

VCE VM Numeracy Unit 1

Chapter 1 — The problem-solving cycle and mathematical toolkit

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Chapter 1 The problem-solving cycle and mathematical toolkit — 1A The four-stage problem-solving cycle

Theory

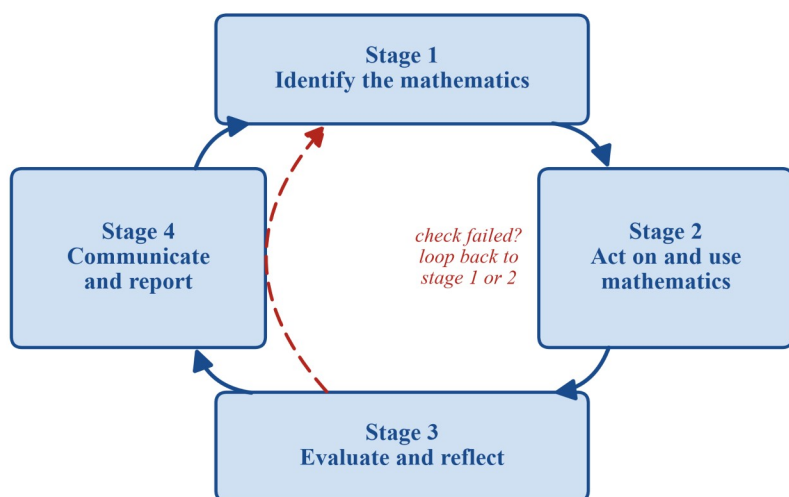
What is a numeracy task?

A **numeracy task** is an everyday situation that needs some maths to sort out. Working out the total cost of your shopping, planning how many tables a lunch needs, checking that a bill is right — these are all numeracy tasks. They come up at home, at work and out in your community.

Every numeracy task in this book is solved with the same routine: the **problem-solving cycle**. The cycle has four stages, and you work through them in order.

The four stages. The study design (Unit 1, Outcome 2) sets the cycle out as four separate stages that always come in the same order. First you work out what maths the task needs. Next you do that maths. Then you check your answer and think about whether it makes sense. Last, you share your answer so that someone else can follow it.

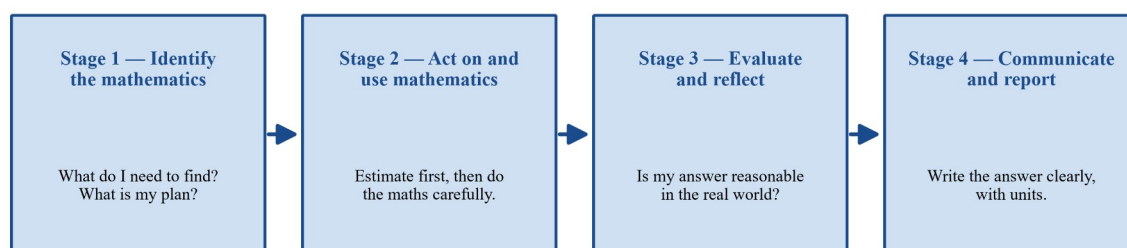
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The four stages always run in the same order — and stage 3 can send you back.

Here is what each stage asks you to do.

Stage	What you do	Key question
1 — Identify the mathematics	Read the task. Pick out the numbers that matter. Decide what you must find, and choose your operations and your plan.	What do I need to find? What is my plan?
2 — Act on and use mathematics	Do the maths. Estimate first, then work out the exact answer — by hand or with a calculator.	Have I estimated first? Is my working neat and in order?
3 — Evaluate and reflect	Check your answer. Compare it with your estimate. Ask if it makes sense in the real world.	Is my answer reasonable?
4 — Communicate and report	Write the answer as a full sentence, with units, so someone else can understand it.	Can someone else understand my answer?



How big are the tasks? The tasks in this unit are short. Each one needs only one or two steps — a single multiplication, or a division and then an addition. You are also not expected to work completely alone. In this unit it is normal and fine for your teacher to prompt you as you go — a hint, a nudge, or a question that gets you moving again.

Looping back. The cycle is a loop, not a straight line. If your check in stage 3 fails — if the answer does not match your estimate, or does not make sense in the real world — you go back. Return to stage 1 to rethink your plan, or to stage 2 to redo the working more carefully. Then move forward through the stages again.

Refresher: the four operations. The cycle runs on the four operations — addition, subtraction, multiplication and division. The words in a task tell you which operation you need.

Operation	What it does	Words that point to it
Addition (+)	puts amounts together	total, altogether, sum, extra, more, increase
Subtraction (−)	takes away, or compares two amounts	left, left over, change, difference, how many more, less, decrease, take away
Multiplication (×)	adds the same amount again and again	each, per, times, lots of (as in “8 punnets at \$3.45 each”)
Division (÷)	shares into equal groups, or splits into equal parts	shared equally, split, per person, how many groups, how many fit into

Order of operations. When a calculation mixes operations, do the multiplications and divisions first, then the additions and subtractions. For example, in $15 + 100 \times 0.30$: first $100 \times 0.30 = 30$, then $15 + 30 = 45$.

Remainders. Sometimes a division does not come out even. Sharing 44 into groups of 6 gives $44 \div 6 = 7$ remainder 2 — six fits into forty-four seven whole times, with 2 left over. What you do with a remainder depends on the real world: sometimes you round up (you need one more table), and sometimes the remainder just stays as it is (2 people left over, or a few coins left in the purse).

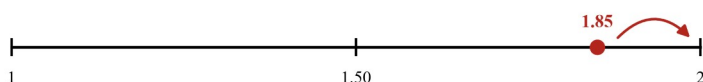
Refresher: rounding for estimation. An **estimate** is a quick, rough answer that is close enough to check your exact answer against. To estimate, round each number to an easy, nearby number, then do the maths in your head.

Rounding rule: if a number is at or past the halfway mark, round **up**; if it is before the halfway mark, round **down**.

- \$1.85 to the nearest dollar: 1.85 is past 1.50, so round up to \$2.
- \$8.60 to the nearest dollar: round up to \$9.
- \$27.60 to the nearest dollar: round up to \$28.
- 44 to the nearest ten: 44 is before 45, so round down to 40.

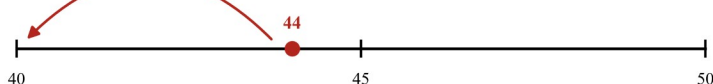
Estimation starts with rounding to an easy, nearby number

1.85 is past the halfway mark (1.50), so it rounds UP to 2



Rounding to the nearest dollar

44 is before the halfway mark (45), so it rounds DOWN to 40



Rounding to the nearest ten

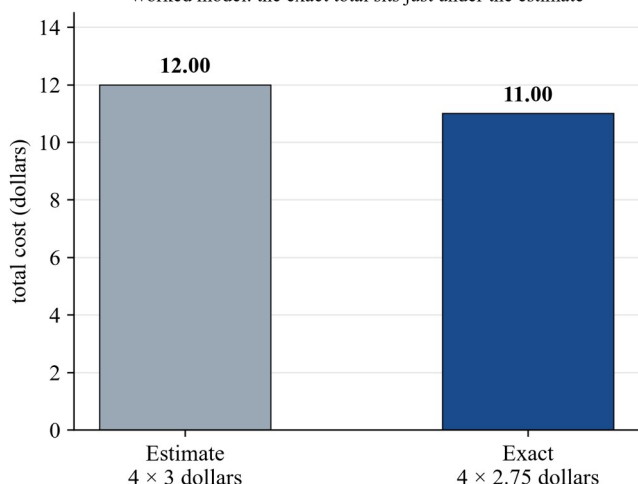
Refresher: money as decimals. Money is written with a decimal point: \$3.45 means 3 dollars and 45 cents. Cents always take two decimal places — write \$11.10, never \$11.1.

- When you add or subtract money, line up the decimal points.
- When you multiply a price by a whole number, you can work in cents: $\$2.35 \times 6$ is $235 \times 6 = 1410$ cents, which is \$14.10.

Worked model: the cycle on a small task. Hani buys 4 loaves of bread at \$2.75 each. How much does Hani pay?

- **Stage 1 — Identify.** Find: the total cost. Plan: multiply — cost = 4×2.75 .
- **Stage 2 — Act.** Estimate first: round \$2.75 up to \$3, so the estimate is $4 \times 3 = \$12$. Exact: $4 \times 2.75 = \$11.00$.
- **Stage 3 — Evaluate.** \$11.00 is close to the estimate \$12. The estimate rounded the price up, so the exact total sits a little below it — reasonable ✓.
- **Stage 4 — Report.** “Hani pays \$11.00 for the four loaves.”

Worked model: the exact total sits just under the estimate



The symbol $\therefore$. Answer lines in this book often start with $\therefore$, which means *therefore* — it flags the final answer. For example: $\therefore$ Hani pays \$11.00.

Your routine for this book. This cycle is the routine you use for every task in this book: identify, act, check, report — and loop back whenever a check fails.

About the data in this section. The prices, plans and numbers here are **made up** (not real): pretend shops, pretend plans 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.

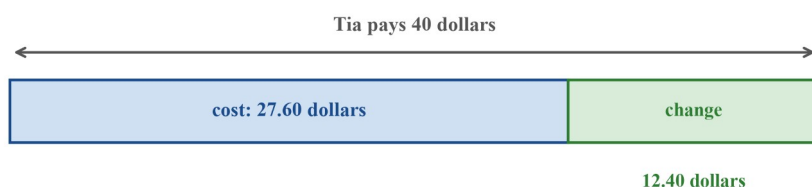
Worked examples

Example 1 — scaffolded

Tia is helping her neighbourhood garden group. She buys 8 punnets of seedlings (a punnet is a small basket of young plants) at \$3.45 each, and hands over \$40 at the counter. How much do the seedlings cost, and how much change does Tia get back?

Working	Comment
Stage 1 — Identify: find (i) the cost of 8 punnets, then (ii) the change from \$40. Plan: $\text{cost} = 8 \times 3.45$; $\text{change} = 40 - \text{cost}$.	Read the task, pick out the numbers that matter, choose the operations, and make a plan.
Stage 2 — Act: estimate: round \$3.45 up to \$3.50, so $8 \times 3.50 = \$28.00$. Exact: $8 \times 3.45 = \$27.60$. Change: $40 - 27.60 = \$12.40$.	Estimate before you calculate exactly — the estimate is the safety net for stage 3.
Stage 3 — Evaluate: \$27.60 is close to the estimate \$28.00 ✓. Also check the change: $27.60 + 12.40 = 40$ ✓ — the cost and the change add back up to the money paid.	Compare with the estimate and check the answer fits the real world. A second check catches slips.
Stage 4 — Report: “The seedlings cost \$27.60, so Tia gets \$12.40 change.”	A full sentence, with units, so the reader gets the answer clearly.

Example 1: the cost and the change make up the 40 dollars paid



$$\text{Change} = \text{money paid} - \text{cost} = 40 - 27.60 = 12.40 \text{ dollars}$$

Example 2 — scaffolded

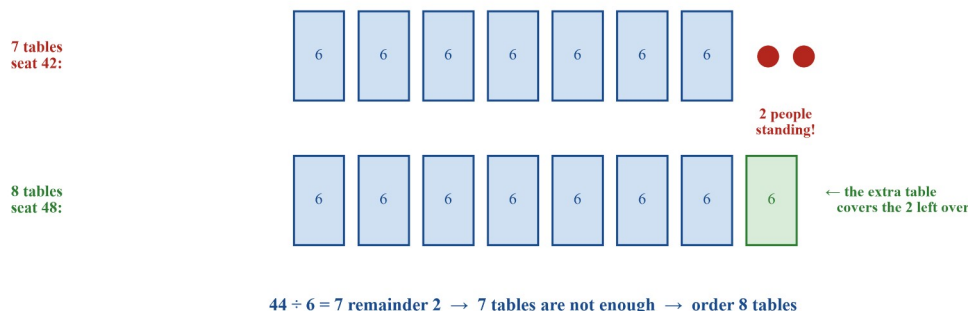
Rosa is helping to set up the school fete lunch. 44 people will sit down to eat, and each table seats 6 people. How many tables should Rosa set up?

Working	Comment
Stage 1 — Identify: find the number of tables for 44 people. Plan: divide — $\text{tables} = 44 \div 6$.	One operation is enough for this task.
Stage 2 — Act: $44 \div 6 = 7$ remainder 2. So 7 tables seat $7 \times 6 = 42$ people.	Write the remainder down — in the real world it is people or things, so it still matters.
Stage 3 — Evaluate: 42 is less than 44 — two people would be left standing. That will not do. Loop back and try 8 tables: $8 \times 6 = 48$ seats, and $48 \geq 44$ ✓, with 4 seats spare.	When the check fails, loop back to stage 2 and test the next sensible number.

Stage 4 — Report: “Rosa should set up 8 tables.”

The report answers the question that was actually asked.

Example 2: the check shows 2 people without a seat — loop back

**Example 3 — unscaffolded**

A neighbourhood house is printing 250 flyers for its open day. Two print shops quote for the job:

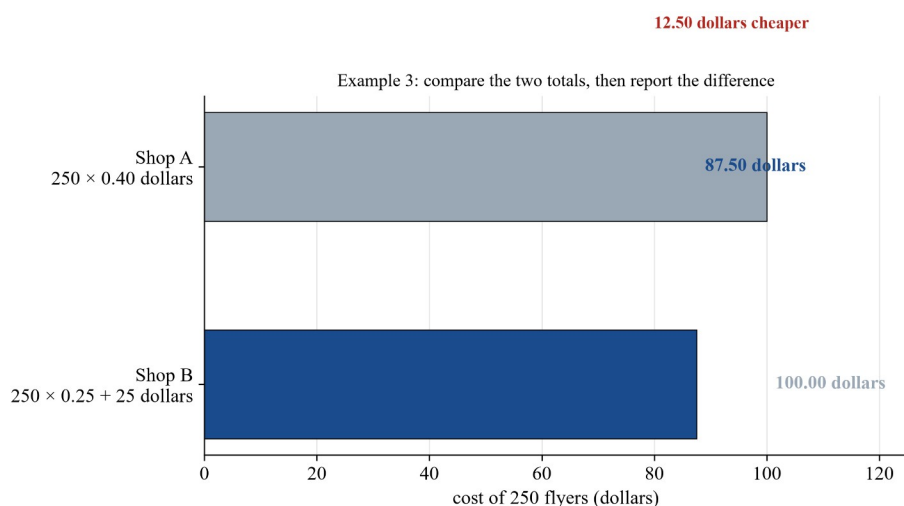
- Shop A charges \$0.40 per flyer, with no other fees.
- Shop B charges \$0.25 per flyer, plus a one-off \$25 set-up fee.

Which shop is cheaper for 250 flyers, and by how much?

Stage 1 — Identify. The task asks for the total cost at each shop for 250 flyers, then which shop is cheaper and by how much. Plan: cost = $250 \times \text{price per flyer}$, then add the set-up fee for Shop B; finish by subtracting to find the difference.

Stage 2 — Act.Shop A: $250 \times 0.40 = \$100.00$.Shop B: printing costs $250 \times 0.25 = \$62.50$; add the set-up fee: $\$62.50 + \$25 = \$87.50$.Difference: $\$100.00 - \$87.50 = \$12.50$.

Stage 3 — Evaluate. Both totals are believable for 250 flyers — each works out at well under \$1 per flyer. Shop B's price per flyer is lower, but it charges the set-up fee; at 250 flyers the lower price wins. Check the subtraction: $87.50 + 12.50 = 100.00 \checkmark$.

Stage 4 — Report. $\therefore$ Shop B is cheaper, and it saves the neighbourhood house \$12.50.

Example 4 — unscaffolded

Jack is buying 7 boxes of tiles at \$23.50 per box. He keys 7×23.50 into his calculator, and the display shows 16.45.

Should Jack trust the display? What is the correct total?

Stage 1 — Identify. The task asks two things: (i) could 16.45 possibly be right, and (ii) what is the exact cost of 7 boxes. Plan: build an estimate band for the total, then calculate exactly and compare.

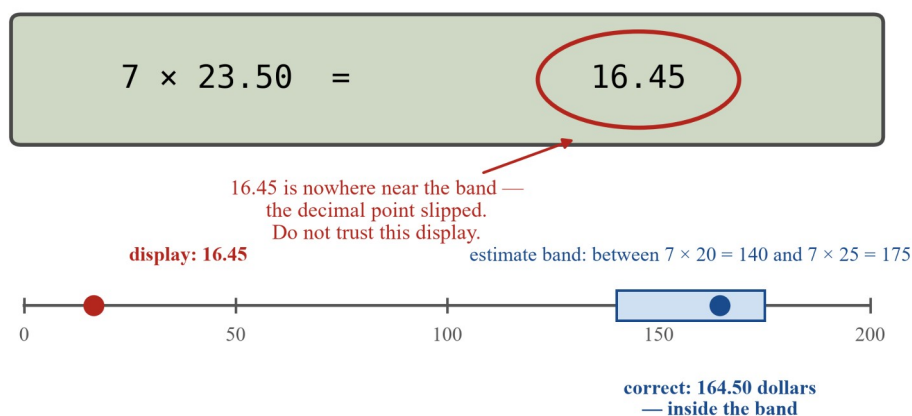
Stage 2 — Act. Estimate: each box is between \$20 and \$25, so the total lies between $7 \times 20 = \$140$ and $7 \times 25 = \$175$.

Exact: $7 \times 23.50 = \$164.50$.

Stage 3 — Evaluate. The display shows 16.45, which is nowhere near the \$140–\$175 band — 7 boxes of tiles cannot cost about \$16. The decimal point has slipped, so the display is wrong. The exact total \$164.50 sits inside the band ✓, so that is the number to trust.

Stage 4 — Report.

∴ Jack should not trust the display; the 7 boxes cost \$164.50.



Stage 2 again, keyed carefully: $7 \times 23.50 = 164.50$ dollars

Practice questions

Scaffolded

Q1. This question is about the cycle itself. (a) Write the four stages of the problem-solving cycle in the correct order. (b) Match each key question to its stage: (i) “Is my answer reasonable?” (ii) “What do I need to find, and what is my plan?” (iii) “Can someone else understand my answer?” (iv) “Have I estimated first?” (c) Your stage 3 check fails. Name the two stages you could loop back to.

Q2. Rosa buys 6 tins of soup at \$1.85 each. (a) Stage 2: estimate the total cost by rounding \$1.85 to the nearest dollar. (b) Stage 2: work out the exact total cost. (c) Stage 3: is your exact answer reasonable? Compare it with your estimate in one sentence.

Q3. Jin buys 15 balls of wool at \$3.60 each and pays with a \$60 note. (a) Work out the exact cost of the wool. (b) Estimate the cost by rounding \$3.60 to \$4, and say whether your exact answer is close. (c) How much change does Jin get?

Q4. Tom packs 50 mugs into cartons. Each carton holds 8 mugs. (a) Work out $50 \div 8$. Give the whole number and the remainder. (b) How many cartons does Tom need so that every mug is packed? (c) Explain why 6 cartons is not enough.

Q5. Anh has \$50 to spend on concert tickets. Tickets cost \$12 each. (a) Work out $50 \div 12$, correct to 2 decimal places. (b) How many whole tickets can Anh buy? (c) How much money does Anh have left over?

Q6. Hana’s step goal for the day is 10 000 steps. By dinner time she has walked 8 250 steps. (a) Estimate the number of steps Hana still needs, by rounding 8 250 to the nearest thousand. (b) Work out the exact number of steps she still needs. (c) Stage 3: is your exact answer close to your estimate? Answer in one sentence.

Unscaffolded

Q7. Hani buys 3 kg of apples at \$3.80 per kg and pays with a \$20 note. Find the cost of the apples and the change Hani gets.

Q8. Tom’s bottle of vitamins holds 100 tablets. The label says to take 3 tablets per day. How many whole days will the bottle last, and how many tablets are left over? Will the bottle last 5 weeks? (There are 7 days in a week.)

Q9. Anh has to prepare 45 reports for work. She has already finished 25 of them. Each of the reports still to do takes 8 minutes to prepare. How many reports does Anh have left, and how many minutes will they take?

Q10. Jin and 5 friends share \$432 equally between the 6 of them. How much does each person receive? Check your answer by multiplying back, and finish with a “∴” sentence.

Q11. Hana splits \$260 equally three ways for her children’s activity fees, correct to the nearest cent. How much is each share? A helper multiplies your share by 3 and gets \$260.01 — one cent more than the \$260 in the pot. Explain where the extra cent comes from.

Q12. A community hall has 145 seats. 45 seats are kept for the performers. The rest are for guests, and guests sit at tables of 8. (a) How many seats are left for guests? (b) Divide your answer by 8, correct to 1 decimal place. (c) How many whole tables can the hall set up? Check that the performers plus the seated guests still fit under the 145 seats.

Q13. Jack swims 1 500 m in a 25 m pool, swimming length after length the whole way. How many lengths does Jack swim? After 55 lengths, how many metres does he still have to swim?

Q14. Tia is checking a student’s working. The student wrote $7 \times 14.50 = 91.50$ (for 7 tickets at \$14.50 each). Use an estimate to show the student’s answer is wrong, then work out the correct total.

Q15. A warehouse gets an order for 300 tins of tomatoes. On the shelf are 12 cartons, and each carton holds 24 tins. Is the shelf enough to fill the order? If not, how many tins short is it?

Q16. Two electricity plans are advertised:

- Plan A: \$25 per month, plus \$0.20 per unit of electricity used.
- Plan B: \$15 per month, plus \$0.30 per unit of electricity used.

A household uses 200 units in one month. Work out the monthly cost of each plan. Which plan is cheaper, and by how much?

Q17. The school fete stall has the price list below.

Item	Price
Hot dog	\$3.50
Drink	\$1.80
Ice cream	\$2.20

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

- Maya buys 2 hot dogs. How much do they cost?
- She also buys 3 drinks. How much do the drinks cost?
- What is the total Maya pays?
- Maya hands over \$20. How much change does she get?

Q18. A sports club runs a BBQ for 45 people. The club allows 3 sausages per person. Sausages come in packs of 15, and each pack costs \$9.75. (a) Show that the club needs 135 sausages. (b) How many packs should the club buy, and what is the total cost? (c) Estimate the total cost by rounding \$9.75 to \$10, check your exact answer against it, and write a “ $\therefore$ ” report sentence for the club.

Answers

Q1. (a) Identify the mathematics; act on and use mathematics; evaluate and reflect; communicate and report. (b) (i) stage 3 (ii) stage 1 (iii) stage 4 (iv) stage 2. (c) Stage 1 or stage 2. **Q2.** (a) \$12. (b) \$11.10. (c) Yes — \$11.10 is close to the estimate \$12. **Q3.** (a) \$54.00. (b) Estimate \$60 — close ✓. (c) \$6.00. **Q4.** (a) 6 remainder 2. (b) 7 cartons. (c) 6 cartons hold only 48 mugs, leaving 2 unpacked. **Q5.** (a) 4.17. (b) 4 tickets. (c) \$2.00. **Q6.** (a) 2000 steps. (b) 1750 steps. (c) Yes — 1750 is close to 2000. **Q7.** Cost \$11.40; change \$8.60. **Q8.** 33 days, 1 tablet left over; 5 weeks = 35 days and $33 < 35$, so no. **Q9.** 20 reports left; 160 minutes. **Q10.** \$72.00 each; check $6 \times 72 = 432$ ✓; $\therefore$ each person receives \$72.00. **Q11.** \$86.67 each; $3 \times 86.67 = \$260.01$ — the extra 1 c comes from rounding each share up to the nearest cent. **Q12.** (a) 100 seats. (b) 12.5. (c) 12 tables; $45 + 96 = 141 \leq 145$ ✓. **Q13.** 60 lengths; after 55 lengths (1375 m), 125 m still to swim. **Q14.** Estimate $7 \times 15 = \$105$, so \$91.50 is far too low; correct: \$101.50. **Q15.** $12 \times 24 = 288$ tins — not enough; short by 12 tins. **Q16.** Plan A \$65.00; Plan B \$75.00; Plan A is cheaper by \$10.00. **Q17.** (a) \$7.00. (b) \$5.40. (c) \$12.40. (d) \$7.60. **Q18.** (a) $45 \times 3 = 135$. (b) 9 packs; \$87.75. (c) Estimate $9 \times 10 = \$90$ — close ✓; $\therefore$ the sausages cost \$87.75.

Fully-worked solutions

Q1. (a) In order: **identify the mathematics; act on and use mathematics; evaluate and reflect; communicate and report.** (b) (i) Stage 3 — evaluate and reflect. (ii) Stage 1 — identify the mathematics. (iii) Stage 4 — communicate and report. (iv) Stage 2 — act on and use mathematics (estimating happens here, before the exact calculation). (c) Stage 1 (rethink the plan) or stage 2 (redo the working more carefully).

Q2. (a) Round \$1.85 up to \$2: estimate = $6 \times 2 = \$12$. (b) $6 \times 1.85 = \$11.10$. (c) Yes — \$11.10 is close to the estimate \$12, so the answer is reasonable.

Q3. (a) $15 \times 3.60 = \$54.00$. (b) Estimate: $15 \times 4 = \$60$. \$54.00 is close to \$60 ✓. (c) Change = $60 - 54 = \$6.00$.

Q4. (a) $50 \div 8 = 6$ remainder 2. (b) The remainder of 2 mugs still needs a carton, so Tom needs $6 + 1 = 7$ cartons. (c) $6 \times 8 = 48$, and $48 < 50$ — 2 mugs would be left unpacked.

Q5. (a) $50 \div 12 = 4.166\dots$, so correct to 2 decimal places: 4.17. (b) Anh can only buy whole tickets: 4 tickets, since $4 \times 12 = \$48$ and $5 \times 12 = \$60$ is more than she has. (c) Left over: $50 - 48 = \$2.00$.

Q6. (a) Round 8250 down to 8000: estimate = $10\,000 - 8\,000 = 2\,000$ steps. (b) Exact: $10\,000 - 8\,250 = 1\,750$ steps. (c) Yes — 1750 is close to the estimate 2000, so the answer is reasonable.

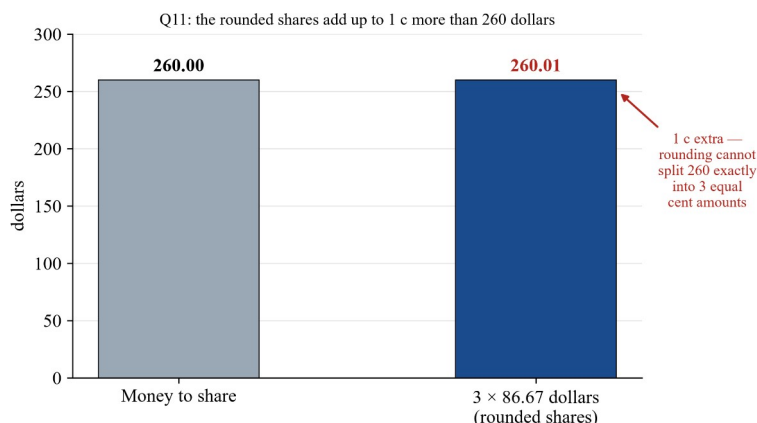
Q7. Cost: $3 \times 3.80 = \$11.40$. Change: $20 - 11.40 = \$8.60$. $\therefore$ the apples cost \$11.40 and Hani gets \$8.60 change.

Q8. $100 \div 3 = 33$ remainder 1, so the bottle lasts 33 whole days with 1 tablet left over ($33 \times 3 = 99$). 5 weeks = $5 \times 7 = 35$ days. $33 < 35$, so the bottle will not last 5 weeks.

Q9. Reports left: $45 - 25 = 20$. Time: $20 \times 8 = 160$ minutes. $\therefore$ Anh has 20 reports left, and they will take 160 minutes.

Q10. $432 \div 6 = 72$, so each person receives \$72.00 — the division comes out exactly, so no rounding is needed. Check by multiplying back: $6 \times 72 = 432$ ✓ — back to the starting amount. $\therefore$ each person receives \$72.00.

Q11. $260 \div 3 = 86.666\dots$, so to the nearest cent each share is \$86.67. Then $3 \times 86.67 = \$260.01$, which is 1 c more than \$260. The extra cent comes from the rounding: \$260 cannot be split into three equal whole-cent amounts, so every share rounds up to the nearest cent, and the three rounded shares overshoot the pot by 1 c.



Q12. (a) Seats left for guests: $145 - 45 = 100$. (b) $100 \div 8 = 12.5$ (already exact at 1 decimal place). (c) Only whole tables can be set up: 12 tables, seating $12 \times 8 = 96$ guests. Check: $45 + 96 = 141$, and $141 \leq 145$ ✓ — everyone fits under the hall's 145 seats.

Q13. Lengths: $1500 \div 25 = 60$ lengths. After 55 lengths: $55 \times 25 = 1375$ m swum, so Jack still has $1500 - 1375 = 125$ m to swim.

Q14. Estimate: round \$14.50 up to \$15: $7 \times 15 = \$105$. The student's \$91.50 is far below the estimate — it is even below $7 \times 14 = \$98$ — so it cannot be right. Exact: $7 \times 14.50 = \$101.50$, which sits just below the estimate \$105 ✓. $\therefore$ the correct total is \$101.50.

Q15. Tins on the shelf: $12 \times 24 = 288$. The order needs 300, and $288 < 300$ — not enough. Short by: $300 - 288 = 12$ tins. $\therefore$ the shelf is 12 tins short of the order.

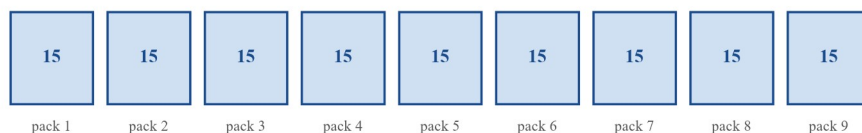
Q16. Plan A: units cost $200 \times 0.20 = \$40.00$; total = $\$25 + \$40.00 = \$65.00$ (multiplication first, then addition). Plan B: units cost $200 \times 0.30 = \$60.00$; total = $\$15 + \$60.00 = \$75.00$. Difference: $75.00 - 65.00 = \$10.00$. $\therefore$ Plan A is cheaper, by \$10.00.

Q17. (a) $2 \times 3.50 = \$7.00$. (b) $3 \times 1.80 = \$5.40$. (c) Total: $7.00 + 5.40 = \$12.40$. (d) Change: $20 - 12.40 = \$7.60$.

Q18. (a) Sausages needed: $45 \times 3 = 135$ $\therefore$ the club needs 135 sausages. (b) Packs: $135 \div 15 = 9$ packs — the division comes out exactly, so 9 whole packs cover the BBQ with none left over. Cost: $9 \times 9.75 = \$87.75$. (c) Estimate: round \$9.75 up to \$10: $9 \times 10 = \$90$. The exact \$87.75 sits just below \$90 ✓ — reasonable. $\therefore$ the club buys 9 packs, and the sausages cost \$87.75.

Q18: whole packs only — 9 packs cover the BBQ exactly

9 packs $\times$ 15 sausages = 135 sausages



$45 \text{ people} \times 3 \text{ sausages} = 135 \text{ sausages needed} \rightarrow 135 \div 15 = 9 \text{ packs} \rightarrow 9 \times 9.75 \text{ dollars} = 87.75 \text{ dollars}$

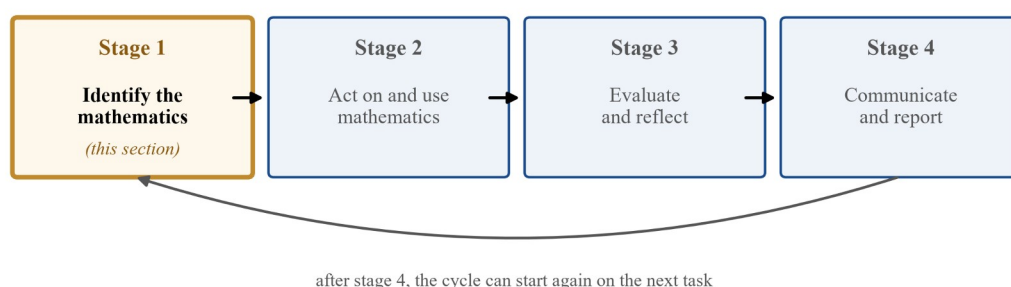
Chapter 1 The problem-solving cycle and mathematical toolkit — 1B Identify the mathematics: from real-world context to maths plan

Theory

About the data in this section. The prices, signs, receipts, timetables and charts in this section are **made up** (not real): pretend businesses 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.

