Mathematics Level 4

Chapter 6 — Statistics

Aboriginal and Torres Strait Islander content has been excluded as accuracy cannot be guaranteed, and it is better to be respectful than cover the entire curriculum inaccurately.

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Contents

Acquiring data and building many-to-one displays

Code `VC2M4ST01` (Victorian Curriculum F–10 Version 2.0, Mathematics, Level 4; authority file `maths_4.json`): "acquire data for categorical and discrete numerical variables to address a question of interest or purpose using digital tools; represent data using many-to-one pictographs, column graphs and other displays or visualisations; interpret and discuss the information that has been created". This section draws on elaborations `VC2M4ST01.E01`, `.E02`, `.E03` and `.E04`. `.E05` is not covered in this book; see the note at the front of the book about Aboriginal and Torres Strait Islander content.

What you need to know

In Year 3 you made one-to-one displays, where one symbol stood for one thing. This section builds on that. Now one symbol can stand for **more than one** thing — that new step is what this section is about.

Data and variables. Data are pieces of information that you collect, like the answers people give to a question, or the counts you make when you watch something. **Variables** are the things you are asking about or counting — the things that *vary*, because they can be different for different people or things. At this level there are two kinds of variables:

- **Categorical data** — the answers are categories, or groups. The answers are words, not numbers. Example: *What is your favourite vegetable?* The answers might be corn, carrot or tomato.
- **Discrete numerical data** — the answers are counts: whole numbers like 0, 1, 2, 3, and so on. Example: *How many pets do you have?* You can have 3 pets, but not 3.5 pets — a count is always a whole number.

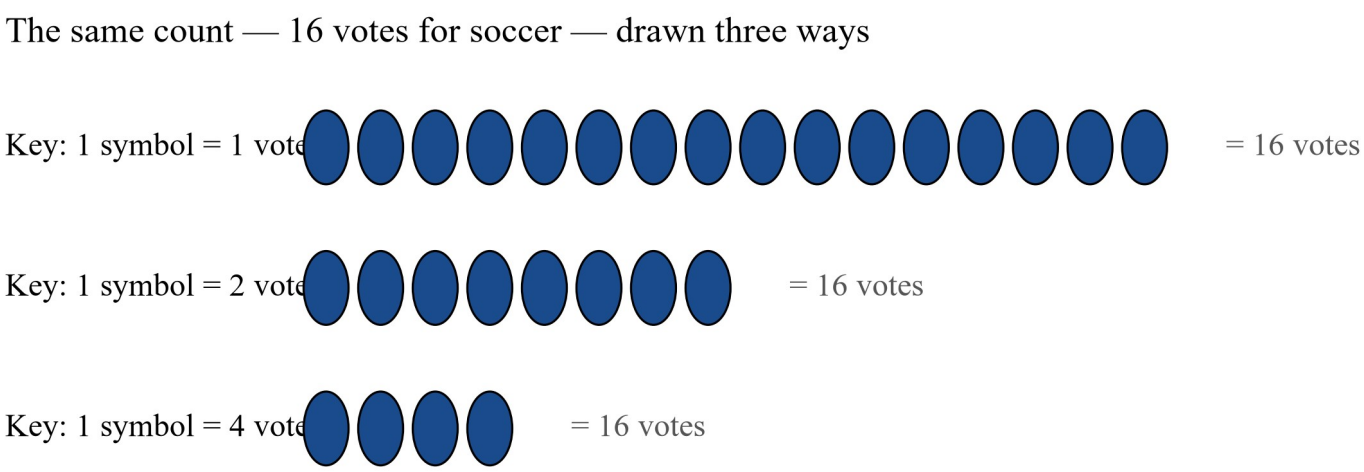
A question of interest. Data are always collected to answer a question. A **question of interest** is a question you want to answer, and that data *can* answer. *Which vegetable should our class grow?* is a question of interest — you can answer it by collecting votes. *Is corn yummy?* is not — it only asks for an opinion, one person at a time, with nothing to count.

Acquiring data. To **acquire** data means to get them. There are several ways:

- run a **survey** — ask a question and record each person's answer, once each;
- make an **observation** — watch something and record what you see, like counting the birds in the school yard one morning;
- do a **practical activity** — like planting seeds and counting how many sprout;
- run a **repeated chance experiment** — like rolling a die 30 times and tallying each face.

You can record what you get with **tally marks** (each mark is one answer, and the fifth mark goes across the group of four, like `IIII/`), with a **table** on paper, or with a **digital table** in a program. Sometimes you do not collect the data yourself at all: someone else has already collected them and shared them. Data you get this way are called **secondary data**. You will meet more of these in 6C.

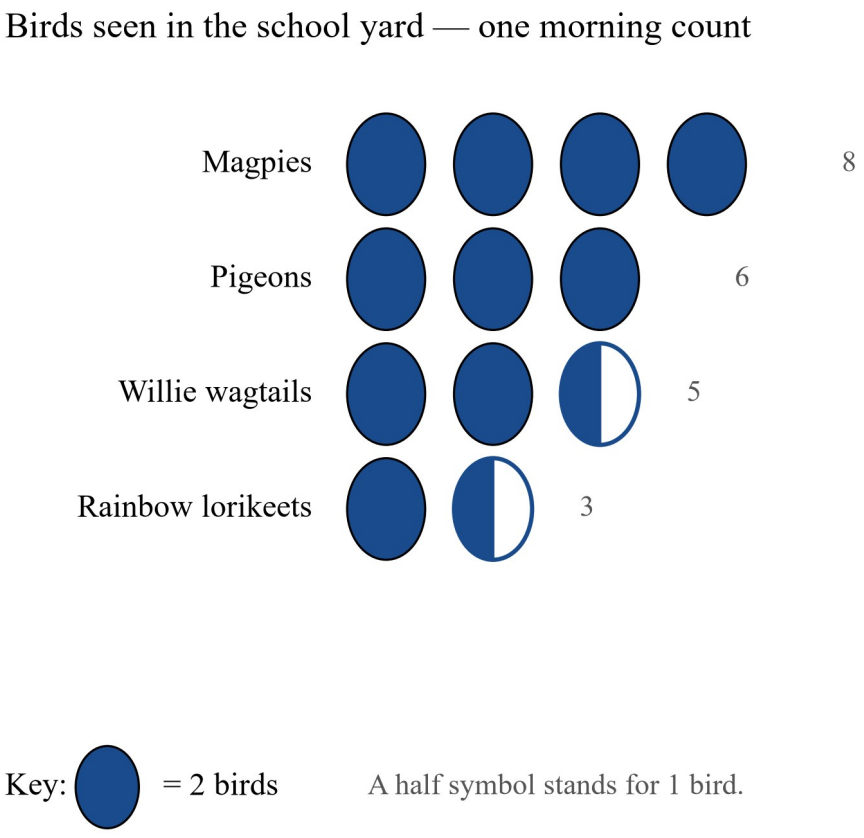
Why many-to-one? Say 16 students voted for soccer. A one-to-one pictograph needs 16 symbols in one row — a very long row. With a key where one symbol stands for 2 votes, the row has 8 symbols. With a key of 4, it has only 4. The data are the same; the display is just easier to read.



The count 16 shown three ways as rows of symbols: with a key of 1 symbol = 1 vote the row has 16 symbols; with a key of 2 the row has 8 symbols; with a key of 4 the row has 4 symbols.

A display where one symbol stands for more than one piece of data is called a **many-to-one display**. The **key** tells you what one symbol stands for.

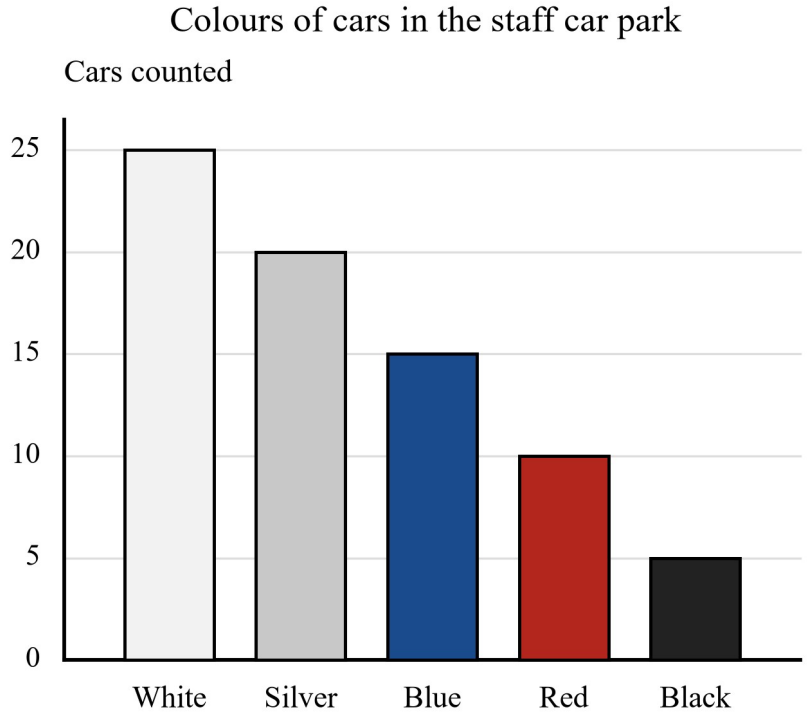
Pictographs and keys. A **pictograph** shows each count as a row of symbols. Always read the key first. When a count is an odd number and the key is 2, the last symbol is drawn as a **half symbol**, because half of 2 is 1.



A pictograph of birds seen in the school yard in one morning count, with a key of one symbol = 2 birds. Magpies 8 (4 symbols), pigeons 6 (3 symbols), willie wagtails 5 (two and a half symbols), rainbow lorikeets 3 (one and a half symbols).

In the pictograph above, the willie wagtail row has 2 whole symbols and 1 half symbol: 2 + 2 + 1 = 5 birds.

Column graphs and scales. A **column graph** shows each count as a column. The numbers up the side make a **scale**. At this level the scale often counts in 2s, 5s or 10s — that is the many-to-one idea again, this time in the numbers up the side. Read the scale before you read the columns.



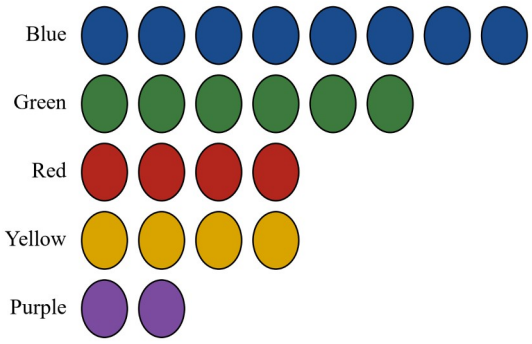
A column graph of the colours of cars in a staff car park, with the scale counting in 5s from 0 to 25. White 25, silver 20, blue 15, red 10, black 5.

In the graph above the scale counts in 5s. Each line is 5 more than the one before: 5, 10, 15, 20, 25. The white column reaches the 25 line, so 25 white cars were counted. The black column reaches the 5 line, so 5 black cars were counted. You will read a column that lands between two lines in Example 2.

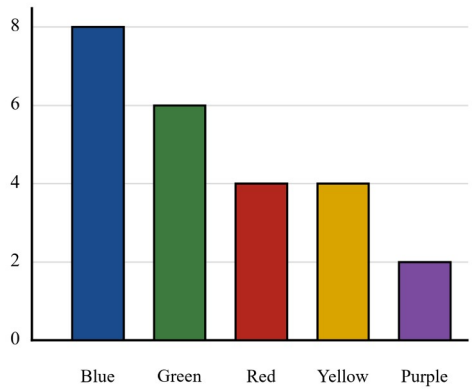
Read all the information before you judge. One symbol can stand for any number of pieces of data, so two displays of the *same* data can look quite different, and a longer row does not always stand for more — a longer row can just mean a different key. Before you make judgements (before you say what you think a display shows), read the key, the scale and the labels. Example 3 shows what goes wrong when the key is skipped.

Choosing a good display. More than one display can show the same data. The display should fit the data: a one-to-one pictograph is fine for small counts, but with many votes a key or a scaled column graph keeps the display short and easy to compare.

Display 1 — pictograph (1 symbol = 1 student)



Display 2 — column graph (counts in 2s)



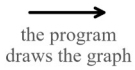
The same data shown two ways. Left: a one-to-one pictograph of favourite colours with one symbol = 1 student (blue 8, green 6, red 4, yellow 4, purple 2). Right: a column graph of the same counts with the scale counting in 2s.

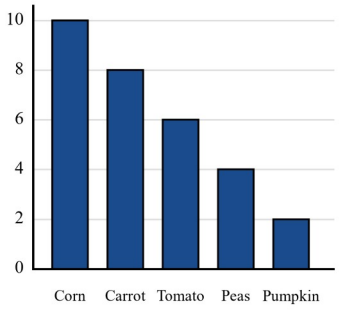
Both displays above are correct — they show the same 24 votes. The column graph is quicker to read and quicker to compare, which is why scaled displays are the habit to build.

Digital tools. You can do all of this on paper, and you can do it with a computer. A **spreadsheet** is a program that keeps data in a grid of small boxes called **cells**, in columns going down and rows going across. Type the categories in column A and the counts in column B, and the program can draw the column graph for you.

A digital table in a spreadsheet

	A	B
1	**Vegetable**	**Count**
2	Corn	10
3	Carrot	8
4	Tomato	6
5	Peas	4
6	Pumpkin	2
7		





A spreadsheet grid with the vegetable names in column A and the counts in column B, an arrow to a small column graph the program has drawn from the same data.

Two real spreadsheet programs are **Microsoft Excel** and **Google Sheets**.

> Source: Microsoft, *Microsoft Excel*, retrieved 2026-08-20. Source: Google, *Google Sheets*, retrieved 2026-08-20.

