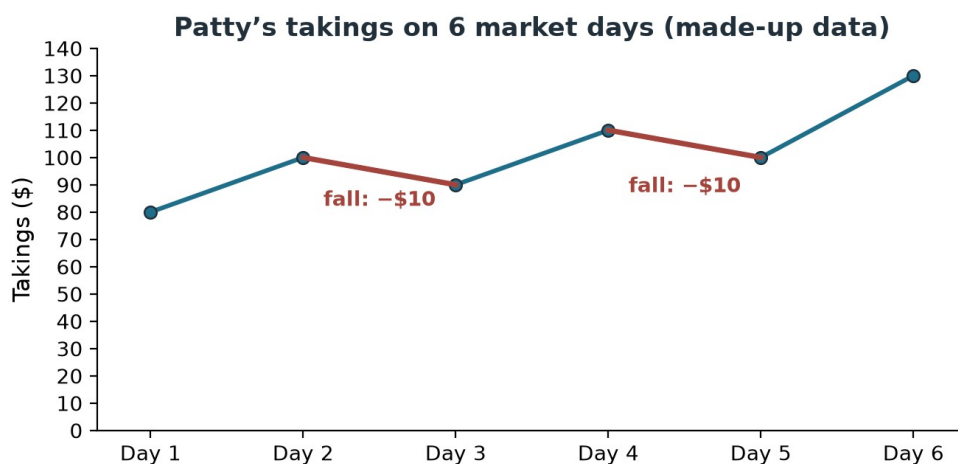
Week 1 mean: $115 \div 5 = 23$ pies a day. Week 2 mean: $125 \div 5 = 25$ pies a day.

Pattern: week 2 sold more on 4 of the 5 days — Monday (+4), Tuesday (+1), Wednesday (+3) and Friday (+4) — and fewer only on Thursday (−2). Range for week 1: $30 - 18 = 12$ pies; range for week 2: $28 - 21 = 7$ pies.

∴ week 2 was the better and steadier week: it sold 10 more pies in total, its mean per day rose from 23 to 25, and its smaller range (7 against 12) means its daily sales were the more consistent.

Example 4 — unscaffolded

The line graph shows Patty's takings on her last 6 market days. Patty says: "My takings went up on every market day."



Line graph of Patty's takings over six market days in dollars: 80, 100, 90, 110, 100, 130

Made-up data: this line graph is drawn for this book.

- Is Patty right? Use numbers from the graph to support your answer.
- Find the change in takings from market day 1 to market day 6, and describe the overall trend.
- Find Patty's mean takings per market day, to the nearest dollar.

Patty is not right. The takings fell twice: from day 2 to day 3, $90 - 100 = -10$, a fall of \$10; and from day 4 to day 5, $100 - 110 = -10$, another fall of \$10.

Overall change, day 1 to day 6: $130 - 80 = +50$, so the takings rose by \$50 from the first market day to the last. The overall trend is rising, with two small dips.

Mean takings: total $80 + 100 + 90 + 110 + 100 + 130 = \$610$; mean $610 \div 6 = 101.6666\dots$

$\therefore$ Patty's claim is wrong — the takings dipped on two of the five changes — but the overall trend is up by \$50, and her mean takings are \$102 per market day (to the nearest dollar).

Practice questions

Scaffolded

Q1. The Sunnyhill Soccer Club had shots on goal in each of its first 5 games: 8, 12, 10, 15 and 11.

- (a) What was the highest number of shots in a game?
- (b) What was the lowest number of shots in a game?
- (c) Find the total number of shots over the 5 games.

Q2. Fill each gap with one word from this bank: **rise · fall · steady · peak**

- (a) On a line graph, if the line goes up, the values _____.
- (b) If the line goes down, the values _____.
- (c) If the line is flat, the values are _____.
- (d) The highest point on a line graph is called the _____.

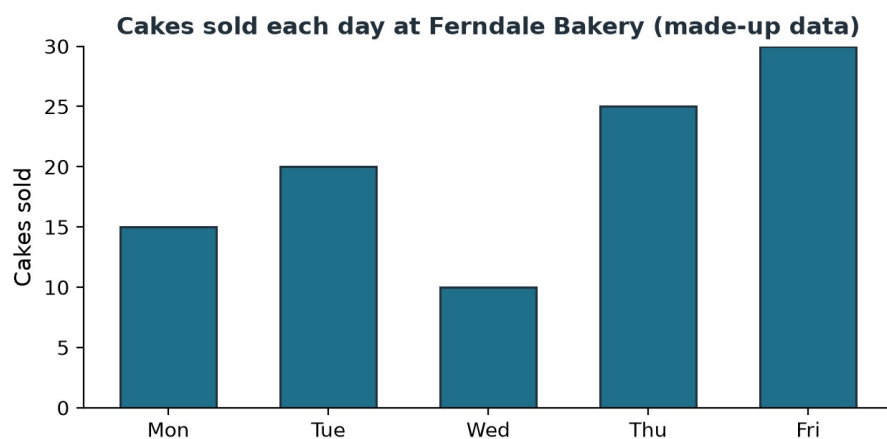
Q3. The table shows the prices on the Grevillea Street canteen menu.

Item	Price
Toastie	\$4.50
Pie	\$3.80
Juice	\$2.20
Muffin	\$3.00
Fruit	\$1.50

Made-up data: the items and every price in this table are made up for this section.

- (a) How much does a pie cost?
- (b) How much more does a toastie cost than a pie?
- (c) Find the total cost of one juice, one muffin and one fruit.

Q4. The bar chart shows the cakes sold each day at Ferndale Bakery.