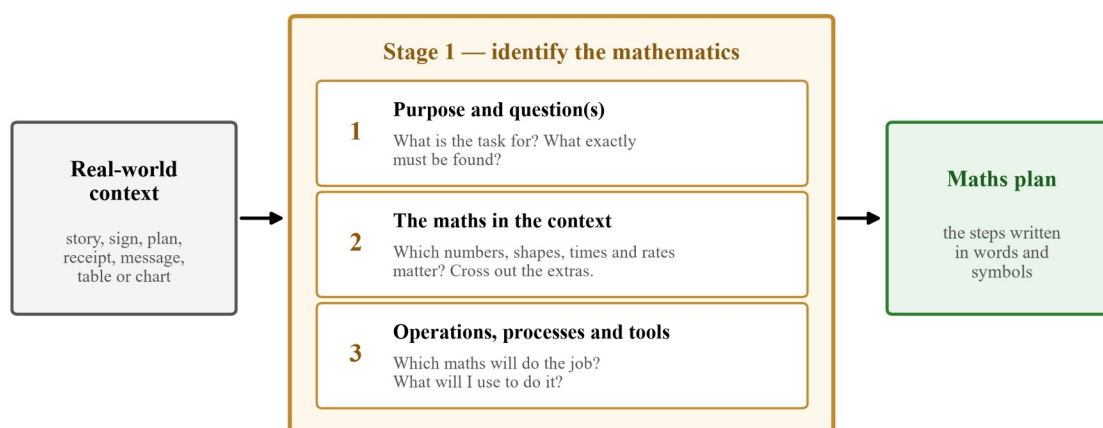
Every numeracy task starts in the real world. It arrives as a sign, a message, a plan, a receipt, a timetable or a chart — never as a number sentence. Stage 1 of the problem-solving cycle is where you slow down and sort out what the task is really asking, and what maths will do it. The study design (Unit 1, Outcome 2) describes this stage as spotting the maths information inside a real-life situation, choosing what matters, working out what it tells you, and deciding which maths to use.

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



Stage 1 sits between the real-world context and the doing of the maths. If you skip it, you end up doing the *wrong* maths neatly. Section 1A walks through all four stages of the cycle; this section goes deep on stage 1 only.

The three finds. Stage 1 is three finds in a row, and then a plan. Find 1 is the purpose and the question(s). Find 2 is the maths hiding in the context. Find 3 is the operations, processes and tools that will do the job. Put the three finds together and you are holding a maths plan.



Find 1: purpose and question(s). The *purpose* is what the task is for — the reason anyone is doing this maths. The *question(s)* are what exactly must be found. Say them in your own words before you touch a number. Watch for two questions hiding inside one. “Can the club afford the trip?” is really two questions: *what will the trip cost in total?* and *is that total less than the money we have?* A plan that answers only one of the two is not finished.

Find 2: the maths in the context. The context brings materials: words, prices, sizes, times, pictures. Your job is to pull the mathematical information out of them. Two habits do most of the work.

- *Keep what the question needs, cross out the rest.* Real messages are full of true facts that this question does not need. Whether a fact is “extra” depends on the question you are asking.

MESSAGE FROM HOLLOWAY GARDEN CARE

Question asked: What does one mow with edging cost?

Mowing costs \$45 per visit.

Edging the paths is \$15 extra.

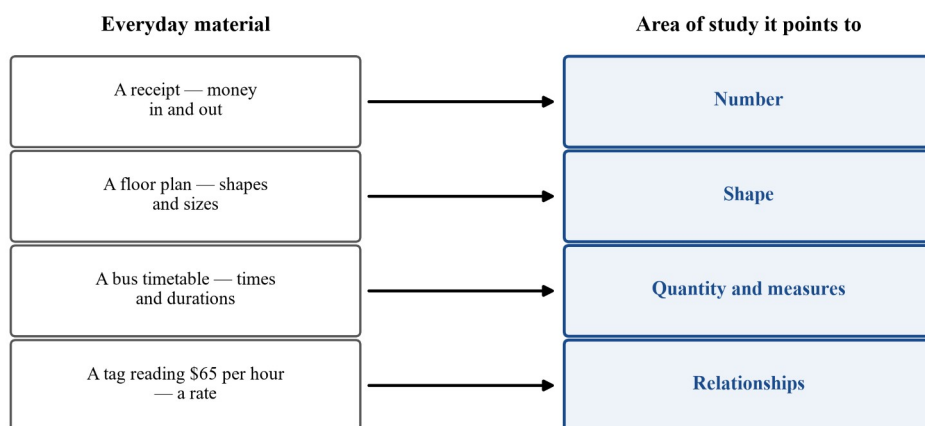
~~Your garden is 20 m by 12 m.~~

~~We visit on Thursdays.~~

The boxed facts are needed for THIS question. The crossed-out facts are true, but they are not needed here — extra information depends on the question you are asking.

Made-up data: a pretend message from a pretend garden business.

- **Name the maths.** Every piece of information you keep belongs to one of the four areas of study. Naming it tells you which part of your maths toolbox to open.



one material can point to more than one area of study

Made-up data: the tag shows a pretend rate.

Area of study	What it covers	What it looks like in a task
Number	money, decimals, percentages, ratio and proportion	prices, totals, change, “% off”
Shape	2D and 3D shapes, plans, symmetry, enlargement and reduction	a floor plan, a sketch, a photo blown up
Quantity and measures	length, perimeter, area, volume, capacity, time, temperature, metric units	“how long is the fence?”, “how much does it hold?”, “how long does the trip take?”
Relationships	rates (\$/m and km/hr), simple formulae, tables, charts and graphs	“\$18.50 per metre”, “80 km/hr”, a bar chart to read

Refresher. Money is decimals. \$3.50 means 350 cents, and the dot lines up in column addition:
 $\$2.05 + \$1.30 = \$3.35$.

Refresher. The percentages you will meet most: 10% of \$350 is \$35 (one tenth); 20% is \$70 (two lots of 10%); 50% is \$175 (half); 25% is \$87.50 (half of half).

Signpost words in the text point straight at the maths:

Words in the task	Maths they point to
total, altogether, how much in all	addition
change, difference, how much left	subtraction
each, per, how much for 8	multiplication (or a rate)
share equally, how many fit, how many each	division
% off, discount	percentage
around the edge, fence, border	perimeter
covers, tiles, lawn, paint a surface	area
fills, holds, packs into	volume or capacity
how long, how much time	time
enlarge, reduce, blow up	scaling
per metre, per hour	rate

Refresher. Time runs in 60s, not 10s: 60 minutes = 1 hour, and 15 minutes = 0.25 of an hour. To add minutes to a clock time, count on: 9:40 am plus 35 minutes is 10:15 am.

Find 3: operations, processes and tools. Now decide the doing. Which operations, in which order? Which process (a formula, a table, a diagram)? Which tools — pen and paper, ruler, calculator, spreadsheet?

Refresher. The four operations: addition $12 + 5 = 17$; subtraction $12 - 5 = 7$; multiplication $12 \times 5 = 60$; division $12 \div 3 = 4$. Every plan is built out of these four.

Refresher. Order of operations: do brackets first, then $\times$ and $\div$, then $+$ and $-$, reading left to right. So $3 \times \$4.50 + \$2 = \$13.50 + \$2 = \$15.50$ — the multiply happens before the add, even though it is written first.

Tool	Good for
pen and paper	the plan itself, lists, number sentences
ruler or tape measure	lengths on a plan or in a room (Section 1E)
calculator	checking a long decimal (Section 1F)
a table or list you make	keeping track of steps and options
the chart or graph in the task	reading values straight off it

Strategy	When it helps
draw a diagram	shapes, fences, rooms, plans
make a table	comparing options, keeping steps in order
convert to the same unit first	cm mixed with m, g mixed with kg
estimate first	so you have a rough answer to check against
break it into two small questions	when the task hides two questions in one

The maths plan. A maths plan is the three finds written down, in order, in words and symbols. Use these lines:

Line of the plan	What you write on it
Purpose	what the task is for
Question(s)	exactly what must be found — all of them
Information given	the facts you need, with the extras crossed out
Mathematics	the areas of study and the operations

Line of the plan	What you write on it
Tools	pen and paper, ruler, calculator, ...
Steps	step 1, step 2, ... in order
Estimate	a rough answer to check the real one against

Here is a filled-in plan for a small fundraiser.

Line	Plan
Purpose	raise money for the club's new kit
Question(s)	how much money did the car wash raise?
Information given	18 cars washed at \$12 each; water for the day cost \$15
Mathematics	Number — multiplication, then subtraction
Tools	pen and paper; calculator to check
Steps	step 1: takings = $18 \times \$12 = \$216.00$. step 2: raised = $\$216.00 - \$15.00 = \$201.00$
Estimate	$20 \times \$12 = \$240.00$, minus \$15 is \$225.00 — near \$201.00, so the answer is sensible

Refresher. Rounding and estimating. To the nearest whole number, 3.7 rounds to 4. To the nearest cent, \$62.9166... rounds to \$62.92 (look at the third decimal place: 6 or more, round up). And with whole things you cannot buy part of one: if the maths says 2.3 tins, you buy 3.

Before you call a plan finished, check it:

- Does it answer every question that was asked?
- Is every number in it a number the question needs?
- Are the units the same wherever two measurements meet?
- Does the estimate roughly agree with the answer?

Three traps. Most lost marks in stage 1 come from three traps. *Extra information:* true facts the question does not need — cross them out. *Two questions in one:* answer both, or say both are answered. *Mixed units:* a shelf in cm and timber sold in m will not divide until they are the same unit.

Refresher. Metric conversions are one step of 10, 100 or 1000: 2.5 m = 250 cm; 40 mm = 4 cm; 2 km = 2000 m; 3 kg = 3000 g; 1.5 L = 1500 mL.

Familiar, unfamiliar, routine. Tasks in this book sit in familiar contexts (shopping, sport, home jobs), routine contexts you have met before in a slightly new coat, and some less familiar ones — a work roster, a quote, a clinic plan. The words may be new even when the maths is not. That is what Section 1G calls familiar, unfamiliar and routine reading: slow down, find the signpost words, and the maths underneath is maths you know.

Worked examples

Example 1 — scaffolded

The Marram Sports Club runs a BBQ Friday. The price sign is shown below.

MARRAM SPORTS CLUB	
BBQ Friday — from 12 noon	
Sausage sandwich	\$3.50
Burger	\$6.80
Chips	\$2.50
Drink	\$2.00
Ice cream	\$3.00
cash only — thank you!	

Made-up data: pretend prices on a pretend club sign.

A customer orders 8 sausage sandwiches and 12 drinks, and pays with a \$100 note. What does the order cost, and what change comes back?

Working	Comment
$8 \times \$3.50 = \$28.00$	8 sausage sandwiches at \$3.50 each
$12 \times \$2.00 = \$24.00$	12 drinks at \$2.00 each
$\$28.00 + \$24.00 = \$52.00$	the two parts make the total
$\$100.00 - \$52.00 = \$48.00$	change from a \$100 note
estimate: $8 \times \$4.00 + 12 \times \$2.00 = \$56.00$	\$52.00 sits near \$56.00, so it is sensible

The order costs \$52.00 and the change is \$48.00.

Example 2 — scaffolded

Milly is organising a birthday party. The hall coordinator sends this message.

Hall hire: \$120 for the afternoon. Catering: \$8.50 per person. Cake: \$45 from the bakery. The hall has 40 chairs. Bookings close on Wednesday. Forecast: 18 °C, fine.

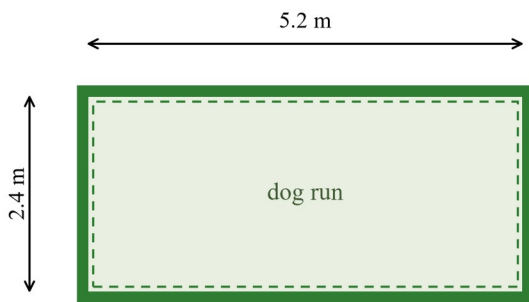
Twenty-five people are coming. Six organisers will share the total cost equally. How much does each organiser pay, correct to the nearest cent?

Working	Comment
cross out: 40 chairs, Wednesday, 18 °C	true facts this question does not need
$25 \times \$8.50 = \$212.50$	catering for 25 people
$\$120.00 + \$212.50 + \$45.00 = \$377.50$	hire + catering + cake
$\$377.50 \div 6 = \$62.9166\dots$	six organisers share equally
$= \$62.92$	correct to the nearest cent
estimate: $25 \times \$8.00 = \$200.00$, then	\$377.50 sits near \$365.00, so the total is sensible
$\$200.00 + \$120.00 + \$45.00 = \$365.00$	

Each organiser pays \$62.92, correct to the nearest cent.

Example 3 — unscaffolded

The Cedar Grove Vet Clinic is fencing a rectangular dog run, 5.2 m long and 2.4 m wide. Fencing costs \$18.50 per metre. What will the fence cost?



the fence goes all the way around the run

Made-up data: pretend sizes for a pretend clinic's dog run.

The fence goes around the run, so the length of fencing is the perimeter.

$$P = 2 \times (5.2 + 2.4) = 2 \times 7.6 = 15.2 \text{ m}$$

$$\text{Cost} = 15.2 \times \$18.50 = \$281.20$$

Estimate: $15 \times \$18.50 = \$277.50$, which sits near \$281.20.

$\therefore$ the fence costs \$281.20.

Example 4 — unscaffolded

Sean's family is 2 adults and 3 children. They look at the entry prices at the Blue Gum Aquatic Centre.

BLUE GUM AQUATIC CENTRE	
entry prices	
Adult	\$7.00
Child	\$4.50
Family (2 adults + 3 children)	\$26.00
children under 3 swim free	

Made-up data: pretend entry prices at a pretend pool.

Is the family ticket cheaper than buying separate tickets, and by how much?

Separate tickets: $2 \times \$7.00 = \$14.00$ for the adults and $3 \times \$4.50 = \$13.50$ for the children.

Total separate: $\$14.00 + \$13.50 = \$27.50$

The family ticket is \$26.00, and $\$27.50 - \$26.00 = \$1.50$.

$\therefore$ the family ticket is cheaper, by \$1.50.

Practice questions

Scaffolded

Q1. Name the operation, then find the answer.

- (a) the total of \$18.60 and \$7.25
- (b) the change from \$50 after spending \$32.40
- (c) the cost of 6 stamps at \$1.25 each

Q2. The Greenhill Canteen price list:

Item	Price
toastie	\$5.20
wrap	\$6.40
fruit salad	\$3.80
smoothie	\$4.60

Made-up data: pretend canteen prices.

- (a) Write two questions this price list can answer.
- (b) Find the cost of 2 toasties and 1 smoothie.
- (c) Nadav buys a wrap and a fruit salad, and pays with a \$20 note. What change comes back?

Q3. A school camp message reads:

Tent hire: \$95 for the weekend. Sleeping bags: \$18.50 each. 4 people are going from our group. The camp is 60 km away. Forecast: 18 °C. Check-in from 2 pm.

- (a) Write the purpose and the question in your own words.
- (b) Write down two facts from the message you do not need.
- (c) Find the total cost for the group.

Q4. Rita is making curtains. Her window is 2.1 m wide. She needs fabric twice as wide as the window, and the fabric costs \$14.00 per metre.

- (a) What question is Rita trying to answer?
- (b) Write the steps, then find the cost of the fabric.
- (c) Estimate the cost first, with 4 m of fabric at \$14.00.

Q5. Choose the best strategy for each job: *draw a diagram*, *make a table*, or *convert to the same unit first*. Say why in one sentence.

- (a) comparing two ticket options side by side
- (b) working out fencing for a yard from a sketch
- (c) fitting a shelf measured in cm into timber sold in m

Q6. The town bus timetable is shown below.

TOWN BUS		
railway station → shopping centre		
Leaves the station	8:15 am · 9:40 am · 12:30 pm	
Trip time	35 minutes	
Day pass	\$7.60	

Made-up data: pretend times and a pretend fare.

- (a) What time does the 9:40 am bus reach the shopping centre?
- (b) How long is the gap between the first and the last departure of the day?
- (c) What do 5 day passes cost?

Unscaffolded

Q7. This receipt from Yard and Home Hardware is missing its total line.

YARD AND HOME HARDWARE		
thanks for shopping with us		

garden seed	1	\$18.90
gypsum	2 @ \$12.50	\$25.00
watering can	1	\$16.45
garden gloves	1	\$8.90

* * *		
exchange within 30 days with receipt		

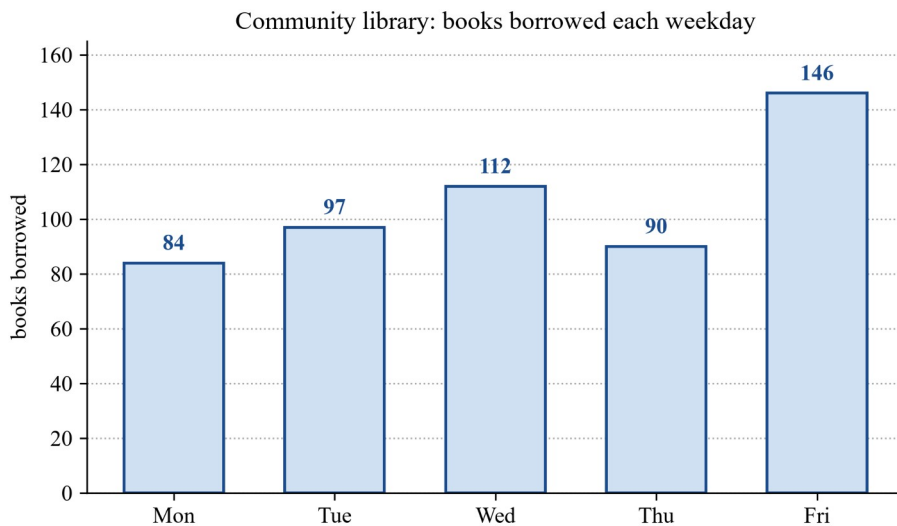
Made-up data: a pretend receipt with pretend prices.

- (a) Find the total of the receipt.
- (b) The customer pays with a \$100 note. What change comes back?
- (c) Write one more question this receipt can answer, and solve it.

Q8. Lottie is pouring a concrete slab 4 m long, 3 m wide and 0.1 m deep. Concrete is sold by the cubic metre.

- (a) Name the three measurements Lottie needs, and say what they let her work out.
- (b) How many cubic metres is the slab?
- (c) Will 1 cubic metre of concrete be enough? How do you know?

Q9. The chart shows books borrowed at the community library last week.



Made-up data: pretend borrowings at a pretend library.

- (a) Which day was busiest, and how many books were borrowed that day?
- (b) How many more books were borrowed on Friday than on Tuesday?
- (c) How many books were borrowed over the five weekdays altogether?

Q10. A farm gate collects 134 eggs in a day. Eggs are packed into cartons of 12, and cartons are sold whole.

- (a) How many cartons must be bought to hold all 134 eggs?
- (b) A calculator says $134 \div 12 = 11.1666\dots$ Explain in one sentence why 11 cartons is not the answer.
- (c) How many spare egg spaces are left in the cartons?

Q11. A workshop cuts shelves 85 cm long from lengths of timber 3 m long.

- (a) How many centimetres is one length of timber?
- (b) How many whole shelves come from one length?
- (c) How long is the offcut left over?

Q12. A train travels 240 km in 3 hours at a steady speed.

- (a) What is its speed in km/hr?
- (b) How far does it travel in 2 h 15 min?
- (c) How long, in minutes, does 60 km take?

Q13. Spoke and Wheel Bikes has a weekend sale: 20% off every bike. The City Comet was \$350.



Made-up data: a pretend sale at a pretend bike shop.

- (a) How much money is taken off the City Comet?
- (b) What is its sale price?
- (c) A second bike was \$480. Use the method “find 10%, then double it” to find the money taken off.

Q14. Kate’s photo is 9 cm by 12 cm. She enlarges it so each side is twice as long.

- (a) What are the new measurements?
- (b) What is the perimeter of the enlarged photo?
- (c) What is the area of the original photo?

Q15. A class trip costs \$240 for the bus plus \$6.50 per student for tickets. There are 28 students, and the budget is \$450. Jesse’s maths plan says only: “ $28 \times \$6.50 = \$182$. So the trip costs \$182.” Name three things missing or wrong in Jesse’s plan, then write the step and the conclusion Jesse left out. Does the trip fit the budget?

Q16. A club orders screen-printed shirts. Printing costs \$8.50 per shirt, plus a one-off \$45 set-up fee for the logo. The club orders 12 shirts.

- (a) What does the printing of 12 shirts cost, before the set-up fee?
- (b) Write the whole cost as one number sentence and solve it, minding the order of operations.
- (c) What does each shirt work out to, correct to the nearest cent?

Q17. Two quotes for mowing a park: Quote A is \$185 for the whole job; Quote B is \$65 per hour. The job takes 3 hours.

- (a) Write Quote A as a cost per hour, correct to the nearest cent.
- (b) What does Quote B cost for the 3-hour job?
- (c) Which quote is cheaper, and by how much?

Q18. The school fete runs a ring-toss stall: \$2 per play. There were 40 plays on Saturday and 35 on Sunday. The prizes cost the stall \$58, and the stall’s target was \$100 profit.

- (a) How many plays were there altogether, and how much money did they take?
- (b) What was the profit after paying for the prizes?
- (c) Was the target met? If not, by how much was it missed?

Answers

- Q1.** (a) addition, \$25.85 (b) subtraction, \$17.60 (c) multiplication, \$7.50
- Q2.** (a) any two, e.g. “What does a wrap and a smoothie cost?” and “How much cheaper is a toastie than a wrap?” (b) \$15.00 (c) \$9.80
- Q3.** (a) purpose: work out what the camp costs our group; question: what is the total of tent hire and 4 sleeping bags? (b) any two of: 60 km, 18 °C, 2 pm (c) \$169.00
- Q4.** (a) what will the fabric cost? (b) fabric 4.2 m; cost \$58.80 (c) \$56.00
- Q5.** (a) make a table (b) draw a diagram (c) convert to the same unit first
- Q6.** (a) 10:15 am (b) 4 h 15 min (c) \$38.00
- Q7.** (a) \$69.25 (b) \$30.75 (c) any one, e.g. how much more did the seed cost than the gloves? \$10.00
- Q8.** (a) length, width and depth — together they give the volume in cubic metres (b) 1.2 m^3 (c) no; 1.2 m^3 is more than 1 m^3
- Q9.** (a) Friday, 146 books (b) 49 books (c) 529 books
- Q10.** (a) 12 cartons (b) 11 cartons hold only 132 eggs, and 2 eggs would have no carton (c) 10 spare spaces
- Q11.** (a) 300 cm (b) 3 shelves (c) 45 cm
- Q12.** (a) 80 km/hr (b) 180 km (c) 45 minutes
- Q13.** (a) \$70 (b) \$280 (c) \$96
- Q14.** (a) 18 cm by 24 cm (b) 84 cm (c) 108 cm^2
- Q15.** missing: the \$240 bus; a total; a comparison with the budget (and no estimate). True total \$422.00; yes, it fits, with \$28.00 left over
- Q16.** (a) \$102.00 (b) \$147.00 (c) \$12.25
- Q17.** (a) \$61.67 per hour (b) \$195.00 (c) Quote A, by \$10.00
- Q18.** (a) 75 plays, \$150.00 (b) \$92.00 (c) no — missed by \$8.00
-

Fully-worked solutions

- Q1.** (a) “Total” means addition: $\$18.60 + \$7.25 = \$25.85$. (b) “Change” means subtraction: $\$50.00 - \$32.40 = \$17.60$. (c) “6 at \$1.25 each” means multiplication: $6 \times \$1.25 = \$7.50$.
- Q2.** (a) Any two questions the list can answer, for example: *What does a wrap and a smoothie cost together?* and *How much cheaper is a toastie than a wrap?* (b) $2 \times \$5.20 = \$10.40$; then $\$10.40 + \$4.60 = \$15.00$. (c) Wrap and fruit salad: $\$6.40 + \$3.80 = \$10.20$. Change: $\$20.00 - \$10.20 = \$9.80$.
- Q3.** (a) Purpose: to work out what the camp will cost our group. Question: what is the total of the tent hire and four sleeping bags? (b) Any two of: the camp is 60 km away; the forecast of 18 °C; check-in from 2 pm. None of these change the cost. (c) Sleeping bags: $4 \times \$18.50 = \$74.00$. Total: $\$74.00 + \$95.00 = \$169.00$.
- Q4.** (a) What will the fabric for the curtains cost? (b) Step 1, width of fabric: $2 \times 2.1 = 4.2 \text{ m}$. Step 2, cost: $4.2 \times \$14.00 = \$58.80$. (c) Estimate: 4 m at \$14.00 is $4 \times \$14.00 = \$56.00$. The real answer, \$58.80, sits near the estimate, so it is sensible.
- Q5.** (a) Make a table — a row per option keeps the prices lined up so they can be compared. (b) Draw a diagram — the fence goes around a shape, and a sketch shows which sides need fencing. (c) Convert to the same unit first — cm and m will not divide or compare until both are in one unit.

Q6. (a) 9:40 am plus 35 minutes is 10:15 am. (b) From 8:15 am to 12:15 pm is 4 hours, then 15 more minutes to 12:30 pm: 4 h 15 min. (c) $5 \times \$7.60 = \$38.00$.

Q7. (a) Add the four lines: $\$18.90 + \$25.00 + \$16.45 + \$8.90 = \$69.25$. (b) $\$100.00 - \$69.25 = \$30.75$. (c) Any one question and its answer, for example: *How much more did the garden seed cost than the gloves?*
 $\$18.90 - \$8.90 = \$10.00$.

Q8. (a) The length (4 m), the width (3 m) and the depth (0.1 m). Together they give the volume of the slab in cubic metres, which is what concrete is sold by. (The price per cubic metre is the other fact to collect before ordering.) (b) $\text{Volume} = 4 \times 3 \times 0.1 = 1.2 \text{ m}^3$. (c) No. The slab needs 1.2 m^3 and 1.2 is more than 1, so 1 cubic metre would run out.

Q9. (a) The tallest bar is Friday, with 146 books. (b) $146 - 97 = 49$ books. (c) $84 + 97 + 112 + 90 + 146 = 529$ books.

Q10. (a) $134 \div 12 = 11$ cartons with 2 eggs left over (11 cartons hold 132). Those 2 eggs still need a carton, so round up: 12 cartons. (b) Cartons are sold whole, and 11 cartons hold only $11 \times 12 = 132$ eggs — 2 eggs would be left with nowhere to go, so the answer must round up, not down. (c) 12 cartons hold $12 \times 12 = 144$ spaces; $144 - 134 = 10$ spare spaces.

Q11. (a) 3 m = 300 cm. (b) $300 \div 85 = 3$ shelves with 45 cm left over; a fourth shelf would need $4 \times 85 = 340$ cm, which is more than 300 cm, so 3 whole shelves. (c) $3 \times 85 = 255$ cm used; $300 - 255 = 45$ cm offcut.

Q12. (a) $240 \div 3 = 80$ km/hr. (b) 2 h 15 min = 2.25 h; $80 \times 2.25 = 180$ km. (c) $60 \div 80 = 0.75$ h, and $0.75 \times 60 = 45$ minutes.

Q13. (a) 20% of \$350: 10% is \$35, so 20% is $2 \times \$35 = \$70$. (b) $\$350 - \$70 = \$280$. (c) 10% of \$480 is \$48; double it: $2 \times \$48 = \$96$ off.

Q14. (a) $9 \times 2 = 18$ cm and $12 \times 2 = 24$ cm. (b) $P = 2 \times (18 + 24) = 2 \times 42 = 84$ cm. (c) $9 \times 12 = 108 \text{ cm}^2$.

Q15. Three things missing or wrong: (1) the \$240 bus cost is not in the plan at all; (2) there is no total for the whole trip; (3) the plan never compares the cost with the \$450 budget, so it reaches no conclusion (an estimate is missing too). The missing step: tickets $28 \times \$6.50 = \$182.00$, then total = $\$182.00 + \$240.00 = \$422.00$. Conclusion: \$422.00 is less than \$450, so the trip fits the budget, with $\$450.00 - \$422.00 = \$28.00$ left over.

Q16. (a) $12 \times \$8.50 = \$102.00$. (b) $12 \times \$8.50 + \$45 = \$102.00 + \$45 = \$147.00$ — the multiply is done before the add. (c) $\$147.00 \div 12 = \$12.25$ per shirt, correct to the nearest cent (it divides exactly).

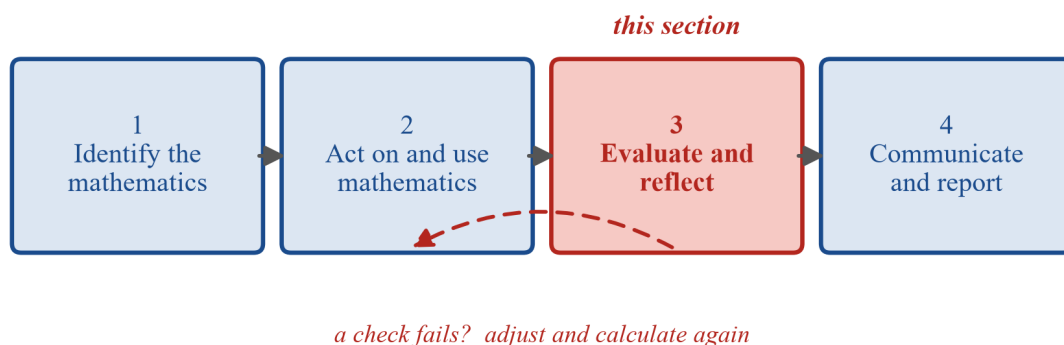
Q17. (a) $\$185 \div 3 = \$61.666\dots$, which is \$61.67 per hour correct to the nearest cent. (b) $3 \times \$65 = \$195.00$. (c) Quote A costs \$185.00 and Quote B costs \$195.00; $\$195.00 - \$185.00 = \$10.00$, so Quote A is cheaper by \$10.00.

Q18. (a) $40 + 35 = 75$ plays; $75 \times \$2 = \$150.00$ taken. (b) $\$150.00 - \$58.00 = \$92.00$ profit. (c) No: the target was \$100.00 and the profit was \$92.00, so it was missed by $\$100.00 - \$92.00 = \$8.00$.

Chapter 1 The problem-solving cycle and mathematical toolkit — 1C Estimate, check and reflect: is the answer reasonable?

Theory

Why check at all. When you finish a calculation, the number on your page or calculator is not finished work. One wrong key, one wrong operation, or a decimal point in the wrong place all give a number that *looks* fine and is wrong. Stage 3 of the problem-solving cycle is where you stop and check: is this answer reasonable?



Checking means three things, done in order. First, **estimate** before you calculate, so you know roughly what to expect. Second, **compare** your exact answer with your estimate. Third, ask whether the answer **fits real life**. If a check fails, you find the slip, adjust, and check again. If a problem truly cannot be solved, saying so — and saying why — is a complete and correct answer.

Estimate first. An estimate is a quick, close-enough number you work out in your head. It is not a guess: you build it from friendly numbers. Here is the habit, on a small job.

Worked model. Four bottles of drink cost \$3.20 each. Before calculating, round \$3.20 down to \$3: $4 \times \$3 = \$12$. Now calculate exactly: $4 \times \$3.20 = \$12.80$. The gap is $\$12.80 - \$12.00 = \$0.80$ on a \$12 estimate — close. So \$12.80 passes the first check. If the calculator had shown \$128.00 or \$1.28, you would know at once something slipped.

One more: six bags of rice at \$4.80 each. In your head, $6 \times \$5 = \$30$. Exactly, $6 \times \$4.80 = \$28.80$. Close again — and a little *under* \$30, which is what you expect, because you rounded the price *up*.

Refresher — rounding to friendly numbers. Rounding is what makes an estimate quick, so here is the rule again. Look at the digit one place to the right of the place you are rounding to. If it is 5 or more, round up. If it is 4 or less, keep the digit and drop the rest.

- 38 to the nearest 10 is **40** (the 8 rounds up).
- \$4.75 to the nearest dollar is **\$5** (75c is more than 50c).
- 246 to the nearest 100 is **200** (46 is less than 50, so round down).
- 12.4 m of ribbon to the nearest whole metre is **12 m** (0.4 is less than 0.5).

Three ways to estimate. You have three tools, and most jobs only need one of them.