Digital tools are permitted in this section but not required — every display you need here can be built on grid paper. In 6C you will run a full investigation of your own, from question to report.

Worked examples

Example 1 — step by step: the vegetable vote

Mr Morris's class of 30 students votes on which vegetable to grow in the garden bed. The question of interest is: *Which vegetable should our class grow?* Each student votes once. The tally chart below records the votes.

Favourite vegetable to grow — tally chart

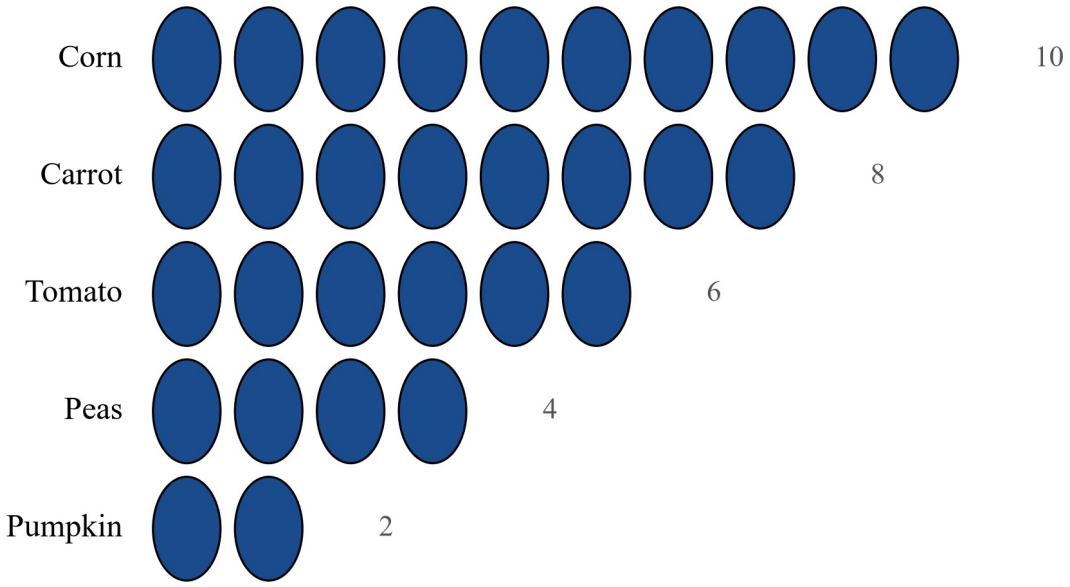
Vegetable	Tally	Count
Corn		10
Carrot		8
Tomato		6
Peas		4
Pumpkin		2
Total		30

A tally chart of the vegetable vote. Corn: two groups of five tally marks, count 10. Carrot: a group of five and 3 marks, count 8. Tomato: a group of five and 1 mark, count 6. Peas: 4 marks. Pumpkin: 2 marks. Total 30.

Working	Comment
Check the total: 10 + 8 + 6 + 4 + 2 = 30.	30 students voted, so the counts must add to 30. Always check.
Build a one-to-one pictograph of the data.	Corn needs a row of 10 symbols — the rows get long.
Build a many-to-one pictograph instead, with a key: 1 symbol = 2 votes.	Corn: 10 votes is 5 symbols. Carrot: 8 votes is 4 symbols. Pumpkin: 2 votes is 1 symbol.
Read the display: corn has the longest row (10 votes), pumpkin the shortest (2 votes).	The key says each symbol is 2 votes, so count the symbols in 2s.
10 − 2 = 8.	Corn got 8 more votes than pumpkin.
Report: “We asked all 30 students. Corn was the most popular choice, with 10 votes, so our class should grow corn.”	Say what you found, and give the numbers that back it up.

The two pictographs for Example 1:

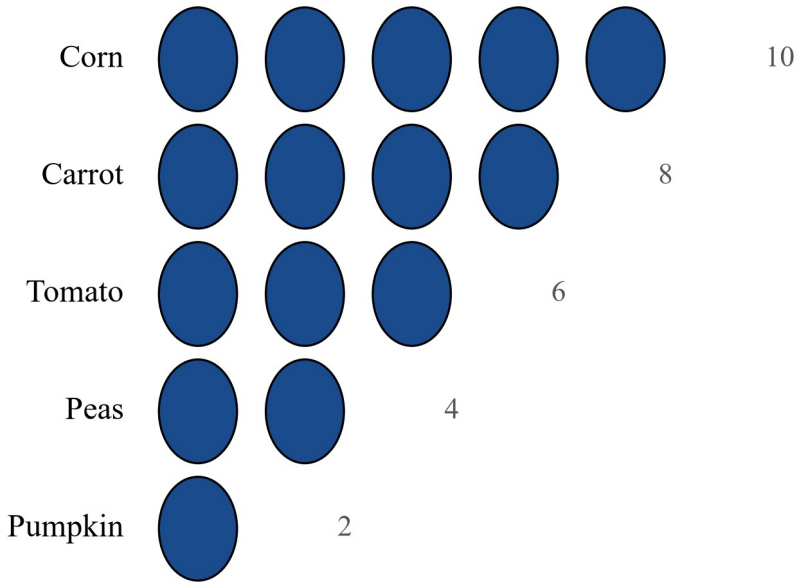
Favourite vegetable — one-to-one pictograph



Key: = 1 vote

A one-to-one pictograph of the vegetable vote with a key of one symbol = 1 vote: corn 10 symbols, carrot 8, tomato 6, peas 4, pumpkin 2.

Favourite vegetable — many-to-one pictograph



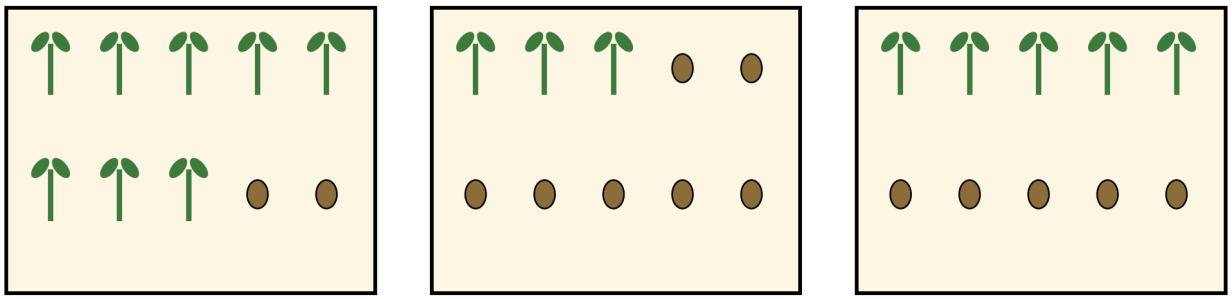
Key: = 2 votes

A many-to-one pictograph of the same vote with a key of one symbol = 2 votes: corn 5 symbols, carrot 4, tomato 3, peas 2, pumpkin 1.

Example 2 — step by step: seeds in the sun, the dark and the shelf

A class runs a science investigation. They plant 10 bean seeds in each of three trays and keep the trays in three places: in the sun, in the dark, and on the shelf. After one week they count the seeds that have sprouted — a seed that has sprouted has a green shoot.

Bean seeds after one week — green shoots have sprouted

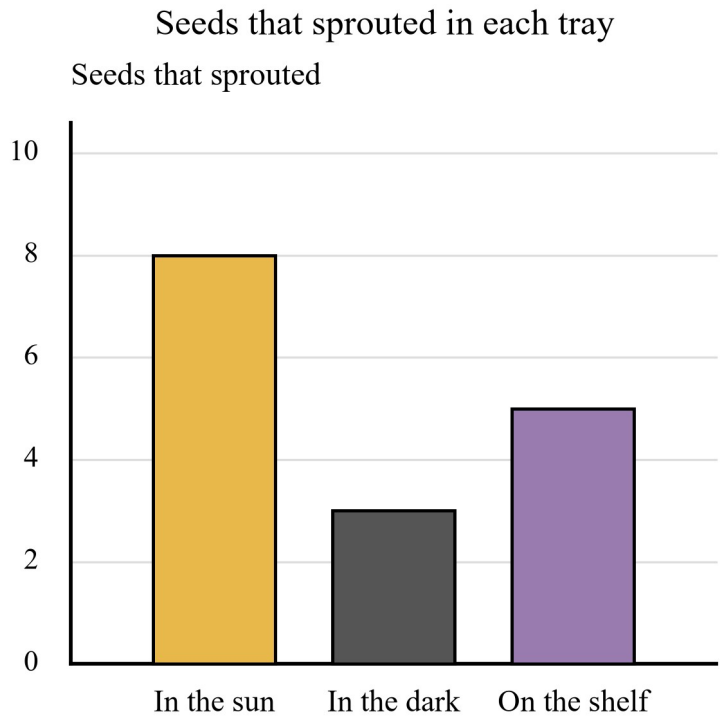


In the sun: 8 of 10 sprouted In the dark: 3 of 10 sprouted On the shelf: 5 of 10 sprouted

Three trays of 10 bean seeds each after one week. In the sun, 8 seeds have green shoots and 2 have not. In the dark, 3 have sprouted and 7 have not. On the shelf, 5 have sprouted and 5 have not.

Working	Comment
Count the green shoots in each tray: sun 8, dark 3, shelf 5.	Each green shoot is one sprouted seed. The data are counts — whole numbers.
Choose a column graph with a scale counting in 2s, up to 10.	The top count is 8, so a scale of 2s reaches it in four steps.
Draw the columns: 8, 3 and 5.	The dark column ends halfway between the 2 line and the 4 line, because 3 is halfway between 2 and 4.
Read the graph: the sun tray has the tallest column (8), the dark tray the shortest (3).	Read the scale first, then the columns.
8 − 3 = 5.	5 more seeds sprouted in the sun than in the dark.
Report: “In our investigation, 8 of 10 seeds sprouted in the tray kept in the sun, and only 3 of 10 in the dark.”	Say what the data show, with the numbers.

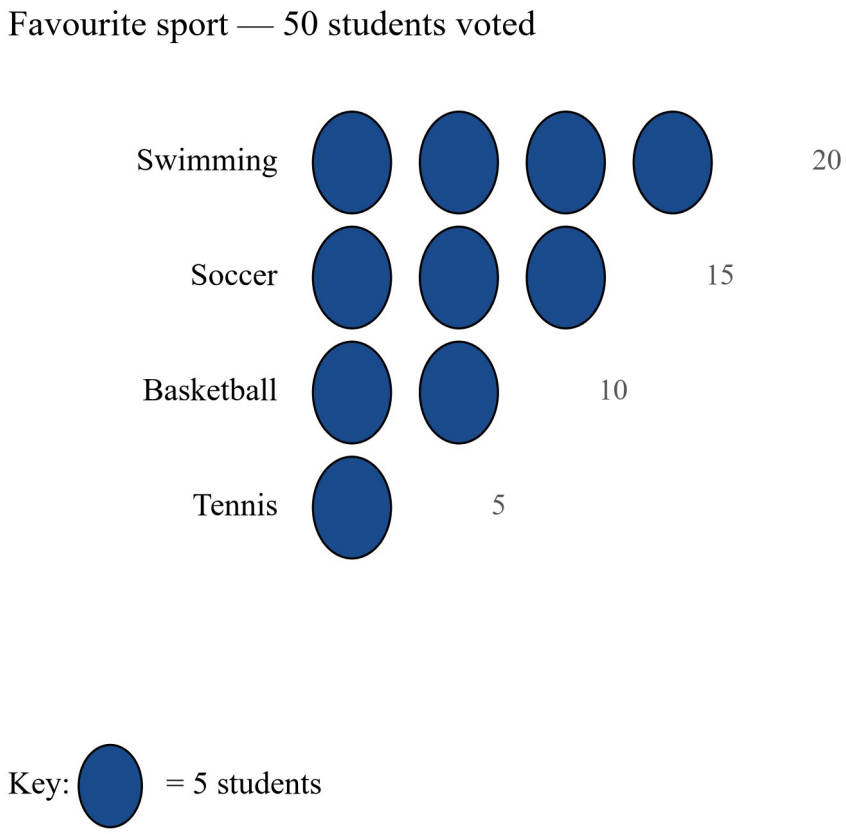
The column graph for Example 2:



A column graph with the scale counting in 2s from 0 to 10. In the sun: 8. In the dark: 3, with the top of the column halfway between the 2 and 4 lines. On the shelf: 5.

Example 3 — on your own: Zoe skips the key

A survey asks 50 students: *What is your favourite sport?* The results are shown in a pictograph with the key **1 symbol = 5 students**.



A pictograph of favourite sport with a key of one symbol = 5 students: swimming 4 symbols (20 students), soccer 3 symbols (15), basketball 2 symbols (10), tennis 1 symbol (5).

Zoe looks at the pictograph and says: “Swimming got 4 votes.”

Zoe has counted the **symbols** and skipped the **key**. The key says one symbol stands for 5 students, so swimming got 4 × 5 = 20 votes, not 4. Reading the key is part of reading the display.

The true counts: swimming 4 × 5 = 20; soccer 3 × 5 = 15; basketball 2 × 5 = 10; tennis 1 × 5 = 5. Check the total: 20 + 15 + 10 + 5 = 50, and 50 students voted. ✓ Swimming was the most popular sport.

Practice questions

Questions with help

Q1. Say whether each question collects **categorical data** or a **count** (discrete numerical data). (a) What is your favourite season? (b) How many library books did you borrow this term? (c) Which house team are you in? (d) How many skips can you do in one minute?

Q2. The tally chart below shows how 30 students voted for the vegetable to grow in the garden bed.

Vegetable	Tally	Count
Corn	𝍸 𝍸	10
Carrot	𝍸 III	8
Tomato	𝍸 I	6
Peas	IIII	4
Pumpkin	II	2

(a) Which vegetable got the most votes?

(b) How many students voted in total?

(c) How many more students chose corn than pumpkin?

