

VCE VM Numeracy Unit 2

Chapter 1 — The problem-solving cycle and mathematical toolkit

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

Attribution: Classbasics Pty Ltd, vwx.au

Distribution note: this document may be distributed, and whole pages may be removed from it, provided only WHOLE pages are removed (never part of a page). This allows teachers to remove tests, exams and subtopics they do not want to issue.

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

Significant effort has been made to ensure this content is legal. Please send any areas of concern to admin@vwx.au with appropriate document/legal references so errors can be verified and changes be made.

Contents

Section	Page
1A The four-stage problem-solving cycle	2
1B Identify the mathematics: from real-world context to maths plan	15
1C Estimate, check and reflect: is the answer reasonable?	27
1D Communicate and report results	40
1E The analogue toolkit: measuring and everyday tools	55
1F The digital toolkit: calculators, spreadsheets, apps and online safety	69
1G Numeracy words: familiar, unfamiliar and routine	83
Chapter 1 — Test A (multiple choice)	95
Test A — Answers	99
Test A — Fully-worked solutions	100
Chapter 1 — Test B (written response)	102
Test B — Answers	106
Test B — Fully-worked solutions	107

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

Theory

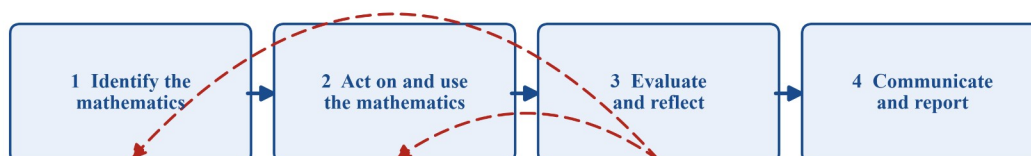
What is a numeracy task? In this book, a *numeracy task* is any everyday job with mathematics inside it. Ordering materials for a worksite. Reading a tram timetable. Packing fruit into boxes. Working out whether you have enough money. The mathematics never comes with a label on it — you have to find it, do it, check it, and report it. This unit teaches you a dependable way to do all four of those things: the **problem-solving cycle**.

The study design (Unit 2, Outcome 2) builds the whole subject on this cycle. The cycle has four separate stages, and you always take them in the same order: first find the mathematics in the task, then do the mathematics, then check your answer and think about it, and last report your results.

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

The four stages. Here is the whole cycle on one page. Learn this table — every worked example, question and test in this book uses it.

Stage	Name	What you do	Key question to ask yourself
1	Identify the mathematics	Read the task. Find the numbers and words that matter. Decide what you are asked to find. Choose a plan — and a tool, if you need one.	What do I need to find, and how will I find it?
2	Act on and use the mathematics	Estimate first. Then do the mathematics carefully, one step per line.	Have I estimated? Is my working neat and careful?
3	Evaluate and reflect	Check the answer against your estimate. Check it against the real world. If a check fails, loop back.	Does my answer pass the estimate check and the real-world check?
4	Communicate and report	Write or say your answer clearly, with units, so somebody else can follow it.	Is my answer clear to someone else?



check failed? loop back

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

Stage 1 — identify the mathematics. Stage 1 turns the words of the task into mathematics. Find the question being asked (“How much ...?”, “How many ...?”, “Which is cheaper?”). Find the numbers that matter. Then choose an operation — addition, subtraction, multiplication or division — or a short chain of them. The refresher below helps you pick the operation from the words in the task.

Refresher: the four operations. These word signals tell you which operation a task needs.

Signal words in the task	Operation	Quick example
total, sum, altogether, add on	addition (+)	“Find the total cost” — add the costs
change, difference, how much more, left over, take away	subtraction (−)	“Find the change” — subtract
each, per, every, the same amount repeated	multiplication (×)	“3 boxes of 12” means $3 \times 12 = 36$
shared equally, split up, how many groups fit	division (÷)	“shared equally among 8 people” — divide by 8

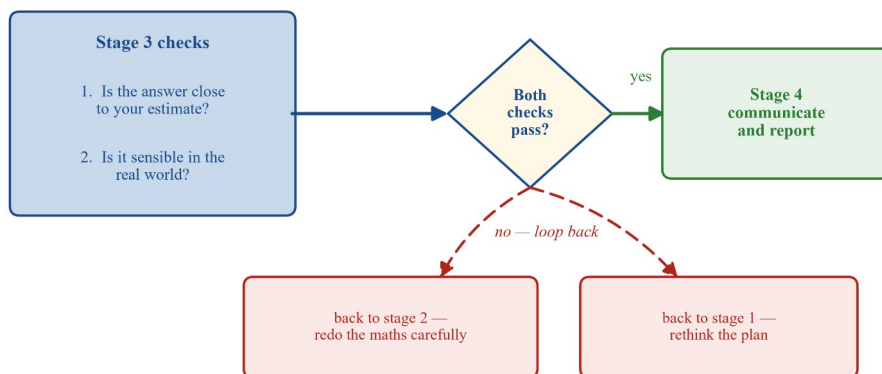
Stage 2 — act on and use the mathematics. Stage 2 is the doing stage. Two habits make it safe. Habit one: **estimate first** — do a quick, rough calculation before the exact one, so stage 3 has something to compare with. Habit two: **work carefully** — one step per line, written neatly, so you (or your teacher) can see where any mistake happened. You can do the mathematics in your head, on paper, with a calculator, or with measuring tools, spreadsheets and phone apps — sections 1E and 1F cover those tools, your **mathematical toolkit**.

Refresher: rounding for estimating. To estimate, round each number to an easy number first, then do the easy calculation. Round \$6.50 to \$7 (nearest dollar). Round 580 to 600 (nearest hundred). Round \$0.58 to \$0.60 (nearest 10 cents). If the last digit you drop is 5 or more, round up; if it is 4 or less, round down. An estimate does not have to be exact — it only has to be close enough to catch big mistakes.

Stage 3 — evaluate and reflect. In stage 3 you judge your own answer with two checks:

1. the **estimate check** — is your exact answer close to your estimate?
2. the **real-world check** — does the answer make sense in the situation? You cannot need 3.5 boxes if boxes are sold whole, and you cannot pay \$260 for four \$6.50 light switches.

If a check fails, the cycle lets you go back: to stage 2 to redo the mathematics, or to stage 1 to rethink the plan. This going back is why it is called a **cycle**, not a straight line.



Stage 4 — communicate and report. In stage 4 you hand your answer to the world. Write a full sentence with units: “The four light switches cost \$26.00.” Sometimes a report is more than a sentence — a table, a diagram or a labelled drawing can say more than words. Section 1D covers reporting in more depth.

How big are the tasks in this unit? Small. In this unit, every task can be done in **one or two steps** — or a few similar steps repeated, like two multiplications and then an addition. You will not face long chains of mathematics. The tasks come from contexts you know well (*familiar*), things people do regularly (*routine*), and some that are a little new to you (*less familiar*). Section 1G explains those words.

Help is part of the plan. At this level, your teacher may prompt you at any stage — a nudge like “What is the question asking?” or “Have you checked your answer?”. The study design expects this. Getting a prompt is not failing; using it well is the skill.

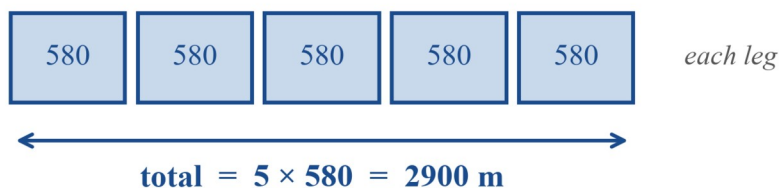
Units 3 & 4 preview. In Units 3 and 4, the same four stages are used on longer tasks with more steps and less familiar contexts — that level is beyond this book and is not assessed in this book’s tests.

Worked model: the cycle on a small task. Watch the four stages run on a task that takes about a minute.

Tane is training for a weekend hike. His fitness app records his training walk as 5 legs of 580 m each. How far does Tane walk in total?

Stage	What Tane does
1 — Identify the mathematics	Find the total distance for 5 equal legs. Equal legs repeated → multiply. Plan: total = 5×580 .
2 — Act on and use the mathematics	Estimate first: round each leg up to 600 m, so $5 \times 600 = 3\,000$ m — expect an answer a little under 3 000. Exact: $5 \times 580 = 2\,900$ m.
3 — Evaluate and reflect	2 900 is close to 3 000, and a little less — which is right, because each leg was rounded up. Real-world check: about 3 000 m is a sensible training walk. Both checks pass.
4 — Communicate and report	“Tane walks 2 900 m in total.”

Estimate: round each leg up to 600 m, so $5 \times 600 = 3\,000$ m.



Notice what the cycle gave Tane: a plan (stage 1), a safety net (the estimate, stage 2), a check on the answer (stage 3), and an answer somebody else can use (stage 4). Stage 2 has no section of its own in this chapter — it is the doing of the mathematics itself, so every chapter of this book practises it. The other three stages each get their own section (1B, 1C and 1D).

The symbol $\therefore$. In this book, answer lines often start with $\therefore$, which means *therefore* — it points to your final answer. For example: $\therefore$ the total distance is 2 900 m.

Where this book goes next. Section 1B practises stage 1 — turning a real-world task into a mathematics plan. Section 1C practises stage 3 — estimating, checking and reflecting. Section 1D practises stage 4 — reporting results clearly. Sections 1E and 1F cover the tools you use in stage 2: measuring and everyday tools, calculators, spreadsheets, phone apps and online safety. Section 1G explains the words *familiar*, *unfamiliar* and *routine*. After chapter 1, chapters 2 to 5 cover this unit’s four areas of study — dimension and direction, data, uncertainty and systematics — and chapter 6 puts everything together in real-life contexts.

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

Examples 1 and 2 are **scaffolded** — each stage is named for you, with teaching comments beside the working. Examples 3 and 4 are **unscaffolded** — clean solutions, in the style your own working should aim for.

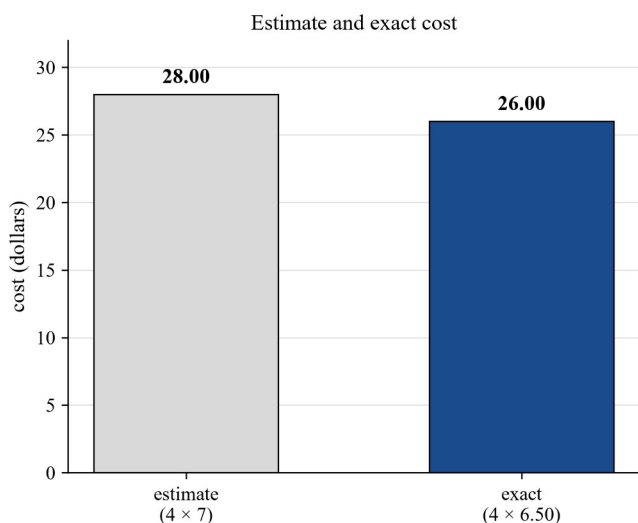


Example 1 — scaffolded

Refresher: multiplying money amounts. Multiplying dollars-and-cents is just ordinary multiplication — keep two decimal places in the answer. For example, $4 \times 2.25 = 9.00$, so 4 items at \$2.25 each cost \$9.00. You can also split it up: $4 \times 2 = 8$ and $4 \times 0.25 = 1$, so $8 + 1 = 9$ dollars.

Hugh is a first-year electrical apprentice (a worker learning the trade). For a job, he buys 4 light switches at \$6.50 each. How much do the switches cost?

Working	Comment
Stage 1 — Identify: find the cost of 4 switches at \$6.50 each. “each” → multiply. Plan: $\text{cost} = 4 \times 6.50$.	Stage 1 turns the words of the task into one calculation and one plan.
Stage 2 — Act: estimate first — round \$6.50 up to \$7, so $4 \times 7 = 28$. Expect an answer a little under \$28. Exact: $4 \times 6.50 = 26.00$, so the cost is \$26.00.	Estimate before you calculate. The estimate is stage 3’s safety net.
Stage 3 — Evaluate: \$26.00 is close to the estimate \$28 — and a little less, which is right because the price was rounded up. Real-world check: 4 switches at just over \$6 each should cost just over \$24, and \$26.00 fits. Both checks pass.	Check twice: close to your estimate, and sensible in the real world.
Stage 4 — Report: “The 4 light switches cost \$26.00.”	A full sentence, with the amount in dollars and cents.



Example 2 — scaffolded

Refresher: division and remainders. When you divide and the number does not split evenly, you get a **remainder** — the amount left over. For example, $25 \div 8 = 3$ remainder 1, because $8 \times 3 = 24$ and $25 - 24 = 1$. In real life, the situation decides what to do with the remainder: you cannot buy part of a box, so you often round up to the next whole one.

Opal is packing peaches at a fruit farm. She has 25 peaches, and each box holds 8 peaches. Boxes must be whole — you cannot use part of a box. How many boxes does Opal need?

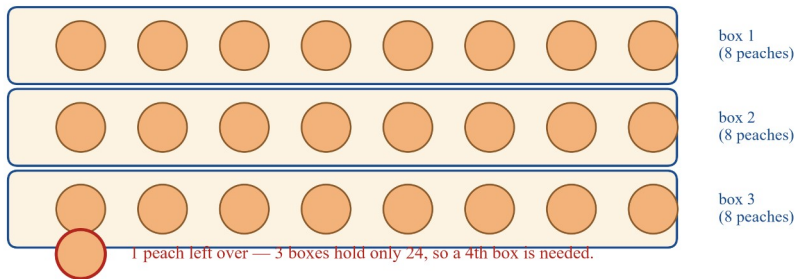
Working	Comment
Stage 1 — Identify: find how many boxes of 8 cover 25 peaches. “how many groups fit” → divide. Plan: $25 \div 8$. Note the real-world rule: boxes must be whole.	Stage 1 includes noticing what kind of answer the real world allows — whole boxes, not part-boxes.
Stage 2 — Act: $25 \div 8 = 3$ remainder 1. So 3 whole boxes hold $3 \times 8 = 24$ peaches.	Using the remainder keeps the working whole — no decimals needed.
Stage 3 — Evaluate: check — do 3 boxes cover all 25 peaches? $24 < 25$, so no: one peach has no box. The	When a check fails, the cycle loops back. Here the real world says to round up.

check fails, so loop back and try 4 boxes: $4 \times 8 = 32$,
and $32 \geq 25$ — 4 boxes cover all the peaches.

Stage 4 — Report: “Opal needs 4 boxes.”

A full sentence, with the unit (boxes).

25 peaches, 8 to a box: $25 \div 8 = 3$ remainder 1



Example 3 — unscaffolded

Refresher: mean and range. The **mean** is the fair-share average: add all the values together, then divide by how many values there are.

$$\text{mean} = \text{total} \div \text{number of values}$$

For example, the mean of 2, 4 and 9 is $(2 + 4 + 9) \div 3 = 15 \div 3 = 5$. The **range** measures the spread of the values:

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

For 2, 4 and 9, the range is $9 - 2 = 7$. A useful check: the mean always sits between the lowest and highest values.

Jasper’s fitness app records how many glasses of water he drinks each day: 3 on Monday, 4 on Tuesday, 2 on Wednesday and 7 on Thursday. Find the mean number of glasses per day over these 4 days, and report your answer in one sentence.

Solution

Stage 1 — Identify. We need the mean number of glasses per day, over 4 days. $\text{mean} = \text{total} \div \text{number of values}$, so the plan is: add the four counts, then divide by 4.

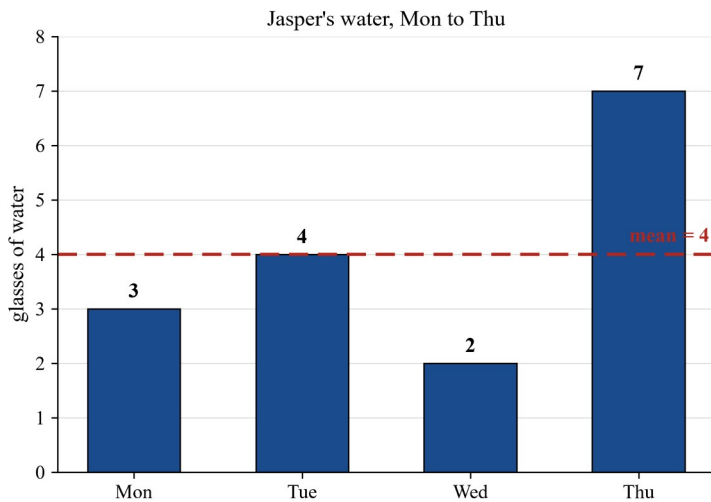
Stage 2 — Act. Estimate: the counts sit between 2 and 7, so the mean should be somewhere in the middle — about 4. Exact working:

$$3 + 4 + 2 + 7 = 16$$

$$\text{mean} = 16 \div 4 = 4 \text{ glasses per day}$$

Stage 3 — Evaluate. The mean must sit between the lowest count (2) and the highest (7) — and 4 does. It also matches the estimate of about 4. Both checks pass.

Stage 4 — Report. ∴ Jasper drank a mean of 4 glasses of water per day.



Example 4 — unscaffolded

Refresher: writing chance. The **probability** of an event is a number from 0 to 1 that says how likely the event is:

$$\text{probability} = \frac{\text{number of ways the event can happen}}{\text{total number of possible outcomes}}$$

Each possible result is called an **outcome**. The same probability can be written as a fraction, a decimal or a percentage: $\frac{1}{4} = 0.25 = 25\%$. A probability of $\frac{1}{2}$ (that is, 0.5 or 50%) is an **even chance** — as likely to happen as not.

Refresher: percentages. A percentage is a number of parts out of 100. Quick shortcuts: 10% of an amount is the amount divided by 10, so 10% of \$60 is \$6. 50% is half (divide by 2). 25% is a quarter (divide by 4), so 25% of 40 is 10.

Lani is playing a board game with friends. On her turn, Lani rolls a standard 1-to-6 die. If it shows an even number — 2, 4 or 6 — she gets a bonus turn. Find the probability that Lani rolls an even number, as a fraction and as a decimal. How does this probability compare with an even chance?

Solution

Stage 1 — Identify. We need the probability of rolling an even number. A standard die has 6 faces, so there are 6 possible outcomes. The even numbers are 2, 4 and 6 — that is 3 ways the event can happen. Plan: probability = $\frac{3}{6}$, then write it as a decimal.

Stage 2 — Act.

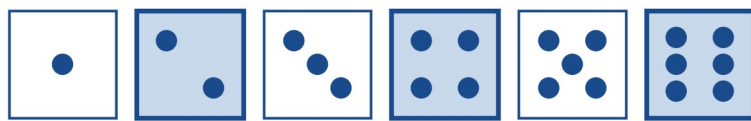
$$P(\text{even}) = \frac{3}{6} = \frac{1}{2}$$

As a decimal: $\frac{1}{2} = 0.5$.

Stage 3 — Evaluate. $0.5 = 50\%$ — exactly an even chance. This makes sense: 3 of the 6 faces are even, so exactly half the faces give Lani a bonus turn. The answer passes the real-world check.

Stage 4 — Report. $\therefore P(\text{even}) = \frac{3}{6} = \frac{1}{2} = 0.5$, which is exactly an even chance.

3 of the 6 faces are even, so probability = $3/6 = 1/2 = 0.5 = 50\%$



exactly an even chance

Practice questions

Do every question with the cycle: identify, act, evaluate, report. In the scaffolded block, the stages are named for you. In the unscaffolded block, run the cycle yourself and show your working — your teacher may prompt you at any stage, and that is part of how this unit works.

Scaffolded

Q1. The problem-solving cycle.

- (a) Write the four stages of the problem-solving cycle, in order.
- (b) Match each key question with its stage (1, 2, 3 or 4): (i) “Does my answer pass the estimate check and the real-world check?” (ii) “What do I need to find, and how will I find it?” (iii) “Is my answer clear to someone else?” (iv) “Have I estimated? Is my working neat and careful?”
- (c) Your stage-3 check fails. Name two stages you could loop back to, and say what you would do at each one.

Q2. Sadie works in an office. The office orders 7 boxes of whiteboard markers at \$4.60 per box.

- (a) Stage 1: write the calculation needed to find the total cost.
- (b) Stage 2: estimate the total cost by rounding \$4.60 to the nearest dollar.
- (c) Stage 2: find the exact total cost, and say in one sentence how it compares with your estimate.

Q3. Dimitri runs a craft morning for children at the community centre. 50 children are coming, and each table seats 12 children.

- (a) How many children can sit at 4 tables?
- (b) Explain why 4 tables are not enough for 50 children.
- (c) How many tables does Dimitri need?

Q4. Cathy works in her family’s homewares store (a shop that sells things for the home). One week she counts the customers each morning: Monday 42, Tuesday 38, Wednesday 45, Thursday 43, Friday 52.

- (a) Find the total number of customers for the week.
- (b) Find the mean number of customers per morning.
- (c) The lowest count is 38 and the highest is 52. Where does your mean sit? Why is that a useful check?