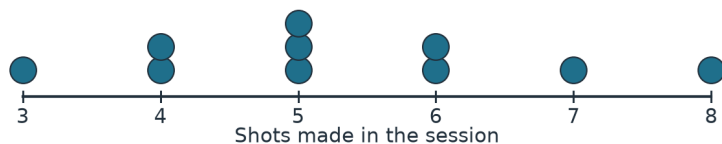
Bar chart of cakes sold each day at Ferndale Bakery from Monday to Friday: 15, 20, 10, 25, 30

Made-up data: this bar chart is drawn for this book.

- (a) How many cakes sold on Wednesday?
- (b) Which day sold the most cakes?
- (c) How many more cakes sold on Friday than on Monday?

Q5. Bridie's basketball team counts the shots it makes at each training session. The dot plot shows 10 sessions.

Bridie's team — shots made at each of 10 training sessions (made-up data)

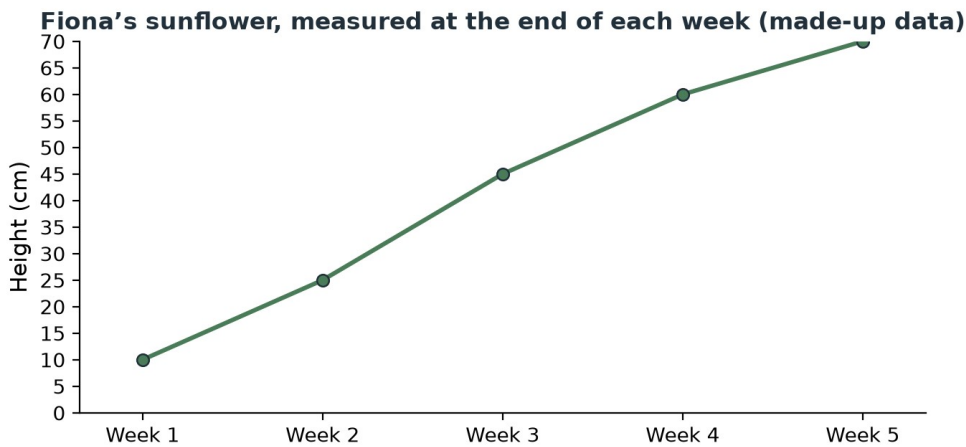


Dot plot of shots made per training session: 3, 4, 4, 5, 5, 5, 6, 6, 7, 8

Made-up data: this dot plot is drawn for this book.

- (a) How many sessions are in the data set?
- (b) In how many sessions did the team make 5 or more shots?
- (c) Find the mean number of shots made per session.

Q6. Fiona measures her sunflower at the end of each week. The line graph shows its height.



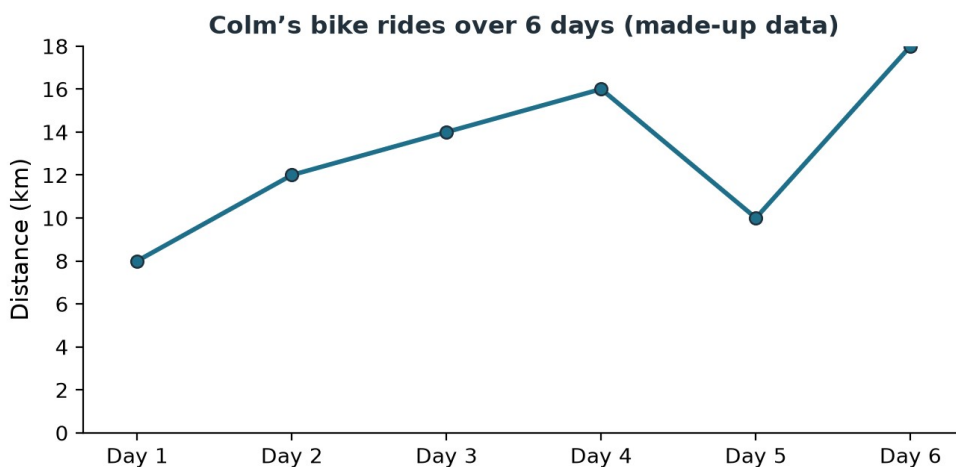
Line graph of the height of Fiona's sunflower in centimetres at the end of weeks 1 to 5: 10, 25, 45, 60, 70

Made-up data: this line graph is drawn for this book.

- (a) How tall was the sunflower at the end of week 2?
- (b) How much did it grow from week 2 to week 3?
- (c) Between which two weeks did it grow the most, and by how much?

Unscaffolded

Q7. The line graph shows the distance Colm rode his bike on each of 6 days.



Line graph of Colm's bike rides in kilometres over six days: 8, 12, 14, 16, 10, 18

Made-up data: this line graph is drawn for this book.

- (a) How far did Colm ride on day 4?
- (b) Describe the change from day 4 to day 5.
- (c) Describe the overall pattern of the rides across the 6 days.
- (d) Find the mean distance ridden per day.

Q8. On 5 hot days, the Corner Crate stall and the Grevillea Street canteen each count the lemonades they sell.

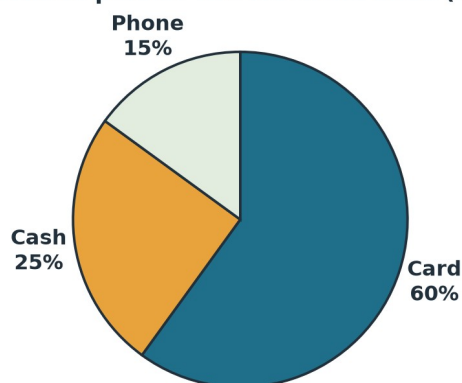
Day	Corner Crate	Grevillea Street canteen
Monday	22	30
Tuesday	28	26
Wednesday	25	34
Thursday	30	28
Friday	35	32

Made-up data: the days and every number in this table are made up for this section.

- Which seller sold more lemonades over the 5 days, and by how many?
- Find the mean number of lemonades per day for each seller.
- On which days did the Corner Crate sell more lemonades than the canteen?

Q9. The Weekend Shed had 300 customers last month. The pie chart shows how they paid.