Q3. A class counted the colours of 20 cars in the staff car park. The list is: white, blue, red, white, silver, white, black, blue, silver, white, red, blue, silver, white, black, silver, red, white, blue, silver. (a) Make a tally chart of the list. (b) Which colour was counted the most? (c) How many black cars were counted?

Q4. The pictograph shows the birds seen in the school yard in one morning count. The key is 1 symbol = 2 birds, and a half symbol stands for 1 bird.

Bird	Symbols
Magpies	4 symbols
Pigeons	3 symbols
Willie wagtails	2 and a half symbols
Rainbow lorikeets	1 and a half symbols

(a) How many of each bird were seen?

(b) Which bird was seen the most?

(c) How many more pigeons than rainbow lorikeets were seen?

Q5. The column graph shows how many bean seeds sprouted in each tray. The scale counts in 2s.

Tray	Column height on the scale
In the sun	8
In the dark	3, halfway between 2 and 4
On the shelf	5

(a) How many seeds sprouted in each tray?

(b) Which tray had the most sprouted seeds?

(c) How many more seeds sprouted in the sun than in the dark?

Q6. The column graph of car colours has a scale counting in 5s: white 25, silver 20, blue 15, red 10, black 5. (a) How many cars were counted in total? (b) How many more white cars than red cars were counted?

Q7. In a pictograph the key is 1 symbol = 2 apples. (a) How would you draw a count of 7 apples? (b) How would you draw a count of 10 apples?

Q8. A class wants to record the bird count in a spreadsheet. (a) What should they type in column A? What should they type in column B? (b) What kind of graph can the program draw from the table?

Questions on your own

Q9. Say whether each question collects categorical data or a count, and explain how you know. (a) What is your favourite flavour of ice cream? (b) How many days were you absent this term? (c) Which vegetable do you like best? (d) How many marbles can you hold in one hand?

Q10. A class of 30 students voted for their favourite sport to play on Friday sport. The tally chart says: soccer 12, netball 9, basketball 6, tennis 4. Without counting the votes again, how can the class tell something is wrong? What might have happened?

Q11. In a pictograph the key is 1 symbol = 4 trees. (a) A row shows 2 whole symbols and 1 half symbol. How many trees is that? (b) How would you draw a count of 10 trees?

Q12. A pictograph shows how many seedlings each year level planted, with the key 1 symbol = 10 seedlings. Year 3 shows 2 and a half symbols; Year 4 shows 4 symbols. Sam says: “Year 4 planted 4 seedlings.” (a) What is wrong with what Sam says? (b) How many seedlings did each year level plant? (c) How many seedlings were planted in total?

Q13. 30 students voted for their favourite fruit. The counts are: apple 12, banana 9, orange 6, pear 3. In the column graph, 1 block stands for 3 votes. How many blocks tall is each column?

Q14. The counts 8, 6, 4 and 2 are shown as two pictographs: one with the key 1 symbol = 2, and one with the key 1 symbol = 4. (a) How many symbols does the count 6 take in each pictograph? (b) Which pictograph uses fewer symbols? (c) Are both pictographs correct displays of the same data? Explain.

Q15. Tom surveyed 30 students and wants to show the counts with a one-to-one pictograph, with no key. Is that a good choice for this data? Suggest a better way and say why it is better.

Q16. Your class wants to find out which kind of book is borrowed the most from the school library. You do not need to ask anyone. Describe one way to get the data.

Q17. A class tested three magnets. They counted the paper clips each magnet picked up: magnet A 6, magnet B 9, magnet C 4. (a) Are these data categorical or counts? (b) Record the data in a table. (c) Which magnet picked up the most paper clips?

Q18. The table shows the lunch orders for a class of 30 students.

Lunch	Count
Pizza	14
Pie	8
Salad	5
Pasta	3

Say whether each statement is true or false. Explain each answer. (a) Pizza was the most popular lunch. (b) More students chose pie and salad together than chose pizza. (c) More than half the class chose pizza. (d) Pasta was the least popular lunch.

Q19. Your class must pick one place to visit: the zoo, the museum or the beach. Write a survey question for the class, with the three places as the answers to choose from.

Q20. A class collected litter in the school yard and sorted it. The table has a missing count.

Litter	paper	plastic	glass	metal	Total
Count	12	9	?	4	30

How many pieces of glass were collected? Show how you know.

Applied

Q21. A Year 4 class in Geelong surveyed 40 students: *Which Victorian AFL club do you support?* The clubs are real Victorian clubs; the votes are from this one class survey.

Club	Geelong	Collingwood	Richmond	Carlton	Essendon	Western Bulldogs
Votes	14	8	6	4	4	4

(a) Draw a column graph of the data. Let 1 block stand for 2 votes.

(b) Which club got the most support?

(c) How many more students supported Geelong than Richmond?

(d) True or false: more students supported Geelong than Collingwood and Richmond together. Explain your answer.

(e) Write one sentence reporting what the class found.

Answers

Q1. (a) categorical; (b) count; (c) categorical; (d) count. **Q2.** (a) corn; (b) 30; (c) 8. **Q3.** (a) white 6, silver 5, blue 4, red 3, black 2; (b) white; (c) 2. **Q4.** (a) magpies 8, pigeons 6, willie wagtails 5, rainbow lorikeets 3; (b) magpies; (c) 3. **Q5.** (a) sun 8, dark 3, shelf 5; (b) the sun tray; (c) 5. **Q6.** (a) 75; (b) 15. **Q7.** (a) 3 whole symbols and 1 half symbol; (b) 5 whole symbols. **Q8.** (a) Column A: the birds (magpies, pigeons, willie wagtails, rainbow lorikeets). Column B: the counts (8, 6, 5, 3); (b) a column graph. **Q9.** (a) categorical; (b) count; (c) categorical; (d) count. See worked answers for reasons. **Q10.** The counts add to 31 (12 + 9 + 6 + 4 = 31), but only 30 students voted. One vote was counted twice, or one tally mark too many was drawn. **Q11.** (a) 10 trees; (b) 2 whole symbols and 1 half symbol. **Q12.** (a) Sam counted symbols and skipped the key; (b) Year 3: 25, Year 4: 40; (c) 65. **Q13.** Apple 4 blocks, banana 3, orange 2, pear 1. **Q14.** (a) key 2: 3 symbols; key 4: 1 and a half symbols; (b) the key-4 pictograph; (c) yes — same data, different keys. **Q15.** No — 30 symbols in a row makes long rows that are hard to read. Better: a key (1 symbol = 2 or 5), or a column graph with a scale. **Q16.** Example: ask the librarian for the borrowing records, or watch the borrowings for a week and tally each kind of book. **Q17.** (a) counts; (b) any table with the three magnets and 6, 9, 4; (c) magnet B. **Q18.** (a) true; (b) false; (c) false; (d) true. See worked answers for reasons. **Q19.** Example: "Which place should our class visit — the zoo, the museum, or the beach?" **Q20.** 5. The counts must add to 30: 12 + 9 + 4 = 25, and 30 − 25 = 5. **Q21.** (b) Geelong; (c) 8; (d) false — Collingwood and Richmond together is 8 + 6 = 14, the same as Geelong, not fewer; (e) example: "In our survey of 40 students, Geelong got the most support, with 14 votes."

Worked answers

Q1. (a) Favourite season — the answers are categories like summer or winter, so categorical. (b) Number of books borrowed — the answer is a count, so a count. (c) House team — the answers are the names of houses, so categorical. (d) Number of skips — the answer is a count, so a count.

Q2. (a) Corn has the tallest count (10). (b) 10 + 8 + 6 + 4 + 2 = 30 students. (c) Corn 10 − pumpkin 2 = 8 more students.

Q3. (a) Go through the list one car at a time and add a tally mark each time.

Colour	Tally	Count
White	𝍸 I	6
Silver	𝍸	5
Blue	IIII	4
Red	III	3
Black	II	2

Check: 6 + 5 + 4 + 3 + 2 = 20 cars. ✓ (b) White was counted the most (6). (c) Black: 2 cars.

Q4. (a) With a key of 2, count the symbols in 2s, and a half symbol is 1: magpies 4 × 2 = 8; pigeons 3 × 2 = 6; willie wagtails 2 × 2 + 1 = 5; rainbow lorikeets 1 × 2 + 1 = 3. (b) Magpies were seen the most (8). (c) Pigeons 6 − rainbow lorikeets 3 = 3 more.

Q5. (a) Read each column against the scale: sun 8, dark 3, shelf 5. (b) The sun tray. (c) 8 − 3 = 5 more seeds.

Q6. (a) 25 + 20 + 15 + 10 + 5 = 75 cars. (b) White 25 − red 10 = 15 more cars.

Q7. (a) 7 apples: 3 whole symbols (6 apples) and 1 half symbol (1 more apple). (b) 10 apples: 10 ÷ 2 = 5 whole symbols.

Q8. (a) Column A holds the categories — the birds (magpies, pigeons, willie wagtails, rainbow lorikeets). Column B holds the counts (8, 6, 5, 3). (b) A column graph.

Q9. (a) Categorical — the answers are flavours, which are categories. (b) Count — the answer is a whole number of days. (c) Categorical — the answers are vegetables, which are categories. (d) Count — the answer is a whole number of marbles.

Q10. Add the counts: 12 + 9 + 6 + 4 = 31. But only 30 students voted, so the counts should add to 30. One vote was counted twice, or one tally mark too many was drawn. Checking that the counts add to the number of people surveyed is a quick way to catch mistakes.

Q11. (a) 2 whole symbols is 2 × 4 = 8 trees, and the half symbol is 2 more… a half symbol stands for half of 4, which is 2 — so 8 + 2 = 10 trees. (b) 10 trees: 2 whole symbols (8) and 1 half symbol (2).

Q12. (a) Sam counted the symbols and did not read the key. The key says 1 symbol = 10 seedlings. (b) Year 3: 2 × 10 + 5 = 25 seedlings (the half symbol is half of 10). Year 4: 4 × 10 = 40 seedlings. (c) 25 + 40 = 65 seedlings.

Q13. 1 block stands for 3 votes, so divide each count by 3: apple 12 ÷ 3 = 4 blocks; banana 9 ÷ 3 = 3 blocks; orange 6 ÷ 3 = 2 blocks; pear 3 ÷ 3 = 1 block.

Q14. (a) Key 2: 6 ÷ 2 = 3 symbols. Key 4: 6 ÷ 4 is 1 whole symbol and 2 left over, and 2 is half of 4, so 1 and a half symbols. (b) The key-4 pictograph uses fewer symbols. (c) Yes. Both show the same counts; the keys only change how many symbols each count takes. The display must say its key, and then both are correct.

Q15. A one-to-one pictograph of 30 votes has long rows and takes a lot of space. A better way is a many-to-one display: a pictograph with a key (1 symbol = 2 or 5 votes), or a column graph with a scale counting in 2s or 5s. The rows stay short, and the columns are quick to compare.

Q16. The library keeps records of every book borrowed, so the data already exist. Ask the librarian for the borrowing records for this term, or watch the borrowings for one week and tally each kind of book. Either way you acquire the data without a survey.

Q17. (a) Counts — each answer is a whole number of paper clips. (b) Any table like:

Magnet	A	B	C
Paper clips	6	9	4

(c) Magnet B picked up the most paper clips (9).

Q18. (a) True — pizza has the tallest count (14). (b) False — pie and salad together: 8 + 5 = 13, and 13 is fewer than 14. (c) False — half of 30 is 15, and 14 is fewer than 15. (d) True — pasta has the smallest count (3).

Q19. The question must give everyone the same three answers to choose from. Example: “Which place should our class visit — the zoo, the museum, or the beach?” Each student picks one answer, and the answers are categorical data.

Q20. The total is 30, so the four counts must add to 30. Paper, plastic and metal: 12 + 9 + 4 = 25. Glass: 30 − 25 = 5 pieces.

Q21. (a) The graph has one column for each club. With 1 block standing for 2 votes, the scale counts in 2s up to 14: Geelong 7 blocks, Collingwood 4, Richmond 3, Carlton 2, Essendon 2, Western Bulldogs 2. Check the blocks: 7 + 4 + 3 + 2 + 2 + 2 = 20 blocks, and 20 × 2 = 40 votes. ✓ (b) Geelong got the most support (14 votes). (c) Geelong 14 − Richmond 6 = 8 more students. (d) False — Collingwood and Richmond together: 8 + 6 = 14, which is the *same* as Geelong, not fewer. So it is not true that more students supported Geelong. (e) Example: “In our survey of 40 students, Geelong was the most supported club, with 14 votes.”

Judging a display: the shape of a distribution and variation in the data

Code VC2M4ST02 (Victorian Curriculum F–10 Version 2.0, Mathematics, Level 4; authority file `maths_4.json`): "analyse the effectiveness of different displays or visualisations in illustrating and comparing data distributions, then discuss the shape of distributions and the variation in the data". This section draws on elaborations `VC2M4ST02.E01`–`VC2M4ST02.E03`.

What you need to know

In Year 3 you made picture graphs and tables where one picture or one tick stood for one thing. In Year 4 there is a new step: one picture can stand for more than one. This section is about reading displays with that step in them, and about judging how good a display is.

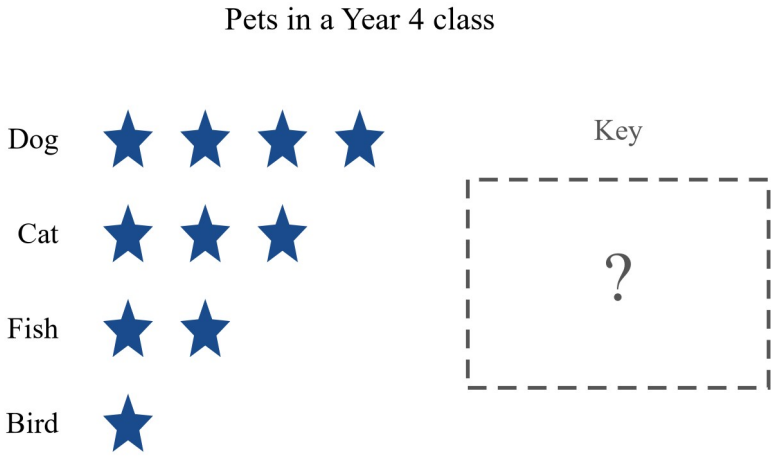
Data and displays. Data is what you find out when you ask a question and collect the answers. A **display** is a way of setting out data so people can see what it shows. In this section you will work with three displays: tables, picture graphs and column graphs.