Q5. At a games night, Peggy spins a spinner with 4 equal sections: red, blue, green and yellow.

- (a) Write the probability that the spinner lands on red as a fraction.
- (b) Write this probability as a decimal.
- (c) An even chance is 0.5. Is the probability of red greater than, less than, or equal to an even chance?

Q6. Petra prints 25 photos at the photo kiosk (a self-serve machine) in the shopping centre. Each print costs \$0.58.

- (a) Estimate the cost by rounding \$0.58 to the nearest 10 cents.
- (b) Find the exact cost.
- (c) The kiosk screen shows \$1.45. Use your estimate to explain why the screen is wrong.

Unscaffolded

Q7. Niko's family orders 4 kebabs for delivery. Kebabs cost \$9.75 each, and the delivery fee is \$6.50. Find the total cost of the order, and check your answer with an estimate (round \$9.75 to \$10).

Q8. Isaac has \$50 to spend on paperback books for his holidays. Each paperback costs \$7.50. Find the greatest whole number of paperbacks Isaac can buy, and the change he receives. Show how you know that one more paperback would be too many.

Q9. Tariq is doing a stocktake (a count of everything in the shop) at the tool shop. He counts 48 boxes of screwdrivers, and each box holds 35 screwdrivers. His calculator display shows $48 \times 35 = 16\,800$. Use an estimate (round 48 to 50) to explain why the display is wrong, then find the correct number of screwdrivers.

Q10. Indira's family keeps 5 hens. This week the hens laid 4, 7, 3, 6 and 5 eggs. Find the mean number of eggs per hen, and the range of the counts.

Q11. A standard 1-to-6 die is rolled once.

- (a) Find the probability that the number showing is greater than 4, as a fraction in simplest form.
- (b) Write this probability as a decimal, correct to 2 decimal places.
- (c) An even chance is 0.5. Is this event greater than, less than, or equal to an even chance?

Q12. Wen catches the tram into the city for work. The tram runs north from the stop near Wen's house, and work is a short walk east from the last stop in the city. Wen must be at work by 9:15 am. The morning timetable is shown below (*to depart* means to leave; *to arrive* means to get there).

Tram	Departs the stop	Arrives in the city
1	7:52 am	8:39 am
2	8:24 am	9:11 am
3	8:47 am	9:31 am

Made-up data: the tram times in this table are made up for this section.

- (a) Which tram or trams could Wen catch to be at work by 9:15 am?
- (b) Could Wen catch the 8:47 am tram? Give a reason from the table.
- (c) If Wen misses the 8:24 am tram, what is the earliest time Wen can arrive in the city?

Q13. Esme's local laundromat (a shop with washing machines you pay to use) charges \$4.80 per load of washing. A new laundromat across town charges \$4.35 per load.

- (a) Which laundromat is cheaper, and by how much per load?
- (b) The new laundromat is 6 km from Esme's house. Give one reason, other than the price per load, why Esme might keep using her local one.

- Q14.** A work team of 8 people wins \$1 240 for a workplace safety award, and shares it equally. Find each person's share, and check your answer with a multiplication.
- Q15.** In an online sale, a \$60 desk lamp has 10% off. Find the discount, and the sale price.
- Q16.** A shopper buys 5 kg of potatoes at \$3.40 per kg, and pays with a \$20 note. Find the cost of the potatoes, and the change the shopper receives.
- Q17.** Hugh needs 6 packets of screws for a job, at \$4.85 per packet. He has \$30 to spend on materials.
- (a) By rounding the price up to \$5, explain how Hugh can tell — without working out the exact cost — that 6 packets will fit inside his \$30.
 - (b) Find the exact cost, and check that your explanation in part (a) was correct.
- Q18.** Tane's surf club runs a fundraising barbecue. The club buys 60 sausages at \$0.85 each, and 60 bread rolls at \$0.35 each. The club starts the day with a \$100 float (the money in the tin at the start).
- (a) Find the cost of the sausages.
 - (b) Find the cost of the bread rolls.
 - (c) Find the total cost of the food, and how much of the \$100 float is left at the end.
-

Answers

Q1. (a) 1 identify the mathematics; 2 act on and use the mathematics; 3 evaluate and reflect; 4 communicate and report. (b) (i) stage 3 (ii) stage 1 (iii) stage 4 (iv) stage 2. (c) Stage 2 — redo the mathematics carefully; or stage 1 — rethink the plan.

Q2. (a) 7×4.60 . (b) \$35. (c) \$32.20 — close to, and a little under, the estimate \$35.

Q3. (a) 48 children. (b) 48 is less than 50 — 2 children would have no seat. (c) 5 tables.

Q4. (a) 220 customers. (b) 44 customers. (c) 44 sits between 38 and 52 — the mean must always sit between the lowest and highest values.

Q5. (a) $\frac{1}{4}$. (b) 0.25. (c) Less than an even chance.

Q6. (a) \$15.00. (b) \$14.50. (c) The estimate is about \$15, but \$1.45 is about one-tenth of that — the screen moved the decimal point.

Q7. \$45.50 (estimate: \$46.50 — close).

Q8. 6 paperbacks; change \$5.00 (7 would cost \$52.50, which is more than \$50).

Q9. Estimate: $50 \times 35 = 1750$; the display 16 800 is about ten times too big. Correct: 1 680 screwdrivers.

Q10. Mean 5 eggs; range 4.

Q11. (a) $\frac{1}{3}$. (b) 0.33 (to 2 decimal places). (c) Less than an even chance.

Q12. (a) The 7:52 am and 8:24 am trams. (b) No — it arrives at 9:31 am, which is after 9:15 am. (c) 9:31 am.

Q13. (a) The new laundromat, by \$0.45 per load. (b) Example: travelling 6 km costs time and petrol, so the small saving may be lost.

Q14. \$155 each (check: $8 \times 155 = 1240$).

Q15. Discount \$6; sale price \$54.

Q16. Cost \$17.00; change \$3.00.

Q17. (a) Rounding up gives an over-estimate: $6 \times 5 = 30$; the true cost must be less, so it fits. (b) \$29.10, which is under \$30.

Q18. (a) \$51.00. (b) \$21.00. (c) Total \$72.00; \$28.00 left.

Fully-worked solutions

Q1. (a) In order: 1 identify the mathematics; 2 act on and use the mathematics; 3 evaluate and reflect; 4 communicate and report.

(b)

(i) Stage 3 — the estimate check and the real-world check are the stage-3 checks. (ii) Stage 1 — finding what to do and planning it. (iii) Stage 4 — reporting so somebody else can follow. (iv) Stage 2 — estimating and working carefully.

(c) Loop back to stage 2 and redo the mathematics carefully (the plan may be right but the working wrong), or loop back to stage 1 and rethink the plan (the wrong calculation may have been chosen).

$\therefore$ the cycle runs identify $\rightarrow$ act $\rightarrow$ evaluate $\rightarrow$ report, and a failed check loops back to stage 1 or stage 2.

Q2. (a) “per box” $\rightarrow$ multiply: $\text{cost} = 7 \times 4.60$.

(b) Estimate: round \$4.60 up to \$5, so $7 \times 5 = 35$ — about \$35.

(c) Exact: $7 \times 4.60 = 32.20$. This is close to \$35, and a little under — which is right, because the price was rounded up for the estimate.

$\therefore$ the total cost is \$32.20.

Q3. (a) 4 tables seat $4 \times 12 = 48$ children.

(b) $48 < 50$: with 4 tables, $50 - 48 = 2$ children would have no seat, so 4 tables fails the real-world check.

(c) Try 5 tables: $5 \times 12 = 60$, and $60 \geq 50$ — everyone has a seat.

$\therefore$ Dimitri needs 5 tables.

Q4. (a) Total = $42 + 38 + 45 + 43 + 52 = 220$ customers.

(b) Mean = $220 \div 5 = 44$ customers per morning.

(c) The mean 44 sits between the lowest count (38) and the highest (52). The mean must always sit between the lowest and highest values, so this is a quick check that catches addition or division mistakes.

$\therefore$ the total is 220 customers and the mean is 44 customers per morning.

Q5. (a) 1 red section out of 4 equal sections: $P(\text{red}) = \frac{1}{4}$.

(b) $\frac{1}{4} = 0.25$.

(c) $0.25 < 0.5$, so red is less likely than an even chance.

$\therefore P(\text{red}) = \frac{1}{4} = 0.25$, which is less than an even chance.

Q6. (a) Estimate: round \$0.58 up to \$0.60, so $25 \times 0.60 = 15.00$ — about \$15.00.

(b) Exact: $25 \times 0.58 = 14.50$, so the cost is \$14.50.

(c) The exact cost, \$14.50, is close to the estimate of \$15.00. The screen’s \$1.45 is about one-tenth of \$14.50 — nowhere near the estimate, so the screen must be wrong (the kiosk moved the decimal point).

$\therefore$ the prints cost \$14.50, and the \$1.45 on the screen is wrong.

Q7. Stage 1: total cost = $(4 \times \text{price of one kebab}) + \text{delivery fee}$. Stage 2: $4 \times 9.75 = 39.00$, so total = $39.00 + 6.50 = 45.50$. Estimate: $4 \times 10 + 6.50 = 46.50$. Stage 3: \$45.50 is close to \$46.50, and a little under — right, because the kebab price was rounded up.

$\therefore$ the total cost of the order is \$45.50.

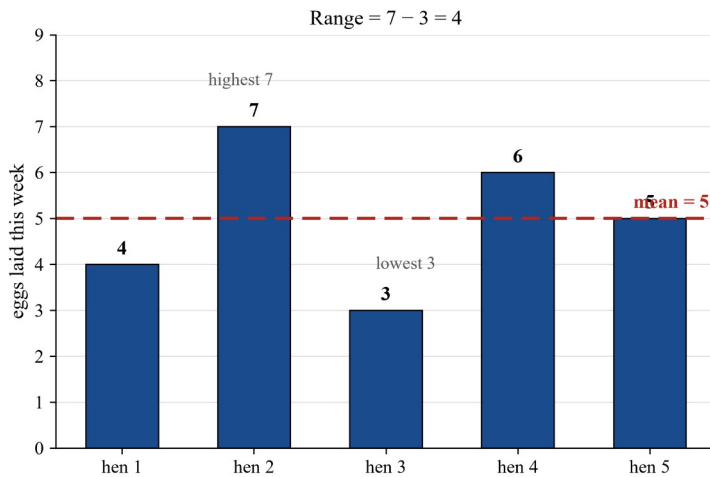
Q8. Test whole numbers of books by multiplying: $6 \times 7.50 = 45.00$ — this fits inside \$50. One more: $7 \times 7.50 = 52.50$ — this is more than \$50, so 7 books is too many. Change: $50.00 - 45.00 = 5.00$.

$\therefore$ Isaac can buy 6 paperbacks and receives \$5.00 change.

Q9. Estimate: round 48 up to 50, so $50 \times 35 = 1750$. The display, 16 800, is about ten times the estimate — far too big to be right (the decimal point moved). Exact: $48 \times 35 = 1680$. Check: 1 680 is close to 1 750, so the exact answer passes.

$\therefore$ there are 1 680 screwdrivers, and the display 16 800 was wrong — about ten times too big.

Q10. Total = $4 + 7 + 3 + 6 + 5 = 25$ eggs. Mean = $25 \div 5 = 5$ eggs per hen. Check: the mean 5 sits between the lowest count (3) and the highest (7) — it passes. Range = $7 - 3 = 4$.



$\therefore$ the mean is 5 eggs per hen, and the range is 4 eggs.

Q11. (a) Numbers greater than 4 on a die: 5 and 6 — that is 2 ways out of 6 outcomes. $P(>4) = \frac{2}{6} = \frac{1}{3}$ in simplest form.

(b) $\frac{1}{3} = 0.3333... = 0.33$ (to 2 decimal places).

(c) $0.33 < 0.5$, so this event is less likely than an even chance.

$\therefore P(>4) = \frac{1}{3} = 0.33$ (to 2 decimal places), which is less than an even chance.

Q12. (a) Tram 1 arrives 8:39 am — before 9:15 am, so it works. Tram 2 arrives 9:11 am — also before 9:15 am, so it works too.

(b) No. The 8:47 am tram arrives at 9:31 am, which is after 9:15 am — Wen would be late for work.

(c) The next tram after 8:24 am is the 8:47 am tram, which arrives at 9:31 am.

$\therefore$ Wen can catch the 7:52 am or 8:24 am tram; the 8:47 am tram arrives too late (9:31 am).

Q13. (a) $4.80 - 4.35 = 0.45$. The new laundromat is cheaper, by \$0.45 per load.

(b) Example: getting to the new laundromat means travelling 6 km, which costs time and petrol — that can easily cost more than the \$0.45 saved on one load. (Other sensible answers are accepted, such as: the local one is closer to home, or Esme knows the machines there.)

$\therefore$ the new laundromat saves \$0.45 per load, but real-world factors like travel matter too.

Q14. Share = $1240 \div 8 = 155$, so \$155 each. Check with a multiplication: $8 \times 155 = 1240$ — exact, so the answer passes.

$\therefore$ each person receives \$155.

Q15. 10% of \$60: $60 \div 10 = 6$, so the discount is \$6. Sale price: $60 - 6 = 54$, so \$54. Check: \$54 is a little under \$60 — sensible for a 10% discount.

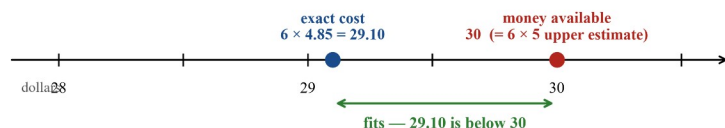
$\therefore$ the discount is \$6 and the sale price is \$54.

Q16. “per kg” → multiply: cost = $5 \times 3.40 = 17.00$, so \$17.00. Change: $20.00 - 17.00 = 3.00$, so \$3.00. Check: \$17.00 is a little under the \$20 note, so a small amount of change makes sense.

∴ the potatoes cost \$17.00 and the change is \$3.00.

Q17. (a) Rounding \$4.85 up to \$5 makes the estimate an **over**-estimate — the true cost must be less than it. $6 \times 5 = 30$, which is exactly the money Hugh has. So the true cost is less than \$30, and 6 packets fit inside it.

(b) Exact: $6 \times 4.85 = 29.10$, so \$29.10. And $29.10 < 30$ — the explanation in part (a) was correct.



∴ 6 packets cost \$29.10, which fits inside the \$30 Hugh has to spend.

Q18. (a) Sausages: $60 \times 0.85 = 51.00$, so \$51.00.

(b) Rolls: $60 \times 0.35 = 21.00$, so \$21.00.

(c) Total: $51.00 + 21.00 = 72.00$, so \$72.00. Check: 120 items for \$72.00 is about 60 cents an item — sensible for sausages and rolls — and \$72.00 is under the \$100 float. Left over: $100.00 - 72.00 = 28.00$, so \$28.00.

∴ the food costs \$72.00 in total, and \$28.00 of the float is left at the end.

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, plans, rosters, receipts, messages and chart figures 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.

Section 1A set out the four stages of the **problem-solving cycle**: identify the mathematics; act on and use mathematics; evaluate and reflect; communicate and report. This section goes deep into **stage 1**. In the study design (Unit 2, Outcome 2), this stage means spotting the maths hidden in a real-life situation, picking out the parts you need and working out what they mean, and then deciding which maths to use.

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

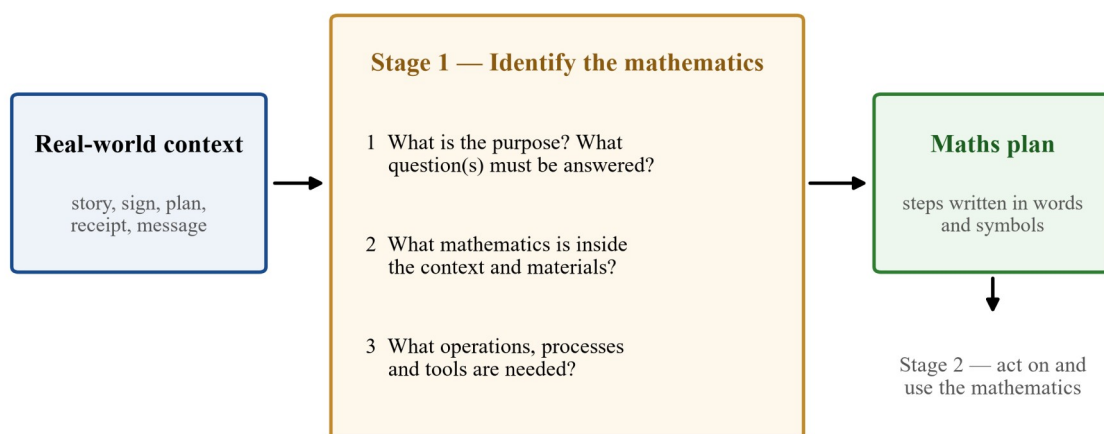
What stage 1 means.

Real-world tasks do not arrive labelled “use this formula”. They arrive as a story, a price sign, a floor plan, a roster, a text message, a receipt. The mathematics is **embedded** in the context — that means it is hidden inside the words and the materials, and your first job is to find it. Stage 1 is where you pull the maths out of the story and write down what you intend to do with it, *before* you calculate anything.

Three things to find.

Every time you meet a real-world task, stage 1 asks you to find three things.

1. **The purpose and the question(s).** What is this task really about? What exact question (or questions) must be answered? Sometimes the question is given to you. Sometimes you must write it yourself.
2. **The mathematics in the context.** Which numbers, sizes, times, prices and shapes are in the story or the materials — and which of them do you actually need? Contexts often carry extra facts you will never use.
3. **The operations, processes and tools.** Which maths will do the job — adding, taking a percentage, finding an area, working out a time? And which tools will help: a calculator, a tape measure, a ruler, a spreadsheet, a phone app, a timetable? (Sections 1E and 1F look at the tools in full.)



Refresher — the four operations.

Nearly every plan is built from four operations. **Addition** (+) puts amounts together: $\$4.50 + \$2.30 = \$6.80$.

Subtraction (−) takes one amount away from another, as in change: $\$10.00 - \$6.80 = \$3.20$. **Multiplication** (×) adds the same amount several times: $3 \times \$4.50 = \$13.50$. **Division** (÷) shares an amount into equal parts: $\$13.50 \div 3 = \$4.50$.

Words that point to mathematics.

The words in a task are signposts. This table translates everyday words into the maths they usually point to.

Words in the task	The maths they point to
total, in all, altogether	addition (+)
how much is left, change, difference, how much more	subtraction (−)
each, per, every, a rate like “per hour”	multiplication (×) or a rate
share equally, split into equal groups, how many fit	division (÷)
% off, discount, half price	percentage
around the edge, fencing, trim, a border	perimeter
covers a floor, a wall, a lawn	area
fills a box, how much it holds	volume or capacity
average	the mean (total ÷ how many)
how long, time between, how many hours	time
a bigger batch, scaling a recipe, a map scale	scaling — multiply every amount by the same number
chance, likely, how likely	probability (Chapter 4)
north of, east of, turn right	direction and maps (Chapter 2)
which is cheaper, the best buy	find each one, then compare
how many tins, rolls, buses to buy	divide, then round up

Refresher — perimeter and area of a rectangle.

The **perimeter** is the distance all the way around the edge. The **area** is the space the shape covers. For a rectangle with length L and width W :

$$\text{perimeter} = 2 \times (L + W) \quad \text{area} = L \times W$$

For a rectangle 5 m long and 3 m wide: perimeter = $2 \times (5 + 3) = 16$ m, and area = $5 \times 3 = 15$ m². Lengths are measured in m or cm; areas in m² or cm².

Refresher — percentages.

A **percentage** is a part out of 100. The quickest handle is 10%: 10% of an amount is one tenth of it, so divide by 10. Everything else builds from there: 20% is two lots of 10%; 5% is half of 10%; 25% is a quarter (÷ 4); 50% is a half; 15% is 10% plus 5%. For example, 20% of \$45: 10% is \$4.50, so 20% is $2 \times \$4.50 = \$9.00$.

Refresher — the mean.

The **mean** (the everyday “average”) spreads a total out equally over the values. Find it by adding the values, then dividing by how many there are. For 12, 18 and 15: the total is 45 and there are 3 values, so the mean is $45 \div 3 = 15$.

Refresher — metric units.

Plans, recipes and labels mix their units, so keep these swaps in your head: 1 m = 100 cm and 1 m = 1000 mm; 1 km = 1000 m; 1 kg = 1000 g; 1 L = 1000 mL; and 1 kL = 1000 L. Going from a bigger unit to a smaller one means multiplying (1.5 m = 150 cm); going from a smaller unit to a bigger one means dividing (1000 g = 1 kg).

Refresher — time in hours and minutes.

One hour is 60 minutes, so part of an hour is a decimal: 15 min = 0.25 h, 30 min = 0.5 h, 45 min = 0.75 h. So 2 h 15 min = 2.25 h, and 0.5 h is 30 min. Pay is usually worked out in decimal hours.