1. **Round to friendly numbers.** Change each number to one you can multiply or divide in your head, as in the worked model above.
2. **Use a benchmark.** A benchmark is a size you already know from everyday life. Compare your answer with it. If someone says a baby weighed 42 kg at birth, your benchmark (a newborn is about 3 to 4 kg) tells you the number is wrong before you calculate anything.
3. **Work backwards.** Use the opposite operation to check a claim. If a bill says $\$236 \div 4 = \$59$ each, check 59×4 and see if you get back to \$236.

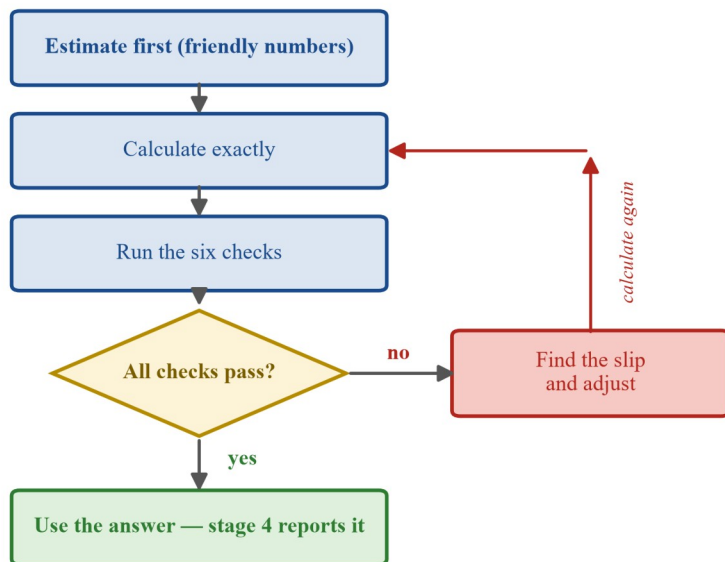
Handy benchmarks to carry with you:

Thing	Handy size
Kitchen bench height	about 90 cm
A doorway	about 2 m high
A bag of sugar	1 kg
A carton of milk	1 L
A teaspoon	about 5 mL
A loaf of bread	\$3 to \$5
Hourly pay in a part-time job	\$25 to \$35 per hour
Walking 1 km	10 to 15 minutes
Boiling a kettle	about 3 minutes

Refresher — elapsed time (how long between two times). Split the time at easy landmarks, then add the pieces. From 9:50 am to 12:20 pm: 9:50 am to 10:00 am is 10 minutes; 10:00 am to 12:00 pm is 2 hours, which is 120 minutes; 12:00 pm to 12:20 pm is 20 minutes. Add: $10 + 120 + 20 = 150$ minutes. And 150 minutes is 2 hours 30 minutes, because $150 = 120 + 30$.

The six checks. Run these on every answer you intend to use or report.

Check	The question to ask	What it looks like
1. Close to my estimate?	Is the exact answer near the number I expected?	Exact \$19.60 against an estimate of \$20.00 — close, pass
2. Right direction?	Should the answer be bigger or smaller than what I started with, and is it?	Buying 8 items costs more than buying 1, never less
3. Reads properly?	Does the calculator screen read as real money or a real measurement?	A screen showing 19.6 means \$19.60, not \$196
4. Opposite operation?	Does working backwards return me to the start?	$\$236 \div 4 = \$59$ checks because $59 \times 4 = 236$
5. Fits real life?	Could this actually happen? Whole objects stay whole.	14 seedlings and \$1 left over — not 14.16 seedlings
6. Answers the question?	Did I answer what was asked, including leftovers and “how many trips”?	“How many trips?” needs 4, not “3 remainder 2”



Refresher — opposite operations. Addition and subtraction undo each other; multiplication and division undo each other. $7 + 5 = 12$, so $12 - 5 = 7$. $6 \times 4 = 24$, so $24 \div 6 = 4$. That pair of facts is the whole of check 4: to test a division, multiply back; to test a multiplication, divide back.

Refresher — money on a calculator screen. A calculator does not show a dollar sign or a trailing zero. For money, the screen 19.6 means \$19.60, because money always runs to two decimal places (cents). Likewise 12.8 means \$12.80: check $8 \times 2.45 = 19.60$ and $4 \times 3.20 = 12.80$. When you write the answer down, write the cents: \$19.60, not \$19.6.

When a check fails: find the slip and adjust. A failed check is useful — it narrows down where the slip is. These are the common shapes a slip takes.

What you see	Likely slip	How to fix it
Answer about 10 times your estimate, e.g. \$1 245.00 when you expected about \$125	Decimal point moved one place: $\$1\,245.00 = 10 \times \$124.50$	Move the decimal point back one place and check again
Answer about 100 times your estimate, e.g. 68 400 when you expected about 700	Decimal point moved two places: $68\,400 = 100 \times 684$	Move it back two places and check again
Answer far <i>below</i> your estimate, e.g. \$52.50 when you expected hundreds	Wrong operation — the numbers were added, not multiplied: $24 + 28.50 = 52.50$	Re-read the question, use the right operation, calculate again
Answer close to your estimate but the cents look odd	A keying slip (one wrong digit)	Re-key the numbers and calculate again

After adjusting, run the six checks again. An adjusted answer is not finished until it passes.

Make the answer fit real life. Numbers on a page live in the real world, and the real world gets a say. The study design notes that when your answer is used to make a decision, things beyond the maths may count as well, such as the effect on people or on money (Unit 1, Outcome 2, the evaluate-and-reflect stage). Weighing up the real situation like this is often called making a *contextual judgement*.

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

In practice this means three habits. Round **up** when people or things must all fit (trips, tents, tables, cartons to pack). Round **down** when you can only use whole amounts you actually have (how many full cartons, how many whole

items you can afford). Round to the **nearest** when the question asks for an amount of money or a measurement, and always state the precision you rounded to (for example, “correct to the nearest cent”).

Refresher — division with a remainder. When one whole number does not divide exactly into another, write what is left as a remainder: $a = q \times b + r$, where q is the number of full groups and r is what is left over, with r smaller than b . The same division can be read three ways, and the question tells you which reading to use.

- **Left over:** $17 = 3 \times 5 + 2$, so 17 items packed 5 to a box give 3 full boxes and 2 items left over.
- **Round up:** 26 people travel 8 to a van. $26 = 3 \times 8 + 2$, and the last 2 people still need a van, so 4 vans are needed.
- **Round down:** 17 eggs go into cartons of 12. $17 = 1 \times 12 + 5$, so there is 1 *full* carton and 5 loose eggs.

When a problem cannot be solved. Sometimes the honest answer is “this cannot be solved”, and the study design expects you to say so and explain why. Two shapes come up most often.

- **Missing information.** The question does not give you a number you need. (“How much fuel for the trip?” with no distance and no fuel price given.) State exactly what is missing.
- **Impossible conditions.** The numbers given cannot all be true at once. (A hall that fits 5 tables of 8 cannot seat 62 people at one sitting.) Show the clash with a calculation.

A sentence of the form “Cannot be solved, because ...” followed by your reason is a complete answer. It is not a failure — it is the check working.

Your reasonableness checklist. Before you report any answer, run down this list.

1. Did I estimate before I calculated?
2. Is my exact answer close to my estimate?
3. Is it the right direction — bigger or smaller than the start, as it should be?
4. Does the calculator screen read as sensible money or measurement (cents written in)?
5. Does the opposite operation take me back to where I started?
6. Are the units right — dollars and cents, hours and minutes, kg, L, cm, m, km?
7. Does the answer fit real life — whole things whole, people not fractions?
8. Did I answer the question actually asked, including leftovers and round-ups?
9. If a check failed, did I find the slip, adjust, and check again — or explain why the problem cannot be solved?

About the data in this section. The prices, wages, bills and timetables here are **made up** (not real): pretend people, pretend businesses 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.

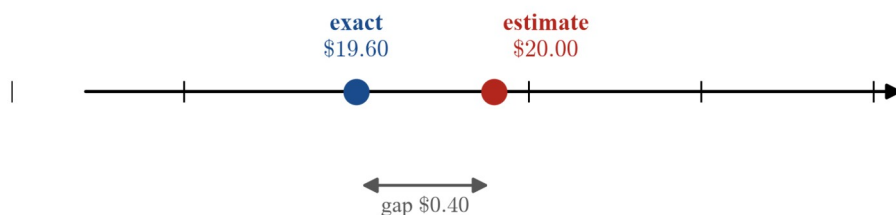
Worked examples

Example 1 — scaffolded

Hana buys 8 packets of pasta at \$2.45 each. Estimate the cost first, then calculate it exactly and check the exact answer against the estimate.

Working	Comment
Round \$2.45 up to \$2.50.	A friendly number: 8 lots of 2 and a half.
$8 \times \$2.50 = \$20.00$	The estimate. Rounding the price up means the estimate sits a little high.
$8 \times \$2.45 = \$19.60$	The exact cost, by calculator or pen and paper.
$\$20.00 - \$19.60 = \$0.40$	Check 1: the gap is 40c on a \$20 estimate — close, so \$19.60 passes.
Watch: \$196.00 or \$1.96 would fail.	Each is 10 times out — a slipped decimal point, not a real price for 8 packets.

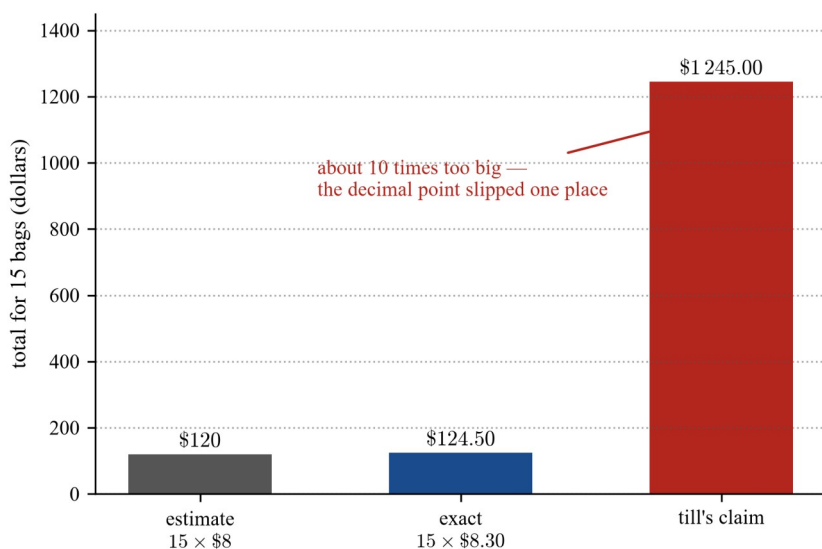
close to the estimate $\Rightarrow$ the exact answer passes check 1



Example 2 — scaffolded

A garden centre sells bags of potting mix for \$8.30 each. A customer buys 15 bags and the till prints a total of \$1 245.00. Check whether the till's total is reasonable, and adjust it if it is not.

Working	Comment
$15 \times \$8 = \$120$	Estimate first: \$8 is a friendly stand-in for \$8.30.
$15 \times \$8.30 = \$124.50$	The exact total the till <i>should</i> print.
$\$1\,245.00 = 10 \times \$124.50$	Check 1 fails badly: the printed total is exactly 10 times the exact one.
$\$1\,245.00 \div 15 = \$83.00$	Check 4, backwards: that would mean \$83.00 a bag. No bag costs that.
Adjust: move the decimal point one place left $\rightarrow$ \$124.50.	The slip shape “10 times too big” means a one-place decimal slip.
\$124.50 matches the exact working and the \$120 estimate.	All six checks now pass, so report \$124.50.



Example 3 — unscaffolded

Mia has saved \$85. Seedlings at her local nursery cost \$6 each. How many seedlings can Mia buy, and what is left over? Check your answer fits real life.

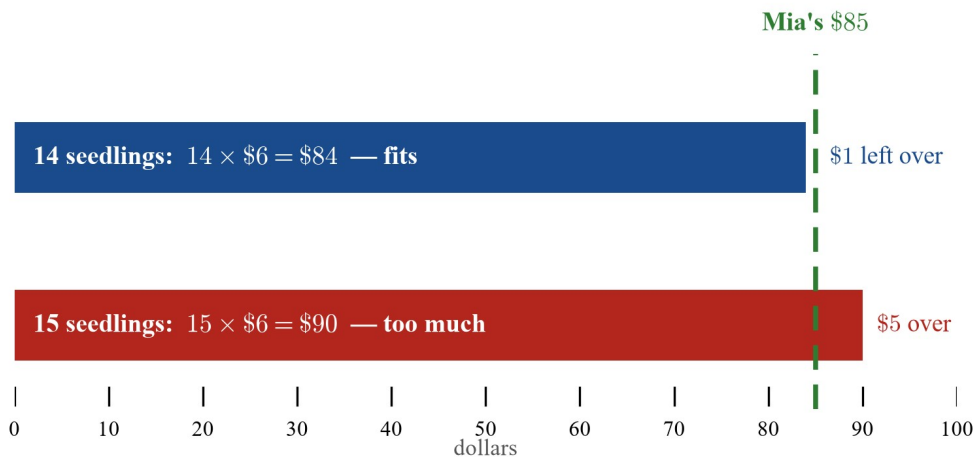
Estimate: $10 \times \$6 = \$60$ and $15 \times \$6 = \$90$, so the answer is between 10 and 15 seedlings, nearer 15.

Exact: divide \$85 by \$6.

$$85 = 14 \times 6 + 1$$

So 14 seedlings cost $14 \times \$6 = \$84$, leaving $\$85 - \$84 = \$1$.

Check against real life: a 15th seedling would cost \$6 and only \$1 is left, and $15 \times \$6 = \$90$ is \$5 more than Mia has. A seedling cannot be bought in pieces, so the remainder is not an extra seedling — it is money left over.



$\therefore$ Mia can buy 14 seedlings and will have \$1 left over.

Example 4 — unscaffolded

A community group plans a dinner in a hall. The hall fits at most 5 tables, and each table seats 8 people. The group sells 62 tickets. Can the dinner seat everyone at one sitting? If not, explain why not.

Maximum seats in the hall:

$$5 \times 8 = 40$$

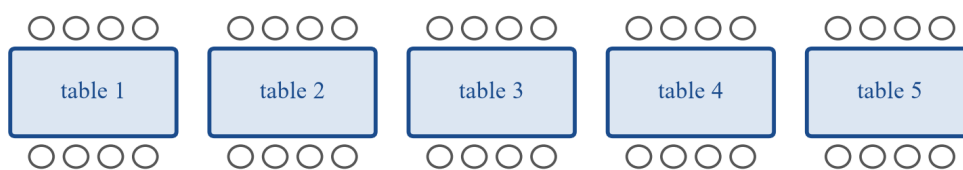
Tickets sold: 62. Compare:

$$62 - 40 = 22$$

Check against real life: 22 ticket-holders would have no seat, so the dinner as planned cannot work at one sitting. The conditions given (at most 5 tables, 8 seats each, 62 tickets) cannot all be satisfied at once.

A fix the group could choose: two sittings would seat $2 \times 40 = 80$ people, and $80 \geq 62$, so two sittings would work.

$$5 \times 8 = 40 \text{ seats at most}$$



62 tickets sold — $62 - 40 = 22$ people would have no seat

the conditions are impossible: the dinner cannot seat everyone at one sitting

$\therefore$ Cannot be solved as one sitting, because the hall seats at most 40 people and 62 tickets were sold — 22 more than the seats available.

Practice questions

Scaffolded

- Q1.** Round each number to a friendly number. (a) 57 to the nearest 10 (b) \$6.30 to the nearest dollar (c) 384 to the nearest 100
- Q2.** Luca buys 7 jars of honey at \$5.80 each. (a) Estimate the total by rounding \$5.80 to the nearest dollar. (b) Calculate the exact total. (c) Find the gap between your estimate and the exact total. Is the exact total reasonable?
- Q3.** Use benchmarks to check whether each claim is reasonable. (a) “My dog weighs about 25 kg.” (b) “For the party we bought 6 L of milk — that is six 1-litre cartons.” (c) “I walk 1 km in about 12 minutes.” (Think: walking speed is about 5 km per hour, so how many minutes is 1 km?)
- Q4.** A delivery van carries 8 boxes per trip. There are 26 boxes to move. (a) Estimate the number of trips using 24 boxes. (b) Write 26 as a number of full loads of 8, plus a remainder. (c) How many trips are needed? Say which way you rounded and why.
- Q5.** Four housemates share a \$236 bill equally. Sam says each person pays \$59. (a) Estimate one share by rounding \$236 to the nearest friendly number. (b) Check Sam’s answer with the opposite operation. (c) Riley wrote \$64 instead. Check Riley’s number the same way and comment.
- Q6.** A sports club buys 18 medals at \$7.60 each. The treasurer has \$140 in the club account. (a) Estimate the cost by rounding both numbers up. (b) Calculate the exact cost. (c) Does \$140 cover the medals? If yes, what change is left? Comment on what your estimate in (a) warned you about.

Unscaffolded

- Q7.** An online ad claims a job pays “\$5 600 for a 16-hour week”. Use the hourly-pay benchmark to check whether this claim is reasonable, and suggest what the true figure might be.
- Q8.** A pair of work boots is marked “\$120 — sale price” in the window. At the counter, Ash is charged \$150. Without any further calculation, is the charge reasonable? Explain, and state the size of the error.
- Q9.** A farm shop packs 112 eggs into cartons of 12. How many full cartons are there, and how many eggs are left over? Check your answer by working backwards.
- Q10.** Nadia reads the prices in her shopping trolley: mince \$9.45, bread \$3.20, cheese \$6.85, bananas \$4.30, pasta \$2.95 and tomatoes \$5.60. Estimate the total by rounding each price to the nearest dollar, then find the exact total and compare.

Item	Price
Mince	\$9.45
Bread	\$3.20
Cheese	\$6.85
Bananas	\$4.30
Pasta	\$2.95
Tomatoes	\$5.60

- Q11.** A print shop quotes 250 flyers at \$0.48 each. The invoice arrives showing \$1 200.00. Check the invoice against an estimate, find the likely slip, and state the correct total.

Q12. A fete committee has a budget of \$450. Its quote list is below.

Item	Cost
Paper plates	\$62.40
Decorations	\$88.75
Prizes	\$119.20
Drink cartons	\$74.60
Signs	\$55.00

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

- (a) Estimate the total by rounding each cost to the nearest \$10.
- (b) Find the exact total, correct to the nearest cent.
- (c) Does the \$450 budget cover the list? How much is left over?

Q13. Say whether each statement is reasonable or not, with a one-line check. (i) “I walked 2 km in 25 minutes.” (ii) “The canteen ordered 60 L of cordial — sixty 1-litre cartons.” (iii) “I carried home 5 kg of sugar as five 1 kg bags.” (iv) “I spent exactly \$45 on loaves at \$4 each and bought 10 loaves.”

Q14. Marco’s payslip shows 24 hours worked at \$28.50 per hour, and a pay amount of \$52.50. Check the pay amount against an estimate, find the likely slip, and state the correct amount. Check your correction with the opposite operation.

Q15. At a school fete, a hoop game scores 5 points per successful hoop. A player’s card shows a total of 32 points. Is 32 possible? Explain with a calculation.

Q16. Riley leaves home at 9:50 am and arrives at an appointment at 12:20 pm. The booking was for 12:05 pm. (a) Estimate the trip time to the nearest half hour. (b) Find the exact trip time in minutes, and in hours and minutes. (c) How late was Riley? What is the latest time Riley could have left home to arrive exactly at 12:05 pm?

Q17. Zoe saves \$45 a week towards a bike that costs \$500. (a) Estimate the number of weeks using \$50 a week. (b) Find exactly how many weeks Zoe must save. Show why one week fewer is not enough. (c) After buying the bike, how much of Zoe’s savings is left over?

Q18. Ash is catering a barbecue for 40 guests and allows 2 sausages per guest. Sausages come in packs of 10 costing \$7 a pack, and Ash’s budget is \$100. Show whether the budget covers the sausages, and find the greatest number of packs \$100 can buy.

Answers

Q1. (a) 60 (b) \$6 (c) 400 **Q2.** (a) \$42 (b) \$40.60 (c) \$1.40 below the estimate — reasonable **Q3.** (a) reasonable (b) reasonable — 6 one-litre cartons (c) reasonable — $60 \div 5 = 12$ minutes per km **Q4.** (a) 3 trips (b) $26 = 3 \times 8 + 2$ (c) 4 trips (round up: the last 2 boxes still need a trip) **Q5.** (a) about \$60 (b) $59 \times 4 = 236$ — Sam is right (c) $64 \times 4 = 256 \neq 236$ — \$20 too much, not reasonable **Q6.** (a) about \$160 (b) \$136.80 (c) yes — \$3.20 change; the estimate rounded both numbers up, so it warned “might not fit” when it does **Q7.** Not reasonable — \$5 600 over 16 hours is \$350 per hour; the likely true figure is \$560 (\$35 per hour, a 10-times slip) **Q8.** Not reasonable — a sale price must be below \$120, and \$150 is \$30 more than the marked price **Q9.** 9 full cartons and 4 eggs left over ($112 = 9 \times 12 + 4$); check $9 \times 12 = 108$, and 10 cartons would need 120 eggs **Q10.** Estimate \$32; exact \$32.35; the estimate is 35c under — reasonable **Q11.** Not reasonable — the true total is \$120.00 and \$1 200.00 is 10 times it; the price was read as \$4.80 instead of \$0.48 **Q12.** (a) \$400 (b) \$399.95 (c) yes — \$50.05 left over **Q13.** (i) reasonable (ii) reasonable (iii) reasonable (iv) not reasonable — $45 \div 4 = 11.25$, and 10 loaves cost \$40, not \$45 **Q14.** Not reasonable — \$52.50 is $24 + 28.50$ (added, not multiplied); correct pay is \$684.00; check $\$684.00 \div 24 = \$28.50$ **Q15.** Not possible — every score is a multiple of 5; 32 is not ($30 < 32 < 35$) **Q16.** (a) about 2 and a half hours (b) 150 minutes = 2 h 30 min (c) 15 minutes late; leave by 9:35 am at the latest **Q17.** (a) about 10 weeks (b) 12 weeks (11 weeks saves \$495, which is \$5 short) (c) \$40 left over **Q18.** Yes — 80 sausages = 8 packs = \$56, well inside \$100; the greatest number of packs is 14 (\$98), since 15 packs cost \$105

Fully-worked solutions

Q1. (a) 57: the ones digit 7 is 5 or more, so round up — 60. (b) \$6.30: 30c is less than 50c, so round down — \$6. (c) 384: the tens part 84 is 50 or more, so round up — 400.

Q2. (a) \$5.80 rounds up to \$6, so the estimate is $7 \times \$6 = \$42$. (b) Exactly: $7 \times \$5.80 = \$40.60$. (c) Gap: $\$42.00 - \$40.60 = \$1.40$. The exact total sits a little under the estimate, which is expected because the price was rounded up. \$40.60 is reasonable.

Q3. (a) A medium dog is tens of kilograms, not grams and not hundreds — 25 kg is reasonable. (b) A milk carton is a 1 L benchmark, so 6 L is 6 cartons — reasonable. (c) Walking about 5 km in 60 minutes means 1 km takes $60 \div 5 = 12$ minutes — the claim matches the benchmark exactly, so it is reasonable.

Q4. (a) 24 boxes at 8 per trip: $24 \div 8 = 3$ trips as an estimate. (b) $26 = 3 \times 8 + 2$: three full loads and 2 boxes left over. (c) The 2 leftover boxes still need a trip, so round up: $3 + 1 = 4$ trips. Three trips would carry only $3 \times 8 = 24$ boxes.

Q5. (a) \$236 rounds to \$240, and $240 \div 4 = 60$, so expect about \$60 each. (b) Opposite operation: $59 \times 4 = 236$. This returns to the bill exactly, so Sam’s \$59 is correct. (c) $64 \times 4 = 256$, which is not \$236 — it is $\$256 - \$236 = \$20$ too much. Riley’s number is not reasonable.

Q6. (a) Round up: $18 \rightarrow 20$ medals and $\$7.60 \rightarrow \$8$, so $20 \times \$8 = \$160$. (b) Exactly: $18 \times \$7.60 = \$136.80$. (c) $\$136.80 \leq \$140$, so the account covers the medals, with $\$140 - \$136.80 = \$3.20$ change. The estimate of \$160 was above \$140 only because both numbers were rounded *up*; the exact working settles it.

Q7. The hourly-pay benchmark is \$25 to \$35 per hour. For 16 hours that is between $16 \times \$25 = \$400$ and $16 \times \$35 = \$560$; using \$30 gives $16 \times \$30 = \$480$. The claimed \$5 600 would mean $\$5\,600 \div 16 = \$350$ per hour — more than 10 times the benchmark, so the claim is not reasonable. The likely true figure is \$560 for the week, since $\$560 \div 16 = \$35$ per hour and $\$5\,600 = 10 \times \$560$: a one-place decimal slip in the ad.

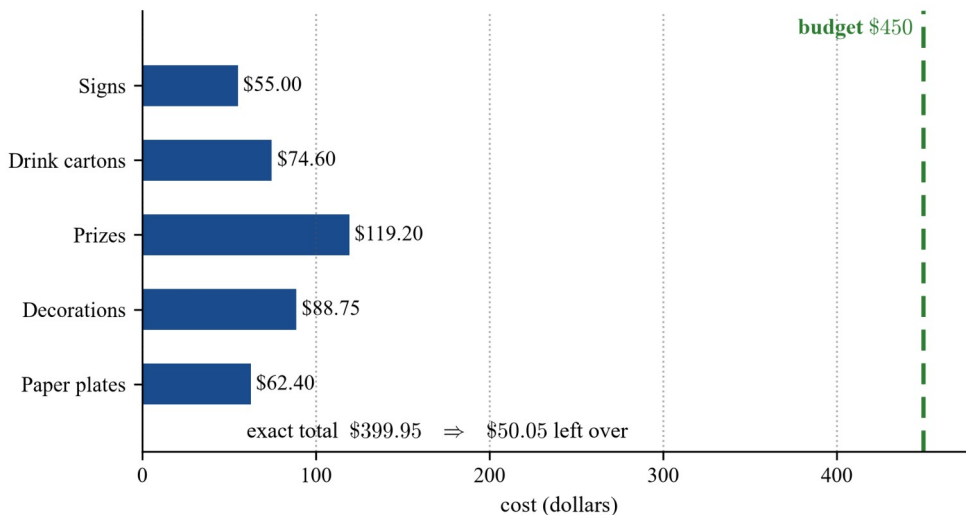
Q8. A sale price must be *below* the marked price. \$150 is above \$120, so the charge fails the direction check before any calculation. The error is $\$150 - \$120 = \$30$ overcharged. Not reasonable — Ash should be charged less than \$120, not \$30 more.

Q9. $112 = 9 \times 12 + 4$, so there are 9 full cartons and 4 eggs left over. Check backwards: $9 \times 12 = 108$ eggs packed, and $108 + 4 = 112$. Also 10 cartons would need $10 \times 12 = 120$ eggs, more than the 112 available, so 9 full cartons is right.

Q10. Round each price to the nearest dollar: \$9, \$3, \$7, \$4, \$3, \$6. Add: $9 + 3 + 7 + 4 + 3 + 6 = 32$, so expect about \$32. Exactly: $\$9.45 + \$3.20 + \$6.85 + \$4.30 + \$2.95 + \$5.60 = \$32.35$. The estimate is $\$32.35 - \$32.00 = \$0.35$ under the exact total — close, so \$32.35 is reasonable.

Q11. Estimate: \$0.48 rounds to \$0.50, and $250 \times \$0.50 = \$125.00$. Exactly: $250 \times \$0.48 = \$120.00$. The invoice's \$1 200.00 is $10 \times \$120.00$ — the “10 times too big” slip shape. The likely cause is reading the price as \$4.80: $250 \times \$4.80 = \$1\,200.00$. The correct total is \$120.00.

Q12. (a) Round each cost to the nearest \$10: \$60, \$90, \$120, \$70, \$60. Add: $60 + 90 + 120 + 70 + 60 = 400$, so expect about \$400. (b) Exactly: $\$62.40 + \$88.75 + \$119.20 + \$74.60 + \$55.00 = \$399.95$, correct to the nearest cent. The gap to the estimate is only $\$400 - \$399.95 = \$0.05$, so the exact total passes check 1. (c) $\$399.95 \leq \$450$, so the budget covers the list, with $\$450 - \$399.95 = \$50.05$ left over.



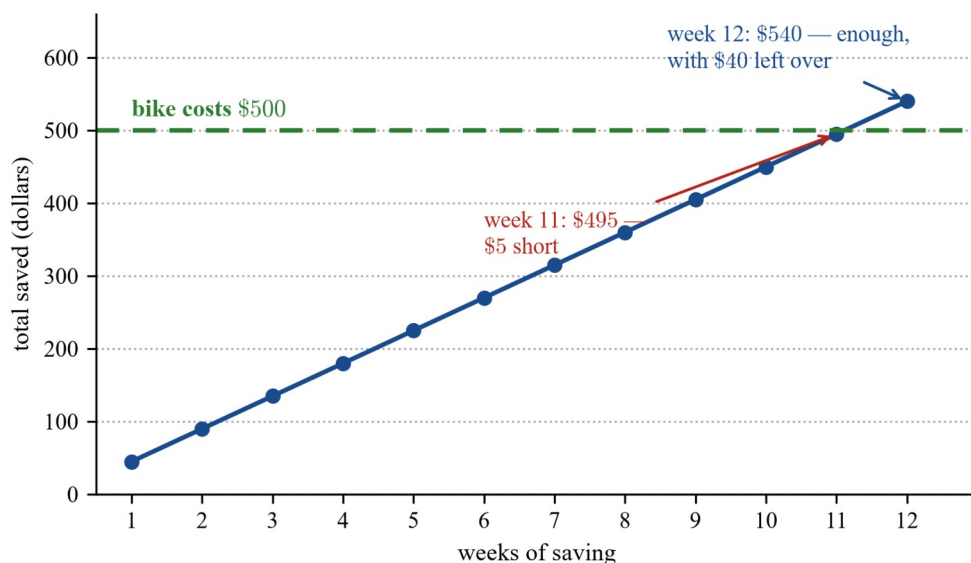
Q13. (i) Reasonable: 2 km at about 12 minutes per km is $2 \times 12 = 24$ minutes, and 24 minutes fits inside the claimed 25. (ii) Reasonable: 60 L in 1 L cartons is $60 \div 1 = 60$ cartons. (iii) Reasonable: 5 kg in 1 kg bags is $5 \div 1 = 5$ bags. (iv) Not reasonable: 10 loaves at \$4 cost $10 \times \$4 = \$40$, not \$45; and $\$45 \div \$4 = 11.25$ loaves, which is not a whole number, so no whole number of \$4 loaves costs exactly \$45.

Q14. Estimate: 24 h $\rightarrow$ 25 h and $\$28.50 \rightarrow \$30$, so $25 \times \$30 = \$750$. The payslip's \$52.50 is far below that, so it fails check 1. The slip shape “far below” means a wrong operation: $24 + 28.50 = 52.50$ — the hours and the rate were added, not multiplied. Correctly: $24 \times \$28.50 = \$684.00$, which sits under the \$750 estimate as expected (both numbers were rounded up). Check with the opposite operation: $\$684.00 \div 24 = \$28.50$ per hour — the rate on the payslip. Marco should be paid \$684.00.

Q15. Every successful hoop adds 5 points, so every possible total is a multiple of 5: 0, 5, 10, ..., 30, 35, ... Now $32 = 6 \times 5 + 2$, which leaves a remainder of 2, and the nearest multiples are $6 \times 5 = 30$ and $7 \times 5 = 35$, with $30 < 32 < 35$. So 32 is not possible — the card has been added up wrongly or written down wrongly.

Q16. (a) 9:50 am to 12:20 pm is a little more than 9:50 am to 12:00 pm, so about 2 and a half hours. (b) Landmarks: 9:50 am to 10:00 am is 10 minutes; 10:00 am to 12:00 pm is 120 minutes; 12:00 pm to 12:20 pm is 20 minutes. Total $10 + 120 + 20 = 150$ minutes, which is 2 h 30 min. (c) The booking was 12:05 pm and Riley arrived at 12:20 pm, so Riley was 15 minutes late. To arrive exactly at 12:05 pm, leave 150 minutes earlier: 12:05 pm back 2 h is 10:05 am, and back 30 more minutes is 9:35 am. Check: 9:35 am plus 2 h 30 min is 12:05 pm. So the latest leaving time is 9:35 am.