Keys. When one picture stands for more than one, the graph needs a **key**. The key tells you what one picture stands for. If the key says 1 star stands for 4 students, then 2 stars stand for 8 students, and half a star stands for 2 students.

When 1 picture stands for 4, half a picture stands for 2.

One blue star labelled "= 4 students", two blue stars labelled "= 8 students", and a star that is half blue and half grey labelled "= 2 students", with the line "When 1 picture stands for 4, half a picture stands for 2." under them.

Without its key, a picture graph does not make sense.

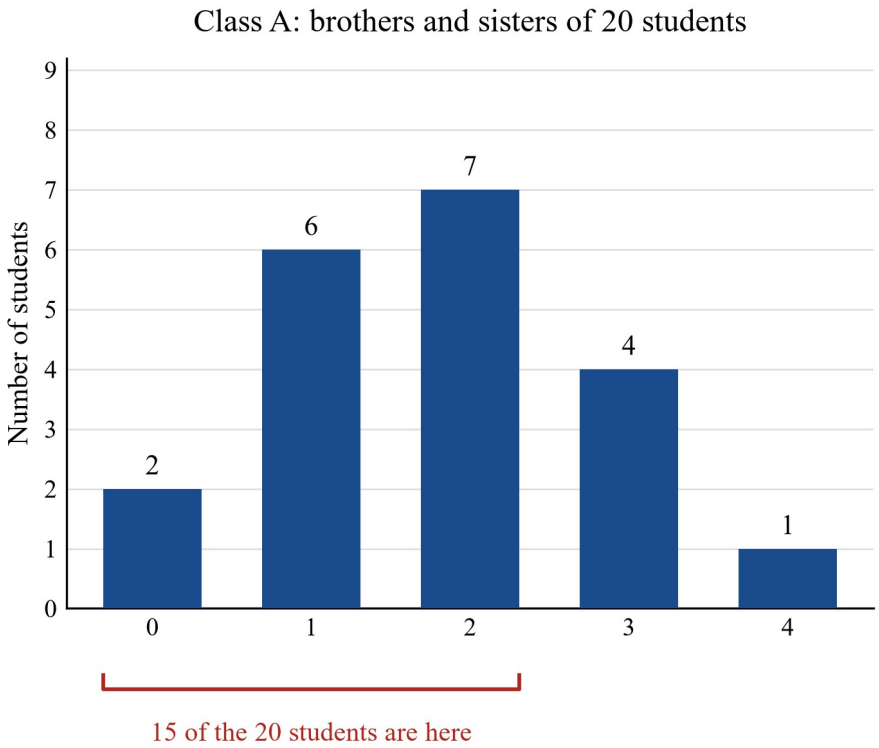


A picture graph titled "Pets in a Year 4 class". Rows of blue stars: Dog 4 stars, Cat 3 stars, Fish 2 stars, Bird 1 star. Where the key should be, there is an empty grey box with a question mark in it.

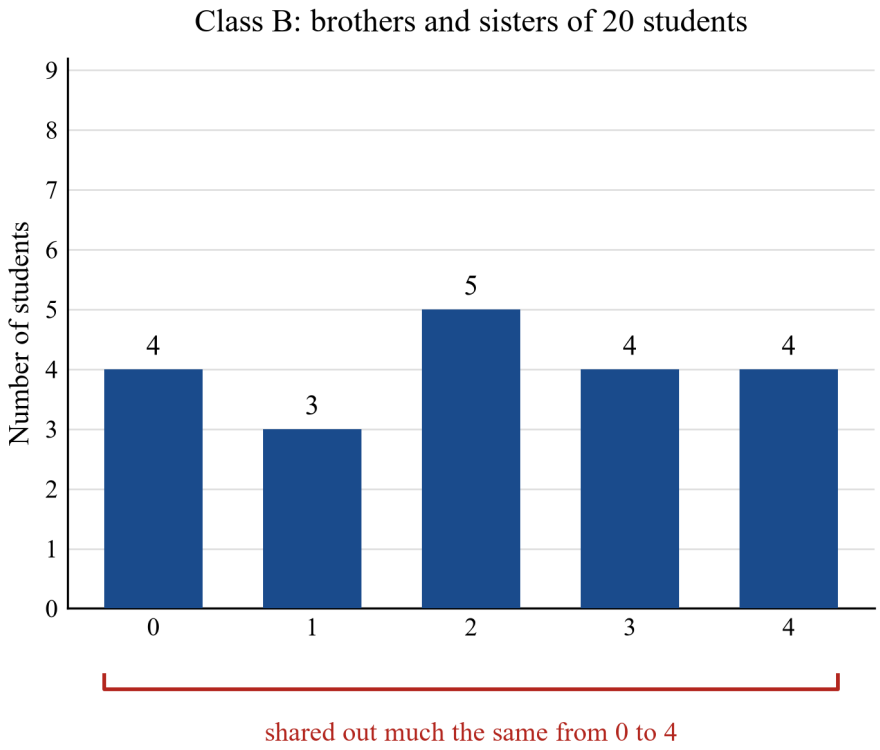
This graph has no key, so you cannot tell how many pets each star stands for. Does one star stand for 1 pet, or 2, or 10? The display does not do its job. A good display always has its key in it.

The shape of the data: bunched or spread. The Victorian Curriculum uses the word **distribution** but does not give it one fixed meaning. In this section, *the distribution of the data* means *the way the data is spread out over the different values* — which values have a lot of data and which have little or no data. The curriculum also uses the word **variation** without one fixed meaning. In this section, *variation* means *how much the data changes from one value to another*.

One good way to talk about shape is to say whether the data is **bunched** or **spread**. Data is bunched when most of it sits near one or two values. Data is spread when it is shared out, with much the same at each value.



A column graph titled "Class A: brothers and sisters of 20 students". Columns: 0 brothers and sisters, 2 students; 1, 6 students; 2, 7 students; 3, 4 students; 4, 1 student. A red line under the columns for 0, 1 and 2 marks them, with the words "15 of the 20 students are here" below it.



A column graph titled "Class B: brothers and sisters of 20 students". Columns: 0 brothers and sisters, 4 students; 1, 3 students; 2, 5 students; 3, 4 students; 4, 4 students. A red line under all five columns marks them, with the words "shared out much the same from 0 to 4" below it.

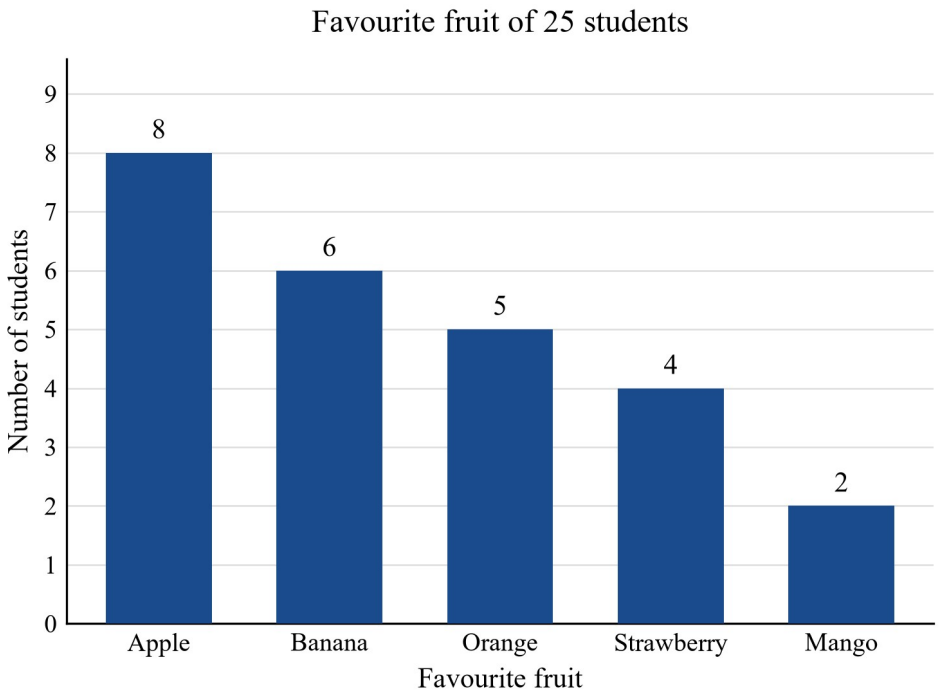
Class A's data is bunched: 15 of the 20 students have 0, 1 or 2 brothers and sisters, so most of the data sits near 1 and 2. Class B's data is spread: the counts are much the same at every value from 0 to 4, with no bunch. Both classes have 20 students, but the shape of the data is not the same. Shape tells you not just how much data there is, but how it sits.

Judging a display. To judge a display, ask: *can I see what I need to see?* Each display is good at a different thing. A column graph shows the shape quickly — you see the tallest column (the **peak**) and you see whether the data is bunched or spread. A table lists every number, so it is good for reading one number straight off. A picture graph with a key is good when the counts are big, because the pictures do the counting for you. The best display is the one that shows what you want to see.

Worked examples

Example 1 — reading a column graph: shape and variation

Twenty-five students were asked: *What is your favourite fruit?* Here are the answers as a column graph. Describe the shape of the data.



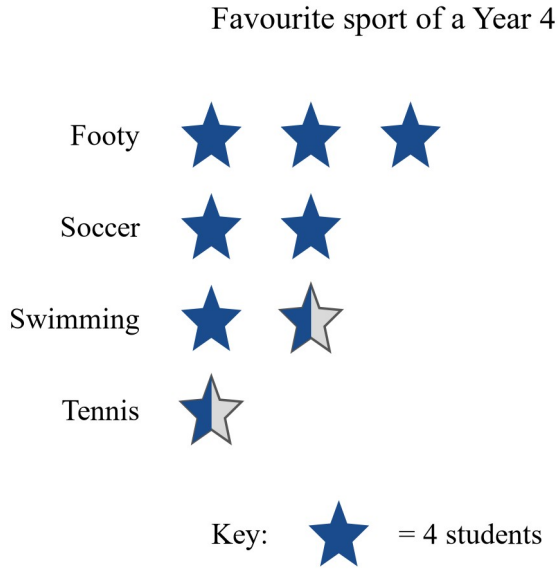
A column graph titled "Favourite fruit of 25 students". Columns: Apple 8, Banana 6, Orange 5, Strawberry 4, Mango 2.

Working	Comment
The peak is apple, with 8.	The tallest column is the value with the most data.
The counts step down: 8, 6, 5, 4, 2.	Each column is shorter than the one before it.
8 + 6 = 14 of the 25 chose apple or banana.	Most of the data sits at those two values.

The shape is bunched: most students chose apple or banana, and only 2 chose mango. There is variation as well — the counts run from 2 up to 8 — but the bunch at apple and banana is the first thing you see.

Example 2 — reading a picture graph with a key

A class of 28 students was asked: *What is your favourite sport?* The picture graph below has the key 1 star = 4 students. Use the key to find how many students chose each sport.



A picture graph titled "Favourite sport of a Year 4 class". Rows: Footy 3 stars; Soccer 2 stars; Swimming 1 whole star and 1 half-blue half-grey star; Tennis 1 half-blue half-grey star. Key: 1 star = 4 students.

Row	Stars	Students
Footy	3 stars	3 × 4 = 12
Soccer	2 stars	2 × 4 = 8
Swimming	1½ stars	4 + 2 = 6
Tennis	½ star	2

Check the count of students: 12 + 8 + 6 + 2 = 28. ✓

The shape is bunched at footy: 12 of the 28 students chose it, more than chose any other sport, and only 2 chose tennis.

Example 3 — the same data in two displays

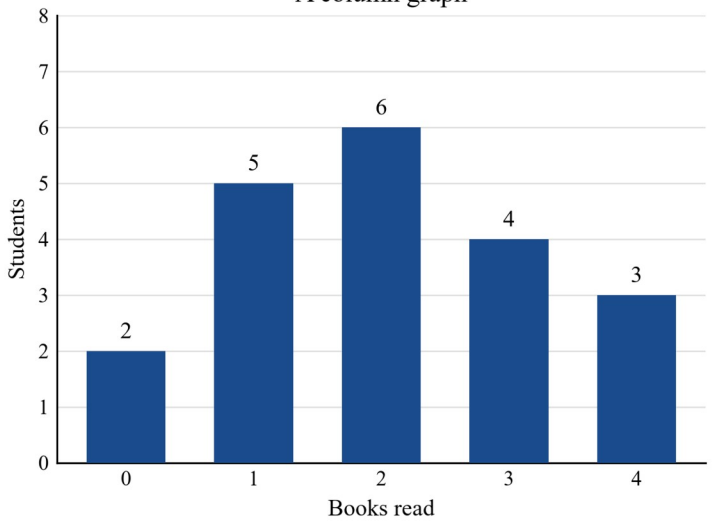
Twenty students were asked how many books they read last month. Here is the same data shown two ways. Compare the two displays.

Books read last month by 20 students

A table

Books read	0	1	2	3	4
Students	2	5	6	4	3

A column graph



The same data shown two ways, under the title "Books read last month by 20 students". Left: a table with the rows "Books read: 0, 1, 2, 3, 4" and "Students: 2, 5, 6, 4, 3". Right: a column graph with columns of height 2, 5, 6, 4, 3 above 0, 1, 2, 3, 4 books.