Familiar, routine and some less familiar.

A **familiar** context is one you have met before; a **routine** task is a job people do often, like pricing an order or reading a roster. A **less familiar** context is new to you — but here is the point that matters for stage 1: a new story does not mean new mathematics. The context may be one you have never seen, while the maths inside it is maths you know. At this level the maths in a task is usually easy to see: it is fairly explicit, or shown in a picture or table, with relatively few **distractors** — extra facts placed in the task that you do not need. Read slowly, find the three things, and the new context becomes an old problem. Section 1G looks at these words in full.

Choosing a strategy.

Once you can see the mathematics, pick a **strategy** — a way of attacking the task. The processes you choose from are the ones this book teaches: the money, measurement and time maths used across the six everyday contexts (Chapter 6), and the four areas of study — dimension and direction (Chapter 2), data (Chapter 3), uncertainty (Chapter 4) and systematics (Chapter 5). A small set of strategies covers most tasks.

Strategy	Use it when
Draw a diagram	the task is about shapes, rooms, routes or anything you can picture
Make a table	numbers change step by step, or you must compare options
Look for a pattern	the same thing keeps happening over and over
Break it into smaller parts	the task holds several smaller jobs inside it
Work backwards	you know the end result but not the start
Use smaller numbers first	the real numbers are awkward — test the plan on easy ones

Writing the maths plan.

Stage 1 ends with a **plan**: your steps written down before you calculate anything. A good plan is clear enough that someone else could pick it up and follow it. Write it in a mix of everyday words and mathematical symbols. Use this template.

Part of the plan	What you write in it
Purpose	why the task exists, in one sentence
Question(s)	exactly what you must find
Information given	the facts and numbers you will use; cross out the extras
Mathematics	the operations and processes (from the signpost table)
Tools	calculator, tape measure, ruler, spreadsheet, phone app, timetable
Steps	numbered, one job per step, words and symbols together
Estimate	a quick in-your-head answer to check against later

Refresher — round up or round to nearest?

Rounding to nearest is the everyday rule: 5.2 becomes 5, 5.6 becomes 6. **Rounding up** is different: 5.2 becomes 6, because you cannot buy 0.2 of a box. When the answer counts things that are sold or hired whole — boxes, tins, rolls, buses — divide first and then **round up** to the next whole number, even when the decimal part is small. Write “round up” in your plan so the reason is on the page.

A worked plan.

Mia is ordering food platters for a meeting of 43 people. One platter serves 8 people, and a platter costs \$23.50. How many whole platters must Mia order, and what do they cost? Here is the plan, filled in.

Part of the plan	Mia's plan
Purpose	Order enough platters for 43 people and find the cost.
Question(s)	How many whole platters? What is the total cost?
Information given	43 people; 1 platter serves 8; a platter costs \$23.50
Mathematics	divide, round up, multiply
Tools	calculator, pen and paper
Steps	1. platters = $43 \div 8 = 5.375$ 2. round up: order 6 platters 3. cost = $6 \times \$23.50 = \$141.00$
Estimate	about 40 people $\div 8 = 5$ platters, about $5 \times \$24 = \$120$ — so \$141.00 is sensible

The estimate sits in the plan on purpose. Stage 3 (section 1C) checks the finished answer against it.

Three traps to check for.

- **Extra information.** Real contexts carry facts you do not need (the weather, the start time, what to bring). Cross them out in your plan so they cannot wander into the working.
- **Two questions hiding in one.** “Is it enough, and how much is left over?” is two questions. List both, or you will answer only half the task.
- **Mixed units.** A plan in centimetres next to a price in metres is a trap. Convert to one unit before you calculate (see the metric refresher above).

Worked examples

Example 1 — scaffolded

A sports club treasurer sends this message about the away game.

“Bus hire is \$180 return. Entry is \$8.50 a player and 17 players are going. The two coaches go free. The game starts at 10:00 am and the bus leaves the club at 8:15 am. Everyone brings a water bottle.”

Made-up data: the treasurer's message and every number in it are made up for this section.

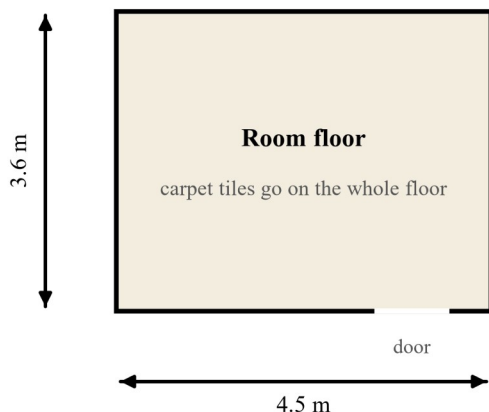
The club must find the total cost of the trip, and the cost per player correct to the nearest cent.

Working	Comment
Purpose and question(s): find what the trip costs. Questions: what is the total cost? What is the cost per player, correct to the nearest cent?	The task hides two questions — list both before touching a number.
Mathematics in the context: needed — \$180 bus, \$8.50 a player, 17 players, coaches free. Not needed — 10:00 am start, 8:15 am departure, water bottle.	Cross out the extras so they cannot sneak into the working.
Operations and tools: multiply (17×8.50), add ($+180$), divide ($\div 17$). Tool: calculator.	Three operations, in order, in the plan.
Step 1: entry = $17 \times \$8.50 = \$144.50$.	The coaches are free, so they add nothing.
Step 2: total = $\$144.50 + \$180.00 = \$324.50$.	Bus plus entry.
Step 3: per player = $\$324.50 \div 17 = \$19.088\dots$, so \$19.09 correct to the nearest cent.	Round only at the step the question asks for.
Estimate: 17 is close to 18, and $\$180 \div 18 = \$10$ each for the bus; add \$8.50 entry to get about \$18.50 — close to \$19.09, so sensible.	The estimate goes in the plan; stage 3 (section 1C) will use it again.

The trip costs \$324.50 in total, which is \$19.09 per player correct to the nearest cent.

Example 2 — scaffolded

Noah is carpeting the meeting room at his club. The plan of the room is shown below. Carpet tiles come in boxes; one box covers 2 m^2 and one box costs \$48. How many whole boxes of tiles must Noah buy, and what do they cost?



Made-up data: the room and every measurement on the plan are made up for this section.

Working

Comment

Purpose and question(s): carpet the whole floor.

Two questions — list both.

Questions: how many whole boxes of tiles? What do they cost?

Mathematics in the context: room 4.5 m by 3.6 m (from the plan); one box covers 2 m^2 ; one box costs \$48.

The plan gives the sizes; the box label gives the cover and the price.

Operations and tools: area (multiply), divide, round up, multiply (for the cost). Tools: calculator, pen and paper.

Tiles cover a surface, so area comes first.

Step 1: area = $4.5 \times 3.6 = 16.2\text{ m}^2$.

Refresher: area of a rectangle = $L \times W$.

Step 2: boxes = $16.2 \div 2 = 8.1$, so buy 9 boxes (round up).

Eight boxes would leave part of the floor bare.

Step 3: cost = $9 \times \$48 = \$432$.

The cost uses whole boxes, not 8.1 of a box.

Estimate: the room is about $4.5 \times 4 = 18\text{ m}^2$, so about $18 \div 2 = 9$ boxes — the exact answer matches the estimate.

A quick estimate catches big slips.

Noah must buy 9 boxes of carpet tiles, and they cost \$432.

Example 3 — unscaffolded

Erin is making pikelets for the school fete. Her recipe card serves 4 people.

Pikelet card — serves 4

Self-raising flour	150 g
Eggs	2
Milk	250 mL

Made-up data: the recipe card and every amount on it are made up for this section.

The fete stall needs the same recipe for 14 people. How much flour, how many eggs and how much milk does Erin need?

Identify first. The purpose is to scale the recipe up to 14 people; the question is the amount of each ingredient; and the mathematics is scaling — multiply every amount by the same number. The scale factor is $14 \div 4 = 3.5$. Flour: $150 \times 3.5 = 525$ g. Eggs: $2 \times 3.5 = 7$ eggs, which is already a whole number. Milk: $250 \times 3.5 = 875$ mL.

$\therefore$ the fete batch needs 525 g of flour, 7 eggs and 875 mL of milk.

Example 4 — unscaffolded

A bike shop sign reads “All helmets 15% off this week.” A helmet is marked \$64. Liam has a \$55 note. What is the sale price of the helmet, and is Liam’s \$55 enough? If it is enough, what change does he get?

Identify first: the purpose is to price the helmet on sale and check Liam’s money; the questions are the sale price, whether \$55 is enough, and the change; and the mathematics is a percentage (the refresher builds 15% from 10% and 5%), then a subtraction and a comparison. Ten per cent of \$64 is \$6.40, and 5% is half of that, \$3.20, so 15% is $\$6.40 + \$3.20 = \$9.60$ off. The sale price is $\$64.00 - \$9.60 = \$54.40$. Because $\$55.00 > \$54.40$, the note is enough, and the change is $\$55.00 - \$54.40 = \$0.60$.

$\therefore$ the helmet costs \$54.40 on sale, and yes, \$55 is enough, with \$0.60 change.

Practice questions

Scaffolded

Q1. Say which one operation each question needs: addition, subtraction, multiplication or division. (a) “What do 6 tickets cost at \$12.40 each?” (b) “How much change do I get from a \$100 note after paying \$76.50?” (c) “48 cupcakes are shared equally onto 6 trays. How many on each tray?”

Q2. The Harbour Lane Bakery price sign is shown below.

Harbour Lane Bakery	
fresh every morning	
P R I C E S	
Meat pie	\$5.20
Sausage roll	\$4.10
Lamington	\$3.60
Coffee	\$4.40
All prices in Australian dollars	

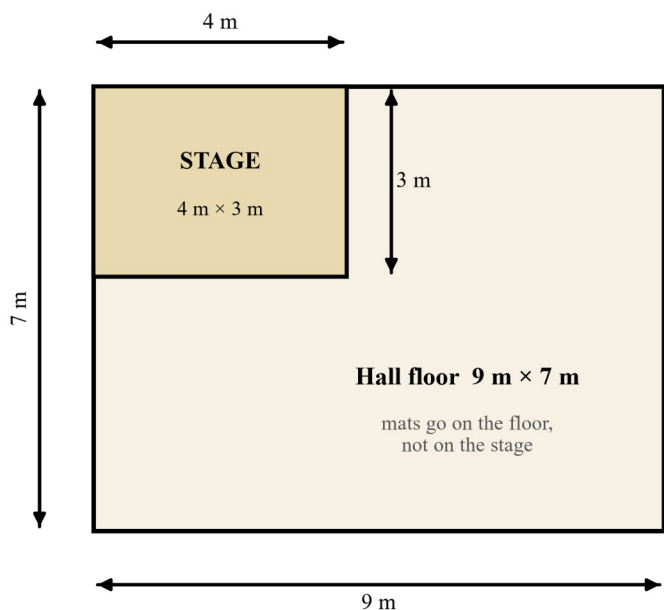
Made-up data: Harbour Lane Bakery and every price on the sign are made up for this section.

- (a) Write two maths questions that this price sign can answer.
- (b) Find the cost of 4 meat pies and 3 lamingtons.
- (c) A customer buys the items in (b) and pays with a \$50 note. How much change is due?

Q3. A footy club member sends this message about the sausage sizzle: “Snags are \$1.20 each and we need 150 of them. Bread is \$2.40 a loaf and we need 8 loaves. The sizzle starts at 9 am at the fire station. Bring your own tongs.

Helpers get a free cup of tea.” (a) State the purpose and the maths question, if you want the total cost of the food. (b) Name two facts in the message that you do not need. (c) Find the total cost of the snags and the bread.

Q4. A community hall floor is a rectangle 9 m by 7 m. A rectangular stage 4 m by 3 m sits in one corner, as shown below. Floor mats go on the floor only, not on the stage, and one box of mats covers 4 m².



Made-up data: the hall plan and every measurement on it are made up for this section.

- What must you find first?
- Name the operations you will use, in order.
- How many whole boxes of mats must the hall buy?

Q5. Choose a strategy for each task from *draw a diagram*, *make a table* or *work backwards*, and say why it fits in one sentence. (a) A seat pattern: the front row of a hall has 10 seats and each row behind it has 3 more. How many seats are in row 8? (b) A driver wants the shortest way to visit three stops and come back to the depot. (c) Ruby had some money. She spent \$25 on shoes, then \$18 on lunch, and had \$20 left. How much money did she start with?

Q6. Harbour Lane Bakery pays \$25.60 per hour. Sam’s weekly roster is shown below.

Sam's weekly roster

Harbour Lane Bakery

Day	Start	Finish
Mon	07:00	13:00
Tue	08:00	13:00
Wed	07:00	13:00
Thu	10:00	18:00
Fri	07:00	13:00

Made-up data: the roster and every time in it are made up for this section.

- Use the roster to find the hours worked on each day, and the total hours for the week.
- Find Sam’s pay for the week.
- Estimate the pay first (think 31 hours at \$25 per hour) and say whether your answer to (b) is sensible.

Un scaffolded

Q7. The receipt below is from Brightside Hardware.

BRIGHTSIDE HARDWARE		
12 Warehouse Way		
TAX INVOICE		
Qty	Item	Amount
1	Drop sheet	\$12.99
2	Masking tape @ \$4.50	\$9.00
3	Paint @ \$28.00	\$84.00
1	Roller set	\$15.50

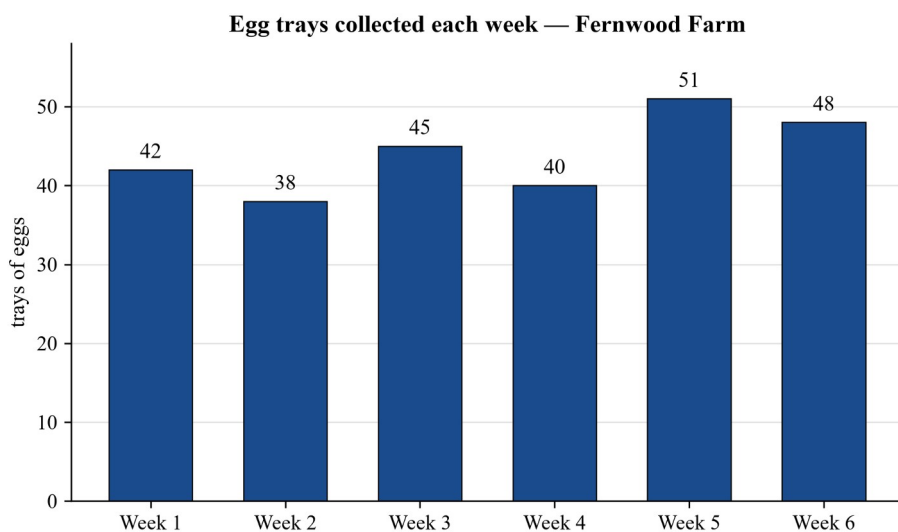
TOTAL		\$
Paid: cash		
Thanks for shopping — see you again!		

Made-up data: Brightside Hardware and every line on the receipt are made up for this section.

- Find the total of the four amounts on the receipt.
- The shopper paid with a \$150 note. What change is due?
- Write one more maths question this receipt can answer, and name the operation(s) it needs.

Q8. Ben wants to work out how many bags of grass seed to buy for his back yard. (a) Name three pieces of information Ben must collect before he can start, and say in one sentence why each one matters. (b) Using your three pieces of information, write Ben's plan as numbered steps in words.

Q9. The bar chart below shows six weeks of egg trays collected at Fernwood Farm.



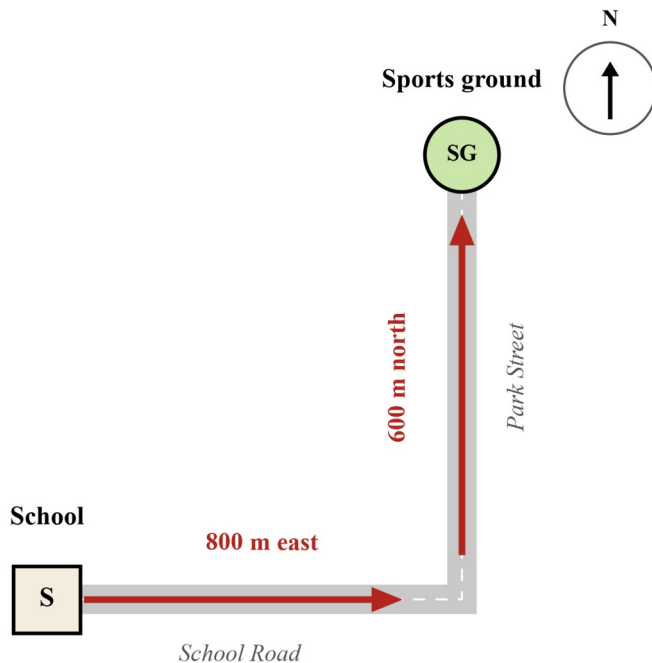
Made-up data: Fernwood Farm and every number in the chart are made up for this section.

- Which week collected the most trays, and how many was it?
- How many more trays did week 5 collect than week 2?
- Find the mean number of trays collected per week over the six weeks.

Q10. A grade of 46 students is going to a football match. Each minibus holds 20 students, and minibuses are hired whole. (a) How many minibuses must be hired? (b) Explain why “2.3 minibuses” is not an answer. (c) How many empty seats are there on the minibuses used?

Q11. A noticeboard is 2.4 m by 1.2 m. Aluminium trim is glued around the edge of the board, and the trim is sold in 1 m strips. The hall needs trim for 3 identical noticeboards. (a) Find the perimeter of one noticeboard, in m. (b) Find the total length of trim needed for the 3 boards, in m. (c) How many whole 1 m strips must be bought?

Q12. The map below shows the walking route from the school to the sports ground: 800 m east along School Road, then 600 m north along Park Street. A class walks this route at 4 km per hour.



Made-up data: the map, the street names and the distances are made up for this section.

- Find the total length of the route, in m.
- Write this length in km.
- How many minutes does the walk take?

Q13. A scone recipe for 5 people uses 250 g of self-raising flour, 40 g of butter and 125 mL of milk. The CFA morning tea needs the same recipe for 20 people. (a) Name the mathematical process this task uses. (b) Find the scale factor. (c) Find the flour, the butter and the milk needed for 20 people, and write the flour in kg as well as g.

Q14. Tane’s shift starts at 6:30 am and finishes at 3:00 pm, with a 30-minute unpaid break. Tane is paid \$27.80 per hour. (a) How many hours is Tane paid for? (b) Find Tane’s pay for this shift, correct to the nearest cent. (c) Estimate the pay first and say whether your answer to (b) is sensible.

Q15. Zoe is checking whether 3 tins of deck stain are enough for her deck, which is 5.4 m by 3.2 m. The tin says one tin covers 7 m², and the job needs 2 coats. Zoe’s plan says: “3 tins times 7 m² each is 21 m², and the deck is about 20 m², so 3 tins is enough.” (a) Find the true area of the deck. (b) Find the total area the 2 coats must cover, and how many whole tins that needs. (c) Is Zoe right? Give a one-sentence reason.

Q16. A lawn mower is marked \$240. A sale takes 20% off the marked price. At the register, club members get a further 5% off the sale price. (a) Find the price after the 20% discount. (b) Find the final price after the extra 5%. (c) Explain in one sentence why the final price is not 25% off \$240 (that is, not \$180.00).

Q17. Rice is sold as a 5 kg bag for \$12.75 and as a 2 kg bag for \$5.60. (a) Find the price per kg of each bag. (b) Which bag is cheaper per kg? (c) Find the cost of 10 kg of rice bought at the cheaper price per kg.

Q18. An old shower head uses 12 L of water per minute. A water-saving head uses 8 L per minute. Showers in this house average 7 minutes, and water costs \$2.10 per kL. (a) How many litres are saved each shower with the new head? (b) How many litres are saved over 30 days of one shower a day? (c) Find the money saved over the 30 days, correct to the nearest cent.