How 300 customers paid at The Weekend Shed (made-up data)



Pie chart of how 300 customers paid at The Weekend Shed: card 60 per cent, cash 25 per cent, phone 15 per cent

Made-up data: this pie chart is drawn for this book.

- Which payment type was used the most?
- How many customers paid in cash?
- How many customers paid by phone?

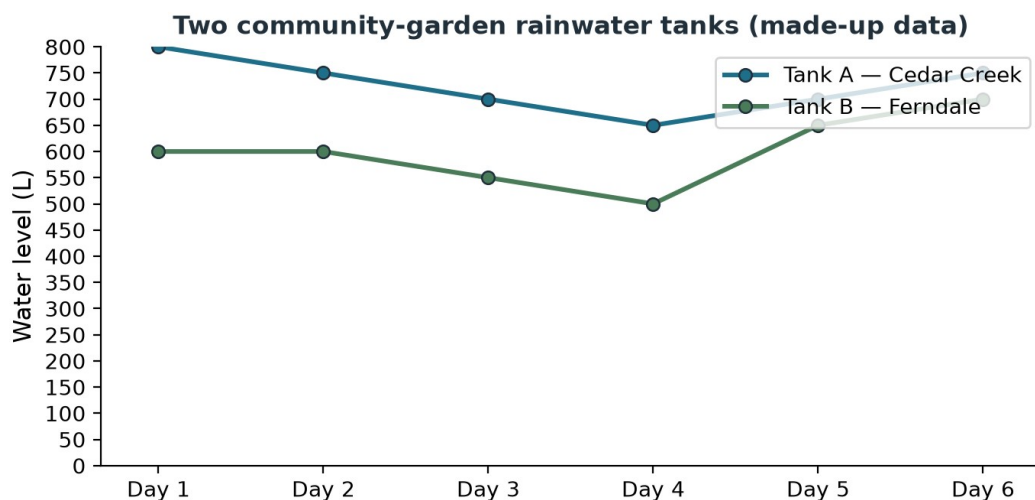
Q10. Tanbark Library counts the DVDs loaned each day for 10 days.

DVDs loaned in a day	Frequency (days)
2	1
3	2
4	4
5	2
6	1

Made-up data: the days and every number in this table are made up for this section.

- How many days are in the data set?
- Find the total number of DVDs loaned, using value $\times$ frequency for each row.
- Find the mean number of DVDs per day, and the range.

Q11. Two rainwater tanks are measured at the end of each day for 6 days: tank A at the Cedar Creek community garden, tank B at the Ferndale community garden. The line graph shows the water level in each tank, in litres.

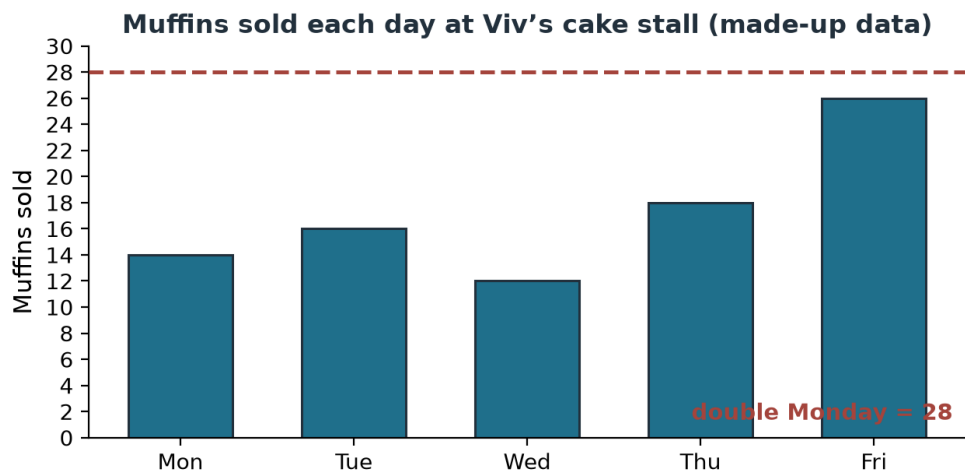


Two-line graph of tank water levels in litres over six days: tank A 800, 750, 700, 650, 700, 750 and tank B 600, 600, 550, 500, 650, 700

Made-up data: this line graph is drawn for this book.

- How many litres were in tank A at the end of day 3?
- Which tank fell more between day 1 and day 4? Show the two changes.
- Describe the pattern of the water level in tank B.

Q12. The bar chart shows the muffins sold each day at Viv’s cake stall. Viv says: “On Friday I sold more than double the muffins I sold on Monday.”



Bar chart of muffins sold each day at Viv’s cake stall from Monday to Friday: 14, 16, 12, 18, 26, with a dashed line at 28 marked double Monday

Made-up data: this bar chart is drawn for this book.

- Work out double Monday’s sales, and say whether Viv is right.
- Find the mean number of muffins sold per day.
- Find the range of the daily muffin sales.

Q13. Clancy's takings on his last 6 market days were \$40, \$38, \$52, \$61, \$45 and \$58. His summary card says: *mean \$49; range \$23; best day Thursday (\$61); quietest day Tuesday (\$38).*

- Show that the mean is \$49.
- Show that the range is \$23.
- Using the facts on the card, write a two-sentence description of Clancy's takings.

Q14. The table shows the drinks sold at the Grevillea Street canteen on three days.