What you notice	Why it matters
The table lists every number.	You can read "3 books: 4 students" straight off.
The graph shows the shape quickly.	You see the peak at 2 books without reading every number.
The two displays hold the same data.	They look different but they say the same thing.

The table and the graph each do a different job well: the table for reading numbers, the graph for seeing the shape.

Practice questions

Questions with help

Q1. Look at the pets picture graph with the empty key box. What is missing from the display, and why does the graph need it?

Q2. A picture graph has the key: 1 star = 4 students. What does half a star stand for?

Q3. A picture graph has the key: 1 star = 4 votes. How many votes does each row show? (a) 3 stars (b) half a star (c) 2½ stars

Q4. Look at the column graph for Class A. How many students have 0, 1 or 2 brothers and sisters? Is Class A's data bunched or spread?

Q5. Look at the column graph for Class B. How many students have 3 or 4 brothers and sisters? Is Class B's data bunched or spread?

Q6. Look at the fruit column graph. Which fruit is the peak? Which fruit was chosen the least?

Q7. Look at the sport picture graph. How many students chose swimming? Show how you used the key.

Q8. Look at the table and the column graph of books read. How many students read 2 books? Which display did you read it from, and why was that display quick to use?

Questions on your own

Q9. How many students were asked about their favourite fruit? Show how you know from the column graph.

Q10. How many more students chose footy than chose tennis? Show your working from the picture graph.

Q11. A picture graph has the key: 1 star = 4 books. How many stars does the row for 10 books need? How many stars does the row for 6 books need?

Q12. Tom asked 8 of his friends how many pets they have. The answers were 1, 1, 2, 1, 0, 1, 2, 1. Is this data bunched or spread? Explain.

Q13. Leo made a table and a column graph of his class's favourite colours.

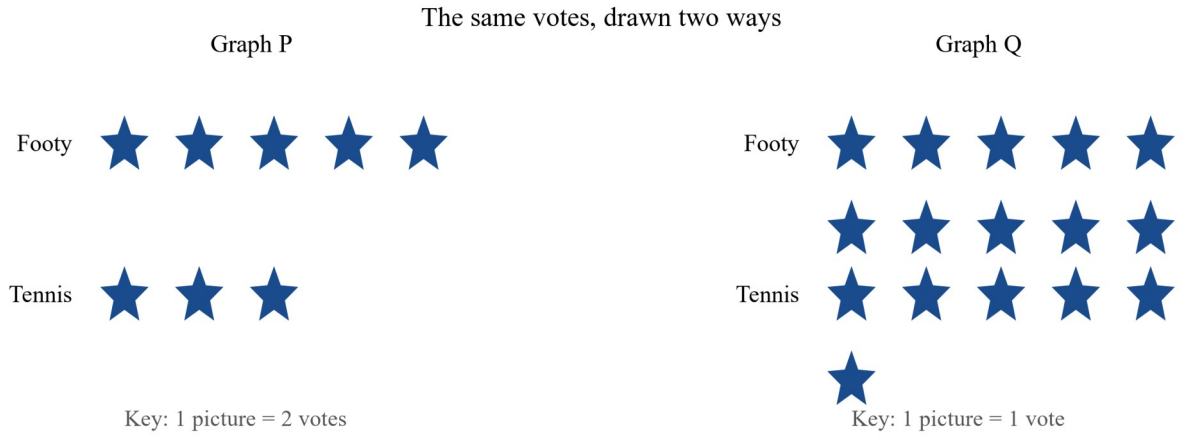
Colour	Blue	Green	Red	Yellow	Purple
Students	8	6	5	3	2

His column graph shows the counts 8, 6, 5, 5, 2. One column does not match the table. Which one?

Q14. Ava's team kicked 3, 5, 6, 4 and 2 goals in its last five games. Think of the column graph of those counts. Is the data bunched at one value, or spread? Explain.

Q15. How many students read 3 or more books last month? Use the table or the column graph.

Q16. Look at Graph P and Graph Q. How many votes for footy does each graph show? The graphs look very different, yet they show the same votes. Why?



Two picture graphs of the same votes, under the title "The same votes, drawn two ways". Graph P: Footy 5 stars, Tennis 3 stars, with the key "1 picture = 2 votes". Graph Q: Footy 10 stars drawn in two rows of 5, Tennis 6 stars drawn as a row of 5 and 1 more, with the key "1 picture = 1 vote".

Q17. Mia wants to make a picture graph with the key 1 star = 4 books. Two rows of her data are 5 books and 7 books. Explain why whole stars and half stars cannot show those rows.

Q18. A class notice shows a picture graph of the lunch clubs students chose. The key is 1 smiley = 4 students. The rows show: handball 3 smileys, soccer 2½ smileys, chess 1½ smileys. The notice says soccer was the club most students chose. Is that right? Explain.

Q19. A picture graph has the key: 1 circle = 2 pets. The dog row shows 4 whole circles and 1 half circle. How many pets is that?

Q20. Two cricket teams each made 102 runs in five games.

Team A: 20, 22, 21, 19, 20 runs. Team B: 5, 40, 12, 38, 7 runs.

The two teams made the same number of runs in all. Which team's runs are bunched? Which team's runs are spread? What does this tell you about adding the runs up and seeing the shape?

Applied

Q21. The picture graph shows days with rain in four Victorian places in the first 18 days of August 2026.

Source: Australian Bureau of Meteorology, Daily Weather Observations for Melbourne (Olympic Park), Ballarat and Bendigo, bom.gov.au/climate/dwo/, retrieved 2026-08-19.

A picture graph titled "Days with rain in the first 18 days of August 2026". Rows, with the key 1 raindrop = 2 days: Melbourne (Olympic Park) 3 whole raindrops and 1 half raindrop; Albury-Wodonga 3 whole raindrops and 1 half raindrop; Bendigo 5 raindrops; Ballarat 6 raindrops.

(a) Which place had the most days with rain? How many days was that?

(b) How many days with rain did Melbourne (Olympic Park) have? How many did Albury-Wodonga have?

(c) Someone says: "The rain was much the same at all four places." Do you agree? Use the shape of the data and the variation between the places in your answer.

Answers

Q1. The key is missing; without it you cannot tell how many pets one star stands for. **Q2.** 2 students. **Q3.** (a) 12 votes. (b) 2 votes. (c) 10 votes. **Q4.** 2 + 6 + 7 = 15 students; bunched. **Q5.** 4 + 4 = 8 students; spread. **Q6.** Apple is the peak; mango was chosen the least. **Q7.** 6 students. **Q8.** 6 students. **Q9.** 25 students. **Q10.** 12 − 2 = 10 more students. **Q11.** 10 books: 2½ stars. 6 books: 1½ stars. **Q12.** Bunched. **Q13.** The yellow column. **Q14.** Spread. **Q15.** 7 students. **Q16.** 10 votes in each graph; the keys are different. **Q17.** Stars with that key can only show even counts, and 5 and 7 are odd. **Q18.** No; handball (12 students), not soccer (10). **Q19.** 9 pets. **Q20.** Team A bunched; Team B spread; adding up does not show the shape. **Q21.** (a) Ballarat, 12 days. (b) 7 days each. (c) No — see worked solutions.

Worked solutions

Q1. The **key** is missing. The key tells you what one picture stands for, and without it a star could stand for 1 pet or for 10. You can still see that dogs are the most common pet, but you cannot say how many dogs there are. The display does not do its job.

Q2. Half a star stands for half of 4, which is **2 students**.

Q3. (a) 3 × 4 = **12 votes**. (b) Half of 4 is **2 votes**. (c) 2 stars are 8 votes and half a star is 2 votes: 8 + 2 = **10 votes**.

Q4. 2 + 6 + 7 = **15 students**. The data is **bunched**: most of it sits at 0, 1 and 2.

Q5. 4 + 4 = **8 students**. The data is **spread**: the counts are much the same from 0 to 4, with no bunch.

Q6. Apple is the peak (the tallest column, 8). **Mango** was chosen the least (2).

Q7. Swimming shows 1 whole star and 1 half star: 4 + 2 = **6 students**.

Q8. 6 students read 2 books. From the table you read the number straight off. From the graph you look at the column above "2" and read how tall it is. Either is fine.

Q9. Add the column heights: 8 + 6 + 5 + 4 + 2 = **25 students**.

Q10. Footy: 3 stars = 3 × 4 = 12 students. Tennis: half a star = 2 students. 12 − 2 = **10 more students**.

Q11. 10 = 4 + 4 + 2, so the row needs 2 whole stars and 1 half star: **2½ stars**. 6 = 4 + 2, so the row needs **1½ stars**.

Q12. The data is **bunched**. Five of the eight answers are 1, and every answer is 0, 1 or 2, so nearly all the data sits at one value. If it were spread, the answers would be shared out over more different values.

Q13. The **yellow** column. The table says 3 students chose yellow, but the graph shows 5. Check the others: blue 8 ✓, green 6 ✓, red 5 ✓, purple 2 ✓.

Q14. The counts are 2, 3, 4, 5, 6 — one game at each count, with no bunch at any one value. So the data is **spread**. The column graph would be much the same height all the way along, like Class B's graph.

Q15. 3 books: 4 students. 4 books: 3 students. 4 + 3 = **7 students**.

Q16. Graph P: 5 stars, and each star is 2 votes, so 5 × 2 = 10 votes. Graph Q: 10 stars, and each star is 1 vote, so 10 × 1 = 10 votes. **The same 10 votes.** The graphs look different because the keys are different: Graph P's pictures stand for 2 votes each, so it needs half as many pictures as Graph Q, where each picture stands for 1 vote.

Q17. With the key 1 star = 4 books, a whole star shows 4 books and a half star shows 2 books, so the counts you can show go up by 2s: 2, 4, 6, 8, and so on. But 5 and 7 are odd numbers, and adding 4s and 2s never makes an odd number. Mia would need a different key, say 1 star = 1 book, to show those rows.

Q18. It is **not right**. Handball: 3 × 4 = 12 students. Soccer: 2½ × 4 = 10 students. Chess: 1½ × 4 = 6 students. Most students chose handball (12), so the notice is wrong.

Q19. 4 whole circles: 4 × 2 = 8 pets. Half a circle: 1 pet. 8 + 1 = **9 pets**.

Q20. Team A's runs are **bunched**: every game is near 20, from 19 to 22. Team B's runs are **spread**: the games go from 5 to 40, with two very big games and three small ones. Adding the runs gives 102 for both teams — the same number. So adding up does not tell you the shape: two sets of data can add to the same number and still have very different shapes.

Q21. (a) **Ballarat**, with 6 raindrops × 2 = **12 days** with rain. (b) Melbourne (Olympic Park): 3 whole raindrops and 1 half raindrop = 3 × 2 + 1 = **7 days**. Albury-Wodonga: the same, **7 days**. (c) **No.** The days with rain go from 7 up to 12. Melbourne and Albury-Wodonga are bunched at 7 days, but Bendigo (10 days) and Ballarat (12 days) had many more days with rain. There is a lot of variation between the places, so the rain was not much the same at all four.

Conducting a statistical investigation with surveys and digital tools

Code `VC2M4ST03` (Victorian Curriculum F–10 Version 2.0, Mathematics, Level 4; authority file `maths_4.json`): "conduct statistical investigations, collecting data through survey responses and other methods; record and display data using digital tools; interpret the data and communicate the results". This section draws on elaborations `VC2M4ST03.E01`, `.E02` and `.E03`.

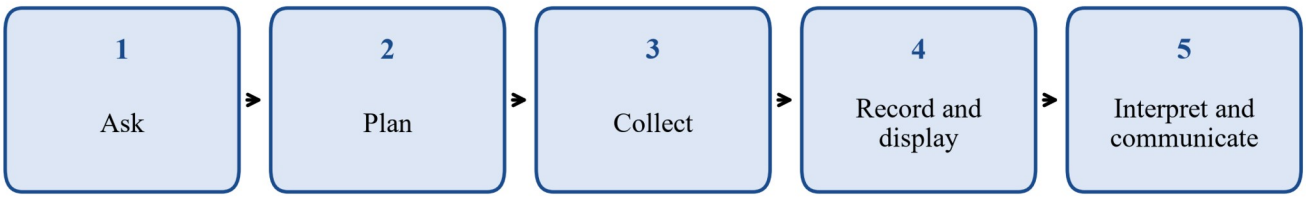
What you need to know

In 6A you collected data and built displays. In 6B you looked carefully at displays. Now you put it all together. A **statistical investigation** is a way of answering a question by collecting data and finding out what the data show. You do not guess the answer — you collect data and let the data answer the question.

Data means information, like the answers people give in a survey or the numbers on a weather page.

The five steps. Every investigation follows the same five steps, in this order.

Step	What you do
1. **Ask**	Choose a question that data can answer.
2. **Plan**	Decide what data you need and how you will get them.
3. **Collect**	Gather the data. Tally marks are a quick way to keep count.
4. **Record and display**	Put the data in a table. Then make a graph. You can use paper, or a digital tool like a spreadsheet.
5. **Interpret and communicate**	Work out what the data show. Then share what you found with others.