Answers

Q1. (a) multiplication. (b) subtraction. (c) division. **Q2.** (a) any two, e.g. “What does a meat pie and a coffee cost together?” and “How much change from \$10 after 2 lamingtons?” (b) \$31.60. (c) \$18.40. **Q3.** (a) purpose: the cost of the sizzle food; question: what do 150 snags and 8 loaves cost altogether? (b) the 9 am start and “bring your own tongs” (or the free cup of tea). (c) \$199.20. **Q4.** (a) the mat area (hall floor minus the stage). (b) multiply (two areas), subtract, divide, round up. (c) 13 boxes. **Q5.** (a) make a table — each row adds the same 3 seats. (b) draw a diagram — the routes are easy to compare as a picture. (c) work backwards — the end is known, not the start. **Q6.** (a) Mon 6 h, Tue 5 h, Wed 6 h, Thu 8 h, Fri 6 h; total 31 h. (b) \$793.60. (c) $31 \times \$25 = \$775$; \$793.60 is close to the estimate, so it is sensible. **Q7.** (a) \$121.49. (b) \$28.51. (c) any one, e.g. “What did one tin of paint cost?” — division ($\$84.00 \div 3$). **Q8.** (a) any three of: the back yard’s length and width (to find its area); the areas of the garden beds and shed (no grass grows there, so they come off); the cover rate on the bag in m^2 per bag (it turns area into bags); that bags are bought whole (round up). (b) 1. find the lawn area = back yard area – beds and shed; 2. bags = lawn area $\div$ cover per bag; 3. round up to whole bags. **Q9.** (a) week 5, 51 trays. (b) 13 trays. (c) 44 trays. **Q10.** (a) 3 minibuses. (b) minibuses are hired whole; 2 would seat only 40 students and leave 6 behind. (c) 14 empty seats. **Q11.** (a) 7.2 m. (b) 21.6 m. (c) 22 strips. **Q12.** (a) 1400 m. (b) 1.4 km. (c) 21 minutes. **Q13.** (a) scaling — multiply every amount by the same number. (b) 4. (c) 1000 g (1 kg) of flour, 160 g of butter, 500 mL of milk. **Q14.** (a) 8 h. (b) \$222.40. (c) about $8 \times \$28 = \$224$; \$222.40 is close, so it is sensible. **Q15.** (a) 17.28 m^2 . (b) 34.56 m^2 ; 5 tins. (c) no — her plan forgets the second coat, so 3 tins (21 m^2 of cover) cannot cover 34.56 m^2 . **Q16.** (a) \$192.00. (b) \$182.40. (c) the extra 5% is taken off \$192.00 (which is \$9.60 off), not off \$240 (which would be \$12.00 off). **Q17.** (a) \$2.55 and \$2.80. (b) the 5 kg bag. (c) \$25.50. **Q18.** (a) 28 L. (b) 840 L. (c) \$1.76.

Fully-worked solutions

Q1. (a) Six lots of the same price is $6 \times \$12.40$, so **multiplication**. (b) Change is the note minus the price, $\$100.00 - \$76.50$, so **subtraction**. (c) Sharing equally into 6 groups is $48 \div 6$, so **division**.

Q2. (a) Any two questions the sign can answer, for example: “What does a meat pie and a coffee cost together?” (addition) and “How much change from \$10 after 2 lamingtons?” (multiplication then subtraction). (b) Pies: $4 \times \$5.20 = \$20.80$. Lamingtons: $3 \times \$3.60 = \$10.80$. Total: $\$20.80 + \$10.80 = \$31.60$. (c) Change: $\$50.00 - \$31.60 = \$18.40$.

Q3. (a) Purpose: work out what the sizzle food costs. Question: what do 150 snags and 8 loaves of bread cost altogether? (b) The 9 am start and “bring your own tongs” (the free cup of tea is also extra). None of them change the cost. (c) Snags: $150 \times \$1.20 = \$180.00$. Bread: $8 \times \$2.40 = \$19.20$. Total: $\$180.00 + \$19.20 = \$199.20$.

Q4. (a) The area the mats must cover — the whole hall floor minus the stage — because mats go on the floor only. (b) Multiply twice (hall area, stage area), subtract (stage from hall), divide (by 4 m^2 per box), then round up to whole boxes. (c) Hall: $9 \times 7 = 63 \text{ m}^2$. Stage: $4 \times 3 = 12 \text{ m}^2$. Mat area: $63 - 12 = 51 \text{ m}^2$. Boxes: $51 \div 4 = 12.75$, so the hall buys **13 whole boxes** (round up).

Q5. (a) **Make a table** — each row adds the same 3 seats, so a table of rows 1, 2, 3, ... reaches row 8 quickly. (Looking for a pattern works for the same reason.) (b) **Draw a diagram** — a sketch of the depot and the three stops makes each possible route easy to see and compare. (c) **Work backwards** — the end (\$20 left) is known and the start is not, so undo the steps: add the \$18 back, then add the \$25 (which gives \$63 at the start).

Q6. (a) Monday, 07:00 to 13:00, is 6 h; Tuesday, 08:00 to 13:00, is 5 h; Wednesday is 6 h; Thursday, 10:00 to 18:00, is 8 h; Friday is 6 h. Total: $6 + 5 + 6 + 8 + 6 = 31 \text{ h}$. (b) $31 \times \$25.60 = \$793.60$. (c) Estimate: $31 \times \$25 = \$775$. The exact \$793.60 is close to \$775, so it is sensible.

Q7. (a) $\$12.99 + \$9.00 = \$21.99$; $+\$84.00 = \$105.99$; $+\$15.50 = \$121.49$. (b) $\$150.00 - \$121.49 = \$28.51$. (c) Any question the receipt supports, for example: “What did one tin of paint cost?” This needs division: $\$84.00 \div 3 = \$28.00$, which matches the printed rate.

Q8. (a) Any three of these, each with its reason: the length and width of the back yard, because the area comes from length times width; the areas of the garden beds, shed or paths, because no grass grows there and they come off the total; the cover rate printed on the bag (m^2 per bag), because it turns an area into a number of bags; and the fact that

bags are sold whole, because the answer must be rounded up. (b) A plan in words: step 1, find the back yard area by multiplying length by width; step 2, subtract the beds, shed and paths to get the lawn area; step 3, divide the lawn area by the cover per bag; step 4, round up to whole bags.

Q9. (a) The tallest bar is week 5, at 51 trays. (b) $51 - 38 = 13$ trays. (c) Total: $42 + 38 + 45 + 40 + 51 + 48 = 264$ trays. Mean: $264 \div 6 = 44$ trays per week.

Q10. (a) $46 \div 20 = 2.3$, and students cannot be left behind, so round up: **3 minibuses**. (b) Minibuses are hired whole. Two minibuses seat only $2 \times 20 = 40$ students, so 6 would have no seat, and “0.3 of a minibus” is not a thing anyone can hire. (c) Seats on 3 minibuses: $3 \times 20 = 60$. Empty seats: $60 - 46 = 14$.

Q11. (a) Perimeter $= 2 \times (2.4 + 1.2) = 2 \times 3.6 = 7.2$ m. (b) Three boards: $3 \times 7.2 = 21.6$ m. (c) Strips: $21.6 \div 1 = 21.6$, so **22 whole strips** (round up).

Q12. (a) $800 + 600 = 1400$ m. (b) $1400 \text{ m} = 1400 \div 1000 = 1.4$ km. (c) Time = distance $\div$ speed $= 1.4 \div 4 = 0.35$ h, and $0.35 \times 60 = 21$ minutes.

Q13. (a) Scaling — every amount is multiplied by the same number. (b) Scale factor $= 20 \div 5 = 4$. (c) Flour: $250 \times 4 = 1000$ g, which is $1000 \div 1000 = 1$ kg. Butter: $40 \times 4 = 160$ g. Milk: $125 \times 4 = 500$ mL.

Q14. (a) From 6:30 am to 3:00 pm is 8 h 30 min, which is 8.5 h. Taking off the 30-minute (0.5 h) unpaid break: $8.5 - 0.5 = 8$ h paid. (b) $8 \times \$27.80 = \$222.40$, so the pay is **\$222.40** correct to the nearest cent. (c) Estimate: $8 \times \$28 = \$224$. The exact \$222.40 is close to \$224, so it is sensible.

Q15. (a) Deck area $= 5.4 \times 3.2 = 17.28 \text{ m}^2$. (b) Two coats must cover $2 \times 17.28 = 34.56 \text{ m}^2$. Tins: $34.56 \div 7 = 4.937\dots$, so Zoe needs **5 whole tins** (round up). (c) No. Zoe’s plan forgets the second coat: her 3 tins cover only $3 \times 7 = 21 \text{ m}^2$, which is less than the 34.56 m^2 the two coats need, so 3 tins is not enough.

Q16. (a) 20% of \$240 is $\$240 \div 10 \times 2 = \$48.00$, so the sale price is $\$240.00 - \$48.00 = \$192.00$. (b) 5% of \$192 is half of 10% (\$19.20), which is \$9.60, so the final price is $\$192.00 - \$9.60 = \$182.40$. (c) Because the extra 5% is taken off the sale price of \$192.00 (which takes \$9.60 off), not off the marked \$240 (which would take \$12.00 off) — the two discounts together take \$57.60 off, not \$60.00, so the final price is \$182.40 and not \$180.00.

Q17. (a) 5 kg bag: $\$12.75 \div 5 = \$2.55$ per kg. 2 kg bag: $\$5.60 \div 2 = \$2.80$ per kg. (b) The 5 kg bag, at \$2.55 per kg against \$2.80 per kg. (c) $10 \times \$2.55 = \$25.50$.

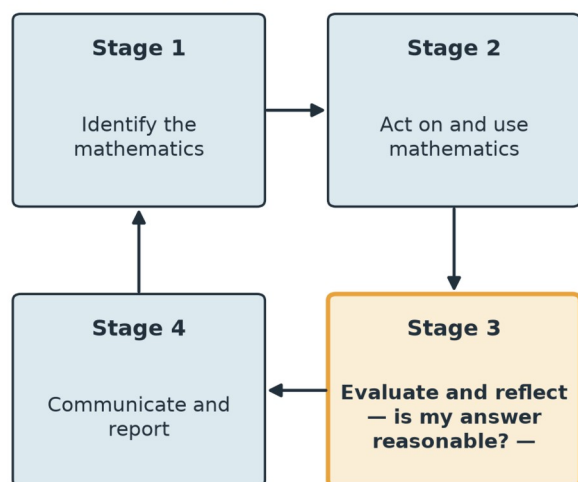
Q18. (a) $12 - 8 = 4$ L saved each minute, and a shower runs 7 minutes: $4 \times 7 = 28$ L saved per shower. (b) $28 \times 30 = 840$ L saved over the 30 days. (c) $840 \text{ L} = 840 \div 1000 = 0.84 \text{ kL}$, and $0.84 \times \$2.10 = \$1.764$, which is **\$1.76** correct to the nearest cent.

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

Theory

In §1A you met the four stages of the problem-solving cycle: **identify the mathematics**, **act on and use mathematics**, **evaluate and reflect**, and **communicate and report**. In §1B you practised stage 1 — finding the mathematics inside a real-life task. This section is **stage 3 — evaluate and reflect**. It asks one big question: **is my answer reasonable?**

The problem-solving cycle — this section is stage 3



Why check at all.

Slips are easy to make, and a wrong answer can cost real money or real time. You might pay too much on a bill, order too little paint, or miss your bus — all because of one wrong number. Most slips are small:

- a wrong key pressed on the calculator;
- the decimal point in the wrong place (an answer 10 times too big or too small);
- the wrong operation used (adding instead of multiplying);
- a step missed out (a delivery fee forgotten).

A short check catches almost all of these. Good problem-solvers **never act on an answer until they have checked it**.

Estimate first.

An **estimate** is a quick, rough calculation that gives a number close to the exact answer. Do it *before* the exact calculation — then you already know roughly what to expect. In this unit, do the estimate in your head or on scrap paper; the exact calculation can be done with a calculator.

Refresher: rounding to friendly numbers. Estimating works by swapping each number for a nearby **friendly number** — one that is easy to calculate with, like a multiple of 10 or a whole dollar. The rule is the same every time: look at the digit just below the place you are rounding to — 5 or more rounds **up**, less than 5 rounds **down**. (Exactly halfway rounds up: $75 \rightarrow 80$, $\$3.50 \rightarrow \$4$.)

Round to	Look at	Examples
nearest 10	the ones digit	$83 \rightarrow 80$; $156 \rightarrow 160$
nearest dollar	the cents	$\$6.75 \rightarrow \$7$; $\$9.20 \rightarrow \$9$
nearest 100	the tens digit	$328 \rightarrow 300$; $4870 \rightarrow 4900$

Worked model: to estimate $6 \times \$19.80$, round $\$19.80$ up to $\$20$, so the estimate is $6 \times \$20 = \$120$. Because the price was rounded *up*, this estimate sits a little *above* the true answer ($6 \times \$19.80 = \$118.80$).

Three ways to estimate.

- **Friendly numbers.** Replace each number with a nearby easy one, as in the model above:
 $6 \times \$19.80 \approx 6 \times \$20 = \$120$.
- **Benchmarks.** A **benchmark** is a number you already know from everyday life. Compare your answer with benchmarks like these:

Everyday benchmarks — numbers you already know

Door height about 2 m	Walking speed about 5 km/h (about 12 min per km)	Jug boils about 3 minutes
Apple about 150 g	Movie ticket about \$15–\$20	Hourly pay often \$20–\$35 an hour

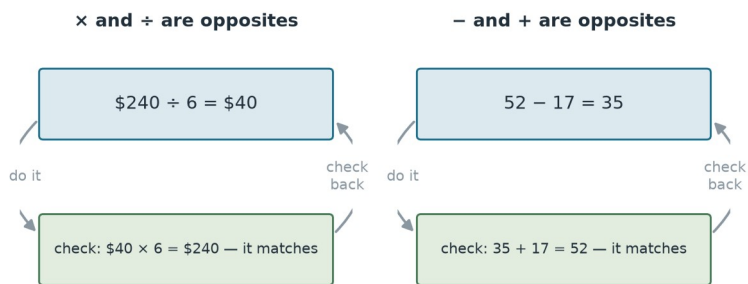
- **Direction.** Ask whether the answer should get *bigger* or *smaller* than the numbers you started with. A sale price goes *down*. More hours worked means *more* pay. Cutting pieces off a plank leaves *less* plank. If your answer moves the wrong way, stop and look again.

Six checks you can run.

Once you have an exact answer, run these checks against it.

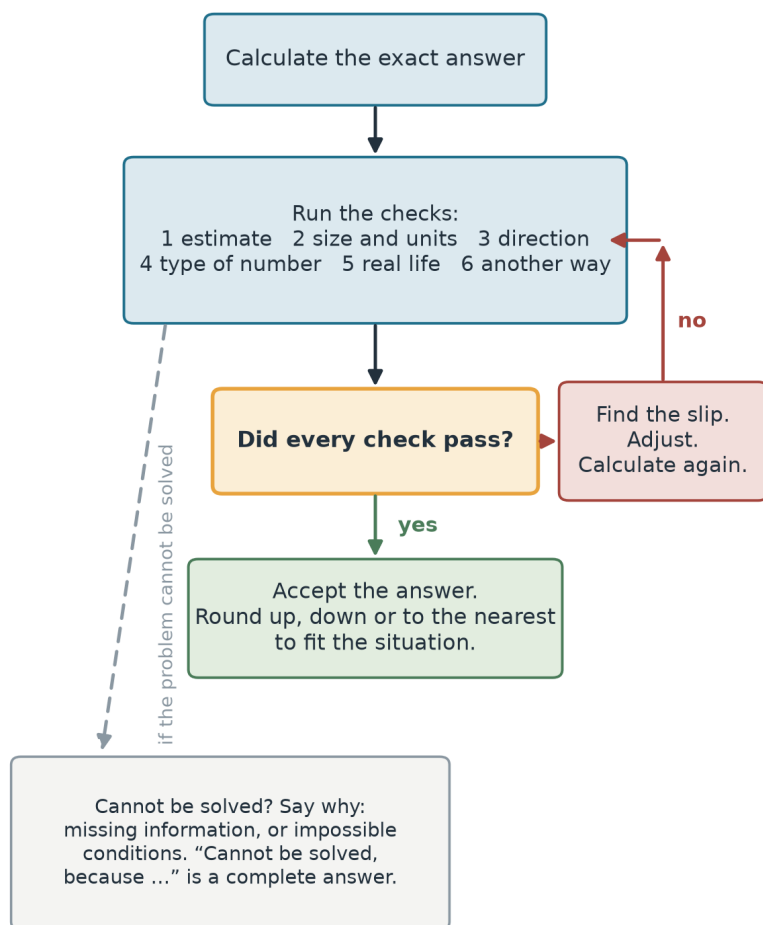
Check	Question to ask
1 — estimate	Is my exact answer close to my estimate?
2 — size and units	Is the number the right size, in the units the question asked for? (A school bus is about 12 m long, not 120 m.)
3 — direction	Did the answer move the way the situation says it should — up or down?
4 — type of number	Can this type of number happen? (You cannot buy half a tin of paint. Money stops at whole cents. People count in whole numbers.)
5 — real life	Would someone who knows this situation believe the number? (Pay of \$800 an hour for babysitting is not believable.)
6 — another way	Does a second method agree? Can you check backwards? Talking it over with your teacher or a classmate counts too — in this unit you are allowed to ask for a prompt before you settle on an answer.

Refresher: opposite operations. Multiplication and division are opposites; addition and subtraction are opposites. Checking backwards means doing the calculation in reverse with the opposite operation. If $\$240 \div 6 = \$40$, check that $\$40 \times 6 = \$240$. If $52 - 17 = 35$, check that $35 + 17 = 52$.



If a check fails: adjust.

If an answer fails a check, do not just throw everything away. Find the slip, **adjust** — fix the working and calculate again — and then run the checks once more on the fixed answer.



When a problem cannot be solved.

Sometimes the honest outcome is *this problem cannot be solved*. There are two common reasons:

- **Missing information.** A number you need was never given. Say exactly what is missing. (“We know the slices per pizza, but not how many people are coming.”)
- **Impossible conditions.** The facts given cannot all be true at once. Say which fact breaks. (“The hall seats 90, but all 96 members must sit at the same time.”)

“Cannot be solved, because ...” is a complete and correct answer. Explaining *why* a problem could not be solved is part of stage 3 — not a failure to solve it.

Contextual judgement: rounding to fit real life.

The pure maths answer is not always the answer you use. The study design calls this step a **contextual judgement** — in plain words, letting the situation, not just the maths, have the final say. When your answer is used to make a decision or a judgement, other things can count too, such as the effect on people or on money (see the study design's Unit 2, Outcome 2, the evaluate-and-reflect stage).

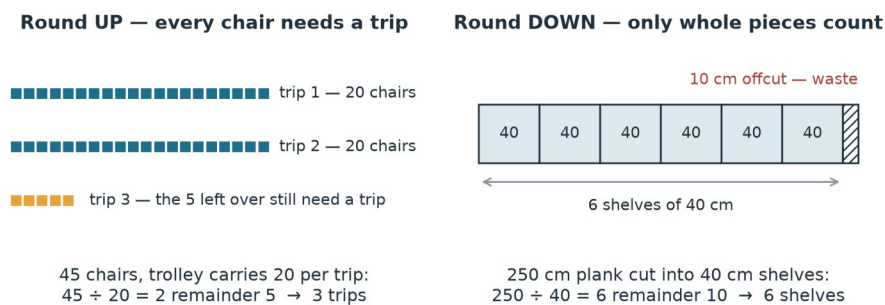
Source: VCAA, VCE Vocational Major Numeracy Study Design, retrieved 2026-10-09.

In practice this usually means **rounding to fit the situation**:

- **Round up** when leaving any out is not an option. 11.5 tins of paint becomes 12 tins — a bare patch of fence is not acceptable. 2.25 trips to move chairs becomes 3 trips — the last chairs still need a trip.
- **Round down** when only complete units count. A 250 cm plank cut into 40 cm shelves gives $250 \div 40 = 6$ remainder 10: 6 shelves, and the 10 cm offcut is waste.
- **Round to the nearest** when a small over- or under-shoot does not matter — like saying a drive of 2 h 50 min is “about 3 hours” when you are planning your day.

It also means thinking about the **consequences**: the extra cost of the twelfth tin, the people who would be left standing without a seat, or the money left over (or missing) in a budget.

Refresher: division and remainders. $23 \div 5 = 4$ remainder 3 means 4 full groups of 5, with 3 left over. The remainder is what stops an answer being a clean whole number — and the *situation* decides what you do with it: round up, round down, or keep it as change.



Refresher: metric lengths. Checks often need a quick unit swap: 1 m = 100 cm and 1 cm = 10 mm, so 1 m = 1000 mm. Example: a 2.5 m shelf board is 250 cm long. Swap to the smaller unit *before* dividing, so all the numbers match.

Refresher: elapsed time. To find how long something takes, count on from the start time in easy jumps. From 8:40 am to 1:10 pm: 8:40 am to 12:40 pm is 4 hours; 12:40 pm to 1:10 pm is 30 more minutes; total 4 h 30 min. For an estimate, jump in whole hours first and say “a little under” or “a little over”.

The reasonableness checklist.

1. Estimate before you calculate.
2. Calculate exactly (a calculator is fine for this step).
3. Compare the exact answer with your estimate — are they close?
4. Check the size, the units and the direction.
5. Check the type of number suits the situation.
6. Check against real life — would someone who knows believe it?
7. Check a second way if you can (opposite operation, another method, or talk it over).
8. If a check fails: find the slip, adjust, calculate again, check again.
9. If the problem cannot be solved, say so and explain why.

10. Round to fit the situation — up, down or nearest — and think about what your answer means for the people involved.

About the data in this section. The prices, wages and times 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.