Q17. (a) At \$50 a week, $\$500 \div \$50 = 10$ weeks as an estimate; saving \$45 a week will take a little longer. (b) Exactly: $500 = 11 \times 45 + 5$. After 11 weeks Zoe has $11 \times \$45 = \$495$, which is $\$500 - \$495 = \$5$ short — one week fewer is not enough. So Zoe must save for 12 weeks, when she has $12 \times \$45 = \$540$. (c) After paying \$500, the leftover is $\$540 - \$500 = \$40$.



Q18. Sausages needed: $40 \times 2 = 80$. Packs needed: $80 \div 10 = 8$ packs exactly. Cost: $8 \times \$7 = \$56$, and $\$56 \leq \$100$, so the budget covers the sausages with $\$100 - \$56 = \$44$ to spare. Greatest number of packs \$100 can buy: $100 = 14 \times 7 + 2$, so 14 packs cost $14 \times \$7 = \$98$ and 15 packs would cost $15 \times \$7 = \$105$, which is over \$100. The greatest number of packs is 14.

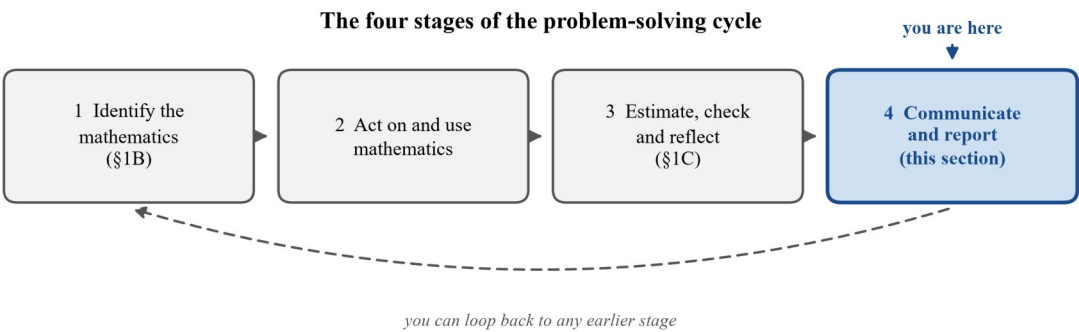
Chapter 1 The problem-solving cycle and mathematical toolkit — 1D Communicate and report results

About the data in this section. The bills, takings, harvests, budgets and plans here are **made up** (not real): pretend businesses 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.

Theory

Where this section sits.

Section 1A set out the four stages of the problem-solving cycle. Sections 1B and 1C took you through the first three: identifying the mathematics, acting on it, and checking whether the answer is reasonable. This section is the fourth stage — **communicate and report results**. A result that stays in your head, or on a calculator screen, is not finished. Someone usually has to receive it and understand it, without you standing next to them explaining.



Good problem-solvers also **loop back**: writing a report often shows up a gap (“wait — I never checked Thursday”), and that sends you back to an earlier stage. That is normal, not a mistake.

Written and oral reports.

You will report results in two broad ways:

- **Written** — a short report, an email, a table on a page, a poster, a graph, a sign. The reader gets it later, so it must stand alone.
- **Oral** — a talk to your class or work team, a handover to a co-worker, a phone call to a customer. The listener hears it once, so it must be short and clearly ordered.

Each way can be **formal** or **informal**:

- **Formal written** uses full sentences, correct units, labelled tables and graphs — a report to a manager, a written quote for a customer.
- **Informal written** is quick and short — a note to a co-worker (“sat takings 246.80, receipts in tin”). Fine for its purpose; wrong for a customer.
- **Formal oral** is a planned talk: question, method, result, check, in that order.
- **Informal oral** is the two-sentence handover at the end of a shift.

The rule behind all four: **match the report to the audience**. The test is whether the person receiving it understands what you found, without asking you anything.

Symbols and shorthand.

Mathematical shorthand is part of reporting: it says a lot in a small space, and every reader of your report needs to read it the same way you wrote it.

Symbol	Name	Reads as	Example
=	equals	“is equal to”	$6 \times \$14.50 = \$87.00$

Symbol	Name	Reads as	Example
$\approx$	approximately equal to	“is about equal to”	\$28.9166... $\approx$ \$28.92 (to the nearest cent)
$\times$ and $\div$	times, divided by	“multiplied by”, “shared between”	\$86.75 $\div$ 3 = \$28.9166...
%	per cent	“out of 100”	rent is 40 % of the income
$\therefore$	therefore (defined in §1A)	“so the result is”	$\therefore$ each friend pays \$28.92
/ in a unit	per	“for each one”	60 km/hr; edging at \$6.75 /m

Two cautions. Use $\approx$ (not $=$) whenever a number has been rounded, and say how it was rounded. And end a piece of working with a $\therefore$ line: it tells the reader “this next sentence is the answer”.

A measurement can also be written two ways that say the same length. This is part of reporting too, because the reader may need the measurement in a different unit:

Refresher. Metric units and equivalent ways of writing a measurement. In this book we use metric units only. The steps you need are:

Length	Capacity	Mass
1 km = 1 000 m	1 L = 1 000 mL	1 kg = 1 000 g
1 m = 100 cm		
1 m = 1 000 mm		

Going from a **bigger unit to a smaller unit, multiply** (a metre is 1 000 millimetres, so metres become 1 000 times as many millimetres). Going from a **smaller unit to a bigger unit, divide**. For example $1.25 \text{ m} = 1.25 \times 1\,000 = 1\,250 \text{ mm}$, and $250 \text{ mL} = 250 \div 1\,000 = 0.25 \text{ L}$. Writing “ $1.25 \text{ m} = 1\,250 \text{ mm}$ ” in a report is correct shorthand: both sides are the same length.

Units and number conventions.

Conventions are the agreed habits that keep reports readable. The ones used in this book:

- **A space between the number and the unit:** 35 km, 7.5 m, 22.3 kg — never “35km”.
- **Money** keeps the dollar sign tight to the number: \$45.49, with cents as decimals.
- **Thousands** are grouped with a space: a 2 400 L tank, an income of \$1 600.
- **Round only at the end.** Carry the full calculator value through the working, and round once, in the result sentence.
- **Say how you rounded:** “to the nearest cent”, “to 1 decimal place”, “to the nearest whole number”. A rounded number with no stated precision is a number the reader cannot trust.

Refresher. Decimal places, cents and rounding to a stated precision. The first digit after the decimal point is the **first decimal place** (tenths); the second is the **second decimal place** (hundredths). Money is counted in cents, and 1 cent is one hundredth of a dollar, so money is written to **two decimal places**: \$12.4 is written \$12.40.

To round to a stated place, look at the digit **one place further right**:

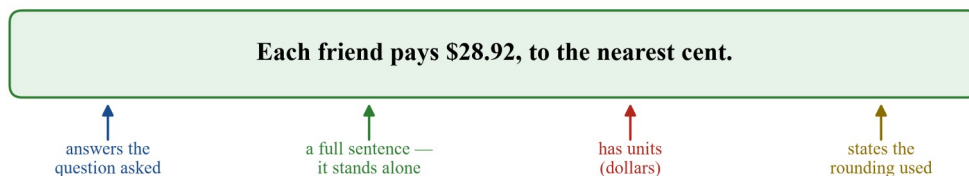
- if that digit is 0 to 4, leave the last kept digit as it is;
- if that digit is 5 to 9, add 1 to the last kept digit.

Then drop the digits you no longer keep. Examples: \$28.9166... to the nearest cent is \$28.92 (the third digit, 6, is 5 or more); 5.8333... to 1 decimal place is 5.8 (the second digit, 3, is 4 or less); 12.6 to the nearest whole number is 13.

The result sentence.

A calculator display is not a report. The display 28.916666 answers no question, carries no units and hides its rounding. The **result sentence** does all of these jobs at once:

A result sentence does four jobs at once



A calculator display like 28.916666 does none of these jobs.

Every result sentence in this book passes a four-part check:

1. it **answers the question that was asked**;
2. it **has units** (dollars, kg, m, hours, days);
3. it is a **full sentence** — it stands alone;
4. it **states the rounding used**, or says the value is exact.

Working someone can read.

Reports usually show some working, so a reader can follow — and check — what you did. Readable working has one step per line, keeps the units, and labels what each line is for. Compare:

$$92.6/4=23.15\text{ok}$$

with:

bill: \$92.60 shared equally between 4 people

share: $\$92.60 \div 4 = \$23.15$

$\therefore$ each person pays \$23.15 (exact — no rounding needed).

The second version can be checked by anyone, months later, without you in the room.

Tables, diagrams and graphs.

A **representation** is any way of setting out results — a table, a diagram, a graph, a plan. The same numbers can communicate well or badly depending on how they are set out:

Before — a note to self

23	31	28	35
1	2	3	4

What do these numbers count?
Days of what? Units? Nobody can tell.

After — a table others can read

Deliveries made each day, Week 3

Day	Deliveries (number)
Monday	23
Tuesday	31
Wednesday	28
Thursday	35

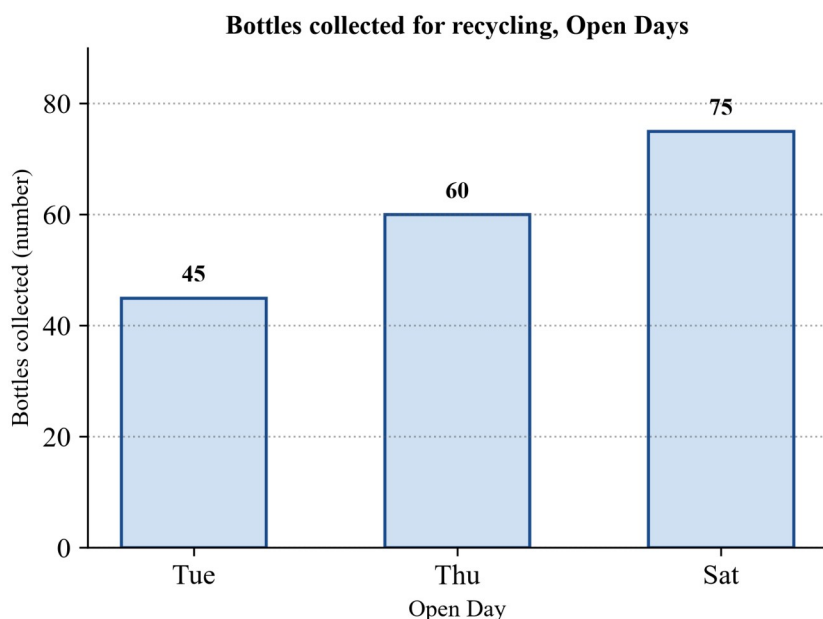
Title, headings and units —
the same numbers, now a report.

The two tables hold exactly the same numbers. Only one of them tells you what the numbers are. A graph has the same rule.

Refresher. Reading a bar chart or line graph. Before you trust a graph, check four things, in this order:

1. the **title** — what is being counted, and over what period;
2. the **axis labels**, including the **units** (number, dollars, kg, days);
3. the **scale** — what each gridline step is worth;
4. the **values** — read from the labelled points or bars, or from the gridlines.

If the title or the axis labels are missing, the graph cannot be read by a stranger, and it needs fixing before it goes in a report.



Choosing the right representation depends on what you are reporting:

- **Table** — exact values the reader may reuse (a price list, a roster, readings).
- **Line graph** — a change over time (a savings balance, a weekly total, a temperature).
- **Bar chart** — a comparison between categories (days, teams, products).
- **Pie chart** — shares of one whole (a budget, a survey), usually as per cents.
- **Diagram or plan** — sizes and layout (a room, a garden bed, a site).

Refresher. Finding common per cents. A **per cent** means “out of 100”, written %. The quickest way to find a per cent of an amount is to find 10 % first by dividing by 10, then build up:

- 10 % of \$ 1 600 = $\$ 1\,600 \div 10 = \$ 160$;
- 40 % is four lots of 10 %: $4 \times \$ 160 = \$ 640$;
- 50 % is half: $\$ 1\,600 \div 2 = \$ 800$; 25 % is a quarter: $\$ 1\,600 \div 4 = \$ 400$;
- 5 % is half of 10 %: $\$ 160 \div 2 = \$ 80$.

Formats and devices.

The **format** is the shape of the report (sentence, table, graph, poster, slides). The **device** is what carries it (paper, whiteboard, spreadsheet or app, phone, your voice — Section 1F looks at the digital toolkit in detail). Match both to the audience:

Who you report to	A good format	A good device
manager or boss	short written report with a table	email or printed page
work team or class	poster or slides with one graph	whiteboard or projector
customer or client	one plain sentence with a rounded number	speech, phone call or sign
yourself	notes with a check line	notebook or phone notes

A short written report.

Six parts cover almost every written report you will need at work or in life: **Question** (one line), **Method** (what you did and why), **Working** (one step per line), **Result** (the $\therefore$ sentence with units and rounding), **Check** (your reasonableness check from §1C), **Conclusion** (what it means in the real situation).

A short written report — the six parts

Question	What is the total cost of 6 movie tickets at \$14.50 each?
Method	Multiply the price of one ticket by the number of tickets.
Working	$6 \times \$14.50 = \$87.00$
Result	The total cost is \$87.00 (exact — no rounding needed).
Check	Estimate: $6 \times \$15 = \$90$. The exact total is \$3.00 below the estimate — close, so the answer is sensible.
Conclusion	A \$100 note covers the tickets, with \$13.00 change.

Reporting out loud.

An oral report follows the same shape, kept short:

1. Say the **question**, in one sentence.
2. Say the **method**, in one sentence.
3. Show **one** table or graph — and point at the parts you mention.
4. Say the **result sentence** slowly, with units and rounding.
5. Give the **check**, then invite questions.

Report the check too.

The check from §1C belongs inside the report, not just in your head — it is what makes your number believable. For example: 6 tickets at \$14.50 gives $6 \times \$14.50 = \$87.00$; your estimate was $6 \times \$15 = \$90$; the exact total sits \$3.00 below the estimate, which is close, so the answer is sensible. One line like that earns a reader's trust.

Worked examples

Example 1 — scaffolded

Three friends share a takeaway order equally. The food came to \$62.30 and the drinks to \$24.45. Report, **to the nearest cent**, what each friend pays, and say what happens to the total when everyone rounds their share up.

Working	Comment
bill total: $\$62.30 + \$24.45 = \$86.75$	Add the two parts of the bill first.
share: $\$86.75 \div 3 = \$28.9166\dots$	The exact share does not terminate — keep the full value for now.
$\therefore$ each friend pays \$28.92, to the nearest cent.	Result sentence: units (dollars) and rounding (nearest cent) both stated.
check: $\$28.92 \times 3 = \$86.76$	Collecting the rounded-up share gives 1 cent more than

if rounded down: $\$28.91 \times 3 = \$86.73$

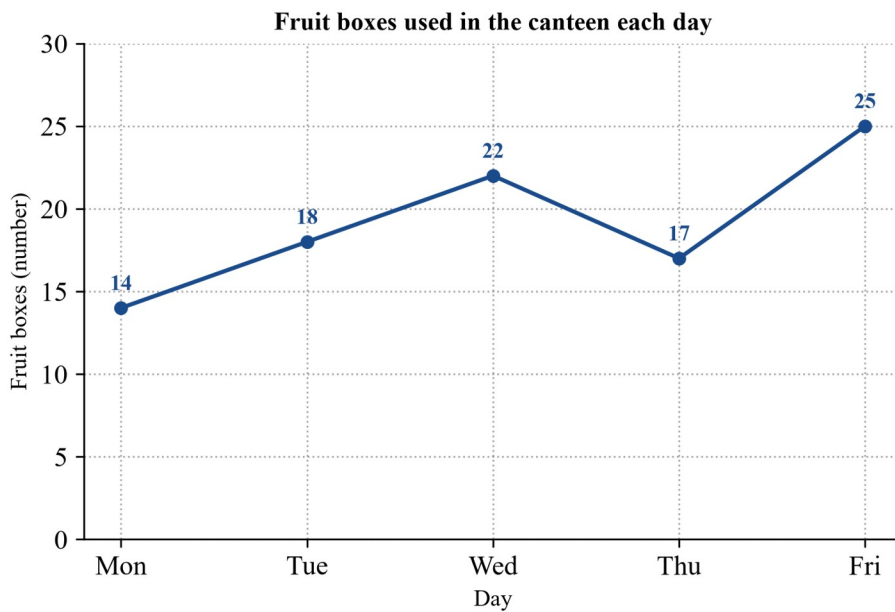
the bill.

Rounding down instead would leave the bill 2 cents short — the reason the rounding must be stated.

Reporting the 1-cent overshoot is part of communicating: the friends can see exactly why the money collected is not exactly the bill.

Example 2 — scaffolded

The line graph shows the fruit boxes used in a school canteen each day of one week.



- (a) Read off the biggest day and its number of boxes. (b) Find the total number of boxes used over the five days.
 (c) How many more boxes were used on Friday than on Tuesday?
 (b) Write a two-sentence report of the results.

(a) biggest day: Friday, 25 boxes

Read straight off the labelled point.

(b) total: $14 + 18 + 22 + 17 + 25 = 96$ boxes

Add the five labelled values.

(c) $25 - 18 = 7$ boxes

“How many more” is a subtraction of the two readings.

(d) “The canteen used 96 fruit boxes over the five days to Friday. Friday was the biggest day at 25 boxes, which is 7 more than Tuesday.”

Two full sentences, units throughout, exact values — and it answers what was asked.

Example 3 — unscaffolded

A crate pack of 4 juice bottles costs \$7.10. Dana’s café needs 60 bottles for a busy weekend. Report what Dana should budget, and explain why multiplying 60 by a rounded price per bottle is a trap.

Work with packs, not with a rounded price per bottle. Dana needs $60 \div 4 = 15$ packs, and $15 \times \$7.10 = \$106.50$. That value is exact, so no rounding is needed at all.

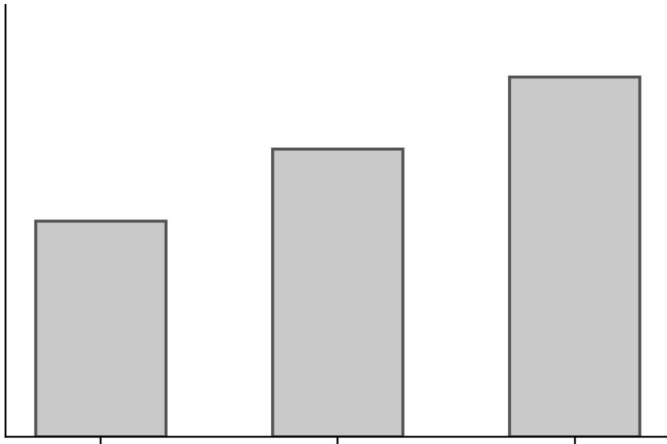
The trap: the price per bottle is $\$7.10 \div 4 = \$1.775$, which rounds to \$1.78 to the nearest cent. Multiplying the rounded price by 60 gives $60 \times \$1.78 = \$106.80$ — \$0.30 **more** than Dana actually pays, because the tiny rounding was multiplied 60 times. Rounding down to \$1.77 would give $60 \times \$1.77 = \$106.20$, which is \$0.30 short. This is why working keeps full precision and only the result sentence rounds.

Check: $\$106.50 \div 60 = \$1.775 \approx \$1.78$ per bottle to the nearest cent, which matches the pack price. ✓

∴ Dana should budget \$106.50 for 60 bottles (exact — no rounding needed); using a rounded per-bottle price would have mis-budgeted by \$0.30 either way.

Example 4 — unscaffolded

A sports club ran a bottle drive over three open days. A member's poster for the club meeting shows only this graph:



The member says “the graph has the bars, so the poster is finished”. List what is wrong with the poster as a piece of communication, then report what the results actually say. (The corrected graph is the bar chart in the Theory notes above.)

As communication, the poster fails in three ways. It has **no title**, so a reader cannot say what is being counted; the **axes carry no labels or units**, so the tallest bar could be bottles, dollars or people; and there is **no result sentence**, so the reader must work out the point of the graph unaided. A member at the back of the room learns nothing.

The fixes are the conventions from Theory: a title (“Bottles collected for recycling, Open Days”), axis labels with units (Open Day; Bottles collected (number)), and value labels on the bars — exactly the corrected bar chart shown earlier.

With the graph readable, the results can be reported: total bottles collected $45 + 60 + 75 = 180$, with Saturday the strongest open day at 75 bottles.

∴ the poster needs a title, labelled axes with units and a result sentence; with them it reports 180 bottles collected over the three open days, and 75 on the best day.

Practice questions

Scaffolded

Q1. (a) Match each symbol to its name: $\therefore$, $\%$, $\approx$, $=$ — names: *per cent*, *therefore*, *equals*, *approximately equal to*. (b) Write these sentences in mathematical symbols: (i) “two point four times five is twelve”; (ii) “nineteen kilometres per hour”. (c) Write this sentence in symbols: “one litre is equal to one thousand millilitres”.

Q2. A market stall's takings were \$214.50 on Friday, \$187.25 on Saturday and \$246.80 on Sunday. (a) Find the total takings for the three days. (b) How much more were the Sunday takings than the Saturday takings? (c) Write part (a) as a result sentence.

Q3. Each of these calculator displays needs to become a result sentence. Write one for each, stating the rounding you use. (a) 34.666666 — dollars per person, three people sharing \$104 equally, **to the nearest cent**. (b) 5.833333 — hours of travel time, **to 1 decimal place**. (c) 11.666666 — the number of 0.3 m shelves that can be cut from a 3.5 m board, where only **whole** shelves count.

Q4. Rewrite each line using the house conventions (space before units, tight dollar sign, stated rounding, space in thousands). (a) 48km (b) \$ 12.4 (c) 2500mL (d) 6.666666 dollars, reported **to the nearest cent**

Q5. Match each situation to the best representation: *table, line graph, bar chart, plan or diagram*. (a) the exact price of each of eight items on a menu (b) a puppy’s weight recorded at the end of each month for six months (c) the number of tries scored by a rugby team in each round of a season (d) the layout and sizes of a bedroom, for ordering new carpet

Q6. Match each audience to the better report: (a) your manager, who must approve a supply order; (b) your class, at the end of a group task; (c) a customer asking the cost of one job. Choices: *a poster with one bar chart; a short written report with a table; one plain sentence with a rounded dollar amount*.

Unscaffolded

Q7. A hardware store sells garden edging at \$6.75 per metre. Priya buys 14 m. (a) Calculate the cost and report it **to the nearest cent**. (b) Write the result sentence for the receipt. (c) Explain why the receipt writes \$94.50 rather than \$94.5.

Q8. A pay slip uses the formula $P = 23h$, where P is the week’s pay in dollars and h is the hours worked. (a) Say in words what the 23 means. (b) Find P when $h = 30$, and write it as a result sentence. (c) Write “twenty-three dollars per hour” using rate shorthand.

Q9. (a) Show that 1.25 m = 1 250 mm, one step per line. (b) Write 3.4 km in metres. (c) Write 250 mL in litres. (d) A door is 850 mm wide. Say why a builder might report 850 mm rather than 0.85 m.

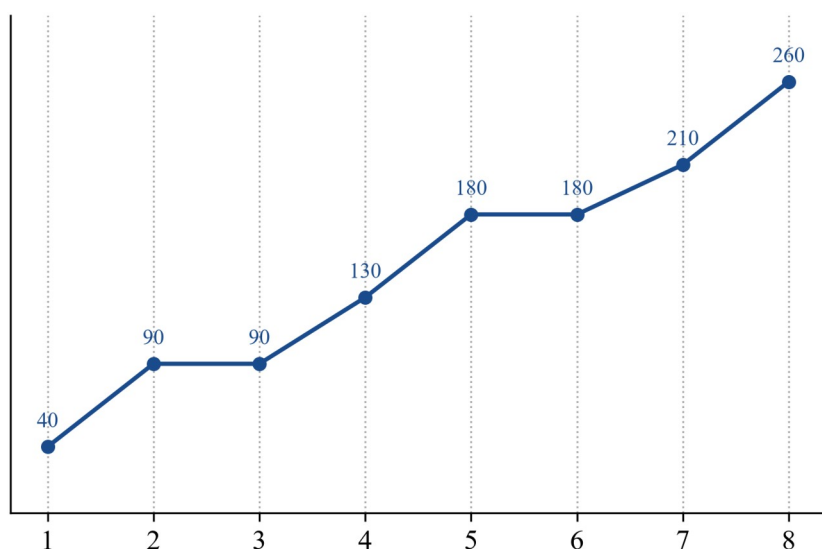
Q10. A supervisor’s note shows only this table of deliveries made:

1	2	3	4
23	31	28	35

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

- Redraw it as a table a stranger could read (title, column headings, units).
- Find the total number of deliveries over the four days.
- State which day had the most deliveries, and how many more than the day with the least.

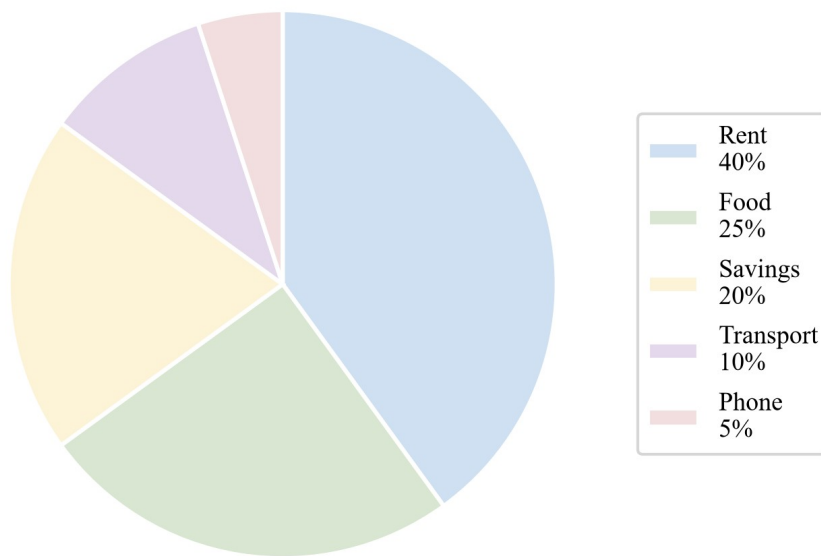
Q11. This line graph shows the money raised by a swim-a-thon at the end of each week.



- Name two things missing from the graph that a reader needs.
- Read off the money raised by the end of week 5.
- Between which pairs of weeks did the total not change?
- Find the increase in the total from week 1 to week 8.

Q12. The pie chart shows where a monthly income goes, as per cent of income.

Where the monthly income goes (per cent of income)



The monthly income is \$1 600. (a) Show that the five percentages add to 100 %, one step per line. (b) Calculate the rent in dollars. (c) Calculate the amount put into savings each month. (d) Write one sentence reporting the largest share of the budget.

Q13. These six sentences are an oral report in the wrong order. Rewrite them in the order a good oral report uses.

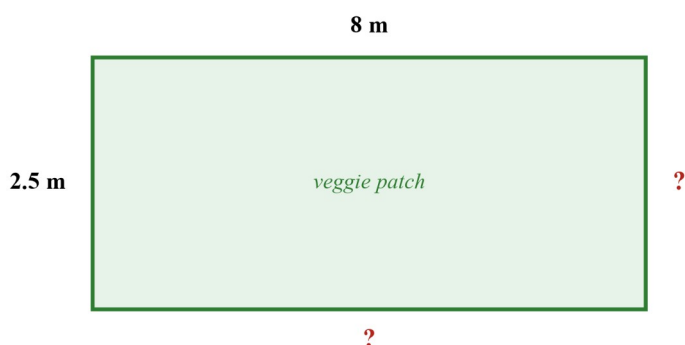
- A. “So the stall made \$227.50 for the equipment fund — enough to buy the new tables.”
- B. “We subtracted the costs from the money taken: \$356.40 – \$128.90.”
- C. “Our question was: how much profit did the Saturday market stall make?”
- D. “The profit is \$227.50.”
- E. “We counted the money taken at the end of the day and kept every receipt for costs.”
- F. “Check: \$227.50 + \$128.90 = \$356.40, which is the money we took. ✓”

Q14. A community hall’s rainwater tank holds 1 800 L. The hall’s garden uses 240 L of tank water per week. (a) Show that $1\,800 \div 240 = 7.5$, one step per line. (b) Report the number of **full** weeks the tank can water the garden. (c) Explain why the answer is not 8 weeks.

Q15. (a) Match each audience to a format: *a whiteboard sketch for the team during a job*; *a printed quote for a customer*; *a slide with one graph for a meeting*. Audiences: a meeting of the whole work group; a customer comparing two prices; co-workers mid-job. (b) Name two devices you could use to give an oral report with a graph. (c) Explain why a pie chart is the wrong choice for reporting a week of daily temperatures. (d) Give one reason a written report must be able to stand alone.

Q16. A gardening group is fencing a rectangular veggie patch. The plan shows two of the four side lengths.

Plan of the veggie patch (not to scale)



Fencing is sold at \$12.50 per metre. (a) State the two missing side lengths, and say how you know them. (b) Find the total distance around the patch. (c) Calculate the cost of the fencing. (d) Write the result sentence for the group's notes.

Q17. A club orders 12 pizzas at \$13.50 each and 8 drinks at \$2.75 each, and pays with a \$200 note. Write a four-line report — Working, Result, Check, Conclusion — giving the total cost and the change.

Q18. An excursion costs \$17.80 per student and 38 students are going. (a) Calculate the exact total cost. (b) Before calculating, a teacher estimated $40 \times \$18 = \$720$. Is the exact total above or below the estimate, and by how much? (c) Write a result sentence that includes the check against the estimate.

Answers

Q1. (a) $\therefore$ therefore; % per cent; $\approx$ approximately equal to; = equals. (b) (i) $2.4 \times 5 = 12$. (ii) 19 km/hr. (c) 1 L = 1 000 mL. **Q2.** (a) \$ 648.55. (b) \$ 59.55. (c) e.g. “The stall took \$ 648.55 over the three days, exact to the cent.” **Q3.** (a) $\therefore$ each person pays \$ 34.67, to the nearest cent. (b) $\therefore$ the trip takes 5.8 hours, to 1 decimal place. (c) $\therefore$ 11 whole shelves can be cut, with 0.2 m of board left over. **Q4.** (a) 48 km. (b) \$ 12.40. (c) 2 500 mL. (d) \$ 6.67, to the nearest cent. **Q5.** (a) table. (b) line graph. (c) bar chart. (d) plan or diagram. **Q6.** (a) short written report with a table. (b) poster with one bar chart. (c) one plain sentence with a rounded dollar amount. **Q7.** (a) \$ 94.50 (exact — no rounding needed). (b) e.g. “The edging costs \$ 94.50 for 14 m, exact to the cent.” (c) money is written to two decimal places so the cents place is visible. **Q8.** (a) the pay rate: \$ 23 per hour. (b) \$ 690.00 (exact). (c) \$ 23/hr. **Q9.** (a) shown in solutions. (b) 3 400 m. (c) 0.25 L. (d) e.g. tape measures read in mm, so 850 mm avoids a decimal and a possible reading mistake. **Q10.** (a) e.g. title “Deliveries made each day”; headings “Day” and “Deliveries (number)”; rows Monday–Thursday with 23, 31, 28, 35. (b) 117 deliveries. (c) Thursday, 12 more than Monday. **Q11.** (a) any two of: no title; no axis labels; no units. (b) \$ 180. (c) weeks 2–3 and weeks 5–6. (d) \$ 220. **Q12.** (a) shown in solutions. (b) \$ 640.00 (exact). (c) \$ 320.00 (exact). (d) e.g. “Rent is the largest share of the budget: 40 %, which is \$ 640.00 of the \$ 1 600 monthly income.” **Q13.** C, E, B, D, F, A. **Q14.** (a) shown in solutions. (b) 7 full weeks. (c) 8 weeks would need 1 920 L, more than the 1 800 L the tank holds. **Q15.** (a) whole work group — slide with one graph; customer comparing prices — printed quote; co-workers mid-job — whiteboard sketch. (b) any two of: whiteboard, projector or screen, poster, laptop or tablet showing a spreadsheet. (c) a pie chart shows shares of one whole at one moment, not a change over days. (d) e.g. the reader may read it later, with nobody there to explain it. **Q16.** (a) 8 m and 2.5 m — opposite sides of a rectangle are equal. (b) 21 m. (c) \$ 262.50 (exact). (d) e.g. “The patch needs 21 m of fencing, costing \$ 262.50, both exact.” **Q17.** Working: $12 \times \$ 13.50 = \$ 162.00$; $8 \times \$ 2.75 = \$ 22.00$; total \$ 184.00. Result: the change from \$ 200 is \$ 16.00. Check: $\$ 184.00 + \$ 16.00 = \$ 200.00$ ✓. Conclusion: the order costs \$ 184.00 and the \$ 200 note covers it with \$ 16.00 change. **Q18.** (a) \$ 676.40 (exact). (b) below the estimate, by \$ 43.60. (c) e.g. “The excursion costs \$ 676.40 in total; the estimate was \$ 720, and the exact total is \$ 43.60 under it, so the answer is sensible.”