Drink	Monday	Tuesday	Wednesday
Water	32	40	36
Juice	18	22	20
Milk	10	8	12
Soft drink	14	16	15

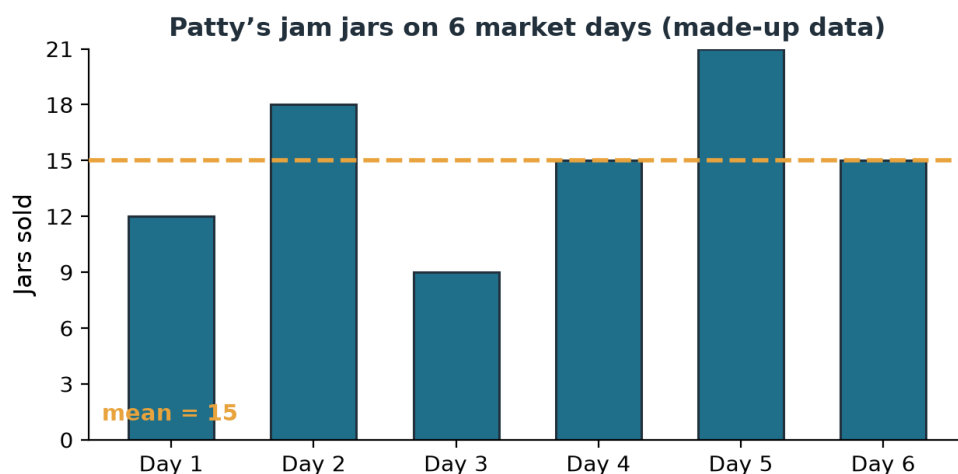
Made-up data: the drinks and every number in this table are made up for this section.

- How many juices sold on Tuesday?
- Find the total number of waters sold over the three days.
- Which drink was the most popular over the three days? Give its total.

Q15. Each question below is about a data set. Match each one to the kind of key fact it asks for. Choose from: **a look-up** · **a total** · **a difference** · **a trend**

- How many loaves were sold on Tuesday?
- Did the takings rise or fall across the week?
- How many more ice-creams were sold on Saturday than on Monday?
- How many DVDs were borrowed altogether?

Q16. The bar chart shows the jars of jam Patty sold on her last 6 market days. The dashed line is the mean.



Bar chart of jars of jam Patty sold over six market days: 12, 18, 9, 15, 21, 15, with a dashed mean line at 15

Made-up data: this bar chart is drawn for this book.

- Find the mean number of jars sold per market day.
- On how many market days did Patty sell more than the mean?
- Find the range of the daily jar sales.

Q17. The table shows the maximum temperature in Cedar Creek on six days.

Day	Mon	Tue	Wed	Thu	Fri	Sat
Maximum temperature (°C)	19	22	24	20	25	23

Made-up data: the days and every number in this table are made up for this section.

- (a) Which day was the warmest?
- (b) Describe the pattern of the temperatures across the six days.
- (c) Find the mean maximum temperature, to 1 decimal place.

Q18. The table shows the vegetables harvested at the Cedar Creek community garden in one week.

Vegetable	Mass harvested (kg)
Tomatoes	24
Beans	18
Carrots	12
Zucchini	16
Leafy greens	10

Made-up data: the vegetables and every number in this table are made up for this section.

- (a) Find the total mass of vegetables harvested.
- (b) How many more kilograms of tomatoes than carrots were harvested?
- (c) Find the mean mass harvested per vegetable.
- (d) Write a two-sentence description of the harvest, using the biggest crop, the smallest crop and the mean.

Answers

Q1. (a) 15 (b) 8 (c) 56 shots

Q2. (a) rise (b) fall (c) steady (d) peak

Q3. (a) \$3.80 (b) \$0.70 (c) \$6.70

Q4. (a) 10 cakes (b) Friday (c) 15 cakes

Q5. (a) 10 sessions (b) 7 sessions (c) 5.3 shots

Q6. (a) 25 cm (b) 20 cm (c) week 2 to week 3, by 20 cm

Q7. (a) 16 km (b) fell by 6 km (c) rose overall, from 8 km to 18 km, with a dip on day 5 (d) 13 km

Q8. (a) the canteen, by 10 lemonades (b) Corner Crate 28, canteen 30 (c) Tuesday, Thursday and Friday

Q9. (a) card (b) 75 customers (c) 45 customers

Q10. (a) 10 days (b) 40 DVDs (c) mean 4 DVDs per day, range 4 DVDs

Q11. (a) 700 L (b) tank A — A fell 150 L, B fell 100 L (c) steady, fell to 500 L at day 4, then rose to 700 L by day 6

Q12. (a) double Monday is $2 \times 14 = 28$ and Friday is $26 < 28$, so Viv is wrong (b) 17.2 muffins (c) 14 muffins

Q13. (a) total \$294, $294 \div 6 = \$49$ (b) $61 - 38 = \$23$ (c) e.g. *Clancy's takings average \$49 a market day, with a range of \$23. His best day was Thursday (\$61) and his quietest was Tuesday (\$38).*

Q14. (a) 22 (b) 108 waters (c) water, 108 drinks

Q15. (a) a look-up (b) a trend (c) a difference (d) a total

Q16. (a) 15 jars (b) 2 market days (c) 12 jars

Q17. (a) Friday (b) e.g. the temperatures rose to Wednesday, dipped on Thursday, peaked on Friday, then cooled a little on Saturday (c) 22.2°C (to 1 d.p.)

Q18. (a) 80 kg (b) 12 kg (c) 16 kg (d) e.g. *The garden harvested 80 kg of vegetables, a mean of 16 kg per crop. Tomatoes were the biggest crop (24 kg) and leafy greens the smallest (10 kg).*

Fully-worked solutions

Q1. (a) The highest value in 8, 12, 10, 15, 11 is 15 **shots**. (b) The lowest value is 8 **shots**. (c) $8 + 12 = 20$; $20 + 10 = 30$; $30 + 15 = 45$; $45 + 11 = 56$. 56 **shots** in total.

Q2. (a) The line going up means the values **rise**. (b) The line going down means the values **fall**. (c) A flat line means the values are **steady**. (d) The highest point is the **peak**.