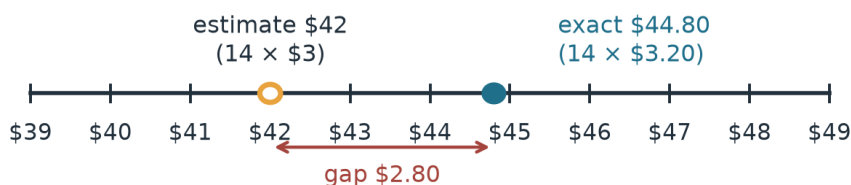
Worked examples

Example 1 — scaffolded

Margie buys 14 trays of vegetable seedlings for her community garden, at \$3.20 per tray. Estimate the cost first, then calculate it exactly, and check that the exact answer is reasonable.

Working	Comment
Estimate: $\$3.20 \approx \$3$, so $14 \times \$3 = \$42$.	Round the price to the nearest dollar — a friendly number.
Exact: $14 \times \$3.20 = \$44.80$.	Now calculate carefully; a calculator is fine here.
Check 1 — estimate: \$44.80 is close to \$42; the gap is \$2.80.	Same size and nearby, so there is no big slip.
Check 3 — direction: the price was rounded <i>down</i> , so the estimate should sit a little <i>below</i> the exact answer — and it does.	The direction check agrees too.
Conclusion: \$44.80 is reasonable. Margie should expect to pay about \$45.	\$448.00 or \$4.48 would each be 10 times out — a slipped decimal point, not a price. Accept \$44.80 and move on.

Slip watch: \$448.00 is 10 times too big; \$4.48 is 10 times too small.



Example 2 — scaffolded

Felix orders 15 paintbrushes at \$4.20 each from Nuts and Bolts Hardware. The online checkout shows a total of \$19.20. Use an estimate to check the total, find the exact cost, and explain the mistake.

Working	Comment
Understand: 15 brushes at \$4.20 each; the checkout claims \$19.20.	Write down what is given and what looks wrong.
Estimate: $\$4.20 \approx \$4$, so $15 \times \$4 = \$60$.	Friendly numbers first.
Check the claim: \$19.20 is nowhere near \$60 — it is only about a third of the estimate, so check 1 fails badly.	A gap that big means a real mistake, not rounding.
Exact: $15 \times \$4.20 = \$63.00$.	Calculate the true total.
Find the slip: $15 + \$4.20 = \$19.20$. The checkout <i>added</i> the number of brushes to the price of one brush, instead of <i>multiplying</i> .	Hunt for where the wrong number could come from — here it is the wrong operation.

Adjust: the correct total is \$63.00. Re-check: \$63.00 against the estimate of \$60 — close, so it passes.

Fix it, then run the checks again on the fixed answer.

Felix's checkout total fails the estimate check

NUTS AND BOLTS HARDWARE	

Paintbrushes	15
Price each	\$4.20

TOTAL	\$19.20

$15 + \$4.20 = \$19.20$
 — the count was ADDED to one price, not multiplied!

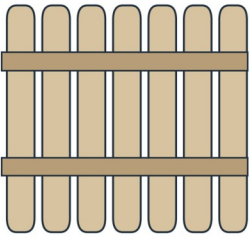
Correct total:
 $15 \times \$4.20 = \$63.00$

Example 3 — unscaffolded

Doug is painting a fence. The fence has an area of 46 m^2 and needs 2 coats of paint. One tin of paint covers 8 m^2 . How many whole tins should Doug buy?

The total area to cover is $46 \times 2 = 92 \text{ m}^2$. The number of tins is $92 \div 8 = 11.5$. Check 4 — half a tin cannot be bought, so test the whole numbers each side. 11 tins cover $11 \times 8 = 88 \text{ m}^2$, which leaves $92 - 88 = 4 \text{ m}^2$ of fence bare — that is not an option, so 11 tins fail. 12 tins cover $12 \times 8 = 96 \text{ m}^2$, which is enough for 92 m^2 , with paint for 4 m^2 to spare. This is a contextual judgement: the maths says 11.5, the situation says round **up**, because the consequence of rounding down is an unpainted patch of fence (and the spare paint in the twelfth tin keeps for touch-ups).

The fence



area 46 m^2 , needs 2 coats
 $46 \times 2 = 92 \text{ m}^2$ to cover

The working

One tin covers 8 m^2

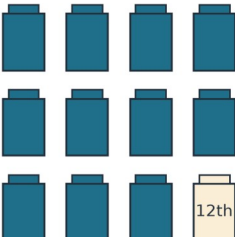
$92 \div 8 = 11.5$ tins

Half a tin cannot be bought

11 tins = $88 \text{ m}^2 \rightarrow 4 \text{ m}^2$ bare

12 tins = $96 \text{ m}^2 \rightarrow$ enough
round **UP** to 12 tins

12 tins



the 12th tin leaves
 4 m^2 of paint spare

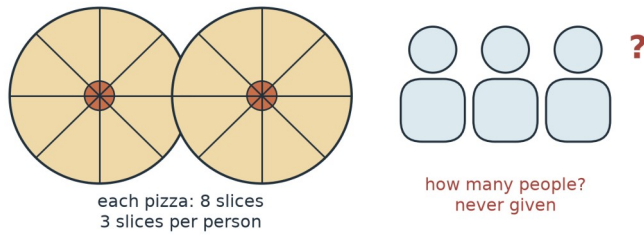
$\therefore$ Doug should buy 12 tins of paint.

Example 4 — unscaffolded

Ema is ordering pizzas for her soccer team after the grand final. Each pizza is cut into 8 slices, and Ema allows 3 slices per person. How many pizzas should Ema order?

Ema knows the slices per pizza (8) and the slices per person (3), but the number of people coming was never given. Without it, no calculation can reach an answer — this problem **cannot be solved** as stated, and naming the missing information *is* the answer: Ema needs to know how many people are coming. To see that everything else is ready, suppose 20 people come: the slices needed are $20 \times 3 = 60$, and the pizzas are $60 \div 8 = 7.5$. Seven pizzas would give only $7 \times 8 = 56$ slices — 4 short — so Ema would round up to 8 pizzas. As soon as the head count arrives, the problem is two quick steps from done.

Ema's pizza order — one fact is missing



Without the head count the problem cannot be solved — and saying so is the answer.

∴ the problem cannot be solved: the number of people coming is missing. (If 20 people came, Ema would order 8 pizzas.)

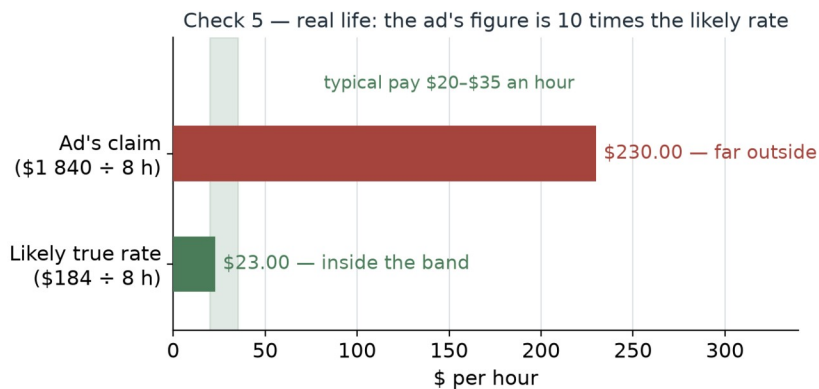
Practice questions

Scaffolded

- Q1.** Round each number as directed. (a) 68 and 134 to the nearest 10. (b) \$7.60 and \$11.85 to the nearest dollar. (c) 412 and 2938 to the nearest 100.
- Q2.** Kylie orders 8 crates of juice for the sports club canteen at \$12.40 per crate. (a) Estimate the cost by rounding \$12.40 to the nearest dollar. (b) Find the exact cost. (c) Is your estimate above or below the exact cost? Explain how you could have predicted this without calculating.
- Q3.** Choose the reasonable value in each case, and say what you compared it with. (a) The mass of a school bag with books in it: 5 kg, 50 kg or 500 kg. (b) The time to walk 1 km: 12 seconds, 12 minutes or 2 hours. (c) A backyard rainwater tank: 50 L, 5 000 L or 500 000 L.
- Q4.** A club is taking 44 supporters to the finals. Each minibus seats 13. (a) Estimate the number of minibuses by rounding 44 to 40 and 13 to 10. (b) Divide exactly: how many full busloads, and how many supporters left over? (c) How many minibuses are needed? Explain why the leftover supporters matter.
- Q5.** Margie shares \$378 equally between her 9 helpers at the market stall. She says each helper gets \$42. (a) Estimate one share by rounding \$378 to \$360 and dividing by 9. (b) Check Margie's \$42 by working backwards with the opposite operation. (c) One helper claims the share should be \$48. Use your estimate and your backwards check to explain why \$48 is wrong.
- Q6.** Hillside Tennis Club buys 12 boxes of tennis balls at \$29.50 per box, plus a one-off delivery fee of \$35. (a) Estimate the total by rounding \$29.50 to \$30 and 12 to 10. (b) Find the exact total. (c) The club has \$400 set aside. Is that enough? Use your estimate and your exact answer to explain, and state the change or the shortfall.

Unscaffolded

Q7. An online ad says a Saturday job at a plant nursery pays “\$1 840 for one 8-hour shift”. Use a benchmark hourly wage to decide whether this figure is reasonable. If it is not, suggest a likely true figure and the mistake that could have caused the ad.



Q8. Pearl is sewing cushion covers for a craft stall. She has 10 m of fabric, and each cover needs 45 cm. How many whole covers can Pearl sew, and how much fabric is left over? Explain why you rounded down here instead of to the nearest whole number.

Q9. The showground hall seats 90 people. A club with 96 members books the hall and promises every member a seat at the same event. Can the promise be kept? Explain why this problem, as stated, cannot be solved, and suggest two changes the club could make.

Q10. Beau wants to know how long his bike ride to his grandfather’s house takes. He knows the track is flat and that he rides at a steady pace. Can he work out the time from these facts alone? Explain your answer, name the missing information, and show what the calculation would look like if the distance were 20 km and Beau rode at 10 km/h.

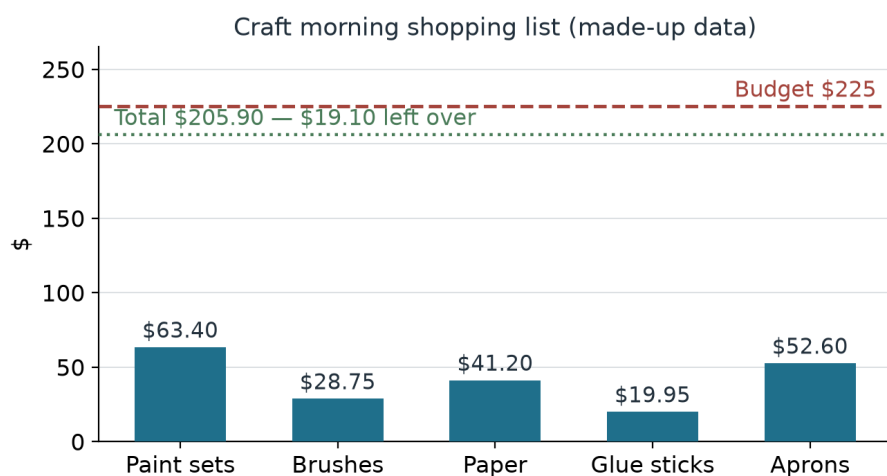
Q11. Felix’s receipt from the hardware store shows: nails \$8.90, sandpaper \$4.25, work gloves \$11.60 and a tape measure \$15.80. Estimate the total by rounding each price to the nearest dollar, then find the exact total. How far out was the estimate?

Q12. An after-school club runs a craft morning with a budget of \$225. Its shopping list is below.

Item	Cost
Paint sets	\$63.40
Brushes	\$28.75
Paper	\$41.20
Glue sticks	\$19.95
Aprons	\$52.60

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

- Estimate the total by rounding each cost to the nearest \$10.
- Find the exact total.
- Does the budget cover the bill? State the amount left over or the shortfall, and suggest one thing the club could do with any money left over.

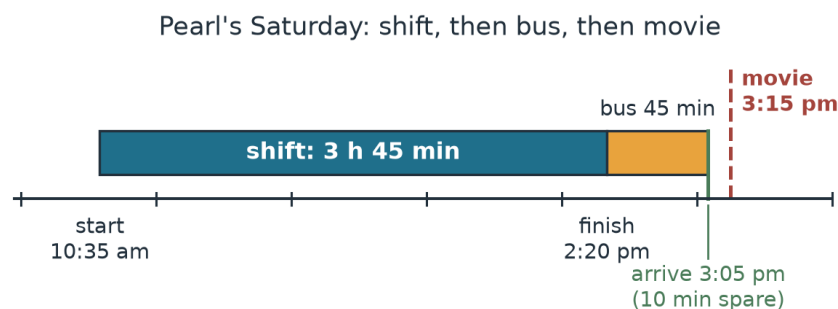


Q13. For each statement, say whether it is reasonable or not, and give a one-line check. (i) “Our school bus is about 12 m long.” (ii) “I drank 20 L of water at football training.” (iii) “The jacket was marked \$80, and in the sale the shop charged me \$95.” (iv) “My little brother was 150 cm tall on his third birthday.”

Q14. Kylie orders 24 T-shirts for her walking group at \$16.50 each, plus \$18.90 postage. The invoice arrives showing \$396.00. Check the invoice against an estimate, find the exact total, and describe the likely error. What should Kylie do?

Q15. A parking meter accepts 50 c coins only. Ema’s parking costs \$6.30. Can she pay the exact amount with 50 c coins? Explain, and say how many coins Ema should use and how much she overpays or underpays with them.

Q16. Pearl’s Saturday shift starts at 10:35 am and finishes at 2:20 pm. (a) Estimate the length of the shift. (b) Find the exact length of the shift, in hours and minutes. (c) After the shift, Pearl catches a bus straight away. The ride takes 45 minutes, and she wants to make it to a movie that starts at 3:15 pm. State her arrival time and whether she makes it.



Q17. Beau saves \$28 of his wage each week towards a \$400 camping tent. (a) Estimate the number of whole weeks he needs by rounding \$28 to \$30. (b) Find how many whole weeks Beau must save for, and explain the rounding you used. (c) State how much Beau has saved by then, and the money left over after he buys the tent.

Q18. The local youth club runs a pancake morning and wants at least 90 pancakes. Each batch of batter makes 12 pancakes, and each batch needs 2 cups of flour. Flour is sold in 3-cup bags. (a) How many whole batches are needed? (b) How many cups of flour are needed for that many batches? (c) How many whole bags of flour should the club buy? Explain the rounding you used.

Answers

Q1. (a) 70; 130. (b) \$8; \$12. (c) 400; 2 900. **Q2.** (a) about \$96. (b) \$99.20. (c) below — the price was rounded down, so the estimate had to land below the exact cost. **Q3.** (a) 5 kg. (b) 12 minutes. (c) 5 000 L. **Q4.** (a) about 4 minibuses. (b) 3 full busloads, 5 supporters left over. (c) 4 minibuses — 3 seat only 39 of the 44. **Q5.** (a) about \$40. (b) $\$42 \times 9 = \$378$ ✓. (c) $\$48 \times 9 = \$432$, not \$378 — \$54 too much, and \$48 is far above the estimate of about \$40. **Q6.** (a) about \$335. (b) \$389.00. (c) yes — \$389.00 is under \$400; change \$11.00. **Q7.** Not reasonable — it works out at \$230 an hour, far above the typical \$20–\$35 benchmark. A likely true figure is \$184 for the shift (\$23 an hour); a zero was probably added by mistake. **Q8.** 22 covers, 10 cm left over — a cover needs a full 45 cm, so the offcut cannot make a 23rd cover. **Q9.** No — $96 - 90 = 6$ members would have no seat, so the promise is impossible as stated. Changes: run two sittings of 48, or book a bigger hall (or cap attendance at 90). **Q10.** No — the distance and his speed are both missing. At 20 km and 10 km/h: $20 \div 10 = 2$ hours. **Q11.** Estimate \$41; exact \$40.55; the estimate is out by only \$0.45. **Q12.** (a) about \$200. (b) \$205.90. (c) yes — \$19.10 left over. **Q13.** (i) reasonable. (ii) not — 20 L is about 33 small 600 mL bottles. (iii) not — a sale price must be *below* \$80. (iv) not — 150 cm suits many 12 year olds; a 3 year old is about 95–100 cm. **Q14.** The estimate (about \$427) shows \$396.00 is too low; exact total \$414.90; the postage of \$18.90 was left off. Query the invoice and pay \$414.90. **Q15.** No — $\$6.30 \div \$0.50 = 12.6$, not a whole number of coins. Use 13 coins (\$6.50), overpaying 20 c; 12 coins (\$6.00) is 30 c short and the meter would reject it. **Q16.** (a) about 4 hours (a little under). (b) 3 h 45 min (225 minutes). (c) she arrives at 3:05 pm — yes, with 10 minutes to spare. **Q17.** (a) about 13 weeks. (b) 15 weeks — 14 weeks gives \$392, which is \$8 short, so round up. (c) \$420 saved, so \$20 left over. **Q18.** (a) 8 batches (7 make only 84). (b) 16 cups. (c) 6 bags — 5 bags hold only 15 cups, so round up.

Fully-worked solutions

Q1. (a) To the nearest 10: $68 \rightarrow 70$ (ones digit $8 \geq 5$, round up); $134 \rightarrow 130$ (ones digit $4 < 5$, round down). (b) To the nearest dollar: $\$7.60 \rightarrow \$8$ (60 c ≥ 50 c, round up); $\$11.85 \rightarrow \$12$ (85 c ≥ 50 c, round up). (c) To the nearest 100: $412 \rightarrow 400$ (tens digit $1 < 5$, round down); $2\,938 \rightarrow 2\,900$ (tens digit $3 < 5$, round down).

Q2. (a) Rounding \$12.40 down to \$12 gives $8 \times \$12 = \$96$, so about \$96. (b) Exact: $8 \times \$12.40 = \$99.20$. (c) The estimate is *below* the exact cost. This could be predicted: rounding the price *down* makes every crate cheaper in the estimate, so the estimate had to land below the exact total (by $8 \times \$0.40 = \$3.20$).

Q3. (a) 5 kg — compare with a 600 mL water bottle, which has a mass of about 0.6 kg: a bag with a few books and a bottle feels like a few bottles, not a person (50 kg) or a small motorbike (500 kg). (b) 12 minutes — the walking benchmark is about 5 km/h, and $60 \div 5 = 12$, so 1 km takes about 12 minutes. 12 seconds is faster than a sprint; 2 hours is a rest stop on the way. (c) 5 000 L — 50 L is about a large bucket, and 500 000 L is a farm dam. A backyard tank holds thousands of litres.

Q4. (a) $40 \div 10 = 4$, so about 4 minibuses. (b) $44 \div 13 = 3$ remainder 5: three full busloads of 13, with 5 supporters left over. (c) 4 minibuses. The 5 leftover supporters still need seats, and 3 minibuses carry only $3 \times 13 = 39$ of the 44. So round up: 4 minibuses, with $4 \times 13 - 44 = 8$ spare seats. (Here the estimate in (a) already matched the answer.)

Q5. (a) $\$360 \div 9 = \$40$, so about \$40 each. (b) Backwards check with the opposite operation: $\$42 \times 9 = \$378$ ✓, so \$42 per helper is right. (c) If each helper got \$48, the total paid would be $\$48 \times 9 = \$432$, which is $\$432 - \$378 = \$54$ more than the \$378 actually shared. The estimate (about \$40) also shows \$48 is far too high. The claim fails both checks.

Q6. (a) $10 \times \$30 = \$300$, plus the \$35 delivery, gives about \$335. (b) Boxes: $12 \times \$29.50 = \$354.00$. Total: $\$354.00 + \$35 = \$389.00$. (c) Yes. The exact total \$389.00 is under \$400, and the estimate of about \$335 already suggested it would fit. Change: $\$400 - \$389.00 = \$11.00$.

Q7. Many part-time shop and nursery jobs pay about \$20 to \$35 an hour, so an 8-hour shift should pay about $8 \times \$20 = \$160$ up to $8 \times \$35 = \$280$. The ad's \$1 840 works out at $\$1\,840 \div 8 = \$230$ an hour — many times the benchmark, and not believable for a Saturday job (check 5). A likely true figure is \$184 for the shift, because

$\$184 \div 8 = \$23$ an hour, which sits inside the benchmark band; $\$1\,840$ is exactly 10 times $\$184$, so a zero was probably added by mistake. The figure is **not** reasonable.

Q8. Swap to the same unit first: $10\text{ m} = 1\,000\text{ cm}$ ($1\text{ m} = 100\text{ cm}$). $1\,000 \div 45 = 22$ remainder 10 (since $22 \times 45 = 990$). Backwards check: $22 \times 45 = 990 \leq 1\,000$ ✓, while $23 \times 45 = 1\,035 > 1\,000$ ✗. Round **down** because each cover needs a full 45 cm of fabric: the 10 cm offcut is too small to make a 23rd cover. So 22 whole covers, with 10 cm of fabric left over.