Fully-worked solutions

Q1. (a) $\therefore$ means *therefore*, % means *per cent*, $\approx$ means *approximately equal to*, = means *equals*. (b) (i) $2.4 \times 5 = 12$. (ii) 19 km/hr — the “/” reads as “per”. (c) 1 L = 1 000 mL.

Q2. (a) $\$ 214.50 + \$ 187.25 + \$ 246.80 = \$ 648.55$ — exact, no rounding needed. (b) $\$ 246.80 - \$ 187.25 = \$ 59.55$. (c) A result sentence needs units, a full sentence and the rounding (or “exact”): “The stall took \$ 648.55 over the three days, exact to the cent.”

Q3. (a) Money is paid to the cent: $\$ 34.666666 \rightarrow \$ 34.67$, so “ $\therefore$ each person pays \$ 34.67, to the nearest cent.” (b) Hours are fine at 1 d.p. here: “ $\therefore$ the trip takes 5.8 hours, to 1 decimal place.” (c) Only whole shelves can be used: 11 whole shelves, with $3.5 - 11 \times 0.3 = 0.2$ m of board left over. Note the context decides: to the nearest whole number the display would round to 12, but a twelfth shelf does not fit.

Q4. (a) 48 km — space between number and unit. (b) \$ 12.40 — money is written to two decimal places, dollar sign tight. (c) 2 500 mL — space as the thousands separator (or 2.5 L, one step smaller). (d) \$ 6.67, to the nearest cent — rounded once, precision stated.

Q5. (a) Exact values a reader may reuse — **table**. (b) A weight changing over time — **line graph**. (c) A comparison between rounds (categories) — **bar chart**. (d) Sizes and layout — **plan or diagram**.

Q6. (a) A manager approving an order needs exact values to reuse — a **short written report with a table**. (b) A class at the end of a task sees it once, from a distance — a **poster with one bar chart**. (c) A customer asking one price needs no table at all — **one plain sentence with a rounded dollar amount**.

Q7. (a) $14 \times \$ 6.75 = \$ 94.50$. This is exact to the cent, so reporting “to the nearest cent” gives \$ 94.50 with nothing rounded away. (b) e.g. “The edging costs \$ 94.50 for 14 m, exact to the cent.” (c) Money is written to two decimal places so the cents place is visible: \$ 94.5 leaves a reader unsure whether the cents were measured at all.

Q8. (a) The 23 is the pay rate: each hour worked pays \$ 23. (b) $P = 23 \times 30 = 690$, so the result sentence is “The week’s pay is \$ 690.00” (exact — no rounding needed). (c) \$ 23/hr — the “/” reads as “per”.

Q9. (a) One step per line:

$$1 \text{ m} = 1\,000 \text{ mm}$$

$$1.25 \times 1\,000 = 1\,250$$

$$\therefore 1.25 \text{ m} = 1\,250 \text{ mm.}$$

(b) km to m is bigger to smaller, so multiply: $3.4 \times 1\,000 = 3\,400 \text{ m}$.

(c) mL to L is smaller to bigger, so divide: $250 \div 1\,000 = 0.25 \text{ L}$.

(d) A tape measure reads in millimetres, so 850 mm is what the builder actually measures; writing 0.85 m invites a decimal-point mistake on site.

Q10. (a) e.g.

Day	Deliveries (number)
Monday	23
Tuesday	31
Wednesday	28
Thursday	35

with a title above it: “Deliveries made each day”. Title, headings and units are what turn four bare numbers into a report. (b) $23 + 31 + 28 + 35 = 117$ deliveries. (c) Thursday had the most (35); Monday had the least (23); $35 - 23 = 12$ more.

Q11. (a) The graph has **no title** and **no axis labels or units** — a reader cannot say what is counted (dollars? number of swimmers?) or over what period. (b) The point above week 5 is at \$ 180. (c) The line is flat between weeks 2 and 3, and again between weeks 5 and 6 — the running total did not grow in those two pairs of weeks. (d) $\$ 260 - \$ 40 = \$ 220$.

Q12. (a) One step per line:

$$40 + 25 = 65$$

$$65 + 20 = 85$$

$$85 + 10 = 95$$

$$95 + 5 = 100$$

$\therefore$ the five percentages add to 100 %, so the shares use up the whole income. ✓ (b) Rent is 40 %: 10 % of \$ 1 600 = \$ 160, so $40 \% = 4 \times \$ 160 = \$ 640.00$ — exact, no rounding needed. (c) Savings is 20 %: $2 \times \$ 160 = \$ 320.00$ — exact. (d) e.g. “Rent is the largest share of the budget: 40 %, which is \$ 640.00 of the \$ 1 600 monthly income.”

Q13. A good oral report runs question → method → working → result → check → conclusion: **C** (the question), **E** (the method), **B** (the working), **D** (the result sentence), **F** (the check), **A** (the conclusion — what the money means for the fund).

Q14. (a) One step per line:

$$240 \times 7 = 1\,680$$

$$1\,800 - 1\,680 = 120$$

$$120 \div 240 = 0.5$$

$$\therefore 1\,800 \div 240 = 7.5.$$

(b) Only **full** weeks count: 7 full weeks (after 7 weeks, 120 L remains — half a week's water, not a full week).

(c) An eighth full week would need $240 \times 8 = 1\,920$ L, and the tank holds only 1 800 L. So 8 weeks is impossible; the honest report is 7 full weeks.

Q15. (a) Meeting of the whole work group — a slide with one graph; customer comparing prices — a printed quote; co-workers mid-job — a whiteboard sketch. (b) Any two of: whiteboard, projector or screen, printed poster, a laptop or tablet showing a spreadsheet or slides. (c) A pie chart shows how one whole is shared at one moment; a week of daily temperatures is a **change over time**, which a line graph shows and a pie chart cannot. (d) The reader often reads a written report later, or in another room, with nobody there to explain it — so every number in it must carry its own meaning (units, rounding, labels).

Q16. (a) Opposite sides of a rectangle are equal, so the missing sides are 8 m (the side opposite the 8 m side) and 2.5 m (opposite the 2.5 m side). (b) Distance around: $8 + 2.5 + 8 + 2.5 = 21$ m. (c) Fencing cost: $21 \times \$12.50 = \$262.50$ — exact, no rounding needed. (d) e.g. “The patch needs 21 m of fencing, costing \$262.50; both values are exact.”

Q17. Working: $12 \times \$13.50 = \$162.00$ for the pizzas; $8 \times \$2.75 = \$22.00$ for the drinks; total $\$162.00 + \$22.00 = \$184.00$. Result: the change from a \$200 note is $\$200 - \$184.00 = \$16.00$. Check: $\$184.00 + \$16.00 = \$200.00$ ✓ — the total and the change return the note. Conclusion: the order costs \$184.00, and the \$200 note covers it with \$16.00 change.

Q18. (a) $38 \times \$17.80 = \$676.40$ — exact, no rounding needed. (b) The exact total is **below** the estimate: $\$720 - \$676.40 = \$43.60$ below it, because both rounded-up numbers (40 students, \$18) overstate the real ones. (c) e.g. “The excursion costs \$676.40 in total; my estimate was \$720, and the exact total sits \$43.60 under the estimate, so the answer is sensible.”

Chapter 1 The problem-solving cycle and mathematical toolkit — 1E The analogue toolkit: measuring and everyday tools

Theory

This section is about the tools you hold in your hands. Outcome 3 of this course is about choosing the right maths tools for everyday and work tasks, and using them well (see the study design's Unit 1, Outcome 3). Source: VCAA, VCE Vocational Major Numeracy Study Design, retrieved 2026-10-08.

About the data in this section. The readings, jobs and numbers here are **made up** (not real): pretend jobs 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.

What a measurement is. A measurement is a number and a unit written together. The *unit* is what you measured in: cm, g, mL, °C, minutes. A number on its own means nothing: 9.4 is not a length, but 9.4 cm is. *Analogue* tools are tools with a part that moves or fills, and you read that part: the hands on a clock face, the needle on a dial, the liquid in a thermometer, the marks on a tape. This section teaches you to read those tools and to pick the right one for the job. (Digital tools — calculators, spreadsheets, apps — are section 1F. Here you only meet digital *displays*, like a clock screen, because reading them is part of telling the time.)

Tools and what they measure.

Tool	What it measures	Units you read
Ruler	Short lengths	mm, cm
Tape measure	Lengths of rooms, beds, bodies	cm, m
Trundle wheel (a wheel on a handle that counts metres as it rolls)	Long lengths outdoors	m, km
Kitchen scale, dial or digital	Mass (how heavy something is)	g, kg
Measuring jug and cup	Capacity (how much a container holds)	mL, L
Thermometer	Temperature (how hot something is)	°C
Clock or watch	Time of day	hours, minutes
Spirit level (a straight bar with a bubble in a tube)	Whether a surface is level (flat, not tipping)	no number — the bubble's position

Refresher: metric units. This book measures in metric units only. These facts are worth knowing cold, because every conversion in this section is one step of one of them.

Length	Mass	Capacity
10 mm = 1 cm	1000 g = 1 kg	1000 mL = 1 L
100 cm = 1 m		
1000 m = 1 km		

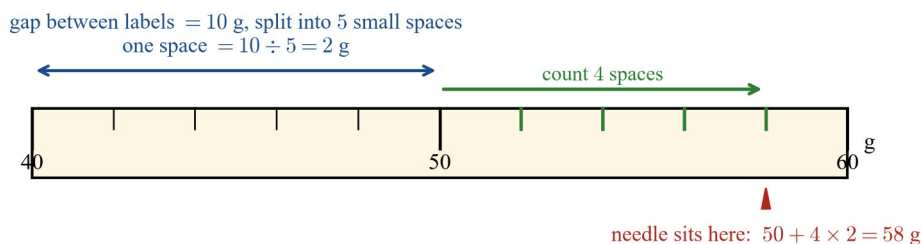
To change a bigger unit to a smaller one, multiply (1.5 kg = 1500 g). To change a smaller unit to a bigger one, divide (1500 g = 1.5 kg).

Reading any scale: four steps. A *scale* is the row or circle of marks and labels on a tool. Lots of people guess at scales. Do not guess — use four steps:

1. **Read the labels.** Find the two labels either side of the pointer, or of the end of the thing you are measuring.
2. **Find the gap.** Subtract the smaller label from the bigger one.
3. **Find one space.** Count the small spaces between those two labels, then divide the gap by that count. That is what one small space is worth.

4. **Count on.** Count the small spaces from the lower label to the pointer, multiply by the value of one space, and add it on.

Here is the method on a zoomed-in strip of a kitchen scale:



The labels either side of the pointer are 40 and 50, so the gap is 10 g. There are 5 small spaces in that gap:

$$\text{one space} = 10 \div 5 = 2 \text{ g}$$

The pointer sits 4 small spaces past 50:

$$50 + 4 \times 2 = 58 \text{ g}$$

So the scale reads 58 g.

Refresher: gap $\div$ spaces = one space. Step 3 is always a simple division: the gap shared out over the spaces in it.

Gap between labels	Spaces in the gap	One space
10	5	$10 \div 5 = 2$
20	4	$20 \div 4 = 5$
100	5	$100 \div 5 = 20$
200	4	$200 \div 4 = 50$

Length: rulers and tape measures. A ruler measures short lengths in cm and mm. Start the object at the 0 mark, not at the physical end of the ruler. The smallest marks are mm: there are 10 mm in every 1 cm. A tape measure does the same job on bigger things — rooms, garden beds, a person's waist — and it rolls up to carry. If the zero end of a tape is worn or torn, hold a clear mark (say the 20 cm mark) at the start of the job, read the tape at the end, and take the start mark off (Example 2 and Q9 use this trick).

Mass: scales. A dial scale has a needle, and you read it with the four steps. A digital scale prints the number and the unit on a screen. Read it, then write the unit down anyway — the screen knows the unit, but your answer sheet does not.

Refresher: reading decimals. The first place after the decimal point is *tenths*; the second place is *hundredths*. On a cm ruler, 1 mm is one tenth of a cm, so 9.4 cm means 9 cm and 4 mm. On a kg scale, 1.25 kg means 1 kg and 250 g, because 0.25 of 1000 g is 250 g. A decimal is just a measurement written in one unit instead of two.

Capacity: jugs and cups. Read a jug at the surface of the liquid, with your eyes level with it. Looking from above makes the reading look higher than it is. Jugs are usually labelled in mL, with lines for the spaces between.

Temperature: thermometers. A tube thermometer has a liquid that rises as it gets hotter; read the temperature at the top of the liquid. A dial thermometer has a needle, and you read it with the four steps. Either way the unit is °C (degrees Celsius).

Time: clocks and digital displays. An analogue clock face has a short hour hand and a long minute hand.

Refresher: minutes count by 5s. The minute hand moves 5 minutes for each number on the face: hand at 1 → 5 minutes, at 2 → 10 minutes, at 3 → 15 minutes, and so on up to 12 → 60 minutes. So a hand at 7 means 35 minutes, and a hand at 11 means 55 minutes.

The hour hand moves too, slowly. When it sits between two numbers, the hour is the number it has passed: at 2:35 the hour hand is past 2 and heading for 3, so the hour is still 2. Reading the nearer number (3) is the most common clock mistake there is.

Digital displays come in two kinds:



12-hour display: 6:45 pm



24-hour display: 18:45

Both screens show the same time of day.

A **12-hour display** counts 1 to 12 twice a day and tags each time with am (before midday) or pm (after midday). A **24-hour display** counts 0 to 23 once a day and needs no tag. To go from a pm time to 24-hour time, add 12 to the hour: 6:45 pm is 18:45. To go back, take 12 off: 18:45 is 6:45 pm. Morning times (am) are the same on both displays.

Levelling: the spirit level. A spirit level has a tube of liquid with a bubble in it, and two centre lines marked on the tube. On a level surface the bubble sits between the two centre lines. On a tipping surface the bubble rides to the higher end. There is no number to read — where the bubble sits *is* the reading.

Tools of the trade. Every trade has its own measuring tools, and knowing them is part of knowing the job.

Trade	Measuring tools of the trade
Builder	Tape measure, spirit level, trundle wheel
Cook	Kitchen scale, measuring jug, food thermometer, timer
Gardener	Tape measure, trundle wheel, watering can with L marks
Nurse	Clinical thermometer, standing scales
Tailor	Soft tape measure, ruler

Choosing the right tool. Three checks pick the tool for almost any job:

- **What kind of quantity is it?** Length, mass, capacity, temperature, time or level — each has its own tools, and the table above matches them up.
- **How big is it?** mm and cm for small things; m for rooms and beds; a trundle wheel for long outdoor lengths a tape would sag along.
- **What can the tool actually show?** Look at the marks. A postal scale whose smallest mark is 500 g cannot weigh a 50 g letter (Q11), and a jug with no marks below 50 mL cannot measure 10 mL.

Using tools well. Reading the tool is half the job. The other half is holding it properly:

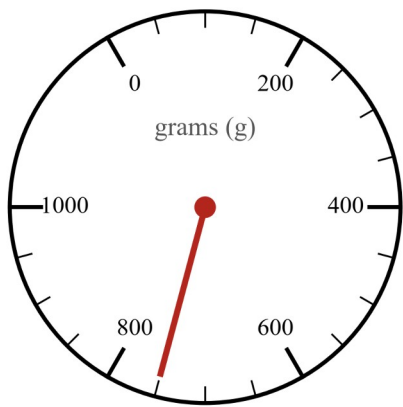
- Check the tool starts at zero before you begin. If the zero is worn, hold a clear mark and subtract it at the end.
- Lay the tool flat and straight along the thing you measure. A sagging or slanting tape reads long.
- Read at eye level. For liquids, read at the surface of the liquid.
- Write the number and the unit down together, straight away.

Where formulas live. This section teaches tools, not formulas. When a job needs a formula — the perimeter of a rectangular bed, the cost per hour of a job — look it up on the formula sheet at the back of this book. Knowing *where* a formula lives, and reaching for it when the job needs it, is part of using the appropriate mathematical tools.

Worked examples

Example 1 — scaffolded

The soccer club runs a pancake morning. The cook zeroes the dial kitchen scale, then pours in flour until the needle stands where the picture shows. The recipe below makes one batch of pancakes; the club needs two batches.



How much flour is on the scale, and how much is that in kg for two batches? Follow the four steps.

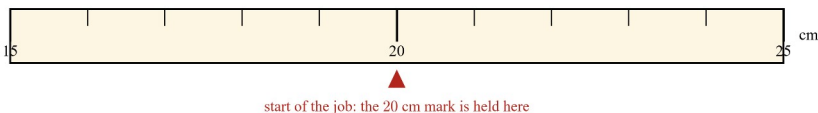
Working	Comment
Labels either side of the needle: 600 and 800.	Step 1 — read the labels first.
$800 - 600 = 200\text{ g}$	Step 2 — the gap between them.
$200 \div 4 = 50\text{ g}$	Step 3 — four small spaces in the gap, so one space is 50 g.
$600 + 3 \times 50 = 750\text{ g}$	Step 4 — the needle is three spaces past 600.
$750 \times 2 = 1500\text{ g}$	Two batches, so double the flour.
$1500 \div 1000 = 1.5\text{ kg}$	1000 g = 1 kg, so divide by 1000.

The scale reads 750 g of flour, and two batches need 1.5 kg.

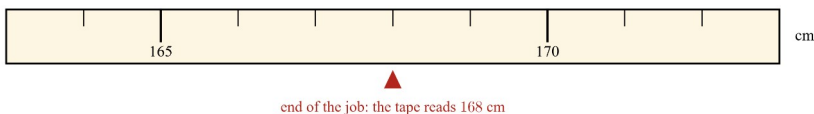
Example 2 — scaffolded

A community garden group is building a vegetable bed. The zero end of their tape measure is worn away, so they hold the 20 cm mark at the start of the bed instead. At the far end the tape reads 168 cm.

At the start



At the end



How long is the bed in cm, and in m?

Working	Comment
Start mark held at the job: 20 cm	The zero is worn, so start at a clear mark.

Working

End reading: 168 cm

$$168 - 20 = 148 \text{ cm}$$

$$148 \div 100 = 1.48 \text{ m}$$

The bed is 148 cm long, which is 1.48 m.

Comment

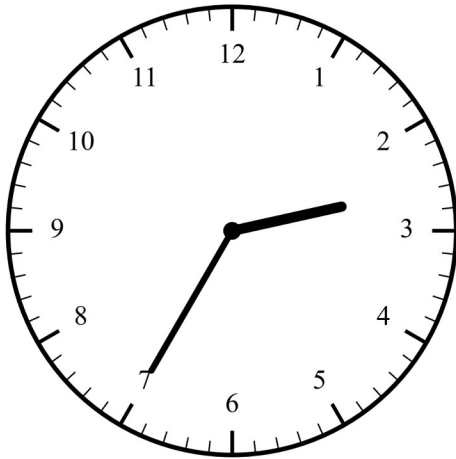
Read the tape at the far end of the bed.

Take the start mark off the end reading.

100 cm = 1 m, so divide by 100.

Example 3 — unscaffolded

Deniz works in an aged-care home. Afternoon tea must be served by 3:00 pm. The wall clock in the kitchen shows the time in the picture. How many minutes does Deniz have left?



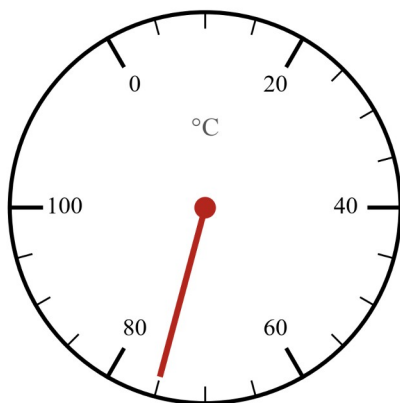
The minute hand points at 7, and $7 \times 5 = 35$, so the clock shows 2:35 — the hour hand is past 2 and not yet at 3, so the hour is 2, not 3.

From 35 minutes past the hour to 60 minutes is a count-on by 5s: 40, 45, 50, 55, 60 — five jumps of 5, which is 25 minutes. (Same thing: $60 - 35 = 25$.)

$\therefore$ Deniz has 25 minutes left to get afternoon tea out.

Example 4 — unscaffolded

A food-truck cook must heat a chicken mixture to at least 70°C before it is safe to serve. The dial thermometer in the mixture stands where the picture shows. Is the mixture safe to serve?



The labels either side of the needle are 60 and 80, a gap of 20, split into 4 small spaces: one space is $20 \div 4 = 5$ °C. The needle is three spaces past 60:

$$60 + 3 \times 5 = 75 \text{ °C}$$

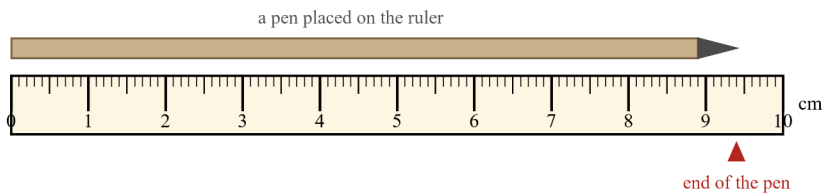
and 75 °C is above the 70 °C the mixture must reach.

∴ yes, the mixture is safe to serve: it stands at 75 °C, above the 70 °C target.

Practice questions

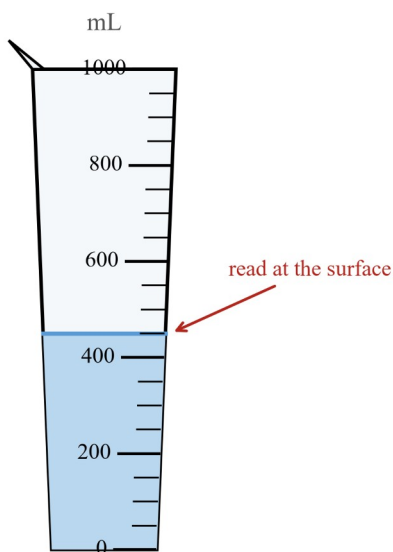
Scaffolded

Q1. A pen lies on a ruler, as pictured.



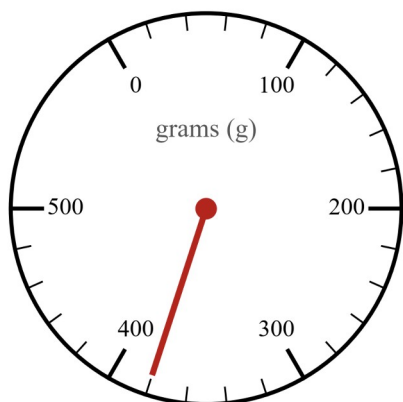
- (a) What is each smallest mark on the ruler worth, in mm?
- (b) What is the length of the pen, in mm?
- (c) Write the same length in cm.

Q2. A measuring jug holds milk up to the line in the picture. A recipe needs 700 mL of milk.



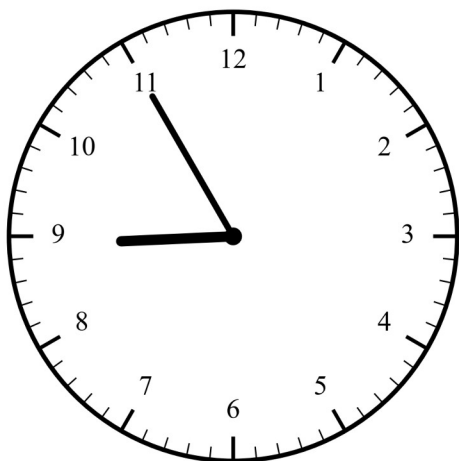
- (a) What is one small mark on the jug worth?
- (b) How much milk is in the jug now?
- (c) How much more milk must be added to reach 700 mL?

Q3. A dial kitchen scale stands where the picture shows.



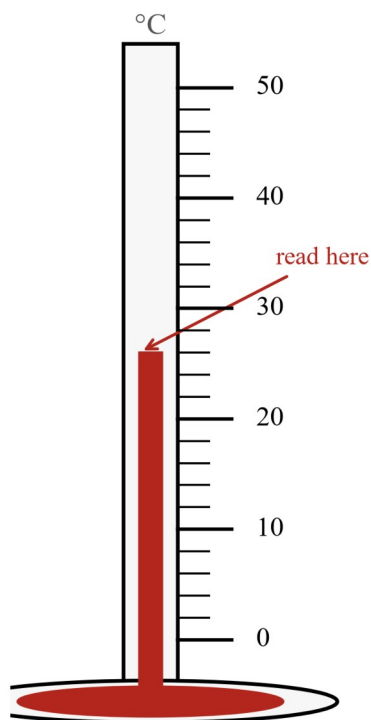
- (a) What is one small space on the dial worth?
- (b) What does the scale read, in g?
- (c) Write the same mass in kg.

Q4. The clock in a school hall shows the morning break time, as pictured.



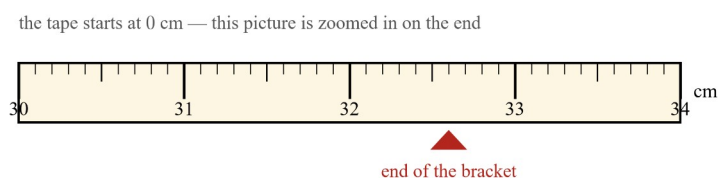
- (a) What time does the clock show?
- (b) The minute hand points at 11. Counting by 5s, how many minutes is that?
- (c) Write the same time on a 12-hour digital display, with am or pm.

Q5. A thermometer hangs in a plant greenhouse, as pictured.



- What unit does this thermometer read in?
- What is one small mark worth?
- What temperature does it show?

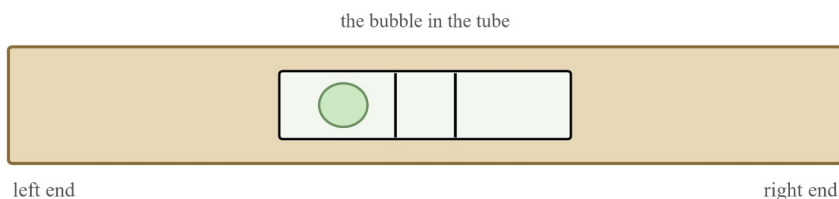
Q6. A metal bracket is measured from the 0 cm end of a tape. The picture is zoomed in on the end of the bracket.



- What is the length of the bracket, in cm?
- Write the same length in mm.
- Two brackets of this length are welded end to end. What is the total length, in cm?

Un scaffolded

Q7. A builder lays a spirit level on a workbench, as pictured.



- Is the bench level?
- Which end of the bench is higher?
- What should the builder do next?

Q8. A trundle wheel counts metres as it rolls. Walking once around a park path, the counter on the handle finishes at 2450 m.

- (a) Write one lap of the path in km.
- (b) The group walks two laps. What is the total distance, in km?

Q9. A tailor's tape measure has a worn zero end. She holds the 15 cm mark at one end of a length of cloth, and the other end lines up with 103.5 cm. How long is the cloth? Say in one sentence why you subtract.

Q10. Choose the better tool for each job, and give a reason in a few words.

- (a) The length of a garden bed about 8 m long, outdoors on grass.
- (b) 300 g of flour for a scone batch.
- (c) Checking that a workbench is flat before fitting a door to it.
- (d) Why is a digital kitchen scale easier to read than a dial kitchen scale?

Q11. A postal scale has labels every 1 kg, with one mark halfway between each pair of labels. A parcel puts the needle one mark past 5.

- (a) What is one mark worth, in kg?
- (b) What does the scale read for the parcel?
- (c) A letter weighs 50 g. Can this scale show that weight? Why?

Q12. A digital kitchen scale shows 1250 g with two equal loaves of bread on it.

- (a) Write the reading in kg.
- (b) What is the mass of one loaf, in g?

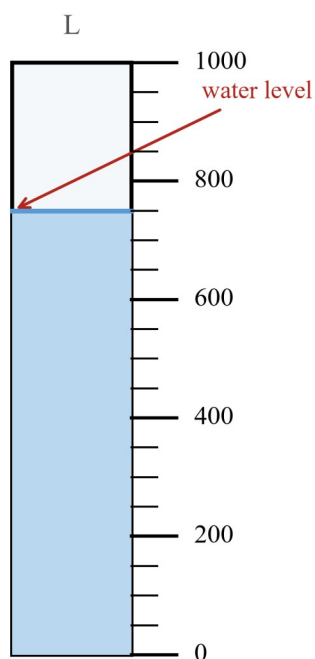
Q13. A work roster says a shift starts at 15:30.

- (a) Write the start time as a 12-hour time with am or pm.
- (b) Why does a 12-hour clock face show every time twice a day?
- (c) You arrive at 3:15 pm. How many minutes early are you?

Q14. A clinical thermometer — the short thermometer a nurse uses for body temperature — reads from 35 °C to 42 °C, with a mark every 0.5 °C. The liquid stands one mark past 38.

- (a) What temperature does it show?
- (b) Normal body temperature is about 37 °C. Is this reading above or below normal?

Q15. A rainwater tank has a height gauge on the side, labelled every 200 L, as pictured.



- What does the gauge read now?
- The tank holds 1000 L when full. How many more litres of water would fill it?

Q16. A measuring cup holds exactly 1 L when filled to its top line, and it has a line at 250 mL. A recipe needs 1 L of milk, measured in cupfuls to the 250 mL line.

- How many mL are in 1 L?
- How many 250 mL cupfuls make 1 L?
- After three cupfuls, how much more milk is needed?

Q17. Each trade below has a measuring job. For each one, write the tool from this section that the trade would use, and the unit the reading would most likely be in.

Trade and job	Tool	Unit
Cook: flour for one tray of scones		
Gardener: distance around a park path, outdoors		
Tailor: a wrist, for a shirt cuff		

Q18. For the school fete, a class sets up a serving table using a bench 240 cm long.

- Write 240 cm in m.
- The tablecloth must hang over both ends, so it needs 50 cm more than the bench. How long is the tablecloth, in cm?
- They lay a spirit level on the table and the bubble sits between the two centre lines. What does that tell them?

Answers

Q1. (a) 1 mm (b) 94 mm (c) 9.4 cm **Q2.** (a) 50 mL (b) 450 mL (c) 250 mL **Q3.** (a) 20 g (b) 380 g (c) 0.38 kg **Q4.** (a) 8:55 (b) 55 minutes (c) 8:55 am **Q5.** (a) °C (degrees Celsius) (b) 2 °C (c) 26 °C **Q6.** (a) 32.6 cm (b) 326 mm (c) 65.2 cm **Q7.** (a) No (b) the left end (c) raise or lower an end until the bubble sits between the two centre lines **Q8.** (a) 2.45 km (b) 4.9 km **Q9.** 88.5 cm **Q10.** (a) trundle wheel (b) kitchen scale (c) spirit level (d) it prints the number and unit — no marks to work out **Q11.** (a) 0.5 kg (b) 5.5 kg (c) no — the smallest mark is 500 g, far bigger than 50 g **Q12.** (a) 1.25 kg (b) 625 g **Q13.** (a) 3:30 pm (b) the face shows 12 hours but a day is 24 hours, so each face time happens twice (am and pm) (c) 15 minutes **Q14.** (a) 38.5 °C (b) above normal **Q15.** (a) 750 L (b) 250 L **Q16.** (a) 1000 mL (b) 4 cupfuls (c) 250 mL **Q17.** Cook: kitchen scale, g; gardener: trundle wheel, m; tailor: tape measure, cm **Q18.** (a) 2.4 m (b) 290 cm (c) the table is level — flat, not tipping either way

Fully-worked solutions

Q1. (a) Each cm on the ruler is split into 10 smallest marks, and $10\text{ mm} = 1\text{ cm}$, so each smallest mark is 1 mm. (b) The pen ends 4 small marks past 9 cm: $9\text{ cm} = 90\text{ mm}$, and $90 + 4 = 94\text{ mm}$. (c) $94\text{ mm} = 9.4\text{ cm}$, because $10\text{ mm} = 1\text{ cm}$ and 4 mm is four tenths of a cm.