Q3. (a) Read the Pie row: **\$3.80**. (b) Line the decimal points up and subtract: $4.50 - 3.80 = 0.70$. A toastie costs **\$0.70 more** than a pie. (c) $2.20 + 3.00 = 5.20$; $5.20 + 1.50 = 6.70$. The total is **\$6.70**.

Q4. (a) The Wednesday bar ends on the 10 gridline: 10 **cakes**. (b) The tallest bar is Friday at 30: **Friday**. (c) $30 - 15 = 15$: 15 **more cakes** on Friday than Monday.

Q5. (a) One dot per session; counting the dots gives 10 **sessions**. (b) Count the dots at 5 and above: 3 dots above 5, 2 above 6, 1 above 7 and 1 above 8: $3 + 2 + 1 + 1 = 7$. 7 **sessions**. (c) Total shots: $3 + 4 + 4 + 5 + 5 + 5 + 6 + 6 + 7 + 8 = 53$; mean $53 \div 10 = 5.3$ **shots a session** (the division finishes exactly, so no rounding is needed).

Q6. (a) The week-2 point sits on the 25 gridline: 25 **cm**. (b) $45 - 25 = 20$: it grew 20 **cm**. (c) The growths week to week are $25 - 10 = 15$, $45 - 25 = 20$, $60 - 45 = 15$ and $70 - 60 = 10$. The biggest is 20 cm, **from week 2 to week 3**.

Q7. (a) The day-4 point sits on the 16 gridline: **16 km**. (b) $10 - 16 = -6$: the ride **fell by 6 km**, from 16 km to 10 km. (c) Day 1 to day 6: $18 - 8 = +10$. The rides **rose overall**, from 8 km to 18 km — they grew to day 4, dipped on day 5, then hit the longest ride on day 6. (d) Total $8 + 12 + 14 + 16 + 10 + 18 = 78$ km; mean $78 \div 6 = 13$ **km a day** (the division finishes exactly, so no rounding is needed).

Q8. (a) Corner Crate total: $22 + 28 + 25 + 30 + 35 = 140$. Canteen total: $30 + 26 + 34 + 28 + 32 = 150$. $150 - 140 = 10$: **the canteen sold 10 more** lemonades. (b) Corner Crate mean: $140 \div 5 = 28$ **a day**. Canteen mean: $150 \div 5 = 30$ **a day**. (c) Compare row by row: Monday $22 < 30$ no; Tuesday $28 > 26$ yes; Wednesday $25 < 34$ no; Thursday $30 > 28$ yes; Friday $35 > 32$ yes. **Tuesday, Thursday and Friday**.

Q9. (a) The biggest slice is card, at 60%: **card**. (b) 25% is one quarter: $300 \div 4 = 75$. **75 customers** paid cash. (c) $15\% = 10\% + 5\%$. 10% of 300 is $300 \div 10 = 30$; 5% is half of that, 15. $30 + 15 = 45$: **45 customers** paid by phone. Check: card is $60\% = 6 \times 30 = 180$, and $180 + 75 + 45 = 300$ ✓.

Q10. (a) The frequency total: $1 + 2 + 4 + 2 + 1 = 10$ **days**. (b) Row totals: $2 \times 1 = 2$, $3 \times 2 = 6$, $4 \times 4 = 16$, $5 \times 2 = 10$, $6 \times 1 = 6$. Total $2 + 6 + 16 + 10 + 6 = 40$ **DVDs**. (c) Mean $40 \div 10 = 4$ **DVDs a day**. Range from the value column: $6 - 2 = 4$ **DVDs**.

Q11. (a) Read tank A's line at day 3: **700 L**. (b) Tank A: $650 - 800 = -150$, a fall of 150 L. Tank B: $500 - 600 = -100$, a fall of 100 L. **Tank A fell more**, by 150 L against 100 L. (c) Tank B was **steady** at 600 L for two days, **fell** to its lowest point, 500 L, at day 4, then **rose** strongly — 650 L at day 5 and 700 L at day 6 (rain refilled it).

Q12. (a) Double Monday: $2 \times 14 = 28$ muffins. Friday sold 26, and $26 < 28$, so **Viv is wrong** — Friday was 2 muffins short of double Monday. (b) Total $14 + 16 + 12 + 18 + 26 = 86$; mean $86 \div 5 = 17.2$ **muffins a day** (the division finishes exactly at 1 d.p., so no rounding is needed). (c) Highest 26, lowest 14: range $26 - 14 = 14$ **muffins**.

Q13. (a) One step per line:

$$40 + 38 = 78$$

$$78 + 52 = 130$$

$$130 + 61 = 191$$

$$191 + 45 = 236$$

$$236 + 58 = 294$$

$$294 \div 6 = 49$$

so the mean is **\$49**, as required. (b) Highest takings \$61 (Thursday), lowest \$38 (Tuesday):

$$61 - 38 = 23$$

so the range is **\$23**, as required. (c) Any two sentences using the card's facts earn the mark, for example: *Clancy's takings average \$49 a market day, and they spread across a range of \$23. His best day was Thursday (\$61) and his quietest was Tuesday (\$38).*

Q14. (a) Juice row, Tuesday column: **22 juices**. (b) Water row across: $32 + 40 = 72$; $72 + 36 = 108$. **108 waters**. (c) Totals by drink: water 108; juice $18 + 22 + 20 = 60$; milk $10 + 8 + 12 = 30$; soft drink $14 + 16 + 15 = 45$. The biggest total is 108, so **water** was the most popular drink.

Q15. (a) One value for one day: **a look-up**. (b) Rise or fall across time: **a trend**. (c) "How many more" compares two values by subtracting: **a difference**. (d) "Altogether" adds everything up: **a total**.

Q16. (a) Total $12 + 18 + 9 + 15 + 21 + 15 = 90$; mean $90 \div 6 = 15$ **jars a market day** — the dashed line sits at 15 ✓. (b) More than 15 jars: 18 and 21. **2 market days** were above the mean. (c) Highest 21, lowest 9: range $21 - 9 = 12$ **jars**.