Q9. No. The hall has 90 seats but 96 members must all sit at the same time, and $96 - 90 = 6$, so 6 members would be left standing. The facts cannot all be true at once — the problem cannot be solved as stated (impossible conditions), and saying so with the reason *is* the answer. Two possible changes: run the event in two sittings of 48 people each ($48 \leq 90$ fits), or book a bigger hall. (Capping attendance at 90 would also fit, but breaks the “every member” promise.)

Q10. No, he cannot. “Flat” and “steady pace” describe the ride but give no numbers: the missing information is the **distance** to his grandfather’s house and Beau’s **speed** (km per hour). With both facts the calculation works; for example at 20 km and 10 km/h the ride takes $20 \div 10 = 2$ hours. Without them the problem cannot be solved — and saying so, with the reasons, is the correct outcome.

Q11. Rounded to the nearest dollar: $\$9, \$4, \$12$ and $\$16$, which add to $\$9 + \$4 + \$12 + \$16 = \$41$. Exact: $\$8.90 + \$4.25 + \$11.60 + \$15.80 = \$40.55$. The estimate is out by only $\$41 - \$40.55 = \$0.45$, and it sits above the exact total because three of the four prices were rounded up. That is a very good check.

Q12. (a) Rounded to the nearest $\$10$: $\$60, \$30, \$40, \$20$ and $\$50$, giving about $\$200$. (b) Exact: $\$63.40 + \$28.75 + \$41.20 + \$19.95 + \$52.60 = \$205.90$. (c) Yes, the $\$225$ budget covers it: $\$225 - \$205.90 = \$19.10$ left over. The club could buy spare glue sticks, or put the $\$19.10$ towards paper for the next craft morning.

Q13. (i) Reasonable — a car is about 4–5 m long, and a school bus is about two-and-a-half cars, so about 12 m fits. (ii) Not reasonable — 20 L is $20\,000 \div 600 \approx 33$ small (600 mL) drink bottles. Nobody drinks that at training; 1–2 L is plenty. (iii) Not reasonable — a sale price must be *below* the marked price, so the charge must be under $\$80$; $\$95$ is $\$15$ *above* it, the wrong direction (check 3). (iv) Not reasonable — 150 cm is the height of many 12 year olds; a 3 year old is about 95–100 cm.

Q14. Estimate: round $\$16.50$ up to $\$17$ and the postage to $\$19$: $24 \times \$17 = \$408$, and $\$408 + \$19 = \$427$, so the total should be a little under $\$427$. The invoice’s $\$396.00$ is about $\$31$ below the estimate — check 1 fails. Exact: $24 \times \$16.50 = \$396.00$ for the shirts, and $\$396.00 + \$18.90 = \$414.90$ in total. The invoice is $\$414.90 - \$396.00 = \$18.90$ short — exactly the postage, which was left off. Kylie should query the invoice and pay the correct total of $\$414.90$.

Q15. No. $\$6.30 \div \$0.50 = 12.6$, and 12.6 coins is not a whole number of coins (check 4). 12 coins give $12 \times \$0.50 = \$6.00$ — 30 c short, so the meter would not accept it. 13 coins give $13 \times \$0.50 = \$6.50$ — 20 c over. So Ema uses 13 coins and overpays by 20 c; she cannot pay the exact amount.

Q16. (a) Counting on in whole hours, 10:35 am to 2:35 pm would be 4 hours, and the shift ends a little before that — so about 4 hours (a little under). (b) Exact: 10:35 am to 1:35 pm is 3 hours, and 1:35 pm to 2:20 pm is 45 minutes, so the shift is 3 h 45 min (that is 225 minutes). (c) The bus leaves at 2:20 pm and takes 45 minutes, so Pearl arrives at 3:05 pm. That is 10 minutes before the 3:15 pm start — yes, she makes it, with 10 minutes to spare.

Q17. (a) Rounding the saving up to $\$30$ gives $\$400 \div \$30 = 13$ remainder $\$10$, so about 13 whole weeks. (b) Exact: $14 \times \$28 = \$392$, which is $\$400 - \$392 = \$8$ short, so 14 weeks fail. $15 \times \$28 = \$420 \geq \$400$, so Beau must save for 15 whole weeks — round **up**, because stopping at 14 weeks means no tent. (The estimate of about 13 sat below the true 15 because rounding the weekly saving *up* made each week look more productive than it is.) (c) After 15 weeks Beau has $\$420$. Buying the $\$400$ tent leaves $\$420 - \$400 = \$20$ over.

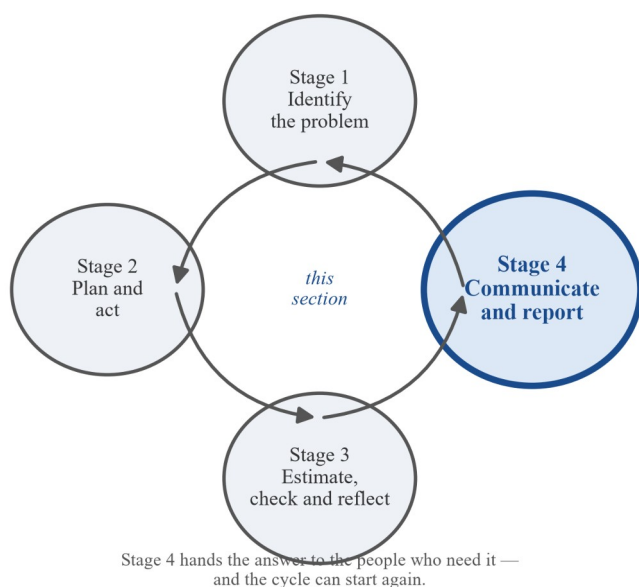
Q18. (a) $90 \div 12 = 7.5$, so test whole batches: $7 \times 12 = 84$ pancakes, which is fewer than the 90 wanted, while $8 \times 12 = 96 \geq 90$. Round up: 8 batches. (b) Flour: $8 \times 2 = 16$ cups. (c) $16 \div 3 = 5$ remainder 1, and 5 bags hold only $5 \times 3 = 15$ cups — 1 cup short — while 6 bags hold $6 \times 3 = 18$ cups, which is enough. Round up: 6 bags (the 2 spare cups keep for the next morning).

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

Theory

About the data in this section. The tables, prices, counts and graphs here are **made up** (not real): pretend shops, pretend clubs 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.

Stage 4: telling people the answer. In this book, solving a problem runs as a cycle of four stages: identify the problem; plan and act; estimate, check and reflect; then communicate and report. This section is the fourth stage. It is where your maths leaves your working and reaches the person who asked for it. An answer that nobody can read or hear has not been reported yet. Stage 4 also closes the loop: a good report often raises the next question, and the cycle begins again.



The four-stage cycle, with stage 4 (communicate and report) highlighted

Who are you reporting to? Two choices shape every report. The first is written or oral (spoken). A written report, table or graph stays there: the reader can come back to it. An oral report is quick, and the listener can ask questions straight away. The second choice is formal or informal. Formal means full sentences, labelled numbers, units and correct symbols — right for a boss, a client, a committee or an assessor. Informal means short forms and everyday words — fine for your own team or your own notes. Both are useful. Pick the form that fits your reader. Ask three questions: who will read or hear this, what do they need to know, and what will they do with it?

Format or device	Good for
Short written report	keeping a record; a boss or committee can re-read it
Table	exact numbers side by side, easy to look up
Bar chart	comparing counts across groups
Line graph	showing change over time
Pie chart	showing shares of a whole (per cents)
Diagram or plan	sizes, positions and layout
Oral report with a graph on a slide	a meeting: people hear it and see it at once
Spoken handover at the end of a shift	fast, and the listener can ask questions now

A spreadsheet or a phone app can build these for you, and Section 1F of this chapter shows how. Everything in this section can also be made with pen and paper.

Informal words, formal symbols. Maths has a shorthand. When you report, swapping everyday words for the right symbol lets a reader see the operation at a glance.

Everyday words	Symbol	Reads as
altogether, in total	+	plus, add
how many more, left over, the difference	−	minus, take away
groups of, times, each	×	times, multiplied by
shared equally between, per, each	÷	divided by
about, close to	≈	approximately equal to
so the answer is	∴	therefore
out of 100	%	per cent

The sign $\therefore$ means “therefore” — “so we can say”. It was defined in Section 1A of this chapter. Two micro examples: four packs at \$12.75 each is $4 \times \$12.75 = \$51.00$ altogether. A mean of 11 goals over 6 games is $11 \div 6 \approx 1.83$ (to 2 decimal places), because the division does not end.

Saying the maths out loud. An oral report needs you to say symbols and shorthand as words. Here is how each one is read.

Symbol or display	Say it as
=	equals, is
≈	is about, is approximately
%	per cent
÷	divided by
km/hr	kilometres per hour
\$/kg	dollars per kilogram
0.85 m = 85 cm	“nought point eight five metres is eighty-five centimetres”
1.25 m = 1 250 mm	“one point two five metres is one thousand two hundred and fifty millimetres”

Rate shorthand: km/hr and \$/kg. A rate compares two different units in one number. The slash reads as “per”. So 60 km/hr means 60 kilometres per hour, and \$3.20/kg means three dollars and twenty cents per kilogram. Rates are useful in a report because they squeeze a comparison into one number: two bags of rice, or two trips, can be compared straight away.

One number, different outfits: fractions, decimals and per cents. The same amount can be written three ways. One small square of a hundred is $\frac{1}{100} = 0.01 = 1\%$. One eighth is $12.5\% = 0.125 = \frac{1}{8}$. Picking the right outfit is part of reporting: a share of a group often reads best as a per cent, a measurement as a decimal.

Same amount, different outfits

12.5%



shaded part: $\frac{1}{8} = 0.125 = 12.5\%$

1%



shaded part: $\frac{1}{100} = 0.01 = 1\%$

1 of the 100 equal parts,
zoomed in

The same shaded amount written as a fraction, a decimal and a per cent

Fraction	Decimal	Per cent
$\frac{1}{2}$	0.5	50%
$\frac{1}{4}$	0.25	25%
$\frac{1}{5}$	0.2	20%
$\frac{1}{8}$	0.125	12.5%
$\frac{1}{10}$	0.1	10%
$\frac{1}{100}$	0.01	1%

Refresher. Fraction to decimal to per cent. Divide the top number by the bottom number to get the decimal, then multiply by 100 to get the per cent. So $\frac{1}{8} = 1 \div 8 = 0.125$, and $0.125 \times 100 = 12.5$, which gives $\frac{1}{8} = 12.5\%$. Going back the other way, a per cent divided by 100 is a decimal: $12.5\% = 12.5 \div 100 = 0.125$.

Refresher. Finding a per cent of an amount. Start from 10%, because 10% of anything is just divide by 10. For a \$450 total: 10% is $\$450 \div 10 = \$45.00$. Then build the others from that one piece:

- 30% is $3 \times \$45.00 = \$135.00$
- 50% is $5 \times \$45.00 = \$225.00$
- 25% is half of 50%, so $\$225.00 \div 2 = \$112.50$
- 5% is half of 10%, so $\$45.00 \div 2 = \$22.50$

Units and the house writing rules. Four rules make your numbers easy to trust.

- Put a space between the number and its unit: 35 km, 12 cm, 90 min.
- Write money with the \$ tight against the number and two decimal places for cents: \$8.40, not \$ 8 . 4. In money, separate thousands with a space: \$1 250.00.
- In maths, keep thousands together with a thin space: 1 250.
- Round once, at the end, at the precision the task asks for — and say that precision in your answer.

Refresher. Rounding to a stated precision. Look at the digit one place to the right of where you stop. If it is 0–4, the last kept digit stays. If it is 5–9, add 1 to the last kept digit.

- \$19.348 to the nearest cent: the third decimal is 8, so \$19.35.
- 8.74 to 1 decimal place: the next digit is 4, so 8.7.
- 7.5 to the nearest whole number: the next digit is 5, so 8.

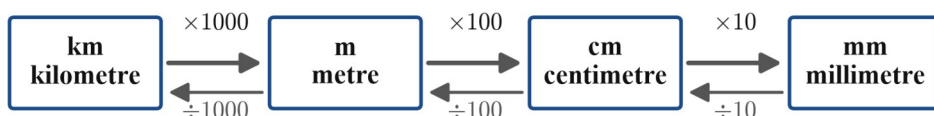
- 2.363 to 2 decimal places: the next digit is 3, so 2.36.

Then say what you did: “(to 1 decimal place)”, “(to the nearest cent)”, or “(exact)” when no rounding was needed.

Refresher. Metric units — two ways to write one measurement. One measurement can be written in a bigger or a smaller unit.

Length	Capacity	Mass
1 km = 1 000 m	1 L = 1 000 mL	1 kg = 1 000 g
1 m = 100 cm		
1 cm = 10 mm		

Bigger unit to smaller unit: multiply. Smaller unit to bigger unit: divide. So $1.25 \text{ m} = 1.25 \times 1000 = 1\,250 \text{ mm}$, and $350 \text{ g} = 350 \div 1000 = 0.35 \text{ kg}$. Also $2.4 \text{ L} = 2\,400 \text{ mL}$, and $400 \text{ mL} = 0.4 \text{ L}$.



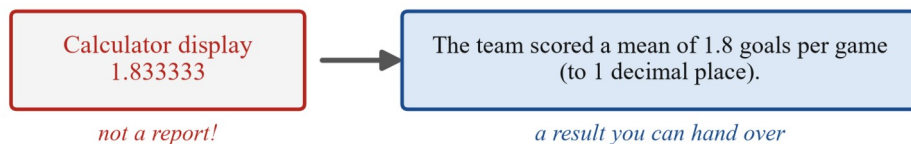
bigger unit → smaller unit: multiply $1.25 \text{ m} = 1.25 \times 1000 = 1\,250 \text{ mm}$

Kilometres, metres, centimetres and millimetres with the multiply and divide steps

The result sentence. A calculator display is not a report. Key in $11 \div 6$ and the screen shows 1.833333. That string of digits answers no-one’s question: it has no units, no sentence, and no rounding stated. Turn it into a result sentence: “The team scored a mean of 1.8 goals per game (to 1 decimal place).” Give every result sentence a four-part check.

- Does it answer the question that was asked?
- Does it carry its units (goals, km, \$, mL)?
- Is it a full sentence a reader can follow?
- Does it state the rounding, or say the value is exact?

From a display to a result sentence



✓ answers the question	✓ carries its units	✓ is a full sentence	✓ states the rounding (or says exact)
------------------------	---------------------	----------------------	---------------------------------------

A calculator display turned into a result sentence, with the four-part check

Working a reader can follow. In a report, show the steps that carry the answer, one step per line, each line labelled. Compare these two ways of writing the same purchase.

$$3 \times 21.99 = 65.97 \text{ ok}$$

Tins of paint: $3 \times \$21.99 = \$65.97$

So the paint costs \$65.97.

The first line cannot be checked by anyone else. The second can be followed line by line, and the last line says what the number means.

Tables, diagrams and graphs. Pick the picture that shows your result fastest. First, two short refreshers for the words this part uses.

Refresher. Mean and range. The mean is the total divided by how many values there are. The range is the biggest value minus the smallest value. For the meals table in the next figure: the total is $38 + 42 + 35 + 45 = 160$ meals, so the mean is $160 \div 4 = 40$ meals per day, and the range is $45 - 35 = 10$ meals.

Refresher. Reading a graph. Read it in this order: the title (what is this about?), the axis labels and their units (what is being counted, in what unit?), the scale (how big is each step?), then the values themselves (the points, the bars, or the table cells). A good table or graph has all four: a title, labelled axes or columns with units, a clear scale, and values a reader can take off without guessing.

X Before

38	42	35	45
----	----	----	----

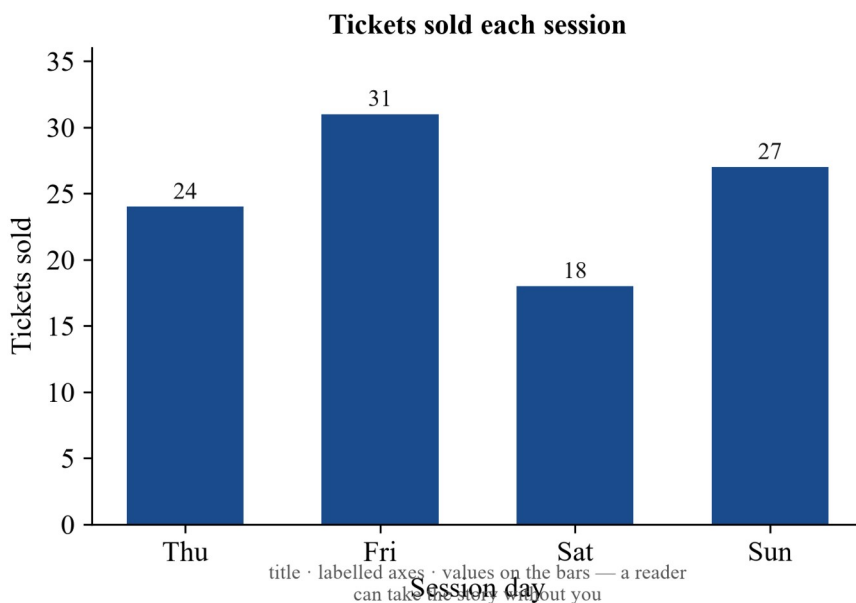
no title · no column names · no days · no units

✓ After

Meals delivered each day

Day	Meals delivered
Monday	38
Tuesday	42
Wednesday	35
Thursday	45
Total	160
Mean per day	40

The same numbers as a bare table and as a titled, labelled table



A titled bar chart with labelled axes and the value on each bar

Which form for which result:

- exact numbers a reader must look up — a table
- change over time — a line graph
- comparing counts across groups — a bar chart
- shares of a whole — a pie chart

- sizes, positions and layout — a diagram or plan

A short written report in six parts. A written report does not need to be long. Six small parts are enough: the question, the method, the working, the result, the check, and the conclusion. Each part is one or two lines. The conclusion answers the question in words.

A short written report — six parts

Question

Do \$50 cover 3 punnets of seedlings at \$4.60 each plus one \$35 bag of potting mix?

Method

Cost the punnets, add the bag, then compare with \$50.

Working

$3 \times \$4.60 = \$13.80$ $\$13.80 + \$35 = \$48.80$

Result

\$48.80 in total — \$50 covers it, with \$1.20 change (exact).

Check

Estimate: $3 \times \$5 + \$35 = \$50$. The exact \$48.80 is \$1.20 under the estimate — close, so the answer is sensible.

Conclusion wraps the parts: “Yes — \$50 is enough, with \$1.20 to spare.”

A six-part written report: question, method, working, result, check, conclusion

An oral report, kept short. A spoken report works in five steps. Say who you are and what you checked. Give the result first, in one sentence. Give the two or three numbers behind it. Say your check. Then stop and take questions. Keep it under a minute. If there is a graph, point at the parts you mean — do not read every number out loud.

Put the check in the report. Stage 3 of the cycle ends with a check (Section 1C of this chapter teaches it), and stage 4 reports that check. A reader trusts a result more when the check is visible. For example: 8 tickets at \$11.25 each is $8 \times \$11.25 = \$90.00$. The estimate was $8 \times \$11.00 = \$88.00$. The exact answer is \$2.00 above the estimate — close, so it is sensible. Put that last sentence in the report.

Every task needs at least one report. No task in this book needs every form above. But every task ends with at least one clear report: a result sentence, a table, a graph or a short talk. Across this book you will use each form at least once, so by the end you have practised them all.

Worked examples

Example 1 — scaffolded

Petra coaches a junior football team. She counts the goals her team scores in 6 games: 2, 1, 3, 0, 2, 3. The club committee has asked for a short report on the season.

Working	Comment
(a) Total goals: $2 + 1 + 3 + 0 + 2 + 3 = 11$	Add the six games.
(b) Mean: $11 \div 6 = 1.833333\dots$	Mean = total $\div$ how many games.
Mean ≈ 1.8 goals per game (to 1 d.p.)	Round once, at the end, and say the precision.
(c) Range: $3 - 0 = 3$ goals	Range = biggest – smallest.
(d) “The team scored 11 goals in 6 games, a mean of 1.8 goals per game (to 1 d.p.), with a range of 3 goals.”	A result sentence: it answers, carries units, is a full sentence and states the rounding.

Example 2 — scaffolded

Ezra is a carpentry student. He cuts one 2.4 m length of pine into 8 equal shelves. His supervisor wants the shelf length reported in metres and in millimetres.

Working	Comment
(a) $2.4 \div 8 = 0.3$	Eight equal parts of 2.4 m.
(b) $0.3 \times 1000 = 300$	Metres to millimetres: multiply by 1 000.
Each shelf is 0.3 m long, which is 300 mm.	Both units, in one sentence.
(c) Check: $8 \times 300 = 2\,400 \text{ mm} = 2.4 \text{ m} \checkmark$	Multiply back to the original length.
“Each shelf is 0.3 m (300 mm) long — exact, no rounding needed.”	Say when a value is exact.