Q2. (a) The labels jump by 200 mL and there are 4 small spaces between them: $200 \div 4 = 50\text{ mL}$. (b) The surface sits one small mark past 400: $400 + 50 = 450\text{ mL}$. (c) $700 - 450 = 250\text{ mL}$ more.

Q3. (a) Labels every 100 g with 5 spaces between: $100 \div 5 = 20\text{ g}$. (b) The needle is four spaces past 300: $300 + 4 \times 20 = 380\text{ g}$. (c) $380 \div 1000 = 0.38\text{ kg}$.

Q4. (a) The minute hand points at 11, so 55 minutes past; the hour hand is between 8 and 9, so the hour is 8: the time is 8:55. (b) $11 \times 5 = 55$ minutes. (c) The break is in the morning, so a 12-hour display shows 8:55 am.

Q5. (a) °C — degrees Celsius. (b) The labels jump by 10 with 5 small spaces between: $10 \div 5 = 2\text{ °C}$. (c) The top of the liquid is three small marks past 20: $20 + 3 \times 2 = 26\text{ °C}$.

Q6. (a) The end of the bracket is 6 mm marks past 32 cm, so 32.6 cm. (b) $32.6 \times 10 = 326\text{ mm}$. (c) $32.6 \times 2 = 65.2\text{ cm}$.

Q7. (a) No — the bubble is not between the two centre lines. (b) The bubble rides to the higher end, and it sits to the left, so the left end of the bench is higher. (c) Lower the left end (or raise the right end) and re-check, until the bubble sits between the two centre lines.

Q8. (a) $2450 \div 1000 = 2.45\text{ km}$. (b) Two laps: $2450 \times 2 = 4900\text{ m}$, and $4900 \div 1000 = 4.9\text{ km}$.

Q9. $103.5 - 15 = 88.5\text{ cm}$. The tape did not start at 0 — it started at the 15 cm mark — so every reading on it is 15 cm too big, and the 15 cm has to come off.

Q10. (a) Trundle wheel: it rolls over grass and counts the metres, where an 8 m tape would sag and is awkward alone. (b) Kitchen scale: mass in g is exactly what it reads, and 300 g is well inside what the scale can weigh. (c) Spirit level: showing whether a surface is level is its one job. (d) A digital scale prints the number and the unit on a screen, so there are no marks to count and no spaces to work out — nothing to misread.

Q11. (a) One mark splits each 1 kg gap into 2 spaces: $1 \div 2 = 0.5\text{ kg}$. (b) One mark past 5: $5 + 0.5 = 5.5\text{ kg}$. (c) No. The smallest mark on the scale is $0.5\text{ kg} = 500\text{ g}$, and a 50 g letter is one tenth of that — the needle would barely move, so the weight cannot be read.

Q12. (a) $1250 \div 1000 = 1.25\text{ kg}$. (b) $1250 \div 2 = 625\text{ g}$ per loaf.

Q13. (a) $15 - 12 = 3$, so 15:30 is 3:30 pm. (b) The face only shows 12 hours, but a day is 24 hours long, so every time on the face happens twice — once before midday (am) and once after (pm). (c) 3:15 pm to 3:30 pm is $30 - 15 = 15$ minutes early.

Q14. (a) One mark past 38, with marks every 0.5 °C: $38 + 0.5 = 38.5$ °C. (b) 38.5 °C is above the normal 37 °C.

Q15. (a) Labels every 200 L with 4 spaces between: $200 \div 4 = 50$ L a space. The water line is three spaces past 600: $600 + 3 \times 50 = 750$ L. (b) $1000 - 750 = 250$ L to fill.

Q16. (a) 1000 mL. (b) $1000 \div 250 = 4$ cupfuls. (c) Three cupfuls is $3 \times 250 = 750$ mL, so $1000 - 750 = 250$ mL more is needed.

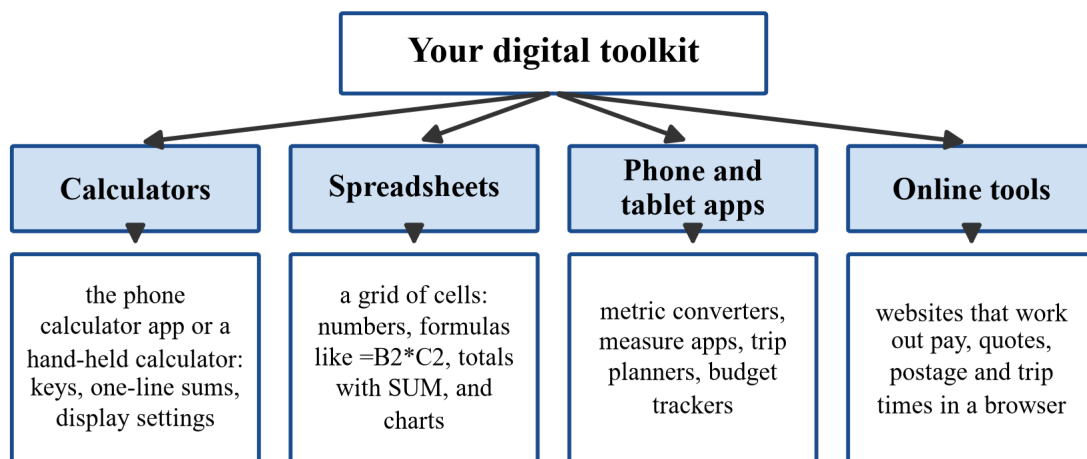
Q17. Cook: kitchen scale, reading in g (flour is a mass of a few hundred grams). Gardener: trundle wheel, reading in m (a long outdoor length). Tailor: tape measure, reading in cm (a wrist is a short length around a body, and the soft tape bends).

Q18. (a) $240 \div 100 = 2.4$ m. (b) $240 + 50 = 290$ cm. (c) The bubble between the centre lines means the table is level: flat, not tipping to either end, so things will not slide off it.

Chapter 1 The problem-solving cycle and mathematical toolkit — 1F The digital toolkit: calculators, spreadsheets, apps and online safety

Theory

Your digital toolkit. A **tool** is anything you use to get an answer: your head, pen and paper, a calculator, a spreadsheet, an app on a phone, a website. Digital tools are fast and they never get tired, but they only do exactly what you tell them to do. This section looks at four families of digital tools, and at the habits that keep their answers trustworthy and your details safe.



All four work the same way: inputs go in, the tool works, an output comes out.

- **Calculators** — hand-held, or the one on your phone. Good for a one-off sum: a total, a share, a percentage.
- **Spreadsheets** — a grid of boxes called cells. Good when numbers keep changing and totals must update: pay sheets, price lists, budgets.
- **Apps** — small programs on a phone or tablet: unit converters, maps and trip planners, measuring tools, step counters.
- **Websites** — online calculators, pay calculators, banking sites. Also the place where you need the most care.

Every task in this section can also be done with pen, paper and a basic calculator. A digital tool is a helper. It is never the thing that does the thinking.

Refresher — order of operations. When a sum has more than one step, do the steps in this order:

1. Brackets first.
2. Then multiply and divide, reading left to right.
3. Then add and subtract, reading left to right.

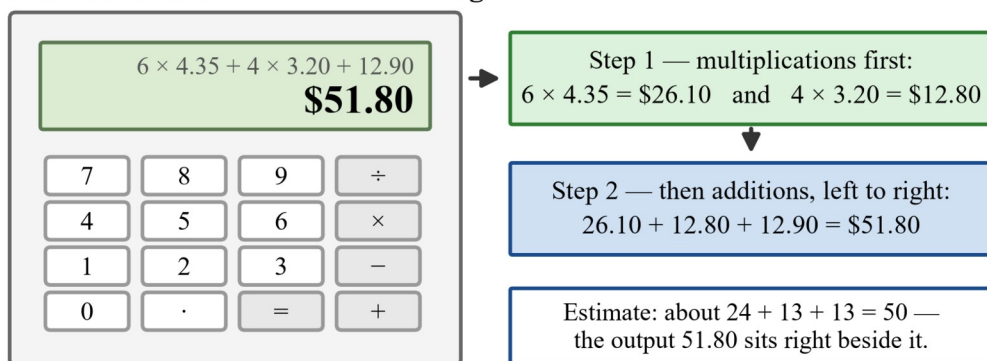
So $3 + 4 \times 5 = 3 + 20 = 23$, but $(3 + 4) \times 5 = 7 \times 5 = 35$. Same numbers, different order, different answer. A scientific calculator follows this order for you. A basic calculator may not — if you are not sure, do one step at a time and write each result down.

Calculators: type what you mean. A calculator shows the sum you typed on its **display**, then shows the answer. Two habits make a calculator trustworthy:

- **Estimate first.** Round the numbers to ones you can do in your head, get a rough answer, then calculate exactly. If the calculator's answer is nowhere near your estimate, something was typed wrong.

- **Read the line back.** Before you press equals, look at the line you typed. Most typing slips are caught here.

A calculator does the whole line in one go

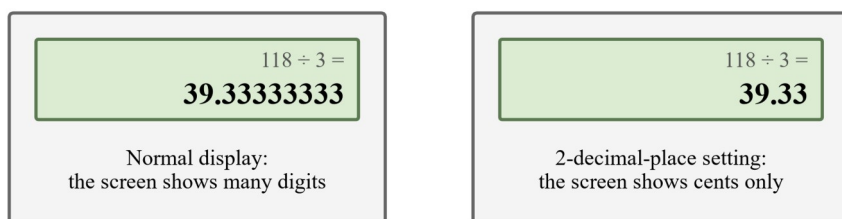


The display above holds $6 \times 4.35 + 4 \times 3.20 + 12.90$, which shows \$51.80. The two multiply steps happen before the adding, so the order is right. The estimate was about \$50, so \$51.80 is sensible.

Refresher — rounding to the cent. Money answers are written to two decimal places, that is, to the nearest cent. Look at the third decimal place to decide: 5 or more, round the cent up; less than 5, leave the cent as it is. So $7.438 \rightarrow \$7.44$ and $7.432 \rightarrow \$7.43$.

Display settings: the tool's display is not your answer's accuracy. A calculator shows as many decimal places as fit on its screen. That is a display setting, not a rule about your answer. You choose the accuracy of your answer, and you say what you chose.

Same sum, two settings



*Both hold the same full value inside. The rounded screen is for **SHOWING** — copying it into the next step puts a rounding error into the working.*

Here $118 \div 3$ fills the display: 39.33333333. As money, to the nearest cent, each share is \$39.33. The same sum can look different under a different setting — some calculators show a fraction, some show two decimals. And if a tool's output looks strange, check its settings before you trust it: a setting left over from last time is a common cause.

Spreadsheets: a grid of named cells. A spreadsheet is a grid. Each box is a **cell**, and each cell has a name: its column letter followed by its row number. The cell in column C, row 4 is named **C4**. You type a **formula** (a sum the sheet works out) into a cell, and the cell shows the formula's answer. Every formula starts with =.

A spreadsheet is a grid of cells; each cell has a name

fx				
	C4	\$1.75		
	A	B	C	D
1	Item	Qty	Price	Total
2	Notebooks	3	\$2.50	\$7.50
3	Sticky notes	2	\$6.00	\$12.00
4	Folders	4	\$1.75	\$7.00
5				\$26.50

the highlighted cell is named C4 — column C, row 4

D2 holds the formula =B2*C2 (3 × \$2.50)

D5 holds =SUM(D2:D4), which shows \$26.50

- $=B2 \times C2$ multiplies the number in B2 by the number in C2. In cell D2 it shows \$7.50.
- $=SUM(D2 : D4)$ adds the block of cells from D2 down to D4. In cell D5 it shows \$26.50.
- Change any input, and every formula that uses it updates at once. That is the whole point of a spreadsheet.

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

A pay sheet shows why this matters:

Hassan's week at the Riverside Garden Centre

	A	B	C	D
1	Day	Hours	Rate	Pay
2	Monday	6	\$24.50	\$147.00
3	Tuesday	7.5	\$24.50	\$183.75
4	Wednesday	5	\$24.50	\$122.50
5	Thursday	8	\$24.50	\$196.00
6	Total			\$649.25

D2 holds the formula
 $=B2 \times C2$

D6 holds
 $=SUM(D2 : D5)$

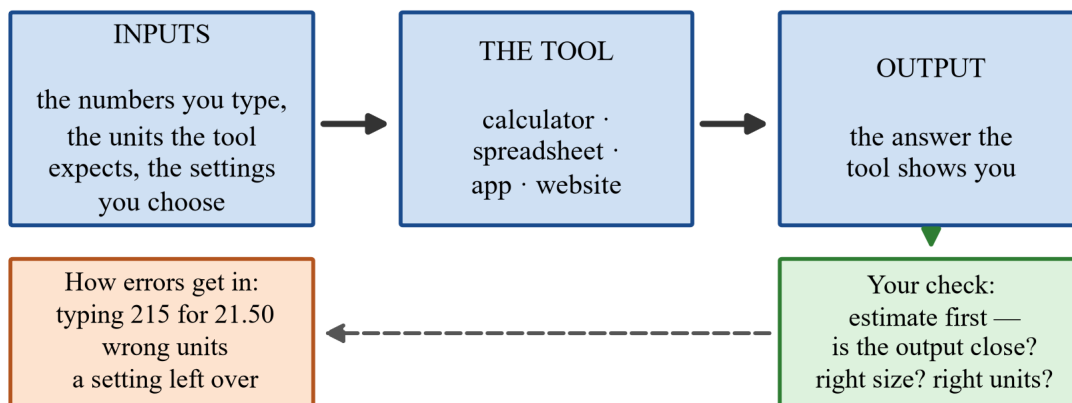
Change one number and every cell that uses it changes with it.

Each pay cell holds the formula $=\text{hours} \times \text{rate}$ (D2 holds $=B2 \times C2$), and D6 holds $=SUM(D2 : D5)$. Type one new hours number and the whole sheet updates — that day's pay and the week's total — with no retyping of formulas and no adding by hand.

Made-up data: Hassan's hours and every number on this pay sheet are made up for this section.

Inputs, the tool, the output. Every digital tool works the same way:

Wrong input, wrong output — the tool never knows the difference



if the estimate and the output disagree, check the inputs and settings — then redo

The tool cannot tell a good input from a bad one. Type 215 where you meant 21.50 and the tool will happily answer for 215. Pick the wrong units and the tool will answer in those units. This is why the check loop matters: estimate first, compare, and if the output is wrong, go back to the inputs and the settings — not to the tool.

Apps: converters, maps, trackers. An **app** is a small program on a phone or tablet. Useful ones for everyday numeracy include unit converters, maps and trip planners, measuring tools, step counters and pay calculators. Two rules keep apps honest:

- **Check the settings.** A converter set to the wrong units will give a wrong-looking answer that is really a right answer to a different question. Make sure the app is set to the units you want before you trust its output.
- **Check what the app asks for.** Apps ask for **permissions** — your approval to reach your location, your messages, your photos. A tool needs permission only for the things its job actually uses.

Metric Converter

From: kilograms
2.5

To: grams

2500 g

Settings: units = METRIC
(metres, grams, litres)

the setting decides which units come out — check it first

Refresher — one-step metric conversions. The metric units in this book convert by multiplying or dividing by 10, 100 or 1000:

- 1 km = 1000 m, and 1 m = 100 cm
- 1 kg = 1000 g
- 1 L = 1000 mL

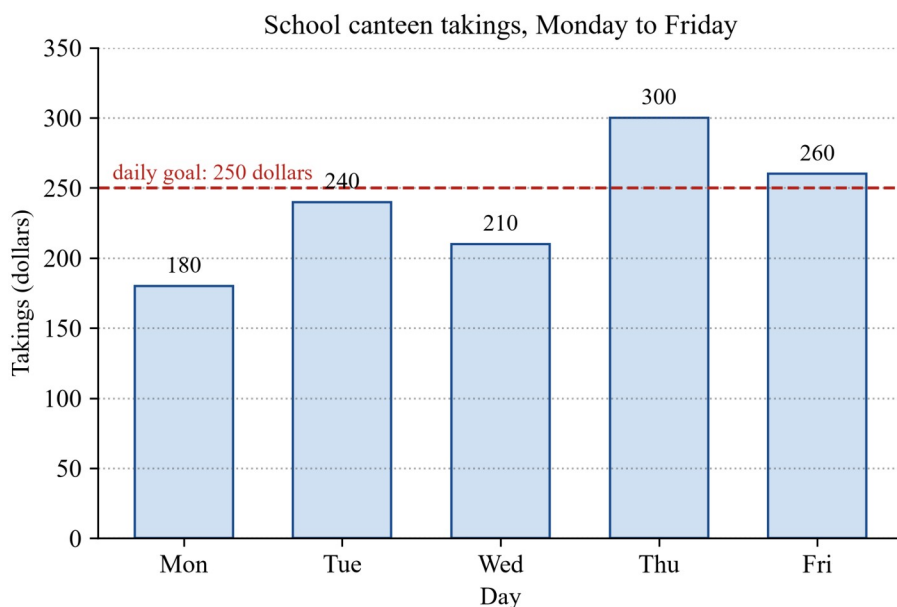
Bigger unit to smaller unit: multiply. Smaller unit to bigger unit: divide. So $3.4 \text{ km} = 3.4 \times 1000 = 3400 \text{ m}$, and $1200 \text{ g} = 1200 \div 1000 = 1.2 \text{ kg}$. The converter app in the figure above does $2.5 \text{ kg} = 2500 \text{ g}$ — one step, multiply by 1000.

Refresher — common percentages. Per cent means out of 100. These five are worth knowing cold, because most everyday percentages are one of them:

Percentage	Means	Of \$240
50%	half	\$120
25%	a quarter	\$60
20%	one fifth	\$48
10%	one tenth	\$24
5%	half of 10%	\$12

The **GST** on an Australian price is 10% of the price before GST. The **subtotal** is the total before GST or discounts are added. A 10% rise adds one tenth; a 10% discount takes one tenth off.

Reading what a tool draws. Spreadsheets and apps will draw charts for you. Read a chart the way you read a sentence: the title first (what is this about?), then the axis labels (what is counted, in what units?), then the bars or points (what numbers?).



The chart above shows a school canteen's **takings** (the money taken in) for each day of one week. The tallest bar is Thursday, \$300. The dashed line is the canteen's goal of \$250 a day; Thursday and Friday reach it. Read only what is there — never invent numbers between the labels.

Made-up data: the canteen's takings for each day are made up for this section.

Online safety. Money and personal numbers travel through websites and messages, so safety is part of numeracy. Three habits:

- **Check the address.** A safe site starts with `https://` and shows a padlock. Just as important: read who owns the address. The owner's name is the part at the end, before any single slash. In `southsidebank-secure.payment.xyz` the owner is `payment.xyz` — not a bank at all.
- **Watch for pressure and prizes.** “Your account closes today”, “you have won”, “pay this small fee now” — scams hurry you so you do not stop to check.
- **Never type personal details into a site or app you reached from a message.** Bank passwords, card numbers and tax file numbers go only into sites you opened yourself and know.

Two addresses for the same pretend bank — only one is real

 `https://southsidebank.com.au`  **safe**

https + padlock, and the bank's own name sits right before .com.au

`http://southsidebank-secure.payment.xyz`  **scam**

no padlock, and the name that owns the address is payment.xyz — “southsidebank-secure” is just a label glued on the front

The habit that catches most mistakes. Pull it all together: estimate first, type with care, read the output, compare it with your estimate — and if the two disagree, check the inputs, the units and the settings, then do it again. One minute of checking saves an hour of wrong answers.

About the data in this section. The pay sheets, price grids and takings charts here are **made up** (not real): pretend businesses 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

Jack buys cleaning supplies for his cleaning rounds: 6 bottles of window cleaner at \$4.35 each, 4 packs of cloths at \$3.20 each, and one bucket at \$12.90. He types the whole sum into his calculator as one line. Find the total, and check it against an estimate.

Working	Comment
Estimate: $6 \times \$4 = \$24$; $4 \times \$3.20$ is about \$13; the bucket is about \$13. So about $\$24 + \$13 + \$13 = \$50$	Round to numbers you can do in your head. The true total should land near \$50.
$6 \times 4.35 = 26.10$	Multiply each line first: $\times$ comes before $+$.
$4 \times 3.20 = 12.80$	The second line.
$26.10 + 12.80 + 12.90 = 51.80$	Then add the three lines.
Read the display back: $6 \times 4.35 + 4 \times 3.20 + 12.90$ shows \$51.80	The typed line matches the working — no slip in the typing.
\$51.80 is near the \$50 estimate	The answer is sensible, so keep it.

Jack's order costs **\$51.80**.

Example 2 — scaffolded

Hassan's pay sheet (the figure in the Theory) pays \$24.50 per hour. (a) Show how the sheet finds Monday's pay and the week's total. (b) Hassan actually worked 6.5 hours on Wednesday, not 5. Find the new Wednesday pay and the new week's total.

Working	Comment
D2 holds $=B2 * C2$, that is $6 \times 24.50 = 147.00$	The formula multiplies the two cells beside it.
D3, D4, D5 hold the same shape: \$183.75, \$122.50, \$196.00	Type the formula once, then copy it down the column.
D6 holds $=SUM(D2 : D5)$: $147.00 + 183.75 + 122.50 + 196.00 = 649.25$	SUM adds the block for you.
Check: hours $6 + 7.5 + 5 + 8 = 26.5$, and $26.5 \times 24.50 = 649.25$	A second route to the same number — the sheet agrees with hand working.
(b) Change B4 from 5 to 6.5. D4 now shows $6.5 \times 24.50 = 159.25$	One edit. The formula does the rest.
D6 now shows $147.00 + 183.75 + 159.25 + 196.00 = 686.00$	Check: new hours $6 + 7.5 + 6.5 + 8 = 28$, and $28 \times 24.50 = 686.00$.

(a) The week's total is **\$649.25**. (b) The new Wednesday pay is **\$159.25** and the new total is **\$686.00**.

Example 3 — unscaffolded

Three workmates share the \$118 cost of a power tool equally. Use a calculator to find each share correct to the nearest cent, then check what three such shares add to.

Solution.

$118 \div 3 = 39.33333333$ on the calculator display.

To the nearest cent, look at the third decimal place: it is 3, less than 5, so each share rounds to \$39.33.

Check: $3 \times 39.33 = 117.99$, and $118 - 117.99 = 0.01$.

The one-cent gap is not a mistake. Each share was rounded down by a fraction of a cent, and three of those fractions make one cent — so someone adds the extra cent when the money is collected.

$\therefore$ Each share is **\$39.33** to the nearest cent, and three rounded shares add to \$117.99, one cent short of \$118.

Example 4 — unscaffolded

Kai uses an online pay calculator. He worked 4.6 hours at \$21.50 per hour, and the site's answer is \$989.00. Kai is sure that is wrong. Show how he can find what went wrong, and find the correct pay.

Solution.

Estimate first: $5 \times 20 = 100$, so the pay should be near \$100 — not near \$1000. The site's answer is about ten times too big.

An answer ten times too big usually means a decimal point went missing. Try the rate with its decimal point dropped: $4.6 \times 215 = 989.00$ — exactly the site's number.

So the rate was typed as 215 instead of 21.50. The correct sum is $4.6 \times 21.50 = 98.90$, which sits close to the \$100 estimate.

∴ The rate was entered as 215 instead of 21.50, and Kai's correct pay is **\$98.90**.

Practice questions

Scaffolded

Q1. Type each sum into a calculator, or work it by hand.

- (a) $5 + 8 \times 3$
- (b) $(5 + 8) \times 3$
- (c) In one sentence, say why the two answers are different.

Q2. Seven friends share a \$40 pizza order equally.

- (a) What does $40 \div 7$ show on a calculator display? Write the display, then round it to the nearest cent.
- (b) If each friend pays that rounded share, how much money is collected?
- (c) How much of the \$40 is left over? Give your answer to the nearest cent.

Q3. Look at the spreadsheet grid in the Theory (Item, Qty, Price, Total).

- (a) What is the name of the highlighted cell?
- (b) What formula sits in D2, and what number does it show?
- (c) What does $=\text{SUM}(D2:D4)$ add, and what number does it show?

Q4. Choose the tool, and do the sum.

- (a) Which digital tool best suits keeping a running total of a week of market sales, where new sales are typed in every day? Give a one-sentence reason.
- (b) A lay-by needs a 20% deposit on \$86. Find the deposit.
- (c) Which app would you use to find the fastest bus route to a game?

Q5. Use the converter-app idea and the metric refresher.

- (a) Write 2.5 kg in grams.
- (b) Write 850 mL in litres.
- (c) Name one setting to check on a converter app before you trust its answer.

Q6. Look at the two web addresses in the online-safety figure.

- (a) Name two things the safe address shows.
- (b) Name two warning signs in the second address.
- (c) A calculator website asks you to type your bank card number “to save your working”. Should you? Give a one-sentence reason.

Un scaffolded

Q7. Erin prices a fencing job: 12 m of edging at \$3.85 per metre, 3 posts at \$7.60 each, and \$9.50 delivery. GST of 10% is added to the subtotal. Use a calculator and the order of operations to find the total of her quote (the price she offers), correct to the nearest cent.

Q8. Hassan’s pay sheet (Theory figure) again.

- (a) Write the formula in D2.
- (b) What number does D6 show before any change?
- (c) Thursday’s hours change from 8 to 4.5. Find the new number in D5 and the new number in D6.

Q9. A delivery van travels 210 km in 2.5 hours.

- (a) Find its speed in km/hr.
- (b) Check your answer with an estimate.
- (c) How far does the van travel in 3 hours at that speed?

Q10. Read the canteen chart in the Theory.

- (a) Which day took the most money, and how much?
- (b) Find the total takings for the five days.
- (c) The canteen’s goal is \$250 a day. How many days reached the goal?

Q11. Four prices on a receipt: \$3.62, \$2.48, \$5.15 and \$1.36.

- (a) Add the four prices exactly.
- (b) Round each price to the nearest dollar first, then add.
- (c) How far apart are the two answers? Which one is the true total, and what rule does this teach?

Q12. A website sells garden edging at \$28 per metre. Mel’s rectangular garden bed is 4.5 m long and 3.2 m wide, and the edging goes all the way around. The site’s quote is \$43 120, which Mel knows is silly.

- (a) Estimate the length of edging needed, then find it exactly. (Perimeter of a rectangle = $2 \times (\text{length} + \text{width})$.)
- (b) Find the correct cost of the edging.
- (c) Show by calculation what Mel most likely typed wrong to get \$43 120. Think about units.

Q13. Theo wants mulch for a rectangular garden bed 3.6 m long and 1.2 m wide. He can measure the bed with a tape measure or with a phone measuring app. Say which tool you would use and one reason why, then find the area of the bed so Theo knows how much mulch to order. (Area of a rectangle = $\text{length} \times \text{width}$.)

Q14. A work jacket marked \$240 is 25% off in a sale. Find the discount and the sale price, and check the discount with one mental step.

Q15. A text message reads: “CityCare: your account is overdue. Pay \$48.20 today at citycare-billing.top or your service will be closed.” Give two warning signs that this is a scam, say what you should do instead of tapping the link, and say in one sentence why tapping the link is the risk.

Q16. A worker is paid \$105 for 7 hours.

- (a) Find the hourly rate.
- (b) Find the pay for 12 hours at that rate.
- (c) In one sentence, say how a spreadsheet would help if the hours change every week.

Q17. A step-counter app asks for permission to read your messages. Say whether the app needs that permission for its job, what the risk is if you allow it, and what the safer choice is.

Q18. Match each job below to the best tool — calculator, spreadsheet or trip app — with a one-sentence reason each, and do the sum in part (a).

- (a) Split an \$88.40 bill equally between 4 people.
- (b) Keep every day's spending for a month and see the running total.
- (c) Find the fastest bus route to a match on Saturday.

Answers

Q1 (a) 29 (b) 39 (c) brackets come first, so in (b) the adding happens before the multiplying, while in (a) the multiplying happens first

Q2 (a) display 5.71428571; \$5.71 to the nearest cent (b) \$39.97 (c) \$0.03

Q3 (a) C4 (b) $=B2 * C2$, showing \$7.50 (c) it adds the three totals $D2 + D3 + D4$, showing \$26.50

Q4 (a) a spreadsheet — the total formula updates as each day's sales are typed in (b) \$17.20 (c) a maps/trip app

Q5 (a) 2500 g (b) 0.85 L (c) the units setting (make sure it is set to metric)

Q6 (a) it starts with `https://` and it shows a padlock (b) any two: no padlock and no `s` in `http://`; the address belongs to `payment.xyz`, not the bank; the bank's name is only a label glued on the front (c) no — card details go only into your bank's own site, opened by you

Q7 \$86.35

Q8 (a) $=B2 * C2$ (b) \$649.25 (c) D5 shows \$110.25; D6 shows \$563.50

Q9 (a) 84 km/hr (b) estimate $200 \div 2.5 = 80$, close to 84 (c) 252 km

Q10 (a) Thursday, \$300 (b) \$1 190 (c) 2 days (Thursday and Friday)

Q11 (a) \$12.61 (b) \$12 (c) \$0.61 apart; the exact sum is the true total — round only at the end

Q12 (a) estimate about 15 m; exactly 15.4 m (b) \$431.20 (c) typing the length as 1540 (centimetres) where the site asks for metres: $1540 \times 28 = 43\ 120$

Q13 tape measure or app, with a sensible reason; 4.32 m²

Q14 discount \$60; sale price \$180; check: $240 \div 4 = 60$

Q15 any two of: pressure (“today”, “will be closed”); the payment address `citycare-billing.top` is not CityCare's own address; an unexpected message asking for payment. Instead: do not tap — contact CityCare on the number from a bill or their known website, or tell a trusted adult. Risk: the link opens a fake payment page that steals your details.

Q16 (a) \$15 per hour (b) \$180 (c) hours in one column, a pay formula beside them and a SUM total — type new hours and every pay and the total update themselves

Q17 not needed — counting steps uses the step sensor, not your messages; risk: the app's maker (or anyone who gets the app's data) could read private messages; safer: refuse the permission, or choose a step counter that asks only for what its job needs

Q18 (a) calculator — a one-off sum; \$22.10 each (b) spreadsheet — a running total that updates as each day is typed in (c) trip app — it holds the routes and times and can compare them

Fully-worked solutions

Q1. (a) Multiply first: $8 \times 3 = 24$, then $5 + 24 = 29$. (b) Brackets first: $5 + 8 = 13$, then $13 \times 3 = 39$. (c) Brackets come first in the order of operations, so in (b) the adding is done before the multiplying, while in (a) the multiplying is done first — same numbers, different order, different answer.

Q2. (a) $40 \div 7 = 5.71428571$ on the display. To the nearest cent: the third decimal place is 4, less than 5, so the share is \$5.71. (b) $7 \times 5.71 = 39.97$, so \$39.97 is collected. (c) $40 - 39.97 = 0.03$, so \$0.03 is left over.

Q3. (a) Column C, row 4, so the cell is named C4. (b) $=B2 * C2$, that is $3 \times 2.50 = 7.50$, so D2 shows \$7.50. (c) It adds the three totals: $7.50 + 12.00 + 7.00 = 26.50$, so it shows \$26.50.