Q17. (a) The highest temperature is 25°C , on **Friday**. (b) For example: the temperatures **rose** from Monday (19°C) to Wednesday (24°C), **fell** on Thursday (20°C), **rose** to the peak on Friday (25°C), then **fell** a little on Saturday (23°C). (c) Total $19 + 22 + 24 + 20 + 25 + 23 = 133$; mean $133 \div 6 = 22.1666\dots \approx 22.2$, so the mean maximum temperature is 22.2°C to 1 decimal place.

Q18. (a) $24 + 18 = 42$; $42 + 12 = 54$; $54 + 16 = 70$; $70 + 10 = 80$. **80 kg**. (b) $24 - 12 = 12$: **12 kg more** tomatoes than carrots. (c) Mean $80 \div 5 = 16$ **kg per vegetable**. (d) Any two sentences using the biggest crop, the smallest crop and the mean earn the mark, for example: *The garden harvested a total of 80 kg, a mean of 16 kg for each of the five vegetables. Tomatoes were the biggest crop at 24 kg and leafy greens the smallest at 10 kg.*

Example checks. Example 1: Thursday 160, quietest Saturday 60; change $130 - 160 = -30$, a fall of 30; Monday to Wednesday rose 20 then steady; total 750, mean 125. Example 2: vanilla biggest at 50%; strawberry 10% of $200 = 20$; mango $15\% = 20 + 10 = 30$; counts add to 200. Example 3: totals 115 and 125; means 23 and 25; week 2 higher on 4 of 5 days; ranges 12 and 7, so week 2 more consistent. Example 4: two falls of \$10 (day 2→3 and day 4→5), so Patty is wrong; overall change $130 - 80 = +50$, trend rising; total \$610, mean $610 \div 6 = 101.6666\dots \approx \$102$ to the nearest dollar.

Chapter 03 — Test A (multiple choice)

Chapter 3 (Data), Sections 3A–3D. Materials: pen, paper and a basic calculator. Section A: 12 multiple-choice questions (12 marks). Approximate time: 25 minutes.

About the data in this test. Every shop, garden, person and number in this test is **made up** (not real). They are built for this book so you can practise the maths of Chapter 3. Nothing here is real data about a real person, business or place.

Section A — Multiple-choice questions

Choose the response that is correct for the question.

Question 1

A shop writes down the size of every coffee it sells: small, medium or large. This data is

- A. numerical — counted
- B. numerical — measured
- C. numerical — grouped
- D. categorical

Question 2

On a tally sheet, one row shows three gates and four loose strokes. The frequency for this row is

- A. 15
- B. 19
- C. 34
- D. 7

Question 3

Thirty students named their favourite pie filling. The frequency table shows: meat 9, sausage roll 7, cheese ?, vegetable 5, apple 4. The total row says 30. The missing frequency for cheese is

- A. 5
- B. 6
- C. 25
- D. 30

Question 4

Which one of these is an example of primary data?

- A. the goal tallies printed in Saturday's newspaper
- B. the number of loans posted on a library website each month
- C. the heights of your classmates that you measured yourself with a tape
- D. the rainfall totals posted on a weather website

Question 5

Tomas wants to show how his pocket money for one week splits into saving, spending and giving. The most appropriate display is

- A. a pie chart
- B. a line graph
- C. a dot plot
- D. a table

Question 6

A bar chart has to show values up to a largest value of 47. Using the four steps for choosing a scale in Section 3B, the vertical axis should count from 0 in

- A. steps of 5, with a top number of 50
- B. steps of 10, with a top number of 47
- C. steps of 2, with a top number of 48
- D. steps of 10, with a top number of 50

Question 7

The vertical axis of a bar chart counts in 20s. A bar ends halfway between the 60 and 80 gridlines. The value of the bar is

- A. 60
- B. 65
- C. 70
- D. 75

Question 8

Five friends count the books they each read over the holidays: 3, 5, 2, 6 and 4. The mean number of books read is

- A. 20
- B. 5
- C. 3
- D. 4

Question 9

The highest temperature on five days was 18°C , 21°C , 17°C , 24°C and 20°C . The range of the temperatures is

- A. 7°C
- B. 41°C
- C. 20°C
- D. 6°C

Question 10

A survey counted the pets in 10 houses on one street. The frequency table shows: 0 pets — 3 houses; 1 pet — 4 houses; 2 pets — 2 houses; 3 pets — 1 house. The mean number of pets per house is

- A. 1.5
- B. 1.1
- C. 6
- D. 11

Question 11

A line graph shows the visitors to the Cedar Creek pool each day: 140 on Monday and 120 on Tuesday. The change in visitors from Monday to Tuesday is

- A. a rise of 260
- B. a fall of 20
- C. a rise of 20
- D. a fall of 120

Question 12

A bakery sold 320 cakes in one month. The pie chart of the sales has four slices: plain 60 %, chocolate 20 %, berry 15 % and apple 5 %. The number of chocolate cakes sold was

- A. 20
- B. 48
- C. 64
- D. 192

End of Section A

Test A — Answers

Question	Answer
1	D
2	B
3	A
4	C
5	A
6	D
7	C
8	D
9	A
10	B
11	B
12	C

Test A — Fully-worked solutions

Question 1. Small, medium and large are words or labels, not numbers, so the data is categorical. Counting how many of each size are sold does not change what was written down, and “grouped” describes a way of organising data in a table — it is not one of the three data types. The answer is **D**.

Question 2. Count the gates in fives, then add the loose strokes: $3 \times 5 + 4 = 15 + 4 = 19$. Option A (15) counts only the gates; option C (34) puts the two digits side by side; option D (7) counts every mark as one. The answer is **B**.

Question 3. The known frequencies add to $9 + 7 + 5 + 4 = 25$. The total is 30, so cheese = $30 - 25 = 5$. Option C (25) is the subtotal of the known rows; option D (30) is the total itself. The answer is **A**.