Example 3 — unscaffolded

Kaori is buying potatoes. At Bluegum Greengrocers a 5 kg bag costs \$6.75. At Mallee Fresh, loose potatoes cost \$1.48 per kg. Which option is cheaper per kilogram, and by how much? Report your answer in one sentence.

Cost per kg of the bag:

$$\$6.75 \div 5 = \$1.35 \text{ per kg (exact)}$$

Loose potatoes cost \$1.48 per kg. The difference is:

$$\$1.48 - \$1.35 = \$0.13 \text{ per kg}$$

$\therefore$ the 5 kg bag at Bluegum Greengrocers is cheaper, by \$0.13 per kg.

Example 4 — unscaffolded

Freya works at Riverside Community Library. At the end of her shift she leaves this note for the next assistant:

shelved abt 240 this wk, busy wk, fri heaviest

Her tally for the week is: Monday 44, Tuesday 51, Wednesday 47, Thursday 45, Friday 53 books re-shelved. Rewrite Freya’s note as a formal written report for the library manager.

Total for the week: $44 + 51 + 47 + 45 + 53 = 240$ books.

Mean per day: $240 \div 5 = 48$ books (exact).

Heaviest day: Friday, with 53 books.

Check: $48 \times 5 = 240 \checkmark$, which matches the tally.

Books re-shelved this week. 240 books were re-shelved over the five days, a mean of 48 books per day (exact). Friday was the heaviest day, with 53 books. Check: $48 \text{ books} \times 5 \text{ days} = 240 \text{ books}$, which matches the tally.

$\therefore$ the shift note becomes a report the manager can read and file.

Practice questions

Scaffolded

Q1. Fill in the missing symbol in each line: =, $\approx$, $\div$ or $\therefore$.

- (a) $3 \times \$12.75$ ____ $\$38.25$
- (b) $11 \div 6$ ____ 1.83 (to 2 decimal places)
- (c) $\$48.75$ ____ $5 = \$9.75$ each
- (d) ____ each shelf is 0.3 m long.
- (e) Write each sentence using symbols: (i) 24 shared equally between 8 is 3; (ii) the total is about \$90.
- (f) Read these out in words: 65 km/hr; $\$3.20$ /kg.

Q2. Words and symbols.

- (a) Match each phrase to its symbol: altogether; how many more; shared equally between 4; about; so the answer is. The symbols are $+$, $-$, $\div 4$, $\approx$, $\therefore$.
- (b) Write “12 out of 100” as a per cent.
- (c) Write $\$2.85$ /kg in words, as you would say it in an oral report.

Q3. One number, three outfits.

- (a) In a survey, 50 of 200 commuters rode a bike. Write this share as a fraction in simplest form, as a decimal and as a per cent.
- (b) Write $\frac{1}{100}$ as a decimal and as a per cent.
- (c) Write 12.5% as a decimal and as a fraction in simplest form.

Q4. Rewrite each measurement in the unit asked.

- (a) 0.85 m in cm
- (b) 3.5 km in m
- (c) 750 g in kg
- (d) 2.4 L in mL

Q5. Each calculator display below came from a real task. Write a result sentence for each, with the rounding stated (or say the value is exact).

- (a) 12.666666 — three people share \$38 equally.
- (b) 2.75 — 11 L of paint is shared equally over 4 walls.
- (c) 21.333333 — a walker covers 64 km over 3 days.

Q6. Fix each line so it follows the house writing rules.

- (a) 62km
- (b) $\$ 8.4$
- (c) 3200g
- (d) 14.375 dollars (write it to the nearest cent)

Unscaffolded

Q7. A 3 kg bag of rice costs \$4.86 at the Greenfield store.

- (a) Find the cost per kilogram.
- (b) Write the cost per kilogram in rate shorthand.
- (c) Report your answer in one sentence.

Q8. A pool pump label reads $L = 15$ m, meaning it moves 15 litres every minute. Henri runs the pump for 40 minutes.

- (a) How many litres does it move?
- (b) Write a result sentence for your answer.

Q9. Jonas rides 18 km in 45 minutes.

- (a) Show that 45 minutes is 0.75 hours. One step per line.
- (b) Find his mean speed in km/hr.
- (c) Report your answer in one sentence.

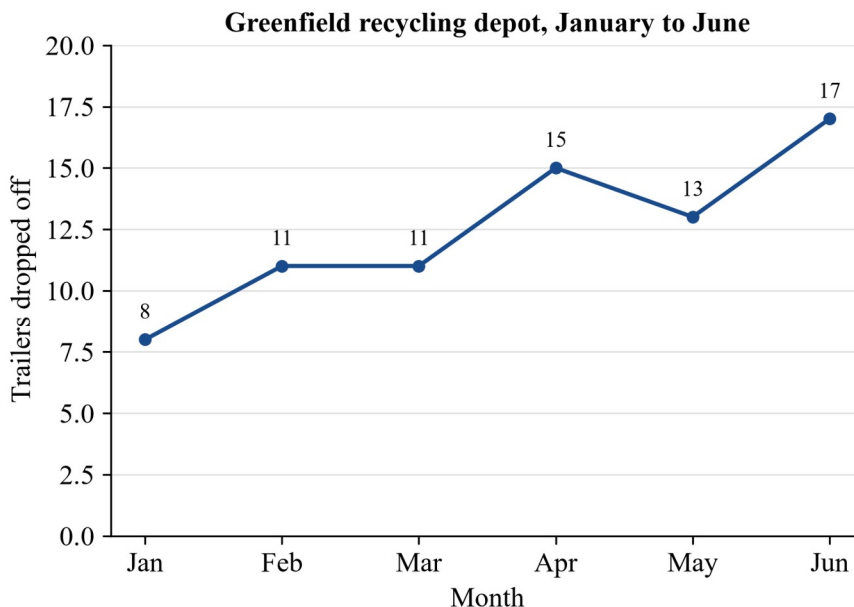
Q10. A strawberry packhouse keeps its counts in a bare table with no labels.

52	47	58	51
----	----	----	----

These counts are made up for this book: pretend punnets on four pretend days, Monday to Thursday in order.

- (a) Redraw the table with a title, column headings and the day names, so a reader can use it.
- (b) Find the total number of punnets packed over the four days.
- (c) Find the mean number of punnets per day.
- (d) Find the range.

Q11. The line graph below shows trailers dropped off at the Greenfield recycling depot.

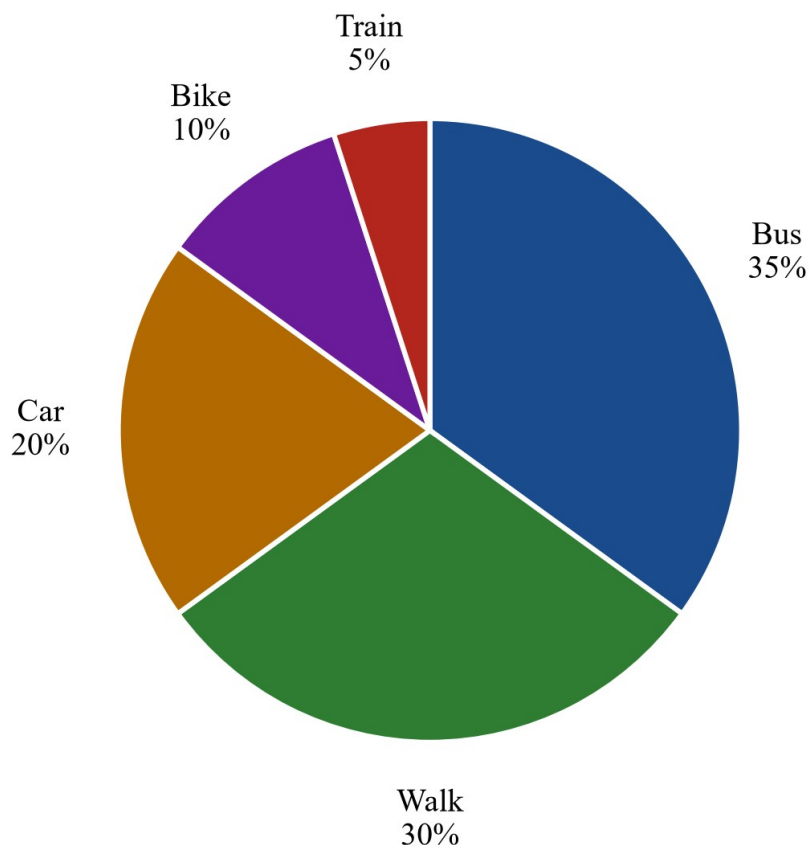


Trailers dropped off at the Greenfield recycling depot, January to June

- (a) Which two months had the same number of trailers?
- (b) How many trailers were dropped off in April?
- (c) Find the total number of trailers from January to June.
- (d) Find the mean number of trailers per month, to 1 decimal place.

Q12. The pie chart below shows how the 40 students in a home group travel to school.

How the 40 students travel to school



The percentages add to 100%.

How the 40 students travel to school, as per cent shares

- (a) Show that the five per cents add to 100%. One step per line.
- (b) How many students travel by bus?
- (c) How many students walk?
- (d) Write a result sentence naming the most common way to travel.

Q13. Dmitri gives an oral report to the Nyala Youth Group about the movie night. These are his six sentences, in the wrong order. Put them in the best order for a spoken report.

- A. “As a check: \$54.75 plus \$41.75 gives \$96.50, our takings — it matches.”
- B. “That is the report — any questions?”
- C. “I am Dmitri from the Nyala Youth Group, reporting on our movie night.”
- D. “Costs were \$41.75.”
- E. “Takings were \$96.50.”
- F. “Our profit was \$54.75.”

Q14. One tin of paint covers 12 m². Sunita must paint a wall with an area of 50 m².

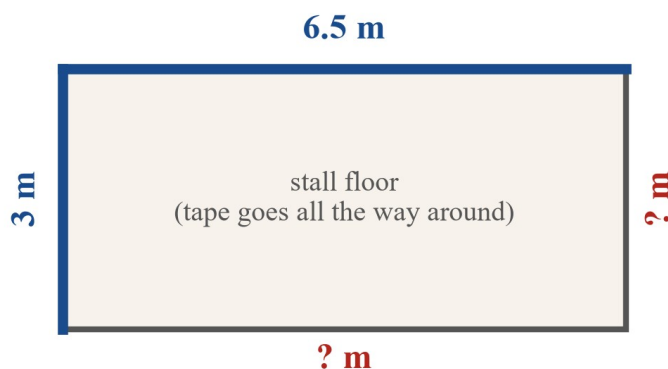
- (a) Show that the number of tins needed is $50 \div 12 = 4.166666\dots$. One step per line.
- (b) How many whole tins must Sunita buy?
- (c) Say why 4 tins are not enough.

Q15. Choosing a form for the reader.

- (a) Match each reader to the best form: (i) a committee at a meeting, who want to see how takings changed month by month; (ii) a customer who wants the exact prices in writing; (iii) a crew setting up a stall tomorrow, who need the layout. The forms are: A a printed quote as a table; B a slide with a line graph; C a quick sketch plan.
- (b) Name two devices that would help Leilani give an oral report about a graph to her team.
- (c) Say why a table is better than a bar chart for reporting exact re-order numbers to a store manager.
- (d) Fix this line so it follows the house rules: 60kg.

Q16. Sunita's craft-market stall floor is a rectangle. The plan below shows two sides; the tape border runs all the way around.

Sunita's craft-market stall floor plan



Sunita's craft-market stall floor plan with two sides labelled and two sides unknown

- (a) Write the lengths of the two sides marked “?”.
- (b) Find the total length of tape needed, in metres.
- (c) Write a result sentence for your answer to (b).

Q17. Malia's netball team buys 8 team caps at \$14.25 each. The team's budget is \$120. Write a four-line report (working, result, check, conclusion) that says whether the budget covers the caps, and by how much.

Q18. The Bundarra Show sells 32 tickets at \$21.50 each.

- (a) Find the exact total takings.
- (b) Estimate the takings by rounding the ticket count to 30 and the price to \$22.
- (c) Is the exact total above or below your estimate, and by how much?
- (d) Write a report sentence that includes the exact total and the check from (c).

Answers

Q1. (a) $=$ (b) $\approx$ (c) $\div$ (d) $\therefore$ (e)(i) $24 \div 8 = 3$ (ii) total $\approx \$90$ (f) 65 kilometres per hour; three dollars and twenty cents per kilogram

Q2. (a) altogether $\rightarrow +$; how many more $\rightarrow -$; shared equally between 4 $\rightarrow \div 4$; about $\rightarrow \approx$; so the answer is $\rightarrow \therefore$ (b) 12% (c) two dollars and eighty-five cents per kilogram

Q3. (a) $\frac{1}{4}$, 0.25, 25% (b) 0.01, 1% (c) 0.125, $\frac{1}{8}$

Q4. (a) 85 cm (b) 3 500 m (c) 0.75 kg (d) 2 400 mL

Q5. (a) Each person pays \$12.67 (to the nearest cent). (b) Each wall takes 2.75 L of paint (exact). (c) The walker covered a mean of 21.3 km per day (to 1 d.p.).

Q6. (a) 62 km (b) \$8.40 (c) 3 200 g (or 3.2 kg) (d) \$14.38 (to the nearest cent)

Q7. (a) \$1.62 per kg (exact) (b) \$1.62/kg (c) “The rice costs \$1.62 per kilogram, exact.”

Q8. (a) 600 L (b) “The pump moved 600 L in 40 minutes (exact).”

Q9. (a) $45 \div 60 = 0.75$ h (b) 24 km/hr (c) “Jonas rode at a mean speed of 24 km/hr (exact).”

Q10. (a) titled table, columns Day and Punnets packed, rows Mon–Thu (b) 208 punnets (c) 52 punnets per day (exact) (d) 11 punnets

Q11. (a) February and March (11 each) (b) 15 (c) 75 trailers (d) 12.5 trailers per month

Q12. (a) $35 + 30 + 20 + 10 + 5 = 100$ (b) 14 students (c) 12 students (d) “The most common way to travel is the bus: 14 of the 40 students (35%).”

Q13. C, F, E, D, A, B

Q14. (a) $50 \div 12 = 4.166666\dots$ (b) 5 tins (c) 4 tins cover only 48 m², which is 2 m² short of 50 m²

Q15. (a) (i) B (ii) A (iii) C (b) any two: point at the graph while speaking; put the result sentence on the slide; hand out a one-page summary (c) bar heights must be read off a scale and can only be estimated, while a table shows the exact numbers (d) 60 kg

Q16. (a) 6.5 m and 3 m (b) 19 m (c) “The tape border is 19 m long (exact).”

Q17. Working: $8 \times \$14.25 = \$114.00$. Result: \$114.00, so yes, the \$120 budget covers it with \$6.00 to spare. Check: estimate $8 \times \$14.00 = \$112.00$; the exact \$114.00 is \$2.00 above — close, sensible. Conclusion: the caps fit the budget with \$6.00 left.

Q18. (a) \$688.00 (b) \$660.00 (c) above, by \$28.00 (d) “Takings were \$688.00 (exact); my estimate of \$660.00 was \$28.00 under, which is close enough to trust the total.”

Fully-worked solutions

Q1. (a) $3 \times \$12.75 = \$38.25$, an exact equality, so $=$. (b) $11 \div 6 = 1.833333\dots$, and 1.83 is a rounded value, so $\approx$. (c) Sharing \$48.75 between 5 is division: $\$48.75 \div 5 = \$9.75$. (d) The line states a conclusion from working, so $\therefore$. (e)(i) $24 \div 8 = 3$. (ii) total $\approx \$90$. (f) 65 km/hr reads as “sixty-five kilometres per hour”; \$3.20/kg reads as “three dollars and twenty cents per kilogram”.

Q2. (a) altogether $\rightarrow +$; how many more $\rightarrow -$; shared equally between 4 $\rightarrow \div 4$; about $\rightarrow \approx$; so the answer is $\rightarrow \therefore$. (b) 12 out of 100 is 12%. (c) “Two dollars and eighty-five cents per kilogram.”

Q3. (a) $\frac{50}{200} = \frac{1}{4}$ (divide top and bottom by 50); $\frac{1}{4} = 1 \div 4 = 0.25$; $0.25 \times 100 = 25$, so 25%. (b) $\frac{1}{100} = 0.01 = 1\%$. (c)

$12.5\% = 12.5 \div 100 = 0.125$; and $0.125 = \frac{125}{1000} = \frac{1}{8}$.

Q4. (a) m to cm is $\times 100$: $0.85 \times 100 = 85$ cm. (b) km to m is $\times 1\,000$: $3.5 \times 1000 = 3\,500$ m. (c) g to kg is $\div 1\,000$: $750 \div 1000 = 0.75$ kg. (d) L to mL is $\times 1\,000$: $2.4 \times 1000 = 2\,400$ mL.

Q5. (a) Money is rounded to the nearest cent: $\$38 \div 3 = 12.666666\ldots \rightarrow$ “Each person pays \$12.67 (to the nearest cent).” (b) $11 \div 4 = 2.75$ ends exactly: “Each wall takes 2.75 L of paint (exact).” (c) $64 \div 3 = 21.333333\ldots \rightarrow$ “The walker covered a mean of 21.3 km per day (to 1 decimal place).”

Q6. (a) Space between number and unit: 62 km. (b) \$ tight, two decimals: \$8.40. (c) Space in the number and before the unit: 3 200 g (or convert: 3.2 kg). (d) Money to the nearest cent with \$: 14.375 $\rightarrow$ \$14.38.

Q7. (a) $\$4.86 \div 3 = \$1.62$ per kg; the division ends, so it is exact. (b) \$1.62/kg. (c) “The 3 kg bag works out at \$1.62 per kilogram (exact).”

Q8. (a) 15 L each minute for 40 minutes: $15 \times 40 = 600$ L. (b) “The pump moved 600 L of water in 40 minutes (exact).”

Q9. (a) 1 hour is 60 minutes, so $45 \div 60 = 0.75$; 45 minutes is 0.75 hours. (b) Speed = distance $\div$ time: $18 \div 0.75 = 24$ km/hr. (c) “Jonas rode 18 km in 45 minutes, a mean speed of 24 km/hr (exact).”

Q10. (a) For example:

Day	Punnets packed
Monday	52
Tuesday	47
Wednesday	58
Thursday	51
Total	208

with the title “Punnets packed each day” above it. (b) $52 + 47 + 58 + 51 = 208$ punnets. (c) $208 \div 4 = 52$ punnets per day (exact). (d) $58 - 47 = 11$ punnets.

Q11. (a) The line is flat between February and March: 11 trailers each. (b) The April point sits at 15. (c) $8 + 11 + 11 + 15 + 13 + 17 = 75$ trailers. (d) $75 \div 6 = 12.5$ trailers per month (exact at 1 d.p.).

Q12. (a) One step per line:

$$35 + 30 = 65$$

$$65 + 20 = 85$$

$$85 + 10 = 95$$

$$95 + 5 = 100$$

so the five shares add to 100%. (b) 35% of 40: $40 \div 100 = 0.4$, then $35 \times 0.4 = 14$ students. (c) 30% of 40:

$30 \times 0.4 = 12$ students. (d) “The most common way to travel is the bus: 14 of the 40 students, or 35% (exact).”

Q13. A spoken report says who and what first (C), gives the result first (F), then the two numbers behind it (E, D), then the check (A), then stops for questions (B). Order: **C, F, E, D, A, B**. Check on the numbers: $\$96.50 - \$41.75 = \$54.75$, and $\$54.75 + \$41.75 = \$96.50 \checkmark$.

Q14. (a) Area to cover is 50 m². One tin covers 12 m².

$$\text{Tins needed} = 50 \div 12$$

$$50 \div 12 = 4.166666\ldots$$

(b) Tins are sold whole, and 4 tins would not cover the wall, so round up: 5 tins. (c) 4 tins cover $4 \times 12 = 48$ m², and $50 - 48 = 2$, so 2 m² of wall would be left unpainted. (5 tins cover $5 \times 12 = 60$ m², which is enough.)

Q15. (a) (i) B — a committee watching a trend wants a line graph on a slide. (ii) A — exact prices in writing is a printed quote as a table. (iii) C — a crew laying out a stall needs a sketch plan. (b) Any two of: point at the graph with a pen or hand while speaking; put the result sentence on the slide under the graph; hand out a one-page summary with the table. (c) A bar's height has to be read off the scale, so a reader can only estimate it; a table prints the exact numbers, which is what a re-order needs. (d) 60 kg.

Q16. (a) Opposite sides of a rectangle are equal, so the bottom side is 6.5 m and the right side is 3 m. (b) Tape length = $6.5 + 3 + 6.5 + 3 = 19$ m. (c) "The tape border around the stall floor is 19 m long (exact)."

Q17. Working: $8 \times \$14.25 = \$114.00$. Result: the caps cost \$114.00, so the \$120 budget covers them with $\$120 - \$114.00 = \$6.00$ to spare. Check: estimate $8 \times \$14.00 = \$112.00$; the exact \$114.00 is \$2.00 above the estimate — close, so it is sensible. Conclusion: yes, the budget covers the caps, with \$6.00 left over.