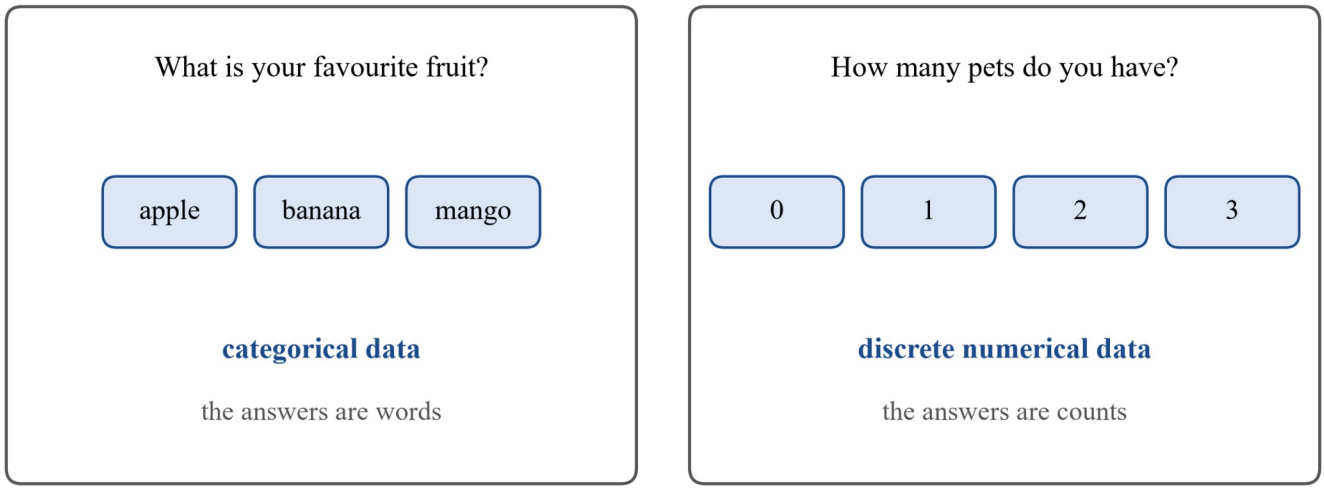


Five numbered boxes joined by arrows from left to right, showing the five steps of a statistical investigation in order: 1 ask, 2 plan, 3 collect, 4 record and display, 5 interpret and communicate.

To **interpret** data means to work out what they are telling you. To **communicate** means to share — to tell other people what you found.

Two kinds of data. At this level, your data will be one of two kinds.

- **Categorical data** — the answers are categories, or groups. The answers are words, not numbers. Example: *What is your favourite fruit?* The answers might be apple, banana or mango.
- **Discrete numerical data** — the answers are counts: whole numbers like 0, 1, 2, 3, and so on. Example: *How many pets do you have?* You can have 2 pets, but not 2.5 pets — a count is always a whole number.

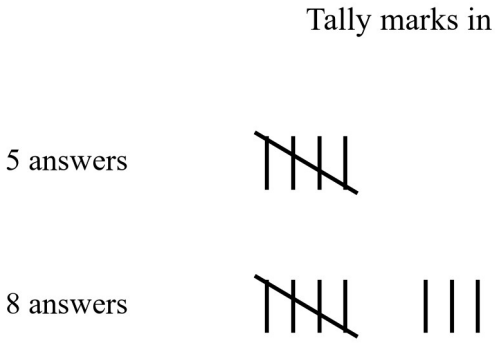


Two survey questions side by side. Left: What is your favourite fruit? with the word answers apple, banana and mango, labelled categorical data, the answers are words. Right: How many pets do you have? with the number answers 0, 1, 2 and 3, labelled discrete numerical data, the answers are counts.

Surveys. A **survey** is a set of questions you ask a group of people, so you can collect their answers as data. A good survey question:

- is clear, so everyone understands it the same way;
- can be answered by everyone in the group;
- has a fixed list of answers to choose from, or asks for a count; and
- is answered once by each person.

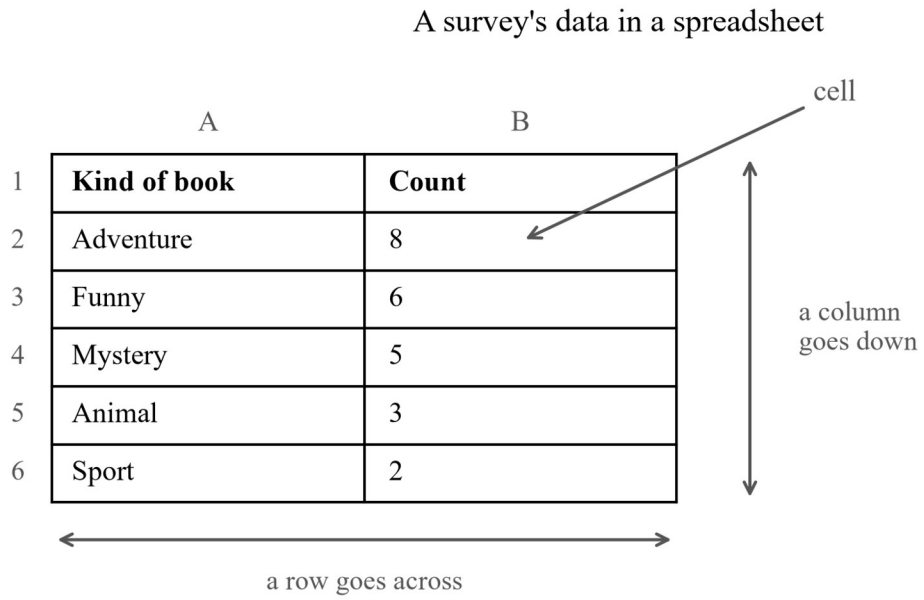
When you collect the answers, record every one. Tally marks help: each mark is one answer, and the fifth mark is drawn across the group of four, like this: 𝙸𝙸𝙸𝙸⁄.



Tally marks for two counts. 5 answers: four straight marks with a fifth mark drawn across them. 8 answers: the same group of five, then three more straight marks. The fifth mark goes across the group of four.

Digital tools. You can record and display data with a computer instead of paper. A **spreadsheet** is a program that keeps data in a grid of small boxes. Each box is called a **cell**. The cells are arranged in columns going down and rows going across. To make a graph from a survey:

1. Type the categories in column A, one in each row.
2. Type the counts next to them, in column B.
3. Select the data and choose a column graph from the program's graph tools.



A spreadsheet grid with the kinds of book in column A and the counts in column B. An arrow on the right points up and down along a column, with the words a column goes down. An arrow below points across a row, with the words a row goes across. A small arrow points to one box, with the word cell.

Two real spreadsheet programs are **Microsoft Excel** and **Google Sheets**.

> Source: Microsoft, *Microsoft Excel*, retrieved 2026-08-19. Source: Google, *Google Sheets*, retrieved 2026-08-19.

You can also do every step on paper — tally marks, table, and a column graph on grid paper. Digital tools are permitted in this section but not required. Learn both ways: a good investigator can work with either.

Data from online sources. Sometimes you do not need to survey anyone, because someone else has already collected the data and put them online. For example, the Bureau of Meteorology publishes weather records for towns across Victoria, and **Google Trends** shows what people are searching for on the internet.

> Source: Google, *Google Trends*, retrieved 2026-08-19.

When you use data from an online source, always write down where the data came from and when you got them. This is called a **source line**, and it looks like this:

> Source: Australian Bureau of Meteorology, Daily Weather Observations for Melbourne (Olympic Park), bom.gov.au, retrieved 2026-08-19.

A source line lets anyone check your data, or find them again.

Worked examples

Example 1 — step by step: a class survey

Ms Chen’s Year 4 class has 24 students. The class wants to buy more books for the reading corner. Ms Chen asks: *What kind of book should we buy more of?*

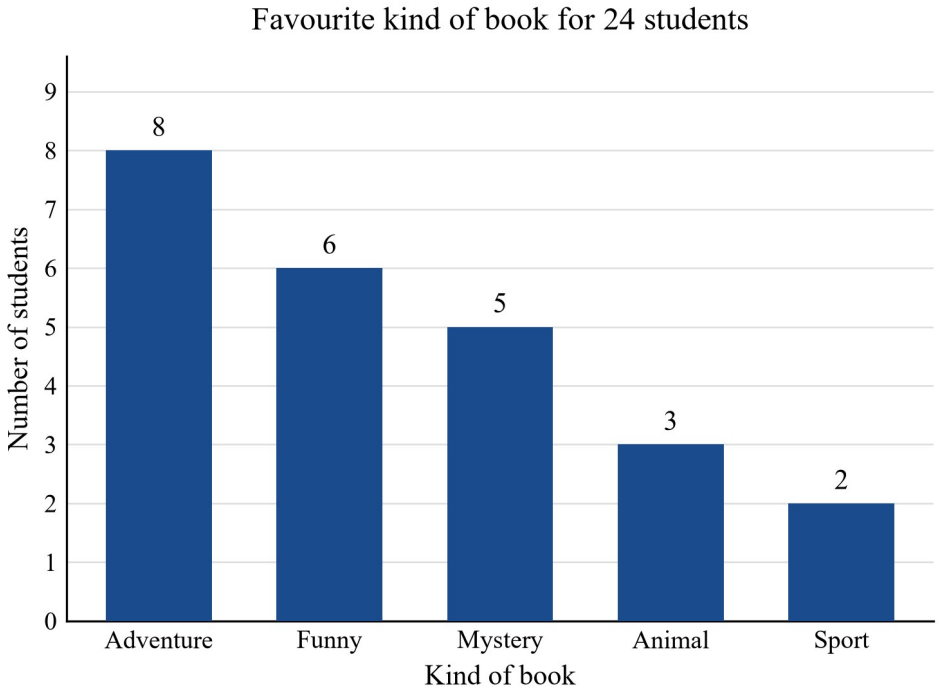
The students vote. The choices are Adventure, Funny, Mystery, Animal and Sport. The results are: Adventure 8, Funny 6, Mystery 5, Animal 3, Sport 2.

Record the data in a table, display them in a column graph, and report what the class should buy.

Working	Comment
Check the total: 8 + 6 + 5 + 3 + 2 = 24.	24 students voted, so the counts must add to 24. Always check.
Make a table with one row for each kind of book.	Put the categories in one column and the counts in the next.
Draw a column graph. Let 1 block stand for 1 vote.	On a spreadsheet, type the categories in column A and the counts in column B, then choose a column graph.
Read the graph: Adventure is the tallest column (8). Sport is the shortest (2).	The tallest column shows the most popular answer.
8 − 2 = 6.	Adventure got 6 more votes than Sport.
Report: "In our survey of 24 students, Adventure books were the most popular choice for the reading corner."	Say what you found, and give the number that backs it up.

The table and graph for Example 1:

Kind of book	Count	Column (1 block = 1 vote)
Adventure	8	
Funny	6	
Mystery	5	
Animal	3	
Sport	2	



A column graph titled Favourite kind of book for 24 students. Adventure 8, Funny 6, Mystery 5, Animal 3, Sport 2.

The class should buy more Adventure books.

Example 2 — step by step: data from an online source

How many days did it rain in the first 18 days of August 2026?

You do not need to survey anyone for this — the Bureau of Meteorology already recorded the weather. Its website shows the rainfall for each day. Here are the daily rainfalls, in millimetres (mm), for Melbourne (Olympic Park):

Day	1	2	3	4	5	6	7	8	9
Rain	0	0	0	0.6	3.6	7.2	0.2	0	1.4

Day	1	2	3	4	5	6	7	8	9
(mm)									

Day	10	11	12	13	14	15	16	17	18
Rain (mm)	24.4	4.0	0	0	0	0	0	0	0

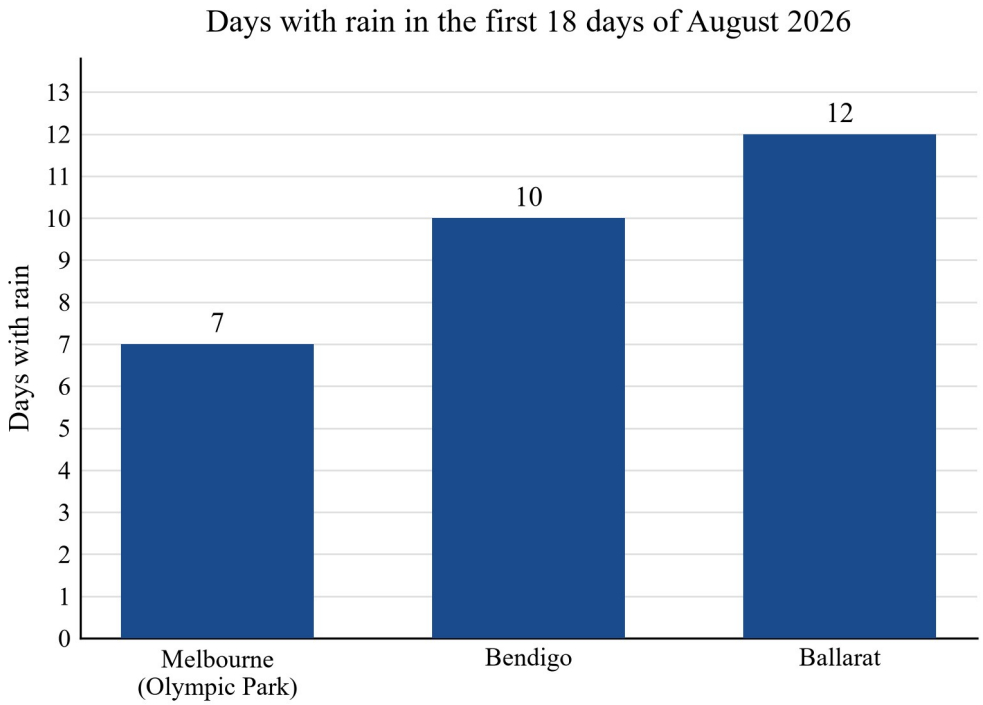
Source: Australian Bureau of Meteorology, Daily Weather Observations for Melbourne (Olympic Park), bom.gov.au/climate/dwo/, retrieved 2026-08-19.

Working	Comment
Look for days with rain greater than 0 mm.	A day with 0 mm had no rain.
Days 4, 5, 6, 7, 9, 10 and 11 had rain.	Count them: that is 7 days.
The same pages show Bendigo had 10 rainy days and Ballarat had 12 rainy days over the same 18 days.	One online source can give you data for more than one town.
Make a column graph of the rainy days for the three towns.	Let 1 block stand for 1 day.
Ballarat is the tallest column (12). Melbourne is the shortest (7).	Ballarat had the most rainy days; Melbourne had the least.
Report: “In the first 18 days of August 2026, Ballarat had the most days with rain (12 days), and Melbourne (Olympic Park) had the least (7 days).”	Name the town and the number.