- Q4.** (a) A spreadsheet: each day's sales goes in one cell and a SUM formula keeps the total up to date with no re-adding. (b) 20% of \$86 is $86 \times 0.20 = 17.20$, so the deposit is \$17.20. (c) A maps/trip app — it holds the routes and the times and can compare them.
- Q5.** (a) kg to g is $\times 1000$: $2.5 \times 1000 = 2500$ g. (b) mL to L is $\div 1000$: $850 \div 1000 = 0.85$ L. (c) The units setting — make sure the app is set to metric, and to the pair of units you want.
- Q6.** (a) It starts with `https://` and it shows a padlock. (b) Any two of: it is only `http://`, with no padlock; the address belongs to `payment.xyz`, not to any bank; the bank's name is only a label glued on the front. (c) No. Card and bank details go only into a site you opened yourself and know — a calculator never needs them.
- Q7.** Lines first: $12 \times 3.85 = 46.20$ and $3 \times 7.60 = 22.80$. Subtotal: $46.20 + 22.80 + 9.50 = 78.50$. GST: 10% of \$78.50 is $78.50 \times 0.10 = 7.85$. Total: $78.50 + 7.85 = 86.35$. The quote totals **\$86.35**.
- Q8.** (a) `=B2*C2`. (b) $147.00 + 183.75 + 122.50 + 196.00 = 649.25$, so D6 shows \$649.25. (c) D5 becomes $4.5 \times 24.50 = 110.25$, so \$110.25. D6 becomes $147.00 + 183.75 + 122.50 + 110.25 = 563.50$, so \$563.50. Check: hours $6 + 7.5 + 5 + 4.5 = 23$ and $23 \times 24.50 = 563.50$. ✓
- Q9.** (a) $210 \div 2.5 = 84$ km/hr. (b) Estimate: $200 \div 2.5 = 80$ — 84 is close to 80, so it is sensible. (c) $84 \times 3 = 252$ km.
- Q10.** (a) The tallest bar is Thursday, at \$300. (b) $180 + 240 + 210 + 300 + 260 = 1190$, so \$1 190. (c) The bars at or over the \$250 goal line are Thursday (\$300) and Friday (\$260): 2 days.
- Q11.** (a) $3.62 + 2.48 + 5.15 + 1.36 = 12.61$, so \$12.61. (b) $4 + 2 + 5 + 1 = 12$, so \$12. (c) $12.61 - 12 = 0.61$, so the answers are \$0.61 apart. The exact sum, \$12.61, is the true total: rounding early loses a little from each price and the losses add up. The rule: carry full accuracy and round once, at the end.
- Q12.** (a) Estimate: $2 \times (4.5 + 3) = 15$ m. Exactly: $2 \times (4.5 + 3.2) = 2 \times 7.7 = 15.4$ m. (b) $15.4 \times 28 = 431.20$, so the correct cost is \$431.20. (c) The site's number is 100 times the correct one: $43\ 120 \div 431.20 = 100$. Typing the perimeter in centimetres, 1540, where the site asks for metres gives $1540 \times 28 = 43\ 120$ — so Mel most likely typed 1540 (cm) instead of 15.4 (m).
- Q13.** A tape measure is a good choice: it needs no battery, no signal and no settings, and a bed this size is easy to tape. (A measuring app is also acceptable with a sensible reason, such as working alone on a long side — as long as its units setting is checked.) Area: $3.6 \times 1.2 = 4.32$, so Theo orders mulch for **4.32 m²**.
- Q14.** Discount: 25% of \$240 is $240 \times 0.25 = 60$, so \$60. Sale price: $240 - 60 = 180$, so \$180. Check: 25% is a quarter, and $240 \div 4 = 60$. ✓
- Q15.** Warning signs, any two: it pressures you with a deadline (“today”, “your service will be closed”); the payment address `citycare-billing.top` is not CityCare's own address; an unexpected message asks for a payment you were not planning. Instead of tapping: stop, then contact CityCare on the number printed on a bill or on their known website, or tell a trusted adult. Why tapping is the risk: the link opens a fake payment page built to steal your card or login details.
- Q16.** (a) $105 \div 7 = 15$, so \$15 per hour. (b) $12 \times 15 = 180$, so \$180. (c) Put hours in one column, the rate in the next, a pay formula `=hours × rate` beside them and a SUM at the bottom: type each week's hours and every pay and the total update themselves.
- Q17.** The app does not need it: counting steps uses the phone's step sensor, and messages have nothing to do with steps. The risk: the app's maker — or anyone who later gets the app's data — could read private messages, including bank codes and personal details. The safer choice: refuse the permission; if the app then refuses to work, choose a different step counter that asks only for what its job needs.
- Q18.** (a) Calculator — one sum, done once: $88.40 \div 4 = 22.10$, so \$22.10 each. (b) Spreadsheet — thirty numbers and a running total: a SUM formula updates as each day is typed in. (c) Trip app — it holds the routes and the times and can compare them for Saturday.

Chapter 1 The problem-solving cycle and mathematical toolkit — 1G Numeracy words: familiar, unfamiliar and routine

Theory

About the data in this section. The shops, workplaces, pay slips, quotes and charts in this section 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.

Why these words matter. The study design (Unit 1, Outcome 1) says your problems come from situations you know well (*familiar*) and from jobs you do often (*routine*), and some come from situations that are newer to you (*less familiar*).

Source: VCAA, VCE Vocational Major Numeracy Study Design, retrieved 2026-10-08.

Three words — *familiar*, *routine*, *less familiar* — and they are worth stopping on, because they tell you **how to start** a task before you do any arithmetic at all. They are also easy to misread as a judgement on you. They are not. These words describe **the task in front of you**, not how clever you are. The same task is familiar to one person and less familiar to another, and both people are fine at maths.

Two words you need first: context and task. Every numeracy job has two halves.

- The **context** is the situation the maths sits in: the shop, the worksite, the pay slip, the medicine label, the excursion booklet.
- The **task** is the job of doing it: the steps you carry out — the reading, the choosing of operations, the calculating, the checking.

Familiar and *less familiar* describe the **context**. *Routine* and *new* describe the **task**. Keeping those two pairs separate is the whole section: once you can name each half, you know how to approach the job.

Two questions, three words. Before you start any task, ask two questions.

The three words of this section

FAMILIAR	LESS FAMILIAR (unfamiliar)	ROUTINE
You know this situation. You have met it before, in or out of school.	New to you — you have not met this situation before.	A procedure done regularly or at set times, and practised often.
<i>Totalling your usual items at the shop you use every day</i>	<i>Reading the parking map of a hospital on your first visit</i>	<i>Entering your hours on the same timesheet every Friday</i>

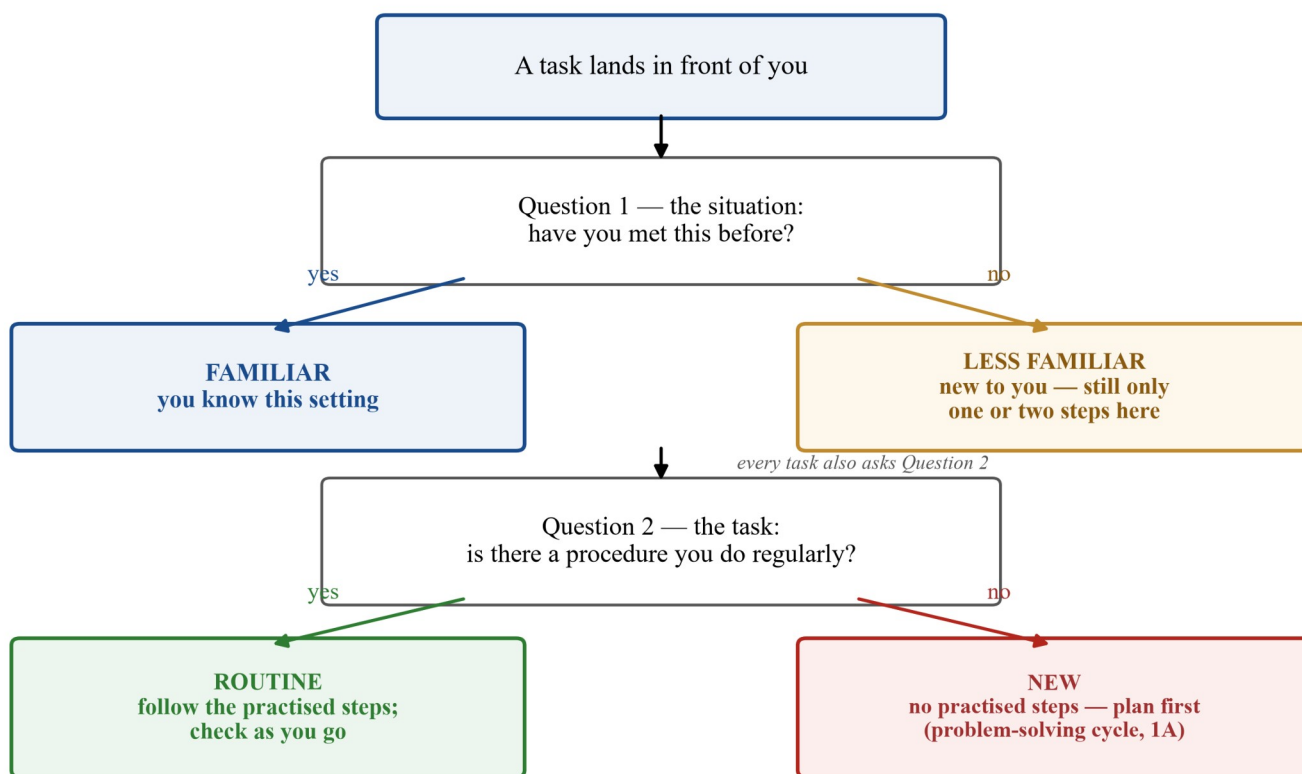
The three words on cards: familiar, less familiar, routine

Made-up data: the three cards are made-up labels for this section, not real categories from a real course.

Familiar and less familiar. A context is **familiar** when you know it from your own life: your own roster, your own supermarket, your own phone plan, your workplace. A context is **less familiar** (the study design's word is *unfamiliar*) when it is new to you: a first pay slip, a hospital form, a quote you have never read before, a shop in a town you have just moved to. Less familiar does **not** mean impossible and does not mean hard maths — it means you should read slowly first, because the setting will not help you yet. And familiar is personal: your pay slip is familiar to you and less familiar to someone who has never had a job.

Routine — and new. A task is **routine** when you do it regularly and the steps are practised: you could almost do it on autopilot, then check it. Totalling your own timesheet, counting the float (the note-and-coin drawer at a register) at open, running the same recipe. A task is **new** when you have not done it regularly, so there are no practised steps to follow yet — you have to plan it first with the problem-solving cycle (Section 1A). New is not the same as hard: costing two quotes for the first time is new, and the maths inside might be one multiplication and one addition.

A sorting guide: two questions about any task



A two-question sorting guide: question 1 sorts the context, question 2 sorts the task

Made-up data: the flowchart is a made-up study aid for this section.

Choosing your approach. The two answers together tell you how to start.

- **Familiar context, routine task:** get on with it, and check as you go (Section 1C).
- **Familiar context, new task:** you know the setting, so spend your time on planning the steps.
- **Less familiar context, routine task:** read the setting carefully first; then your practised steps will carry you.
- **Less familiar context, new task:** use the full problem-solving cycle (Section 1A) — identify the mathematics, plan, carry out, then check and communicate.

Refresher — estimate by rounding. Round each number to a friendly one, do the maths in your head, and keep the estimate to check the exact answer at the end. For 42.3 L of petrol at \$1.87 a litre: 42.3 is about 40 and \$1.87 is about \$2, so the fill is about $40 \times \$2 = \$80$. An exact answer a long way from \$80 means re-check. (Estimating and checking is Section 1C.)

Labels change as you gain experience. This is the point students miss: the labels are not fixed to a task, they are fixed to a *person meeting that task today*. Jordan's first pay slip was less familiar and every line was new. Ten weeks later the same slip is familiar and checking it is routine. Nothing about the slip changed — Jordan changed. That is what learning looks like in these words: less familiar becomes familiar, and new becomes routine.

Labels change as you gain experience



The task did not change. The person's experience did.

The same made-up pay slip labelled at week 1 and at week 10

Made-up data: Jordan, the workplace and both sets of labels are made up for this section.

The words across the six numeracies. The study design lists six numeracy areas. The same three words apply in every one of them.

Numeracy	A task in that area	Words for the person meeting it today
Personal	Reading your own weekly roster to find your start time	familiar and routine — your own roster, read every week
Civic	Reading a council rates notice (the council's yearly charge on a property) for the first time and finding the four equal payments	less familiar context (first notice); the task — dividing the year's amount by 4 — is routine
Financial	Checking a fortnightly pay slip against your own hours	familiar and routine, once you have done it a few times
Health	Reading a medicine label to time three doses a day	routine for the person who does it daily; less familiar the first time
Vocational	Counting the float at open, the same as every morning	familiar and routine
Recreational	Costing a one-off club trip you have never planned	less familiar and new — plan it with the problem-solving cycle

Your school will assess three of these six areas; this book meets all six in Chapter 6. Notice the civic row: the same rates notice is *routine* for the person who reads one every year. The labels always belong to a person, not to the paper.

Worked model — sorting four tasks. Here is the sorting done in full on four everyday jobs.

Refresher — “per” means divide. A cost *per* something is a total shared out: cost per kg = total cost ÷ number of kg. So \$12.00 for 5 kg is $\$12.00 \div 5 = \$2.40$ per kg. Costs per kg, per m and per hour are all this same division (unit prices are taught in full in Chapter 2).

#	The job	Context	Task	Words
1	Entering the café's milk order on the supplier's online form — same form, same amounts, every Monday	familiar: own café, own form	routine: practised steps, done weekly	familiar and routine
2	Comparing two rice	familiar: rice from	new: no practised	familiar and new

#	The job	Context	Task	Words
	deals, 5 kg for \$12.00 or 8 kg for \$17.60, by cost per kg — never done it	the usual supermarket	steps yet, so plan first	
3	Totalling a trolley at a supermarket in a new town, never shopped there	less familiar: new shop, new layout	routine: totalling a trolley is practised	less familiar and routine
4	Costing a class excursion never planned before — bus hire plus an entry fee per student	less familiar: never been on the planning side	new: no practised steps, so use the cycle	less familiar and new

The maths in row 2, for interest: $\$12.00 \div 5 = \$2.40$ per kg and $\$17.60 \div 8 = \$2.20$ per kg, so the 8 kg bag is \$0.20 per kg cheaper. Two divisions — the task is *new*, not hard.

The next three refreshers cover the arithmetic the examples and questions in this section borrow. They are one-line reminders, not new topics.

Refresher — adding and subtracting money. Line the decimal points up in a column, add or subtract as with whole numbers, then put the decimal point back in line. $\$47.80 + \$23.65 = \$71.45$, and $\$120.00 - \$71.45 = \$48.55$. Check a subtraction by adding back: $\$48.55 + \$71.45 = \$120.00$.

Refresher — time is not decimal. There are 60 minutes in an hour, so count time in chunks, never in tenths. To count back 55 minutes from 9:00 am: back one hour is 8:00 am, then forward 5 minutes is 8:05 am. To add 5 hours 30 minutes to 7:45 am: add the 5 hours (12:45 pm), then the 30 minutes (1:15 pm).

Refresher — one-step metric conversions. The four lines you need in this section:

- 1 000 g = 1 kg, so 900 g = 0.9 kg (small unit to big unit: divide by 1 000)
- 1 000 mL = 1 L
- 100 cm = 1 m
- 1 000 m = 1 km

Big unit to small unit: multiply. Small to big: divide. (Conversion is taught in full in Chapter 4.)

Worked examples

Example 1 — scaffolded

Priya's week holds the four tasks in the cards below. For each card: do the maths, then label the job for Priya — is the **context** familiar or less familiar, and is the **task** routine or new?

Priya's four tasks this week

Card A — Sunday budget check <i>done every Sunday in her budget book</i> Budget for the week: \$120.00 Groceries so far: \$47.80 Petrol so far: \$23.65 <i>How much is left to spend?</i>	Card B — community garden bee <i>Priya's first working bee</i> Mulch bed: rectangle 4 m long, 2 m wide Edging: pieces 1 m long Edging goes right around the bed <i>How many edging pieces are needed?</i>
Card C — Saturday baking <i>the same recipe every Saturday</i> Scones: 1 batch makes 12 Flour: 1 batch needs 300 g Today: a triple batch <i>How many scones? How much flour, in g and in kg?</i>	Card D — getting to the show <i>Priya must arrive by 9:00 am</i> Bus ride: 25 minutes Walk: 10 minutes Train ride: 20 minutes <i>Total travel time? What is the latest she can leave home?</i>

Priya's four task cards: a budget check, a garden bee, Saturday baking, getting to a show

Made-up data: Priya and all four cards, including every number on them, are made up for this section.

Working	Comment
Card A: $\$47.80 + \$23.65 = \$71.45$ spent; $\$120.00 - \$71.45 = \$48.55$ left	Familiar context (her own budget book) and routine task (the same Sunday check every week). Check: $\$48.55 + \$71.45 = \$120.00$.
Card B: around the bed, $4 + 2 + 4 + 2 = 12$ m; edging pieces are 1 m long, so 12 pieces	Less familiar context (first working bee) and new task (she has never edged a bed). Two steps only: add the four sides, then match them to 1 m pieces. New, not hard.
Card C: $3 \times 12 = 36$ scones; $3 \times 300 = 900$ g; and 900 g = 0.9 kg	Familiar context (her own Saturday baking) and routine task (the same recipe, scaled the same way each time). The g-to-kg step is the one-step conversion above.
Card D: $25 + 10 + 20 = 55$ minutes; 55 minutes before 9:00 am is 8:05 am	Familiar context (the show is at a hall she knows) but new task (working <i>backwards</i> from an arrival time is something she has never done). Count back in chunks: 9:00 am back 1 hour is 8:00 am, forward 5 minutes is 8:05 am.

Example 2 — scaffolded

Marco works in a warehouse Monday to Friday and totals his timesheet every Friday without thinking about it. On Saturday his supervisor offers him a one-off Sunday shift with two pay options, shown below. Label the Friday job and the Sunday decision, then work out which option pays more, and by how much.

Marco's Sunday market offer

phone-accessories stall — Marco expects to sell 14 cases

Option 1

\$120 for the day, plus

\$5 for every phone case he sells

Option 2

\$200 flat, whatever he sells

Also this week: Marco enters his hours on the same Friday timesheet he has used since he started.

Marco's Sunday options: Option 1, \$120 for the day plus \$5 per case; Option 2, \$200 flat

Made-up data: Marco, his warehouse and both pay options are made up for this section.

Working	Comment
Friday timesheet: same sheet, same steps, every Friday	Familiar context (his own job) and routine task (practised steps, done weekly).
Sunday decision: a one-off offer he has never priced before	The workplace is familiar, but the <i>decision</i> is a new task: there are no practised steps for it, so Marco plans it — cost each option, then compare.
Option 1: $\$5 \times 14 = \$70$; then $\$120 + \$70 = \$190$	The bonus for 14 cases, added to the day rate.
Option 2: \$200, flat	Nothing to calculate — read it and compare.
Compare: $\$200 - \$190 = \$10$	Option 2 pays \$10 more for the Sunday.
Labels on the Sunday job: familiar context, new task	Notice the arithmetic was one multiplication, one addition and one subtraction. The words describe the task, not the arithmetic: a new task needs planning even when the maths inside is easy.

Refresher — rounding to whole things. In real life answers often have to be whole: packs, days, tickets, people. Round to the whole number that actually *works*, and always show the check. 3.8 packs of rolls means 4 packs, because 3 packs are not enough. 16.6 days of tablets means 16 whole days, because day 17 has no tablets. The check is the point: $16 \times 6 = 96$ fits in the pack, $17 \times 6 = 102$ does not.

Example 3 — unscaffolded

Minh fills a pill organiser for his grandfather every week. The vitamin label reads “2 tablets, 3 times a day”, and a pack holds 100 tablets. How many **whole days** will one pack last, and how many tablets are left over? Then label the job for Minh: context and task.

2 tablets, 3 times a day, is $2 \times 3 = 6$ tablets each day.

Days in a 100-tablet pack: $100 \div 6 = 16$ remainder 4. Days have to be whole here, so check both sides of 16: $16 \times 6 = 96$ tablets, which fits in the pack, while $17 \times 6 = 102$ tablets, which is more than the pack holds. So the pack lasts 16 whole days with $100 - 96 = 4$ tablets left over.

For Minh the context is familiar — his own grandfather, the same organiser, every week — and the task is routine: the same practised steps each time (read the label, multiply for the day, divide the pack, check).

∴ one pack lasts 16 whole days with 4 tablets left over, and for Minh the job is a familiar context and a routine task.

Example 4 — unscaffolded

A student committee is planning a social for 40 people and has two venue quotes, shown below. (a) For a committee that has never costed an event before, label the comparing job: context and task. (b) Which venue costs less for 40 people, and by how much?

Two quotes for the club disco — 40 people coming

Venue A — the town hall		Venue B — the bowling club	
Hall hire:	\$150	Room hire:	\$90
Plus per person:	\$4	Plus per person:	\$5

Two made-up venue quotes: Venue A, \$150 room hire plus \$4 per person; Venue B, \$90 room hire plus \$5 per person

Made-up data: both venues and both quotes are made up for this section.

Venue A for 40 people: $\$4 \times 40 = \$160$, then $\$150 + \$160 = \$310$.

Venue B for 40 people: $\$5 \times 40 = \$200$, then $\$90 + \$200 = \$290$.

Comparing: $\$310 - \$290 = \$20$, so Venue B costs less.

- (a) The context is less familiar — this committee has never priced an event — and the task is new: there were no practised steps, so they had to plan it (read each quote, cost each for 40 people, compare). The maths inside was two multiplications and two additions, so again: new, not hard.

∴ Venue B is cheaper by \$20 for 40 people, and for this committee the comparing job is a less familiar context and a new task.

Practice questions

Scaffolded

Q1. Ali has shopped at the same corner shop for years and knows where everything is. Today the shop has switched on a new self-checkout screen he has never used.

- (a) Is the context of *shopping there* familiar or less familiar for Ali? Give a reason.
(b) Is the context of *checking out today* familiar or less familiar for Ali? Give a reason.
(c) His items come to \$18.60 and he pays with a \$20 note. How much change does he get?

Q2. Josh checks the same bus app every morning before work. This week the club also asks him to plan the travel for a one-off away day, which he has never done.

- (a) Is reading the bus app each morning a routine task or a new task for Josh? Give a reason.
(b) Is planning the away-day travel a routine task or a new task for Josh? Give a reason.
(c) The app shows his bus at 7:52 am and his connecting train at 8:17 am. How many minutes are between them?

Q3. Look at three jobs.

- (i) Filling in the same Friday timesheet at work.
- (ii) Baking the same cake recipe every Sunday.
- (iii) Planning the seating for a one-off family reunion.
- (a) Which job is a new task?
- (b) Give two reasons why the other two jobs are routine tasks.
- (c) For the new task, name the first stage of the problem-solving cycle (Section 1B).

Q4. Sort these four jobs.

- (i) Josh totalling his own hours on the same timesheet every Saturday.
- (ii) Ali choosing between two new add-ons on his own phone plan, a decision he has never made.
- (iii) Hine's first shift at a café, where the register is the same model as at her old job, so ringing up a sale follows steps she already knows.
- (iv) The class's first sausage sizzle: 50 people, 2 sausages each, and bread rolls come in packs of 8.
- (a) For each job, give both labels: familiar or less familiar context, and routine or new task.
- (b) Give a reason for the two labels you put on job (iii).
- (c) For job (iv), work out how many packs of bread rolls are needed. Round to whole packs and show the check.

Q5. Josh fills the ute for his mowing rounds: 42.3 L of petrol at \$1.87 a litre.

- (a) Estimate the cost by rounding 42.3 L to 40 L and \$1.87 to \$2.
- (b) Find the exact cost, to the nearest cent.
- (c) This is the same fill-up every week. Give both labels for the job and a reason.

Q6. Hine swims at her local leisure centre about 8 times a term. Casual entry is \$4.50 a swim; a 10-visit pass is \$26. She has never compared the two before.

- (a) What do 8 casual swims cost?
- (b) How much would the 10-visit pass save her over those 8 swims?
- (c) Give both labels for the comparing job, and say what Hine should do about the task being what it is.

Unscaffolded

Refresher — 10% off. 10% of a number is that number $\div 10$. So 10% off \$45 is $\$45 \div 10 = \$4.50$ off, making the sale price $\$45 - \$4.50 = \$40.50$. (Percentages are taught in full in Chapter 2.)

Q7. Ruby opens and closes The Denim Den, a clothing shop. Here are five of her jobs.

- 1. Counting the \$200 float at open, the same as every morning.
- 2. Reading the new card machine's summary screen at close — today is the first time.
- 3. Taking 10% off a \$45 jacket for a regular customer.
- 4. Planning a one-off window display for the street parade.
- 5. Spreading 96 pairs of jeans evenly over 6 display shelves.
- (a) Label each job: familiar or less familiar context, routine or new task. Give a reason for any one of your five.
- (b) Do the maths in job 3 (the discount, and the sale price to the nearest cent) and job 5 (jeans per shelf).
- (c) After a month of closing shifts, what has happened to the labels on job 2? Explain.

Q8. A delivery sheet at a warehouse says 32 cartons per pallet and 18 pallets in the load. Grace has checked sheets like this for three years; Ben is on his first shift and has never seen one.

- (a) Give both labels for the sheet check as Grace meets it, with a reason.
- (b) Give both labels for the sheet check as Ben meets it, with a reason.
- (c) How many cartons are in the load?

Q9. Jordan’s fortnightly pay slip from Harbour View Aged Care is shown below. In week 1 her manager sat with her and explained every line; six months on, she checks the slip herself each fortnight. *Gross* means the pay before tax is taken out; *net* means the pay that actually arrives, after tax.

Harbour View Aged Care <i>fortnightly pay slip — Jordan Nguyen</i>	
Hours worked	26
Hourly rate	\$24.50
Gross pay	\$637.00
Tax taken out	\$76.45
Net pay (what reaches her bank)	\$560.55

Jordan’s made-up pay slip: 26 hours at \$24.50 an hour, gross \$637.00, tax \$76.45, net \$560.55

Made-up data: Jordan, the workplace and every figure on the slip are made up for this section.

- Check the gross pay on the slip using the hours and the hourly rate.
- Check the net pay on the slip using the gross pay and the tax.
- Next fortnight Jordan works 4 more hours at the same rate. What is the gross pay for that fortnight?
- Label the slip check for Jordan in week 1, and for Jordan now. What does the change tell you about these words?

Q10. A card on the mortar bin at a bricklaying site reads: mix cement to sand in the ratio 1 to 2. Mortar is the cement-and-sand mix laid between bricks. Tom the brickie makes this mix several times a day; a first-day student has never read the card. The job is 9 buckets of mortar in total.

Refresher — sharing by a simple ratio. “Cement to sand, 1 to 2” means 1 part cement for every 2 parts sand, so $1 + 2 = 3$ parts altogether. Divide the total by 3 to find one part, then take 1 part of cement and 2 parts of sand. (Ratios are taught in full in Chapter 2.)

- How many buckets of cement?
- How many buckets of sand?
- Give both labels for reading-and-mixing this card as Tom meets it, and as the first-day student meets it.

Q11. Two print shops quote as shown below.

Two ways to print your photos

SnapHappy Prints		PhotoPlus	
Per photo:	\$0.35	Membership fee (per year):	\$20
Membership fee:	none	Then per photo:	\$0.10

Two made-up print quotes: SnapHappy, 35 cents a photo with no fee; PhotoPlus, \$20 set-up plus 10 cents a photo

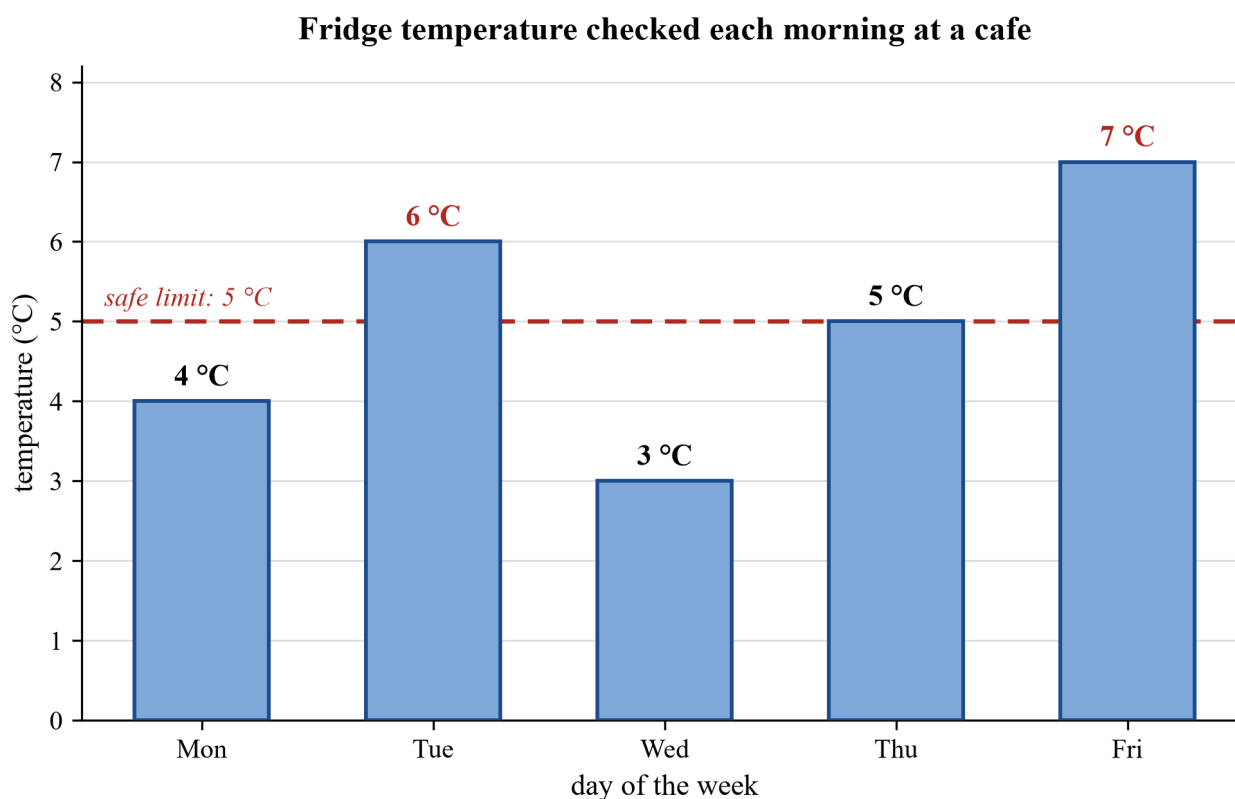
Made-up data: both shops and both quotes are made up for this section.

- (a) What does SnapHappy charge for 200 prints?
- (b) What does PhotoPlus charge for 200 prints?
- (c) What does each shop charge for 40 prints, and which is cheaper at 40? What does that tell you about calling either shop “the cheap one”?
- (d) A student prints photos often but has never compared print prices before. Give both labels for the comparing job.

Q12. Here are four of Ali’s jobs.

- (i) Tallying the gate takings at his footy club’s home games, the same way every week.
 - (ii) Comparing pizzas by the slice: Mario’s is \$18 cut into 8 slices; Luigi’s is 2 pizzas for \$20, each cut into 6 slices.
 - (iii) On his first day at a car wash, reading the cycle chart (rinse 12 minutes, wash 18 minutes, wax 10 minutes) and finding the total cycle time.
 - (iv) Costing the sausages for a one-off barbecue fundraiser: 150 sausages at \$0.80 each.
- (a) Sort the four jobs: familiar or less familiar context, routine or new task. Give a reason for any one of your four.
 - (b) Do the maths in job (ii). Give each price per slice to the nearest cent, and say which shop is cheaper per slice.
 - (c) Do the maths in job (iii) and job (iv).

Q13. A café owner checks the fridge temperature every morning before opening, and writes it on a chart. This week's chart is below. Food safety rules say the fridge must sit at 5 °C or below.



A made-up bar chart of fridge temperatures: Mon 4, Tue 6, Wed 3, Thu 5, Fri 7 degrees C, with a dashed safe-limit line at 5 degrees C

Made-up data: the café and the five temperatures are made up for this section.

- Which day was coldest, and what was the temperature?
- On which days was the fridge above the 5 °C safe limit?
- The owner has made this same check every morning for two years. Give both labels for the morning check, with a reason.

Q14. A class is planning its first excursion: a return bus hire of \$280, plus an entry fee of \$7.50 per student, for 24 students.

- What do the entry fees cost altogether?
- What does the whole excursion cost?
- Give both labels for the costing job as a student who has never planned an excursion meets it. Does “less familiar” mean the maths inside is hard? Point at the maths inside to support your answer.

Q15. Sam's Saturday shift starts at 7:45 am. He is on the clock for 5 hours 30 minutes, including a 45-minute unpaid break.

- What time does Sam finish?
- How many hours and minutes is Sam paid for?
- Sam has worked this same shift shape every Saturday for a year. Give both labels for reading this roster, with a reason.

Q16. Your turn to write the questions.

- (a) From your own life, write one task for each of the four combinations: familiar and routine; familiar and new; less familiar and routine; less familiar and new.
- (b) For each of your four tasks, give a one-sentence reason for each label.
- (c) Compare your four tasks with a classmate's. Why might the same task get different labels from the two of you?

Q17. The swim club runs the canteen at the summer carnival. At the end of the day the coin tin holds five \$20 notes, three \$10 notes and eight \$5 notes.