Question 4. Primary data is data you collect yourself for your own question. Measuring your classmates with your own tape is primary data. The newspaper, the library website and the weather website all publish data that someone else collected — that is secondary data. The answer is **C**.

Question 5. The week’s pocket money is one whole split into shares, and the table in Section 3B matches “one whole split into shares” to a pie chart. A line graph shows change over time, a dot plot shows a small set of individual values, and a table is for looking up exact amounts. The answer is **A**.

Question 6. The largest value is 47. Step 5: the first multiple of 5 that is at least 47 is 50, but counting 0, 5, 10, ..., 50 takes 11 numbers — more than the 10 the rule allows. Step 10: the first multiple of 10 that is at least 47 is 50, and counting 0, 10, 20, 30, 40, 50 takes 6 numbers — that fits. Option B fails because 47 is not on the step, and step 2 would take 25 numbers. The answer is **D**.

Question 7. The axis counts in 20s, so the halfway number is half of 20 more than the lower gridline: $60 + 10 = 70$. Option B (65) comes from assuming the axis counts in 10s. The answer is **C**.

Question 8. Total = $3 + 5 + 2 + 6 + 4 = 20$, and there are 5 friends, so mean = $20 \div 5 = 4$. Check: 4 sits between the lowest count (2) and the highest (6). Option A (20) is the total with the division left out; option B (5) divides by 4 instead of 5. The answer is **D**.

Question 9. Sort first: the lowest temperature is 17°C and the highest is 24°C . Range = highest – lowest = $24 - 17 = 7$, so the range is 7°C . Option C (20°C) is the mean, not the range; option D (6°C) subtracts the first value listed ($24 - 18$) instead of the lowest. The answer is **A**.

Question 10. Value $\times$ frequency for each row: $0 \times 3 = 0$, $1 \times 4 = 4$, $2 \times 2 = 4$, $3 \times 1 = 3$; total = 11 pets. The count is $3 + 4 + 2 + 1 = 10$ houses, so mean = $11 \div 10 = 1.1$ pets per house. Option A (1.5) averages the value column ($6 \div 4$) and ignores the frequencies; option D (11) is the total, not divided. The answer is **B**.

Question 11. Change = later value – earlier value = $120 - 140 = -20$. The minus sign means a fall, so the visitors fell by 20. Option C reverses the direction; option D mistakes Tuesday’s value for the change. The answer is **B**.

Question 12. 10 % of 320 is 32. Chocolate is $20\% = 2 \times 10\%$, so $2 \times 32 = 64$ chocolate cakes. Option A (20) reads the percentage as the count; option B (48) is the berry slice ($15\% = 32 + 16$); option D (192) is the plain slice (6×32). The answer is **C**.

Chapter 03 — Test B (written response)

Chapter 3 (Data), Sections 3A–3D. Materials: pen, paper and a basic calculator. Section B: 7 questions (31 marks). Approximate time: 40 minutes. Answer every question in the space provided. Round only where a question tells you to, and say how far you rounded. Show your working wherever more than one mark is available.

About the data in this test. Every shop, garden, person and number in this test is **made up** (not real). They are built for this book so you can practise the maths of Chapter 3. Nothing here is real data about a real person, business or place.

Section B

Question 1 (4 marks)

The Corner Crate asks 18 customers to name the fruit they buy most often. The answers, in the order they were given, are:

Apple, Banana, Apple, Orange, Mango, Apple, Banana, Other, Orange, Apple, Banana, Mango, Apple, Orange, Banana, Apple, Mango, Banana

The results are to be organised into this frequency table:

Fruit	Frequency
Apple	?
Banana	?
Orange	?
Mango	?
Other	?
Total	?

a. Tally the answers and complete the frequency table. 2 marks

b. Write the total for the table and say how it checks your tally. 1 mark

c. How many more customers chose apple than orange? 1 mark

Question 2 (4 marks)

The Cedar Creek Community Garden measures the heights of 12 sunflower seedlings, in cm:

22, 27, 31, 24, 29, 35, 26, 33, 28, 30, 25, 32

The garden group wants to organise the heights into a grouped frequency table with groups 20–24, 25–29, 30–34 and 35–39:

Height (cm)	Frequency
20–24	?
25–29	?
30–34	?
35–39	?
Total	?

a. Write the 12 heights in order, from smallest to largest.

1 mark

b. Complete the grouped frequency table.

2 marks

c. How many seedlings are 30 cm or taller?

1 mark

Question 3 (4 marks)

Patty records the number of jars of jam she sells at her Corner Crate market stall on each of 6 market days. She wants a display that lets the 6 days be compared easily. Her biggest day was 31 jars.

a. Which display is most appropriate for these numbers, and why?

2 marks

b. Using the four steps for choosing a scale in Section 3B, give the step and the top number for the vertical axis.

2 marks

Question 4 (5 marks)

The Cedar Creek Community Garden collects rainwater in a tank. Over one week, the water level in the tank, in litres, is measured at 6 pm each day and drawn as a line graph. The table shows the values on the line graph:

Day	Mon	Tue	Wed	Thu	Fri	Sat
Water level (L)	850	800	800	620	700	900

a. What was the water level on Wednesday?