The graph for Example 2 (1 block = 1 day):

Town	Days with rain	Column
Melbourne (Olympic Park)	7	[redacted]
Bendigo	10	[redacted]
Ballarat	12	[redacted]

Source: Australian Bureau of Meteorology, Daily Weather Observations for Melbourne (Olympic Park), Ballarat and Bendigo, bom.gov.au/climate/dwo/, retrieved 2026-08-19.



A column graph titled Days with rain in the first 18 days of August 2026. Melbourne (Olympic Park) 7 days, Bendigo 10 days, Ballarat 12 days.

Notice something: on 10 August, Melbourne had 24.4 mm of rain — a very wet day! But it still counts as just **one** rainy day. A count tells you *how many* days it rained, not *how much* rain came down.

Example 3 — on your own: testing what someone says

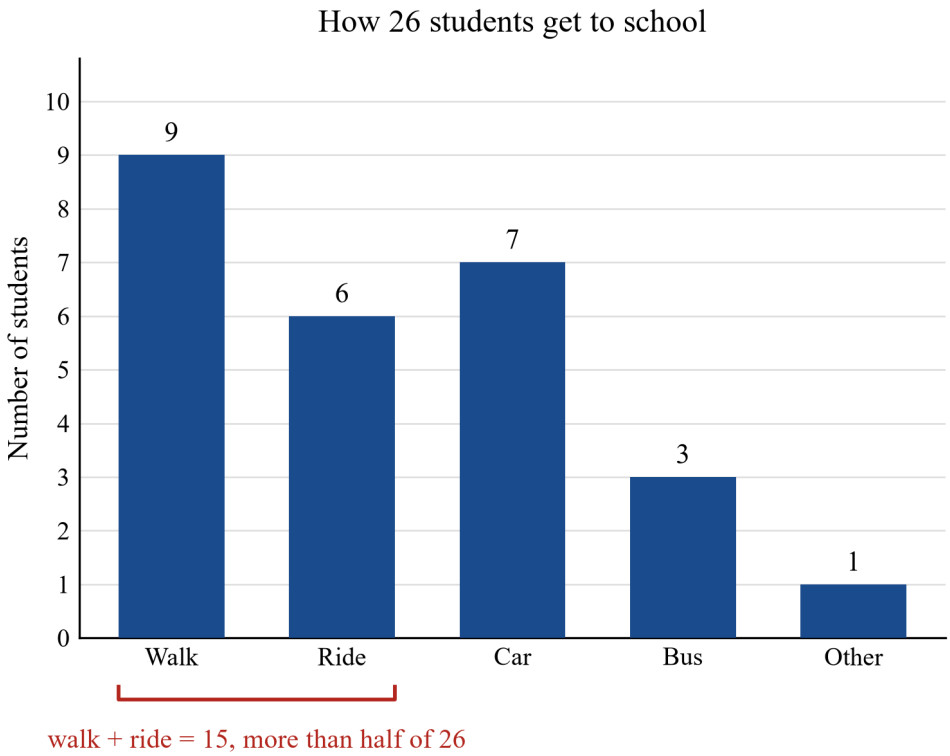
Noah says: "Most students in our class walk or ride to school." His class has 26 students. How can you find out if Noah is right?

Ask each student: *How do you usually get to school?* The answers are categories: walk, ride, car, bus or other. Ask all 26 students, once each. Say the results are:

Way to school	walk	ride	car	bus	other
Count	9	6	7	3	1

Check: 9 + 6 + 7 + 3 + 1 = 26. All 26 students are counted.

Walk and ride together: 9 + 6 = 15 students. Half of 26 is 13. Since 15 is more than 13, **more than half** the class walks or rides. "Most" means more than half, so Noah is right.



A column graph titled How 26 students get to school. Walk 9, ride 6, car 7, bus 3, other 1. A red line under the walk and ride columns marks them, with the words walk + ride = 15, more than half of 26, below it.

To report: "We asked all 26 students how they get to school. 15 walk or ride, which is more than half the class. So most students walk or ride to school — Noah is right."

Investigation activity — your turn to conduct one

Now conduct your own statistical investigation, following all five steps. Choose a question, or make up your own:

- What is the most popular lunchtime game in our class?
- What is the most popular fruit in our class?
- How do the students in our class get to school?

Plan. Write your survey question. List the answers people can choose from. Decide who you will ask.

Collect. Ask each person once. Record every answer with tally marks.

Record your survey results

Category	Tally	Count
Total		

A blank tally chart titled Record your survey results, with the columns Category, Tally and Count, four empty rows to write in, and a Total row.

Record and display. Put your results in a table. Then make a column graph — on grid paper, or in a spreadsheet. If you use a spreadsheet, type the categories in column A and the counts in column B, then make a column graph.

Interpret and communicate. Write three sentences:

1. What question did you ask?
2. What did you find? Give the numbers.
3. How do you know your results are right? (Check that your counts add up to the number of people you asked.)

Your teacher may use this activity for the class investigation task.

Practice questions

Questions with help

Q1. Put the five steps of a statistical investigation in order. The steps are mixed up: *collect the data · interpret and communicate · ask a question · record and display · plan*. Write them in order from first to last.

Q2. Is each question collecting **categorical data** or **discrete numerical data** (a count)? (a) What is your favourite colour? (b) How many brothers and sisters do you have? (c) What sport do you play most? (d) How many library books did you borrow this term?

Q3. Ruby asked 12 friends: *What is the best pet?* Their answers were: dog, cat, dog, fish, dog, cat, bird, dog, cat, fish, dog, cat. (a) Draw a tally table showing the count for each pet. (b) Which pet got the most votes? (c) How many votes did fish get?

Q4. In a column graph, 1 block stands for 2 votes. The columns are: footy — 4 blocks; tennis — 3 blocks; swimming — 5 blocks; dance — 2 blocks. (a) How many votes did each sport get? (b) Which sport got the most votes? (c) How many students voted in total?

Q5. Mia surveyed her class about their favourite day of the week. The results were: Monday 4, Tuesday 6, Wednesday 3, Thursday 5, Friday 8. (a) If Mia types her data into a spreadsheet, what should she put in column A? What should she put in column B? (b) What kind of graph should she make?

Q6. A survey asked 18 students: *What is your favourite fruit?* The table shows the results.

Fruit	Count
Apple	7
Banana	5
Orange	4
Pear	2

(a) Which fruit is the most popular?

(b) Which fruit is the least popular?

(c) How many more students chose apple than pear?

Q7. You want to find the most popular lunchtime game. Which question is better, and why? A: *Do you like lunchtime games?* B: *Which game do you play most at lunch — handball, soccer, basketball, or another game?*

Q8. Priya found data on a website and used them in her investigation. (a) What two things should she write down about the data? (b) Why does she write them down?

Questions on your own

Q9. Your class is planning a party. Write a survey question to find out which snack the class should buy. Include three answers people can choose from.

Q10. Say whether each question collects categorical data or discrete numerical data (a count), and explain how you know. (a) How many pets do you have? (b) What is your favourite day of the week? (c) How many days did you walk to school this week? (d) What colour is your school bag?

Q11. A class voted on their favourite kind of movie. The tally marks are shown below. Remember: in tally marks, the fifth mark goes across the group of four.

Kind of movie	Tally
Adventure	𝍸 III
Funny	𝍸
Mystery	III

(a) How many votes did each kind get?

(b) How many students voted in total?

(c) How many more students chose Adventure than Mystery?

Q12. The table shows how 24 students get to school. Leo drew a column graph, but he made a mistake on one column. His graph shows: walk — 9 blocks; car — 6 blocks; bus — 4 blocks; ride — 3 blocks.

Way to school	walk	car	bus	ride
Count	9	6	4	5

Which column is wrong on Leo's graph? How can you tell?

Q13. 30 students voted for their favourite sport. In the column graph, 1 block stands for 3 votes. Soccer got 12 votes and swimming got 6 votes. (a) How many blocks tall is the soccer column? (b) How many blocks tall is the swimming column?

Q14. Leo surveyed 24 students about their favourite game. His table shows the counts 8, 7, 6 and 4. Without counting the votes again, how can Leo tell something is wrong? What might have happened?

Q15. Your school wants to know where students most like to play at lunchtime. (a) Write a question you could ask. (b) List three places students could choose from. (c) Will the answers be categorical data or counts?

Q16. A class of 28 students was asked how they get to school. The results were: walk 9, car 8, bus 5, ride 4, train 2. Say whether each statement is true or false. Explain each answer. (a) The most common way to get to school is walking. (b) More students come by car than by bus and train together. (c) More than half the class comes by car. (d) The train is the least common way to get to school.

Q17. Ava says: "In our class of 26 students, more students have a dog than any other pet." Describe the data you would collect to test what Ava says. What result would show that she is right?

Q18. (a) Name one place online where you can get data for an investigation. (b) When you use data from that place, what should you write down?

Q19. 20 students were asked about their favourite fruit. The results were: apple 8, banana 6, orange 4, pear 2. Write two sentences to report the results to the class.

Q20. Match each question to the best way to get the data: *survey your class*, or *find the data online*. (a) What kind of book do students in our class like best? (b) How many days did it rain in Ballarat this month? (c) What are people in Australia searching for on the internet this week?

Applied

Q21. The table shows the number of days with rain in four Victorian towns, for the first 18 days of August 2026.

Town	Melbourne (Olympic Park)	Albury-Wodonga	Bendigo	Ballarat
Days with rain	7	7	10	12

Source: Australian Bureau of Meteorology, Daily Weather Observations for Melbourne (Olympic Park), Albury-Wodonga, Bendigo and Ballarat, bom.gov.au/climate/dwo/, retrieved 2026-08-19.

(a) Draw a column graph of the data. Let 1 block stand for 1 day.
(b) Which town had the most days with rain?
(c) Two towns had the least days with rain, with the same count. Which towns were they?
(d) How many more days with rain did Ballarat have than Bendigo?
(e) Write one sentence reporting what you found.

Answers

Q1. Ask a question → plan → collect the data → record and display → interpret and communicate. **Q2.** (a) categorical; (b) count; (c) categorical; (d) count. **Q3.** (a) dog 5, cat 4, fish 2, bird 1; (b) dog; (c) 2. **Q4.** (a) footy 8, tennis 6, swimming 10, dance 4; (b) swimming; (c) 28. **Q5.** (a) Column A: the days of the week. Column B: the counts; (b) a column graph. **Q6.** (a) apple; (b) pear; (c) 5. **Q7.** B. Question A is a yes-or-no question — it does not tell you which game is most popular. Question B gives everyone the same answers to choose from. **Q8.** (a) Where the data came from (the source) and when she got them (the date); (b) so anyone can check the data or find them again. **Q9.** Example: "Which snack should we buy for the party — chips, fruit, or popcorn?" **Q10.** (a) count; (b) categorical; (c) count; (d) categorical. See solutions for reasons. **Q11.** (a) Adventure 8, Funny 5, Mystery 3; (b) 16; (c) 5. **Q12.** The ride column. It shows 3 blocks but the table says 5. **Q13.** (a) 4 blocks; (b) 2 blocks. **Q14.** The counts add to 25 (8 + 7 + 6 + 4 = 25), but only 24 students were surveyed. He may have counted one vote twice, or made one tally mark too many. **Q15.** (a) Example: "Where do you most like to play at lunchtime?"; (b) any three places, for example the oval, the library, the undercover area; (c) categorical data. **Q16.** (a) true; (b) true; (c) false; (d) true. See solutions for reasons. **Q17.** Ask each student what pet they have, or if they have no pet. Count how many have each pet. Ava is right if the number of students with a dog is more than the number with any other pet. **Q18.** (a) Example: the Bureau of Meteorology weather records, or Google Trends; (b) the source and the date you got the data. **Q19.** Example: "We asked 20 students about their favourite fruit. Apple was the most popular choice, with 8 votes, and pear was the least popular, with 2 votes." **Q20.** (a) survey your class; (b) find the data online; (c) find the data online. **Q21.** (b) Ballarat; (c) Melbourne (Olympic Park) and Albury-Wodonga (7 days each); (d) 2 days; (e) example: "In the first 18 days of August 2026, Ballarat had the most days with rain (12 days), and Melbourne (Olympic Park) and Albury-Wodonga had the least (7 days each)."

Worked solutions

Q1. The steps in order are: (1) ask a question; (2) plan; (3) collect the data; (4) record and display; (5) interpret and communicate.

Q2. (a) Favourite colour — the answers are categories like red or blue, so categorical. (b) Number of brothers and sisters — the answer is a count, so discrete numerical. (c) Sport you play most — the answers are categories like soccer or tennis, so categorical. (d) Number of library books — the answer is a count, so discrete numerical.

Q3. (a) Go through the list one answer at a time and add a tally mark each time.

Pet	Tally	Count
Dog	𝍸	5
Cat	𝍸	4
Fish	II	2
Bird	I	1

Check: 5 + 4 + 2 + 1 = 12, and Ruby asked 12 friends. ✓ (b) Dog got the most votes (5). (c) Fish got 2 votes.

Q4. (a) 1 block stands for 2 votes, so multiply the blocks by 2: footy 4 × 2 = 8; tennis 3 × 2 = 6; swimming 5 × 2 = 10; dance 2 × 2 = 4. (b) Swimming got the most votes (10). (c) Total: 8 + 6 + 10 + 4 = 28 students.

Q5. (a) Column A holds the categories — the days of the week (Monday, Tuesday, Wednesday, Thursday, Friday). Column B holds the counts (4, 6, 3, 5, 8). (b) A column graph.

Q6. (a) Apple has the biggest count (7), so apple is the most popular. (b) Pear has the smallest count (2), so pear is the least popular. (c) Apple 7 − pear 2 = 5 more students.