- (a) How much money is in the tin?
- (b) Counting the tin is something the treasurer does at every carnival, while planning this year's raffle is something nobody has done before. Label each of those two jobs.
- (c) The carnival still needs \$300 in total for new starting blocks. Raffle tickets cost \$2 each. How many tickets must be sold to make up the gap?

Q18. Ruby says: "If the context is less familiar, then the maths inside must be hard."

- (a) Do you agree? Use one question from this section as an example to support your answer.
- (b) In one sentence each: what do *familiar* and *less familiar* tell you about a job, and what do *routine* and *new* tell you?

Answers

- Q1.** (a) Familiar — years of shopping there, he knows the shop. (b) Less familiar — the new screen is a part of the shop he has never met. (c) \$1.40.
- Q2.** (a) Routine — same app, same steps, every morning. (b) New — a one-off job with no practised steps. (c) 25 minutes.
- Q3.** (a) Job (iii). (b) Any two of: done regularly; at a set time each week; practised steps he or she can follow without planning. (c) Identify the mathematics.
- Q4.** (a) (i) familiar and routine; (ii) familiar and new; (iii) less familiar and routine; (iv) less familiar and new. (b) Less familiar: first shift at a café she has never worked in; routine: the register and its steps are the same as her old job. (c) 13 packs — $100 \text{ sausages} \div 8 = 12.5$, and 12 packs hold only 96 sausages, so round up.
- Q5.** (a) About \$80. (b) \$79.10. (c) Familiar and routine — the same weekly fill, with practised steps at the pump and for the cost.
- Q6.** (a) \$36.00. (b) \$10.00. (c) Familiar context (her local centre), new task (she has never compared the two prices); so plan it — cost each option for her 8 swims, then compare.
- Q7.** (a) 1: familiar and routine; 2: less familiar context and new task at first; 3: familiar and routine; 4: less familiar and new; 5: familiar and routine. Reasons vary. (b) \$4.50 off, sale price \$40.50; 16 pairs per shelf. (c) Less familiar becomes familiar — the screen is now known — and the reading of it becomes routine with practice.
- Q8.** (a) Familiar and routine — same warehouse, same sheet, three years of practice. (b) Less familiar and new — the site and the sheet are new to him and he has no practised steps for it yet. (c) 576 cartons.
- Q9.** (a) $26 \times \$24.50 = \$637.00$ — matches the slip. (b) $\$637.00 - \$76.45 = \$560.55$ — matches the slip. (c) \$735.00. (d) Week 1: less familiar and new; now: familiar and routine. The labels follow the person's experience, not the paper.
- Q10.** (a) 3 buckets. (b) 6 buckets. (c) Tom: familiar and routine — the same mix several times a day. First-day student: less familiar context and new task — the card's words are not known yet, so plan first.
- Q11.** (a) \$70.00. (b) \$40.00. (c) SnapHappy \$14.00, PhotoPlus \$24.00 — SnapHappy is cheaper at 40 prints, though PhotoPlus was cheaper at 200, so neither shop is “the cheap one” for every job. (d) Familiar context (printing is usual for them) and new task (comparing print prices has no practised steps yet).
- Q12.** (a) (i) familiar and routine; (ii) familiar and new; (iii) less familiar and routine; (iv) less familiar and new. Reasons vary. (b) Mario's \$2.25 per slice; Luigi's \$1.67 per slice — Luigi's is cheaper per slice. (c) (iii) 40 minutes; (iv) \$120.00.
- Q13.** (a) Wednesday, 3 °C. (b) Tuesday (6 °C) and Friday (7 °C). (c) Routine — the same check every morning at a set time with practised steps — and familiar, being her own café.
- Q14.** (a) \$180.00. (b) \$460.00. (c) Less familiar and new for a student who has never planned one. No — the maths inside is one multiplication and one addition, both routine steps; less familiar describes the setting, not the difficulty.
- Q15.** (a) 2:00 pm. (b) 4 hours 45 minutes. (c) Familiar and routine — the same shift shape every Saturday for a year.
- Q16.** Answers vary. (c) Because the labels belong to the person meeting the task: your context and your practised steps are not your classmate's.
- Q17.** (a) \$170. (b) Counting the tin: familiar and routine; planning the raffle: less familiar and new. (c) 65 tickets.
- Q18.** (a) Disagree — for example Q14: costing the excursion is less familiar and new for the student, yet the maths inside is one multiplication and one addition. (b) Familiar/less familiar tells you whether the person knows the setting; routine/new tells you whether the steps are practised from doing the job regularly. Neither pair says how hard the maths is.

Fully-worked solutions

Q1. (a) Familiar: Ali has shopped there for years, so the setting is his own. (b) Less familiar: the self-checkout screen is a part of the shop he has never met, so today the setting holds something new for him. (c) Change: $\$20.00 - \$18.60 = \$1.40$. Check: $\$1.40 + \$18.60 = \$20.00$.

Q2. (a) Routine: the same app and the same steps every morning, so the steps are practised. (b) New: the away-day travel is a one-off job he has never done, so there are no practised steps — he plans it with the problem-solving cycle. (c) From 7:52 am to 8:00 am is 8 minutes; from 8:00 am to 8:17 am is 17 minutes; $8 + 17 = 25$ minutes.

Q3. (a) Job (iii), the reunion seating — a one-off job with no practised steps. (b) Any two of: jobs (i) and (ii) are done regularly (every Friday, every Sunday); they happen at a set time; and the steps are practised, so no planning is needed first. (c) Identify the mathematics — work out what the question is asking, what information is given and what operations are needed, before planning anything.

Q4. (a) (i) Familiar context (his own timesheet) and routine task (every Saturday). (ii) Familiar context (his own phone plan) and new task (a decision he has never made). (iii) Less familiar context (a café she has never worked in) and routine task (the register steps are her old job's steps). (iv) Less familiar context (the class's first sizzle) and new task (nobody has costed one before). (b) Less familiar because today is Hine's first shift in a workplace new to her; routine because the register is the same model as at her old job, so the steps she follows are already practised. (c) Sausages: $50 \times 2 = 100$. Packs: $100 \div 8 = 12.5$, and packs must be whole. Check both sides: 12 packs hold $12 \times 8 = 96$ sausages, which is not enough for 100; 13 packs hold $13 \times 8 = 104$, which is enough. So round **up** to 13 packs.

Q5. (a) Estimate: $40 \times \$2 = \$80$. (b) Exact: $42.3 \times \$1.87 = \$79.101$, which to the nearest cent is **\$79.10** (the third decimal place is 1, so round down). The exact answer sits close to the \$80 estimate, so it is sensible. (c) Familiar context (the same ute, the same weekly rounds) and routine task (the same fill-up and the same cost calculation every week).

Q6. (a) $8 \times \$4.50 = \$36.00$. (b) The pass costs \$26, so it saves $\$36.00 - \$26.00 = \$10.00$ over her 8 swims. (c) Familiar context — her local centre, which she knows well — and new task, because she has never compared the two prices before. Because the task is new, she plans it: cost each option for her 8 swims (done above), then compare.

Q7. (a) 1: familiar and routine (same float, same count, every morning). 2: less familiar context and new task today (a screen she has never read). 3: familiar and routine (a regular customer, a practised discount). 4: less familiar and new (a one-off display nobody has planned). 5: familiar and routine (same shelves, same count, weekly). Reasons vary; any one sensible reason is enough. (b) Job 3: 10% of \$45 is $\$45 \div 10 = \$4.50$ off, so the sale price is $\$45.00 - \$4.50 = \$40.50$. Job 5: $96 \div 6 = 16$ pairs per shelf. (c) The context moves from less familiar to familiar (the screen is now known to her), and the task moves from new to routine (reading it becomes a practised end-of-day step). Same screen, different Ruby.

Q8. (a) Familiar context (her own warehouse) and routine task (sheets like this for three years). (b) Less familiar context (first shift, new site) and new task (he has no practised steps for reading the sheet yet). (c) $32 \times 18 = 576$ cartons.

Q9. (a) Gross: $26 \times \$24.50 = \$637.00$, which matches the slip. (b) Net: $\$637.00 - \$76.45 = \$560.55$, which matches the slip, so both lines check out. (c) Next fortnight: $26 + 4 = 30$ hours, so gross is $30 \times \$24.50 = \$735.00$. (d) Week 1: less familiar context and new task — every line had to be explained. Now: familiar context and routine task — the same slip, checked the same way each fortnight. The change shows that these words follow a person's experience: with practice, less familiar becomes familiar and new becomes routine.

Q10. Parts: $1 + 2 = 3$. One part: $9 \div 3 = 3$ buckets. (a) Cement, 1 part: $1 \times 3 = 3$ buckets. (b) Sand, 2 parts: $2 \times 3 = 6$ buckets. Check: $3 + 6 = 9$ buckets in total. (c) Tom: familiar context (his own site) and routine task (the same mix several times a day). First-day student: less familiar context (a site and a card never seen) and new task (no practised steps for reading a ratio card yet).

Q11. (a) SnapHappy: $200 \times \$0.35 = \$70.00$. (b) PhotoPlus: $\$20 + (200 \times \$0.10) = \$20 + \$20 = \$40.00$. (c) At 40 prints: SnapHappy $40 \times \$0.35 = \$14.00$; PhotoPlus $\$20 + (40 \times \$0.10) = \$20 + \$4.00 = \$24.00$. SnapHappy is cheaper at 40 prints, even though PhotoPlus was cheaper at 200 — so neither shop is “the cheap one” for every job;

the cheaper shop depends on how many prints you need. (d) Familiar context (printing photos is usual for this student) and new task (comparing print prices is a decision with no practised steps yet).

Q12. (a) (i) Familiar and routine — his own club, the same tally every week. (ii) Familiar and new — pizza is a familiar setting, but comparing by the slice is a method he has never used. (iii) Less familiar and routine — a workplace new to him, but reading a chart and adding times are practised steps. (iv) Less familiar and new — a one-off fundraiser nobody has costed before. (b) Mario's: $\$18 \div 8 = \$2.25$ per slice. Luigi's: 2 pizzas cut into 6 slices each is $2 \times 6 = 12$ slices, so $\$20 \div 12 = 1.6666\dots$, which to the nearest cent is $\$1.67$ per slice (the digits after the cents are 66..., so round up). Luigi's is cheaper per slice. (c) (iii) Cycle time: $12 + 18 + 10 = 40$ minutes. (iv) Sausages: $150 \times \$0.80 = \$120.00$.

Q13. (a) Wednesday, at 3°C — the shortest bar. (b) Above 5°C : Tuesday (6°C) and Friday (7°C). Thursday sits exactly on the limit, and the rule allows 5°C or below, so Thursday is fine. (c) Routine — the same check, every morning, at a set time, with practised steps — and familiar, because it is her own café and her own fridge.

Q14. (a) Entry fees: $24 \times \$7.50 = \$180.00$. (b) Whole excursion: $\$180.00 + \$280.00 = \$460.00$. (c) Less familiar context (the student has never been on the planning side of an excursion) and new task (no practised steps for costing one). "Less familiar" does not mean hard maths: the maths inside is one multiplication ($24 \times \$7.50$) and one addition ($\$180.00 + \$280.00$), both routine steps.

Q15. (a) Start 7:45 am; add 5 hours to get 12:45 pm; add 30 minutes to get 1:15 pm; add the 45-minute break to get 2:00 pm. So Sam finishes at 2:00 pm. (b) Paid time: 5 hours 30 minutes minus the 45-minute unpaid break. 5 hours 30 minutes is 330 minutes; $330 - 45 = 285$ minutes; 285 minutes is 4 hours 45 minutes. (c) Familiar context (his own job, his own roster) and routine task (the same shift shape every Saturday for a year, so reading it is practised).

Q16. Answers vary with your own life. A model set: familiar and routine — totalling your own hours on the same timesheet every Friday; familiar and new — choosing between two new bulk-buy deals at your usual supermarket; less familiar and routine — taking money on the register on your first shift at a café, using a register you have used before; less familiar and new — planning the seating for a one-off family reunion. (c) The labels belong to the person meeting the task, not to the task: your setting and your practised steps are different from your classmate's, so the same job can be familiar to one of you and less familiar to the other.

Q17. (a) Notes: $5 \times \$20 = \$100$, $3 \times \$10 = \$30$, $8 \times \$5 = \$40$; total $\$100 + \$30 + \$40 = \$170$. (b) Counting the tin: familiar context and routine task (the same count at every carnival). Planning the raffle: less familiar context and new task (a one-off plan nobody has made before). (c) Still needed: $\$300 - \$170 = \$130$. Tickets at $\$2$ each: $\$130 \div \$2 = 65$ tickets. Check: $65 \times \$2 = \$130$.

Q18. (a) Disagree. In Q14 the excursion costing is a less familiar context and a new task for the student, yet the maths inside is one multiplication and one addition — routine steps. A less familiar context tells you to read slowly; it says nothing about how hard the arithmetic is. (b) *Familiar* and *less familiar* tell you whether the person knows the setting the maths sits in. *Routine* and *new* tell you whether the steps are practised from doing that job regularly. Neither pair measures the difficulty of the maths or the ability of the person.

Chapter 01 — Test A (multiple choice)

Chapter 01: The problem-solving cycle and mathematical toolkit (Sections 1A to 1G). Answer all 12 questions. Each question is worth 1 mark, so Section A is worth 12 marks. Suggested time: 20 minutes.

Materials: pen, paper and a basic scientific calculator. No other technology is needed.

Choose the one best answer for each question and write its letter on the question paper.

About the data in this test. Every name, price, time and measurement here is **made up** (not real). The situations are invented to give you practice; they do not report facts about any real person, business or place.

Section A — Multiple-choice questions

Question 1

Jo has worked out the exact cost of her order. She now compares that cost with the estimate she made before calculating, to see whether the exact cost is reasonable. Which stage of the problem-solving cycle is Jo in?

- A. act on and use mathematics
- B. evaluate and reflect
- C. communicate and report
- D. identify the mathematics

Question 2

A community bus holds 22 passengers. A group of 58 people is going on a trip, everyone must travel on the same run, and no one can be left behind. How many buses are needed?

- A. 2
- B. 2.64
- C. 3
- D. 14

Question 3

A club is working out the total entry cost for its group at a pool party. The notice on the wall reads:

Entry: \$4.50 per person. 12 people from the club are going. The pool is 25 m long. Doors open at 6 pm.
Bring your own towel.

Which list gives only information that is **not** needed to work out the total entry cost?

- A. the 25 m pool and the 6 pm doors
- B. the \$4.50 price and the number of people
- C. the number of people and the 6 pm doors
- D. the \$4.50 price and the towel reminder

Question 4

A club buys 3 boxes of drinks at \$4.60 per box, plus a \$6.25 delivery fee. What is the total cost?

- A. \$32.55
- B. \$13.80
- C. \$20.05
- D. \$10.85

Question 5

Mia buys 9 pots of flowers at \$12.40 each. Her calculator display shows 11.16. Which statement is correct?

- A. The display is correct, because \$11.16 is a sensible price for one pot.
- B. The display is wrong: the estimate $9 \times \$12 = \$108$ means the total is exactly \$108.00.
- C. The display is correct, because 11.16 rounds to \$11.20, which is close to \$12.40.
- D. The display is wrong: the estimate $9 \times \$12 = \$108$ means the total sits near \$108, but 11.16 is about one tenth of that, so the decimal point has slipped one place.

Question 6

Ravi has \$60 to spend. Pens cost \$4.50 each. What is the greatest number of pens Ravi can buy?

- A. 13
- B. 12
- C. 13.33
- D. 14

Question 7

Three friends share an \$80 restaurant bill equally. The calculator shows $80 \div 3 = 26.666666$. Which sentence reports each friend's share correctly, to the nearest cent?

- A. Each friend pays 26.666666.
- B. Each friend pays \$26.66, to the nearest cent.
- C. Each friend pays \$26.67, to the nearest cent.
- D. Each friend pays \$26.7.

Question 8

A gardener measures the height of a seedling at the end of each week for 8 weeks. She wants to show how the height changed over the 8 weeks. Which display is the best choice?

- A. a pie chart
- B. a line graph
- C. a bar chart
- D. a table of the 8 measurements

Question 9

A kitchen dial scale has labels at 200 g and 300 g, with 5 small spaces between the two labels. The needle sits 2 small spaces past the 200 g label. What does the scale read?

- A. 240 g
- B. 204 g
- C. 220 g
- D. 250 g

Question 10

A work roster shows a shift finishing at 21:15. What is the same time on a 12-hour clock?

- A. 9:15 am
- B. 11:15 pm
- C. 21:15 pm
- D. 9:15 pm

Question 11

Tai opens his bank's website himself to check his balance. The bank's own web address is bayviewbank.com.au. Which address shows Tai is on the bank's real, secure site?

- A. <http://bayviewbank.com.au/login>
- B. <https://bayview-secure.top/login>
- C. <https://bayviewbank.com.au/login>
- D. <https://bayviewbank.com.au.fixnow.xyz/login>

Question 12

Today is Hana's first day at a new warehouse. She is handed a scanner gun she has never used before and shown a delivery door she has never seen. For Hana today, what are the correct labels for scanning parcels with the gun?

- A. familiar context, routine task
- B. familiar context, new task
- C. less familiar context, routine task
- D. less familiar context, new task

End of Section A

Test A — Answers

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

Test A — Fully-worked solutions

Q1. B. Comparing the exact answer with the estimate to judge whether it is reasonable is stage 3, evaluate and reflect (§1A). Identify the mathematics (D) comes first — finding out what the question needs; act on and use mathematics (A) is the stage where Jo did the calculating, estimate included; communicate and report (C) is the stage where she tells someone the result. If the comparison had failed, Jo would loop back to stage 2 and do the mathematics again.

Q2. C. $58 \div 22$ gives 2 whole buses with 14 people left over, because $58 = 2 \times 22 + 14$. The 14 people still need a bus, so round **up**: 3 buses are needed (§1A, §1C). Check: $3 \times 22 = 66$ seats, which covers all 58 people. A leaves 14 people behind, B is not a whole number of buses, and D is the number of people left over, not the number of buses.

Q3. A. The total entry cost needs only the price and the number of people: $12 \times \$4.50 = \$54.00$. The length of the pool and the door time say nothing about cost, so A is the list that holds only information that is not needed (§1B). B lists the two facts that are needed, and C and D each mix one needed fact with one that is not needed.

Q4. C. Multiply before adding (§1A, §1F): $3 \times \$4.60 = \$13.80$, then $\$13.80 + \$6.25 = \$20.05$. A adds the fee to one box's price first and then multiplies: $3 \times \$10.85 = \$32.55$. B forgets the delivery fee, and D counts one box instead of three.

Q5. D. Estimate with friendly numbers: $9 \times \$12 = \$108$, so the true total sits near \$108 (§1C). The display reads 11.16, which is about one tenth of that — the decimal point has slipped one place. The correct total is $9 \times \$12.40 = \$111.60$, and $11.16 \times 10 = 111.60$ recovers it. A mistakes the total for a single price — one pot costs \$12.40, not \$11.16. B treats the estimate as if it were the exact total. C rounds a wrong display and calls it correct.

Q6. A. $\$60 \div \$4.50 = 13.33\dots$ Only whole pens count, and Ravi cannot spend money he does not have, so round **down**: 13 pens (§1C). Check both sides: $13 \times \$4.50 = \$58.50$, which fits inside \$60, while $14 \times \$4.50 = \$63.00$, which does not. B leaves \$1.50 unused when a 13th pen would fit, C is not a whole number of pens, and D costs \$3.00 more than Ravi has.

Q7. C. Money runs to two decimal places. In 26.666666 the third decimal digit is 6, which is 5 or more, so the share rounds **up** to \$26.67, and the sentence must carry the units and state the rounding (§1D). A reports the raw display with no units and no rounding, B chops the extra digits off instead of rounding, and D writes money to only one decimal place — \$26.7 is not a money amount.

Q8. B. The gardener records one quantity (height) at regular times and wants to show how it changed — a line graph is the representation for a change over time (§1D). A pie chart shows shares of one whole, and no whole is being shared here (A). A bar chart compares separate categories, while these readings are a sequence of weeks (C). A table gives the exact heights but does not show the rise and fall at a glance (D).

Q9. A. Four steps for any scale (§1E): the gap between the labels is $300 - 200 = 100$ g and there are 5 spaces, so one space $= 100 \div 5 = 20$ g. Count on from the label: $200 + 2 \times 20 = 240$ g. B counts one space as 2 g, C counts one space as 10 g, and D is a halfway guess between the two labels.

Q10. D. 21:15 is after 12:00 noon, so subtract 12 and tag the time with pm: $21 - 12 = 9$, giving 9:15 pm (§1E). A drops the pm tag, B subtracts 10 instead of 12, and C puts pm on a 24-hour time — a 12-hour clock never shows an hour above 12.

Q11. C. Two signs mark the bank's real site (§1F): https at the front, and the owner name — the part at the **end** of the address, before the first single slash — is the bank's own, bayviewbank.com.au. Only C has both. A has no s, so the connection is not secure. B's owner is bayview-secure.top and D's owner is bayviewbank.com.au.fixnow.xyz: in both, the bank's name is decoration glued on the front and the site belongs to someone else.

Q12. D. The warehouse is new to Hana — a first day makes the context **less familiar** — and she has never used the scanner gun, so she has no practised steps to follow: the task is **new** (§1G). New does not mean hard; it means plan first. A and B call the context familiar, which it cannot be on day one, and C calls the task routine, which needs practised steps Hana does not have yet.

Chapter 01 — Test B (written response)

Chapter 01: The problem-solving cycle and mathematical toolkit (Sections 1A to 1G). Answer all eight questions in the spaces provided. Section B is worth 40 marks. Suggested time: 45 minutes.

Materials: pen, paper and a basic scientific calculator. No other technology is needed.

Show your working. Where a question asks you to round, use the precision the question states, and say what you rounded to.

About the data in this test. Every name, price, time and measurement here is **made up** (not real). The situations are invented to give you practice; they do not report facts about any real person, business or place.

Section B

Question 1 (5 marks)

Noah buys 6 notebooks at \$3.25 each and pays with a \$50 note. Use the four stages of the problem-solving cycle to answer parts a to d.

a. Stage 1, identify the mathematics: write down the two amounts Noah needs to find. 1 mark

b. Stage 2, act on and use mathematics: round \$3.25 to the nearest dollar and use it to estimate the cost of the 6 notebooks. 1 mark

c. Stage 2: find the exact cost of the 6 notebooks, and the change Noah receives from the \$50 note. 2 marks

d. Stage 3, evaluate and reflect: use your estimate to say whether your exact cost is reasonable, and explain why. 1 mark

Question 2 (5 marks)

A council is hosting a morning tea for volunteers. The venue's message reads:

Room hire: \$80 for the morning. Catering: \$6.75 per person. 30 people are coming. The room has 50 chairs. Bookings close on Friday. Weather forecast: 22 °C and sunny.

a. Write down the aim of this task in one sentence. 1 mark

b. Name two facts in the message that this task does not need. 1 mark

c. Find the total cost of the morning tea for 30 people. 2 marks

d. The council has budgeted \$300. Does the morning tea fit within the budget? Give the amount it is under or over. 1 mark

Question 3 (6 marks)

A sports club buys 7 bags of oranges at \$5.80 per bag.

a. Estimate the total cost by rounding \$5.80 to the nearest dollar.

1 mark

b. Find the exact total cost.

1 mark

c. The till prints \$406.00 as the total. Use your estimate to explain why this cannot be right, name the likely slip, and give the correct total.

2 marks

d. Three committee members share the exact total equally, to the nearest cent. Find each person's share, and the total of the three rounded shares.

2 marks

Question 4 (5 marks)

(i) A student's draft report has two lines: 32 kg and \$ 9 . 5.

(ii) A 145 cm plank is cut into 6 equal pieces. The calculator shows $145 \div 6 = 24.166666$.

(iii) A club wants to show how the money it raised changed from month to month across one year.

a. Rewrite the two lines in (i) using this book's conventions: a space between the number and the unit, and money to two decimal places.

2 marks

b. Write a result sentence for the length of one piece in (ii), correct to 2 decimal places.

2 marks

c. For (iii), name the best display and give one reason for your choice.

1 mark

Question 5 (5 marks)

A measuring jug has labels at 400 mL and 600 mL, with 4 small spaces between the two labels. The surface of the milk in the jug sits 3 small spaces past the 400 mL label.

a. Find the value of one small space. 1 mark

b. How much milk is in the jug? 1 mark

c. A recipe needs exactly 1 L of milk. How many more millilitres must be added to the jug? 1 mark

d. Name the best tool for each job: (i) measuring the distance around a 500 m park path; (ii) checking that a workbench is level before tiling. 2 marks

Question 6 (4 marks)

A work roster shows a shift starting at 14:50. The shift runs for 3 hours 40 minutes.

a. Write the start time in 12-hour time with am or pm. 1 mark

b. How many minutes long is the shift? 1 mark

c. Find the finishing time. Give it in 12-hour time with am or pm. 2 marks

Question 7 (5 marks)

(i) In a pay spreadsheet, cell A2 holds 8 (the hours worked) and cell B2 holds 23.50 (the hourly rate in dollars).

(ii) An online store shows a subtotal of \$150 before GST. GST of 10 % is added at checkout.

(iii) Tai receives this text message: "Bayview Bank: your account is locked. Verify today at bayview-secure.fixnow.top."

a. Write the formula that goes in cell C2 to find the pay for the shift, and the number that C2 shows. 2 marks

b. Find the GST, and the total at checkout. 2 marks

c. Give two warning signs that the message in (iii) is a scam. 1 mark

Question 8 (5 marks)

Omar has stacked shelves at the same store every Saturday for a year. Today the manager hands him two supplier quotes for cartons of the same product and asks him to work out which quote is cheaper per carton — something Omar has never done before. Quote 1 is \$180 for 12 cartons; quote 2 is \$136 for 8 cartons.

a. Give both labels for the Saturday shelf-stacking job: the context (familiar or less familiar) and the task (routine or new). 1 mark

b. Give both labels for the quote job today. 1 mark

c. Find the cost per carton of each quote, to the nearest cent. 2 marks

d. Does a new task always mean hard maths? Answer in one sentence, using the maths in part c as your example. 1 mark

End of Section B

Test B — Answers

Q1. (a) the total cost of the 6 notebooks, and the change from \$50. (b) \$18. (c) \$19.50; change \$30.50. (d) reasonable — the exact cost sits \$1.50 above the estimate, which rounded the price down.

Q2. (a) e.g. “Work out the total cost of the morning tea for 30 people.” (b) any two of: the 50 chairs, the Friday booking deadline, the weather forecast. (c) \$282.50. (d) yes; \$17.50 under budget.

Q3. (a) \$42. (b) \$40.60. (c) \$406.00 is about ten times the estimate, so the decimal point slipped one place; the correct total is \$40.60. (d) \$13.53 each; the three rounded shares total \$40.59.

Q4. (a) (i) 32 kg (ii) \$9.50. (b) e.g. “Each piece is 24.17 cm long, to 2 decimal places.” (c) line graph — it shows a change over time.

Q5. (a) 50 mL. (b) 550 mL. (c) 450 mL. (d) (i) trundle wheel (ii) spirit level.

Q6. (a) 2:50 pm. (b) 220 minutes. (c) 6:30 pm.

Q7. (a) $=A2 * B2$; C2 shows 188.00, so the pay is \$188.00. (b) GST \$15.00; total \$165.00. (c) any two of: urgency and pressure (“locked”, “today”); the address owner is fixnow.top, not the bank; an unexpected message asking Tai to verify his details.

Q8. (a) familiar context, routine task. (b) familiar context, new task. (c) quote 1: \$15.00 per carton; quote 2: \$17.00 per carton. (d) no — the maths in (c) is two routine divisions; “new” means no practised steps for the job itself, not hard maths.

Test B — Fully-worked solutions

Q1. (a) Stage 1 identifies the mathematics: the two amounts are the total cost of the 6 notebooks and the change from the \$50 note (§1A). (b) \$3.25 rounds down to \$3, because 25 cents is below the halfway point of 50 cents. The estimate is $6 \times \$3 = \$18$. (c) The exact cost is $6 \times \$3.25 = \$19.50$, and the change is $\$50.00 - \$19.50 = \$30.50$. (d) Stage 3 compares the two: \$19.50 sits \$1.50 above the \$18 estimate. The estimate rounded the price down, so the exact total should sit a little higher — it does, and the gap is small against an \$18 estimate, so the exact cost is reasonable (§1A, §1C).

Q2. (a) The aim, e.g. “To work out what the morning tea will cost the council” (§1B). (b) The questions ask only about cost, so any two of these facts are not needed: the 50 chairs, the Friday booking deadline and the weather forecast (§1B). (c) Catering: $30 \times \$6.75 = \$202.50$. Total: $\$202.50 + \$80.00 = \$282.50$. (d) $\$300.00 - \$282.50 = \$17.50$, so the morning tea fits the budget with \$17.50 to spare.

Q3. (a) \$5.80 rounds up to \$6, so the estimate is $7 \times \$6 = \$42$ (§1C). (b) The exact total is $7 \times \$5.80 = \$40.60$. (c) The estimate says the total sits near \$42, so \$406.00 — about ten times the estimate — cannot be right. The decimal point has slipped one place; moving it back gives \$40.60, which matches part (b) (§1C). (d) $\$40.60 \div 3 = 13.5333\dots$ The third decimal digit is 3, below 5, so each share rounds down to \$13.53, to the nearest cent. The three rounded shares total $3 \times \$13.53 = \$40.59$, one cent short of \$40.60, because each share lost a fraction of a cent in the rounding (§1C, §1D).

Q4. (a) (i) 32 kg — a space goes between the number and the unit. (ii) \$9.50 — money always runs to two decimal places, so the trailing zero must show (§1D). (b) In 24.166666 the third decimal digit is 6, which is 5 or more, so the length rounds up to 24.17 cm. A result sentence answers the question, carries the unit and states the rounding: “Each piece is 24.17 cm long, to 2 decimal places.” Check: $6 \times 24.17 = 145.02$ cm, close to the 145 cm plank, so the rounding is right (§1D). (c) A line graph — it shows one quantity (money raised) changing over time. A bar chart would compare the months as separate categories and hide the trend, and a table gives exact amounts but no picture of the change (§1D).

Q5. (a) Four steps for any scale (§1E): the gap is $600 - 400 = 200$ mL and there are 4 spaces, so one space $= 200 \div 4 = 50$ mL. (b) Count on from the label: $400 + 3 \times 50 = 550$ mL of milk. (c) 1 L is 1 000 mL, so $1\,000 - 550 = 450$ mL more must be added. (d) (i) Trundle wheel — it clicks off metres over long outdoor distances, and a tape measure is too short for a path. (ii) Spirit level — its bubble sits between the centre lines when a surface is level.

Q6. (a) 14:50 is after noon, so subtract 12 and tag with pm: $14 - 12 = 2$, giving 2:50 pm (§1E). (b) Time counts in 60s, not in decimals: $3 \times 60 + 40 = 220$ minutes. (c) Count on in chunks: 14:50 plus 3 hours is 17:50; plus 10 minutes is 18:00; plus 30 more is 18:30. Subtract 12 and tag with pm: the shift finishes at 6:30 pm (§1C, §1E).

Q7. (a) A formula starts with = and refers to cells, not typed numbers: $=A2 * B2$. C2 shows $8 \times 23.50 = 188.00$, so the pay is \$188.00 (§1F). (b) GST is 10% of the pre-GST price, and 10% means divide by 10: $\$150 \div 10 = \$15.00$. The total is $\$150.00 + \$15.00 = \$165.00$ (§1F). (c) Any two of: the message pushes urgency and pressure — “locked” and “today”; the address owner is fixnow.top, not the bank, with the bank’s name glued on the front as decoration; it is a message Tai did not expect, asking him to verify account details — the rule is never to type personal details into a site reached from a message (§1F).

Q8. (a) The store is Omar’s own workplace of a year, so the context is **familiar**; stacking shelves every Saturday is a job with practised steps, so the task is **routine** (§1G). (b) The store is still a familiar context, but Omar has never costed quotes before — no practised steps exist for that job — so the task is **new**: familiar context, new task. (c) “Per” means divide: quote 1 is $\$180 \div 12 = \$15.00$ per carton and quote 2 is $\$136 \div 8 = \$17.00$ per carton. Both divide exactly, so rounding to the nearest cent changes nothing. Quote 1 is cheaper by \$2.00 per carton. (d) No — new is not the same as hard: the maths inside part (c) is two divisions, both routine steps. “New” says only that Omar has no practised plan for the job itself, so he should plan his steps first with the problem-solving cycle (§1G, §1A).