1 mark

b. Find the change in the water level from Wednesday to Thursday. Did the level rise or fall? 2 marks

c. Describe the pattern of the water level across the six days in one or two sentences. 2 marks

Question 5 (4 marks)

Ava times her walk to school on five days. The times, in minutes, are: 12, 15, 13, 18 and 12.

a. Find the total of the five times. 1 mark

b. Find the mean walking time. 1 mark

c. Find the range of the times. 1 mark

d. Ava's goal is a mean walking time of 13 minutes or less. Has Ava met her goal? Give a reason from your answer to part b. 1 mark

Question 6 (5 marks)

The Ferndale Bakery records the number of loaves it sells each day for 14 days. The frequency table shows the results:

Loaves sold in a day	Number of days
18	2
20	4
22	5
24	2
26	1

a. How many days are in this data set? 1 mark

b. Find the total number of loaves sold. Use value $\times$ frequency for each row. 2 marks

c. Find the mean number of loaves sold per day, correct to 1 decimal place. 1 mark

d. Find the range of the daily loaf sales. 1 mark

Question 7 (5 marks)

Tanbark Library loaned 600 items last month. The pie chart of the loans has four slices: books 50 %, DVDs 25 %, magazines 15 % and other items 10 %.

a. Which type of item was loaned the most? 1 mark

b. How many DVDs were loaned? 1 mark

c. How many magazines were loaned? Build 15 % from simpler shares and show your working. 2 marks

d. How many items are in the other slice? 1 mark

End of Section B

Test B — Answers

Question 1. (a) Apple 6, Banana 5, Orange 3, Mango 3, Other 1. (b) Total 18 — it equals the 18 customers asked, so every answer was tallied exactly once. (c) 3 more customers. **Question 2.** (a) 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35. (b) 20–24: 2; 25–29: 5; 30–34: 4; 35–39: 1; total 12. (c) 5 seedlings. **Question 3.** (a) Bar chart — the counts for the 6 days sit side by side, so the days are easy to compare (a line graph with a matching reason also earns the marks). (b) Step 5, top 35. **Question 4.** (a) 800 L. (b) $620 - 800 = -180$: the level fell by 180 L. (c) e.g. the level fell from 850 L, stayed steady at 800 L on Tuesday and Wednesday, dropped to its lowest point of 620 L on Thursday, then rose to its peak of 900 L on Saturday. **Question 5.** (a) 70 minutes. (b) 14 minutes. (c) 6 minutes. (d) No — the mean is 14 minutes, and 14 is greater than 13. **Question 6.** (a) 14 days. (b) 300 loaves. (c) 21.4 loaves (to 1 decimal place). (d) 8 loaves. **Question 7.** (a) Books. (b) 150 DVDs. (c) 90 magazines. (d) 60 items.

Test B — Fully-worked solutions

Question 1.

- a. Go through the list once and tally each fruit. The completed frequency table is: Apple 6, Banana 5, Orange 3, Mango 3, Other 1.
- b. Total = $6 + 5 + 3 + 3 + 1 = 18$. The frequencies add to 18, which equals the 18 customers asked — so every answer was tallied exactly once and nothing was counted twice.
- c. Apple 6 and orange 3: $6 - 3 = 3$. Three more customers chose apple than orange.

Question 2.

- a. Find the smallest value and work up: 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35. Count back — that is 12 heights, so none was missed.
- b. Read off the ordered list: 22 and 24 fall in 20–24, so frequency 2; 25, 26, 27, 28 and 29 fall in 25–29, so 5; 30, 31, 32 and 33 fall in 30–34, so 4; 35 falls in 35–39, so 1. Check: $2 + 5 + 4 + 1 = 12$, the number of seedlings measured.
- c. Seedlings 30 cm or taller are in the last two groups: $4 + 1 = 5$ seedlings.

Question 3.

- a. A **bar chart**: the data is a count of jars for each of the 6 market days, and a bar chart puts the days side by side so they are easy to compare. (A line graph with a matching reason also earns the marks.)
- b. The largest value is 31. Step 1 takes 32 numbers and step 2 takes 17 numbers (0, 2, 4, ..., 32) — both more than the 10 the rule allows. Step 5: the first multiple of 5 that is at least 31 is 35, and counting 0, 5, 10, 15, 20, 25, 30, 35 takes 8 numbers — that fits. So the scale is **step 5, top 35**.

Question 4.

- a. Read across from Wednesday: the water level was 800 L.
- b. Change = later value – earlier value = $620 - 800 = -180$. The minus sign means a fall, so the level **fell by 180 L**.
- c. Any one or two sentences using the numbers earn the marks, for example: *the level fell from 850 L on Monday and stayed steady at 800 L on Tuesday and Wednesday, dropped to its lowest point of 620 L on Thursday, then rose to its peak of 900 L on Saturday.*

Question 5.

- a. Total = $12 + 15 + 13 + 18 + 12 = 70$ minutes.
- b. There are 5 days, so mean = $70 \div 5 = 14$ minutes. Check: 14 sits between the lowest time (12) and the highest (18).
- c. Range = highest – lowest = $18 - 12 = 6$ minutes.
- d. No. The mean is 14 minutes and $14 > 13$, so Ava did not meet her goal of a mean of 13 minutes or less.

Question 6.

- a. The days are the frequencies: $2 + 4 + 5 + 2 + 1 = 14$ days.
- b. Value $\times$ frequency for each row: $18 \times 2 = 36$, $20 \times 4 = 80$, $22 \times 5 = 110$, $24 \times 2 = 48$, $26 \times 1 = 26$. Total = $36 + 80 + 110 + 48 + 26 = 300$ loaves.
- c. Mean = total $\div$ count = $300 \div 14 = 21.428571\dots$. The question asks for 1 decimal place, so the mean is 21.4 loaves per day. Check: 21.4 sits between the lowest daily sales (18) and the highest (26).
- d. Range = highest – lowest = $26 - 18 = 8$ loaves.

Question 7.

- a. The biggest slice is books at 50 %, so **books** were loaned the most.
- b. 25 % is one quarter: $600 \div 4 = 150$ DVDs.
- c. Build 15 % as 10 % + 5 %. 10 % of 600 is 60; 5 % is half of 10 %, so 5 % of 600 is 30. Magazines = $60 + 30 = 90$.
- d. 10 % of 600 is 60 items. Check: books are 50 % = 300, and $300 + 150 + 90 + 60 = 600$ — the four counts add back to the total loaned.