Q7. Question B is better. Question A is a yes-or-no question, so it cannot tell you *which* game is most popular. Question B gives every student the same list of answers to choose from, so the answers can be counted and compared.

Q8. (a) She should write the source — where the data came from — and the date she got them. Together these make a source line. (b) So that anyone reading her report can check the data, or find them again.

Q9. The question must be clear and give fixed answers to choose from. Example: “Which snack should we buy for the party — chips, fruit, or popcorn?” Each student chooses one answer, and the answers are categorical data.

Q10. (a) Count — the answer is a whole number of pets. (b) Categorical — the answers are the names of days. (c) Count — the answer is a number of days, from 0 to 5. (d) Categorical — the answers are colours.

Q11. (a) Count the tally marks. A group of five is four marks with one across: Adventure: 𝍸 III = 5 + 3 = 8; Funny: 𝍸 = 5; Mystery: III = 3. (b) Total: 8 + 5 + 3 = 16 students. (c) Adventure 8 − Mystery 3 = 5 more students.

Q12. The ride column is wrong. The table says 5 students ride, so the ride column should be 5 blocks tall — Leo drew only 3. You can check by comparing each column with the table, or by adding Leo’s blocks: 9 + 6 + 4 + 3 = 22, which is not 24. With 5 blocks for ride the total is 9 + 6 + 4 + 5 = 24. ✓

Q13. 1 block stands for 3 votes, so divide the votes by 3. (a) Soccer: 12 ÷ 3 = 4 blocks. (b) Swimming: 6 ÷ 3 = 2 blocks.

Q14. Add the counts: 8 + 7 + 6 + 4 = 25. But only 24 students were surveyed, so the counts should add to 24. One vote was counted twice, or one tally mark too many was drawn. Checking that the counts add to the number of people surveyed is a quick way to catch mistakes.

Q15. (a) Example: “Where do you most like to play at lunchtime?” (b) Example: the oval, the library, the undercover area. (c) The answers are names of places — categories — so the data are categorical.

Q16. (a) True — walking has the biggest count (9). (b) True — bus and train together: 5 + 2 = 7, and 8 is more than 7. (c) False — half of 28 is 14, and only 8 students come by car. 8 is less than 14. (d) True — the train has the smallest count (2).

Q17. Ask each of the 26 students: *What pet do you have?* with the choices dog, cat, fish, bird, another pet, or no pet. Each student answers once. Count the answers for each pet. Ava said more students have a dog than any other pet. She is right only if the number of students with a dog is more than the number with any other pet on its own.

Q18. (a) Example: the Bureau of Meteorology, which publishes weather records for Victorian towns; or Google Trends, which shows what people are searching for. (b) Write a source line: where the data came from, and the date you got them.

Q19. Your report should name the question, give the most popular choice and its count, and say something about the rest. Example: “We asked 20 students about their favourite fruit. Apple was the most popular choice, with 8 votes, and pear was the least popular, with 2 votes.”

Q20. (a) Survey your class — the data live in your classmates’ answers. (b) Find the data online — the Bureau of Meteorology has already recorded the rainfall. (c) Find the data online — Google Trends shows what people are searching for.

Q21. (a) The graph has one column for each town. With 1 block standing for 1 day: Melbourne (Olympic Park) ■■■■■■■ (7); Albury-Wodonga ■■■■■■■ (7); Bendigo ■■■■■■■■■■ (10); Ballarat ■■■■■■■■■■■■ (12). (b) Ballarat had the most days with rain (12). (c) Melbourne (Olympic Park) and Albury-Wodonga both had 7 days — the least, with the same count. (d) Ballarat 12 − Bendigo 10 = 2 more days. (e) Example: “In the first 18 days of August 2026, Ballarat had the most days with rain (12 days), and Melbourne (Olympic Park) and Albury-Wodonga had the least (7 days each).”

Test

Chapter test T6 — Statistics

Chapter	Chapter 6 — Statistics (subtopics 6A, 6B and 6C)
Content descriptions in this test	VC2M4ST01, VC2M4ST02, VC2M4ST03
Total marks	**15**
Time	This is a classroom check, not an exam. It is not timed. Most students will need about 25 minutes.
What you need	Pencil and ruler. Grid paper for Question 3.
Calculators and digital tools	You do not need a calculator or a digital tool for any question. Digital tools such as a spreadsheet are allowed, but every question can be done on paper.

Name: _____ Date: _____

Q1. (1 mark) A survey question can collect two kinds of data. **Categorical data** are answers that are categories — words, not numbers. **Discrete numerical data** are answers that are counts, like 0, 1, 2, 3.

Which of these questions collects categorical data?

A. How many pets do you have?

B. What is your favourite day of the week?

C. How many books did you borrow from the library this term?

D. How many goals did your team kick in the last game?

Q2. (2 marks) A Year 4 class of 24 students voted on where to go for the class excursion. The choices were Melbourne Zoo, Sovereign Hill and the Melbourne Royal Show. The tally marks below show the votes. Each mark is one vote, and the fifth mark goes across the group of four.

Place	Tally
Melbourne Zoo	𝍸 III
Sovereign Hill	𝍸 II
Melbourne Royal Show	𝍸 IIII

(a) How many votes did each place get? (1 mark)

(b) Which place got the most votes? How many more votes did it get than the place with the fewest? (1 mark)

Q3. (3 marks) The table shows the days with rain in the first 18 days of August 2026, for three Victorian towns.

Town	Melbourne (Olympic Park)	Bendigo	Ballarat
Days with rain	7	10	12

Source: Australian Bureau of Meteorology, Daily Weather Observations for Melbourne (Olympic Park), Bendigo and Ballarat, bom.gov.au/climate/dwo/, retrieved 2026-08-19.

(a) Draw a column graph of these data on the grid paper. A column graph shows each count as a column. Number the scale in 2s from 0 to 12: 0, 2, 4, 6, 8, 10, 12. Draw one column for each town. (2 marks)

(b) Which town had the most days with rain? (1 mark)

Q4. (1 mark) A pictograph shows each count as a row of symbols. The **key** tells you what one symbol stands for. In one pictograph, the key says: 1 symbol = 4 students.

How many students are shown by a row with 2 whole symbols and 1 half symbol?

A. 6 students

B. 8 students

C. 10 students

D. 12 students

Q5. (2 marks) Ten students were asked: *How many pets do you have?* Their answers were:

1, 1, 2, 1, 0, 1, 1, 2, 1, 1

Data is **bunched** when most of it sits near one or two values. Data is **spread** when it is shared out, with much the same at each value.

(a) Is this data bunched or spread? (1 mark)

(b) How do you know? (1 mark)

Q6. (2 marks) Grace drew a pictograph of her class's favourite fruit. Each row shows the votes for one fruit. Grace forgot to write the key. Her brother looks at the banana row, which shows 3 symbols, and says: "3 students chose banana."

(a) Why can't you be sure that Grace's brother is right? (1 mark)

(b) If the key was 1 symbol = 2 students, how many students chose banana? (1 mark)

Q7. (1 mark) A statistical investigation answers a question by collecting data. It has five steps. Write the numbers 1 to 5 in the boxes to put the steps in order, from first to last.

Step	Order
Record and display the data	____
Ask a question	____
Interpret and communicate	____
Collect the data	____
Plan	____

Q8. (3 marks) A Year 4 class of 25 students voted on which sport to play at lunch on Friday. In a survey, everyone answers the same question once each. The votes were:

Sport	Soccer	Basketball	Netball	Tennis
Votes	9	7	6	3

(a) Check that the votes match the 25 students. Show your check. (1 mark)

(b) Write two sentences to report what the class found. One sentence should name the sport with the most votes and say how many votes it got. The other sentence should name the sport with the fewest votes and say how many votes it got. (2 marks)

End of test — 15 marks

Solutions

Total: **15 marks**. Q1–Q3 assess VC2M4ST01 (6A); Q4–Q6 assess VC2M4ST02 (6B); Q7–Q8 assess VC2M4ST03 (6C).

Answer key

Q	Marks	CD	Answer
1	1	VC2M4ST01	B
2	2	VC2M4ST01	(a) Melbourne Zoo 8, Sovereign Hill 7, Melbourne Royal Show 9; (b) Melbourne Royal Show, 2 more votes
3	3	VC2M4ST01	(a) column graph with the scale in 2s; columns 7, 10 and 12; (b) Ballarat
4	1	VC2M4ST02	C — 10 students
5	2	VC2M4ST02	(a) bunched; (b) 7 of the 10 answers are 1
6	2	VC2M4ST02	(a) the key is missing, so no one knows what one symbol stands for; (b) 6 students
7	1	VC2M4ST03	Ask 1, Plan 2, Collect 3, Record and display 4, Interpret and communicate 5
8	3	VC2M4ST03	(a) 9 + 7 + 6 + 3 = 25, so the check works; (b) see the worked solutions

Worked solutions

Q1. (1 mark) **B.** "What is your favourite day of the week?" The answers are the names of days — categories, or words — so the data is categorical. Each of the other questions has a count as its answer: a number of pets (A), books (C) or goals (D). Those collect discrete numerical data.

Q2. (2 marks) (a) Count the tally marks. A group of five is four marks with one across: Melbourne Zoo 5 + 3 = 8 votes; Sovereign Hill 5 + 2 = 7 votes; Melbourne Royal Show 5 + 4 = 9 votes. Check: 8 + 7 + 9 = 24, and 24 students voted. ✓ — 1 mark for all three counts.

(b) The Melbourne Royal Show got the most votes (9). The place with the fewest votes was Sovereign Hill (7). 9 − 7 = 2, so the show got 2 more votes than Sovereign Hill. — 1 mark for both parts.

Q3. (3 marks) (a) — 2 marks:

- 1 mark for a scale numbered in 2s from 0 to 12: 0, 2, 4, 6, 8, 10, 12.
- 1 mark for the three columns drawn to the right heights: Melbourne (Olympic Park) 7, Bendigo 10, Ballarat 12. The column for 7 ends halfway between the 6 line and the 8 line, because 7 is halfway between 6 and 8.

(b) Ballarat had the most days with rain (12 days). — 1 mark.

Q4. (1 mark) **C.** The key says 1 symbol = 4 students. Two whole symbols are 2 × 4 = 8 students. Half a symbol stands for half of 4, which is 2 students. 8 + 2 = 10 students. Option B (8) leaves out the half symbol; option D (12) counts the half symbol as a whole one.

Q5. (2 marks) (a) Bunched. — 1 mark.

(b) Seven of the ten answers are 1, and every answer is 0, 1 or 2. Most of the data sits at one value, so the data is bunched, not shared out. — 1 mark for saying that most of the data sits near one value (7 of the 10 answers are 1).

Q6. (2 marks) (a) The pictograph has no key. Without the key, you cannot tell what one symbol stands for — Grace's brother may have counted the symbols and skipped the key. — 1 mark for saying that the key is missing, or that no one knows what one symbol stands for.

(b) 3 × 2 = 6 students. — 1 mark.

Q7. (1 mark) The steps in order are: Ask a question (1), Plan (2), Collect the data (3), Record and display the data (4), Interpret and communicate (5). — 1 mark for all five in order; no part marks.

Q8. (3 marks) (a) The votes must add to 25, because 25 students each voted once: 9 + 7 + 6 + 3 = 25. ✓ The check works. — 1 mark.

(b) Example report: "In our survey of 25 students, soccer was the most popular sport, with 9 votes. Tennis was the least popular sport, with 3 votes." — 1 mark for naming the sport with the most votes (soccer) and its count (9); 1 mark for naming the sport with the fewest votes (tennis) and its count (3).

Coverage and marking notes (teacher)

Paper rules (per TOC §7). This is a classroom check, not an exam: untimed, with a guidance duration of 25 minutes for lesson planning. Materials per §7 where the CDs name them: grid paper for Question 3. Calculator and digital-tool rules per D7: the CDs for `VC2M4ST01` and `VC2M4ST03` name digital tools — permitted, not required; the CD for `VC2M4ST02` is silent. Every item can be done on paper.

Multiple choice. 2 of 15 marks (Q1 and Q4) — no more than a quarter of the test, per §7. Both MCQ items are authored for this paper and level-checked against §6 before use.

Coverage — every CD this chapter owns contributes separately scored items.

Items	CD	Rubric language — the CD's achievement-standard extract, verbatim from `maths_4.json`
Q1–Q3	`VC2M4ST01`	"Students create many-to-one data displays, assess the suitability of displays for representing data and informally discuss the shape of distributions and variation in data." Q2 reads a completed tally (frequency) table and Q3 creates a many-to-one column graph — the written form §7 requires together with task K3.
Q4–Q6	`VC2M4ST02`	Same extract. Q4 and Q6 judge the suitability of displays (a skipped key; a missing key) and Q5 discusses the shape of the data (bunched or spread) and the variation in the data, informally.
Q7–Q8	`VC2M4ST03`	"They use surveys and digital tools to generate categorical or discrete

Items	CD	Rubric language — the CD's achievement-standard extract, verbatim from `maths_4.json`
		numerical data in statistical investigations and communicate their findings in context." Q7 orders the steps of an investigation; Q8 interprets survey data and communicates the finding in context.

Conducting is evidenced by task K3. `VC2M4ST03` requires students to *conduct* an investigation; that is evidenced by task K3 (§7), not by this paper. Q7 and Q8 are the written items §7 requires in T6 for `VC2M4ST01` and `VC2M4ST03`.

Level check (§6). Categorical and discrete numerical variables only; Q3 is a column graph of counts by town, not a line graph over time. Nothing beyond the Year 4 lines of §6 is used or asked.

Data. The days-with-rain figures in Q3 are real Bureau of Meteorology observations for three Victorian towns, carried from 6B and 6C with the same source line and date. All other data are class-survey data generated for this paper; the places named in Q2 are real Victorian places.