Q18. (a) $32 \times \$21.50 = \$688.00$ (exact). (b) $30 \times \$22 = \$660.00$. (c) $\$688.00 - \$660.00 = \$28.00$, so the exact total is \$28.00 above the estimate. (d) "Ticket takings were \$688.00 (exact); my estimate of \$660.00 was \$28.00 under the exact total — close enough to trust the figure."

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

Theory

About the tools and readings in this section. The scales, dials, tapes, clocks, jugs, thermometers and levels here are **made up** (not real): pretend tools with pretend readings, built for this book so you can practise measuring. Nothing here is a real product, a real business or a real measurement.

Section 1B showed how to find the mathematics in a task and write a plan; the plan almost always names a **tool** — a tape measure, a scale, a clock, a calculator. This section is about the tools you hold in your hands. It builds three tool skills that the study design sets out in Unit 2, Outcome 3:

- using many kinds of tools and devices, analogue and digital, to do a job and get a result;
- knowing how accurate each kind of tool is, and what errors it can give;
- looking back at the tools you used, by checking each result against your estimate.

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

What is an analogue tool?

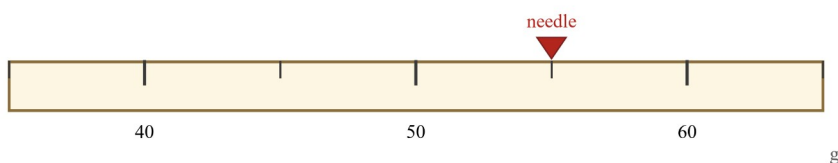
An **analogue** tool shows a quantity with a needle, a pointer, a liquid level or a printed scale that **you** read. A dial scale, a tape measure, a clock with hands, a measuring jug and a thermometer are all analogue. A digital tool shows the number for you on a screen. Digital tools, apps and spreadsheets are section 1F; this section is the analogue toolkit.

The assessment in this unit asks you to **identify, select and apply** a wide range of tools. That means three things: know what each tool measures, choose the right one for the job, and use it well enough to trust the reading.

Four steps that read any scale.

Every analogue scale works the same way, even one you have never seen before.

1. Find the two **labelled marks** the pointer sits between.
2. Work out one **small space**: $(\text{bigger label} - \text{smaller label}) \div \text{the number of small spaces between them}$.
3. Count how many small spaces past the smaller label the pointer sits.
4. Reading = smaller label + $(\text{spaces} \times \text{one small space})$.



Made-up data: the scale and its reading are made up for this section.

The zoomed scale above is marked in grams. The needle sits between the labels 40 and 50, and there are two small spaces between them, so one small space is $(50 - 40) \div 2 = 5$ grams. The needle sits three spaces past 40, so the reading is $40 + 3 \times 5 = 55$ grams.

Refresher — metric units.

Analogue tools mix their units, so keep these swaps ready. Going to a smaller unit means multiplying; going to a bigger unit means dividing.

Swap	Do this	Example
m to cm	multiply by 100	$2.5 \text{ m} = 250 \text{ cm}$

Swap	Do this	Example
cm to m	divide by 100	92 cm = 0.92 m
cm to mm	multiply by 10	8.3 cm = 83 mm
mm to cm	divide by 10	45 mm = 4.5 cm
kg to g	multiply by 1000	0.75 kg = 750 g
g to kg	divide by 1000	2500 g = 2.5 kg
L to mL	multiply by 1000	2 L = 2000 mL
mL to L	divide by 1000	500 mL = 0.5 L

Tapes, rulers and the worn zero.

A **ruler** measures short lengths in cm and mm; its smallest mark is usually 1 mm. A **tape measure** does the same job over longer distances: keep the tape straight and tight, and read the mark level with the end of the object. The metal zero end of an old tape gets bent or worn, and then zero no longer lines up. The fix is to start at a clear mark further along the tape and **subtract**: if you hold the 60 cm mark at one end and the other end reads 143 cm, the length is $143 - 60 = 83$ cm.

Clocks and time.

On a clock with hands, the **minute hand** points at the big numbers and each big number is worth 5 minutes: at the 8 it shows $8 \times 5 = 40$ minutes. The **hour hand** sits *between* two numbers most of the time — read the number it has passed, not the one it is heading towards.

Refresher — counting on time.

To find how long between two times, count on in easy jumps. From 4:40 to 5:15: first count on to the whole hour, 4:40 to 5:00 is 20 minutes, then 5:00 to 5:15 is 15 minutes, so the total is $20 + 15 = 35$ minutes. To add time to a clock, do the same jumps forwards.

Refresher — 24-hour time.

Rosters, timetables and job sheets often use **24-hour time**, which runs from 00:00 (midnight) to 23:59 and never repeats a number. After midday, add 12 to the hour: 7 pm is $7 + 12 = 19$, so 19:00. To go back, subtract 12: 18:30 is $18 - 12 = 6$, so 6:30 pm. Times before midday keep their hour: 11:40 am is 11:40.

Mass, capacity and temperature.

A **scale** measures **mass** (how heavy) in g or kg — dial scales, platform scales and spring balances all show it with a needle or a pointer. A **measuring jug** measures **capacity** (how much liquid) in mL or L: set it flat, let the liquid settle, and read the level with your eyes level with the surface, not from above. A **thermometer** measures **temperature** in °C from a liquid column.

Refresher — negative readings.

Freezers and winter mornings live below zero. On a thermometer, the numbers count *down* as the column drops, so a column ending below a label means subtract. If each small mark is 1 °C and the column ends three marks below -15, the reading is $-15 - 3 = -18$ °C.

Level and straight, and tools you handle.

A **spirit level** tells you whether a surface is flat and level, or whether a post is straight up and down. It has a small tube of liquid with a bubble: the surface is level only when the bubble sits between the two centre lines. Hands-on objects — blocks, fraction tiles, a tape you can hold against a doorway — are also part of the toolkit (the study design calls them **manipulatives**); they let you see and feel a measurement before you write it down.

The toolkit at a glance.

Quantity	Units	Analogue tools
length (short)	mm, cm	ruler
length (long)	cm, m	tape measure, measuring wheel
mass	g, kg	dial scale, platform scale, spring balance
capacity	mL, L	measuring jug
temperature	°C	thermometer
time	hours, minutes	clock, egg-timer style sand timer
level and straight	—	spirit level

Tools of trade and industry.

Every trade carries its own measuring tools, and the tools tell you what that job is about.

Worker	Analogue tools at work	They measure
Carpenter	tape measure, spirit level, measuring wheel	length; level
Chef	kitchen scales, measuring jug, oven thermometer, timer	mass; capacity; temperature; time
Tailor	soft tape measure, ruler	length
Gardener	measuring wheel, long tape	length

Choosing the right tool.

Ask two questions before you pick a tool up.

- **Which quantity?** Length, mass, capacity, time, temperature or level? A bathroom scale measures mass, so it can never pour out 300 mL of milk.
- **How fine must the answer be?** A platform scale marked every 1 kg cannot show 400 g; a jug with no marks between its labels cannot show 350 mL. The smallest mark on the tool sets the finest answer it can give.

Good practice is to **estimate first** (section 1C), then measure, then compare the two. If your estimate and your measurement are far apart, one of them is wrong — measure again.

Recording the reading honestly.

Record what the tool can actually show, and say how fine it is. A tape read to the nearest millimetre gives “84.5 cm, to the nearest millimetre”; a tape whose smallest mark is 1 cm gives “1.84 m, read to the nearest centimetre”. Writing “1.8432 m” from that second tape would claim a fineness the tool never showed.

Accuracy and error.

Accuracy is how close a reading is to the true value; **error** is the gap between them. Common sources of error with analogue tools:

- a worn or bent zero end (start at a clear mark and subtract instead);
- a tape that is slack or not straight (keep it tight and flat);
- reading a scale from an angle instead of straight on (stand level with the mark);
- reading a jug from above instead of at surface level;
- reading before the needle or the liquid has settled;
- choosing a tool whose marks are too coarse for the job.

You cannot remove all error, but you can keep it small — and you must never pretend a reading is finer than the marks allow.

Refresher — rounding to the nearest whole.

When a question asks for a whole number, round **to nearest**: look at the first decimal — 5 or more rounds up, less than 5 rounds down. So 12.6 rounds to 13 and 12.4 rounds to 12. Rounding **up** is different and is used when whole things are bought: 18.35 m of edging rounds to 19 m to buy, because 18 m would leave part of the job unfinished. Every question in this section tells you when to round and which way.

Where the formulas live.

Measuring tasks often feed a formula — perimeter, area or volume. The formula sheet for this book is in Chapter 9 at the back; look formulas up there instead of guessing.

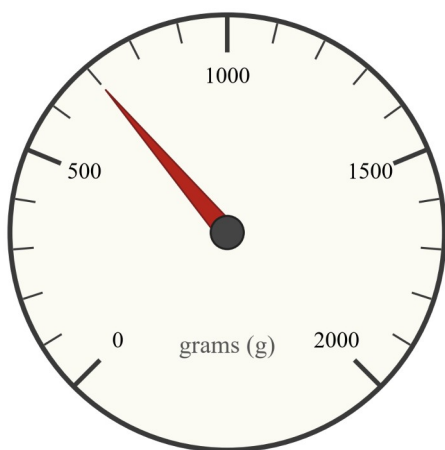
Analogue or digital?

A digital scale shows “700 g” as digits; an analogue dial makes you read the scale yourself. Digital is quicker to read and harder to misread; analogue needs no battery, shows you *roughly* where the value sits at a glance, and the four steps transfer to any device you meet — including unfamiliar ones at a new job. Section 1F covers the digital side of the toolkit.

Worked examples

Example 1 — scaffolded

Sunita weighs fertiliser for the garden club’s seedlings on a dial scale. The scale runs from 0 to 2000 g, the labels are every 500 g, and there are five small spaces between each pair of labels. The needle stops two spaces past the 500 label, as shown below. How much fertiliser is on the scale?



Made-up data: the scale, its marks and its reading are made up for this section.

Question: how much fertiliser is on the scale?

A dial scale measures mass in grams; read it with the four steps.

Step 1 — find the labels: the needle sits between 500 and 1000.

The two labelled marks either side of the needle come first.

Step 2 — one small space: $(1000 - 500) \div 5 = 100$ g.

Five small spaces sit between the labels, so divide the gap by 5.

Step 3 — count the spaces: the needle is 2 spaces past 500.

Count up from the smaller label, never down from the bigger one.

Step 4 — add: $500 + 2 \times 100 = 700$ g.

Reading = smaller label + (spaces $\times$ one small space).

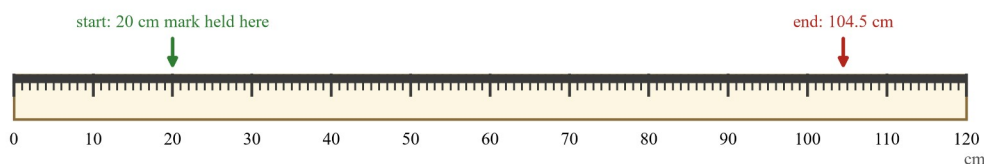
Check: 700 g is just past one-third of the full 2000 g scale, and the needle sits just past that point on the dial.

A quick look at the whole dial catches big slips.

The scale shows 700 g of fertiliser.

Example 2 — scaffolded

Tariq measures a doorway for a new flyscreen. The metal zero end of his tape is bent, so he holds the 20 cm mark at one end of the doorway instead. The other end of the doorway lines up with 104.5 cm on the tape, as shown below. Find the length of the doorway.



Made-up data: the tape and its readings are made up for this section.

Question: how long is the doorway?

A tape measure reads length in cm; the smallest mark is 1 mm.

Start and end: start = 20 cm, end = 104.5 cm.

Only the tape between the two marks lies along the doorway, so the start must come off.

Length = $104.5 - 20 = 84.5$ cm.

Subtract the start mark from the end mark.

Record: 84.5 cm, to the nearest millimetre.

0.5 cm is 5 mm; the answer is as fine as the tape's smallest mark, and no finer.

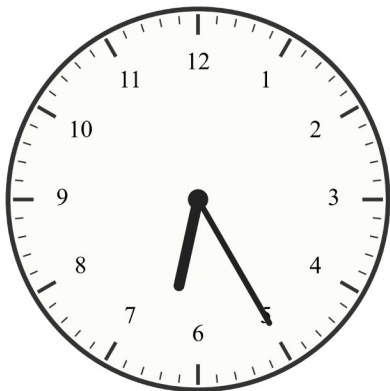
Check the estimate: Tariq estimated about 85 cm (section 1C); 84.5 cm is close.

Comparing the estimate with the measurement is the reflection step.

The doorway is 84.5 cm long, to the nearest millimetre.

Example 3 — unscaffolded

Cleo puts a loaf of bread into the oven when the clock shows the time below. The loaf needs 50 minutes of baking. What time does the bread come out?



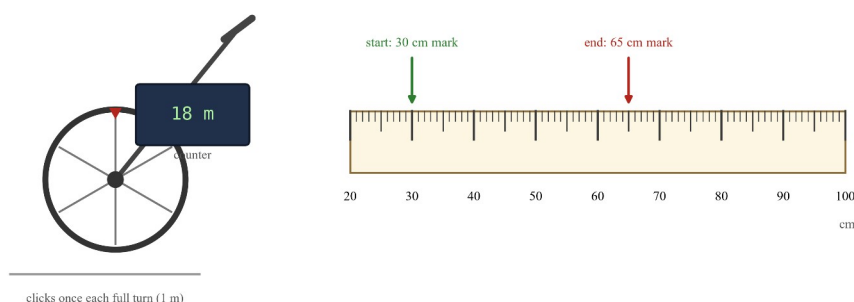
Made-up data: the clock and the baking time are made up for this section.

Read the clock first. The minute hand points at 5, so the minutes are $5 \times 5 = 25$; the hour hand sits between 6 and 7 but has not reached 7, so the clock shows 6:25 pm, not 7:25 pm. Now count on 50 minutes: from 6:25 to 7:00 is 35 minutes, and $50 - 35 = 15$, so add 15 minutes to 7:00.

$\therefore$ the bread comes out at 7:15 pm.

Example 4 — unscaffolded

Elio measures a garden edge with a measuring wheel. The wheel's counter finishes at 18 m, and the last short piece is measured with a tape: the tape is held at the 30 cm mark and the end of the run reads 65 cm, as shown below. The edging is sold only in whole metres. How long is the run, and how many whole metres of edging must Elio buy?



Made-up data: the wheel, the tape and every reading are made up for this section.

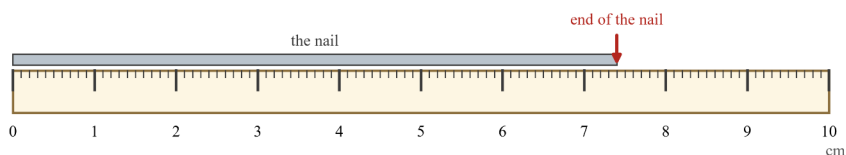
The wheel counter gives 18 m. The tape piece is read by subtraction because it did not start at zero: $65 - 30 = 35$ cm. Convert to metres so the two parts match: $35 \text{ cm} = 0.35 \text{ m}$. The whole run is $18 + 0.35 = 18.35 \text{ m}$. To the nearest metre this is 18 m, but edging is bought in whole metres and 18 m would leave 0.35 m of the run bare, so round **up** instead of to nearest.

$\therefore$ the run is 18.35 m long, and Elio must buy 19 whole metres of edging.

Practice questions

Scaffolded

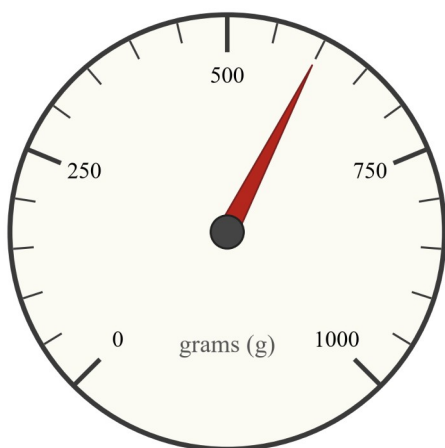
Q1. A nail is laid on a ruler, as shown below.



Made-up data: the ruler and the nail are made up for this section.

- (a) What is each smallest mark on the ruler worth?
- (b) How long is the nail, in mm?
- (c) Write the length of the nail in cm, to the nearest millimetre.

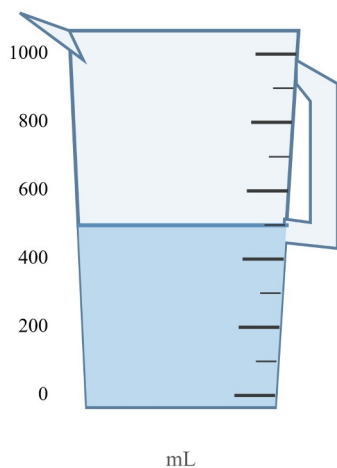
Q2. The deli scale below runs from 0 to 1000 g, has a label every 250 g, and has five small spaces between each pair of labels. The needle rests two spaces past the 500 label.



Made-up data: the scale and its reading are made up for this section.

- (a) What is one small space worth?
- (b) What mass does the scale show?
- (c) The deli packs three identical parcels, each with the mass in (b). Find the total mass, in g and in kg.

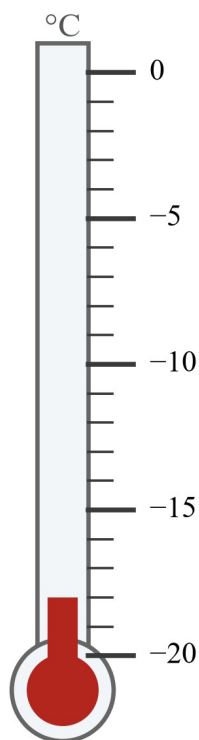
Q3. The measuring jug below has a label every 200 mL and two small marks between each pair of labels.



Made-up data: the jug and its level are made up for this section.

- (a) What is each small mark worth?
- (b) How much liquid is in the jug?
- (c) A recipe needs 800 mL in total. How much more liquid must be added?

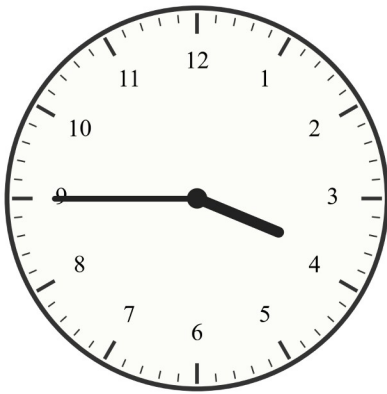
Q4. The freezer thermometer below is labelled every 5 °C, with five small marks between each pair of labels. The column ends three marks below –15.



Made-up data: the thermometer and its reading are made up for this section.

- (a) What unit does this thermometer measure in?
- (b) What is each small mark worth?
- (c) What temperature does the thermometer show?

Q5. The clock below shows the start time of a movie session. The movie runs for 1 h 50 min.



Made-up data: the clock and the run time are made up for this section.

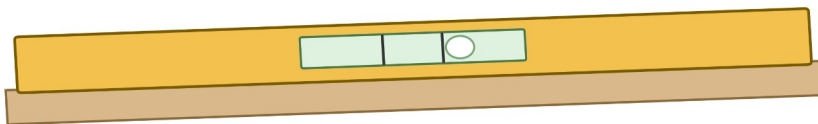
- (a) What time does the clock show? Include am or pm.
- (b) The minute hand points at 9. How many minutes does it show, and how did you work that out?
- (c) What time does the movie finish?

Q6. A class measures a noticeboard with a tape measure whose zero end is worn. They hold the 100 cm mark at one end of the board; the other end reads 184 cm.

- (a) Why do they start at the 100 cm mark instead of the worn zero end?
- (b) How long is the board, in cm?
- (c) Write the length in metres, correct to 2 decimal places.

Unscaffolded

Q7. A carpenter sets a timber onto a frame and checks it with the spirit level shown below.



Made-up data: the level and its bubble are made up for this section.

- (a) Is the timber level? Answer yes or no.
- (b) Which end of the timber is higher, left or right?
- (c) What should the carpenter do next?

Q8. Jasmine's shift at the café starts at 11:40 am and finishes at 7:10 pm.

- (a) How long is the shift, in hours and minutes?
- (b) Write the start time in 24-hour time.
- (c) Write the finish time in 24-hour time.

Q9. Choose the better tool for each job and give one reason.

- (a) Measuring 300 mL of milk for a recipe: a measuring jug or a bathroom scale?
- (b) Checking that a shelf post stands straight up and down: a spirit level or a tape measure?
- (c) Measuring a garden bed 2.5 m long: a 3 m tape measure or a 30 cm ruler?

Q10. Sunita loads flour onto a platform scale at the community kitchen. The scale is labelled every 5 kg and has small marks every 1 kg; the needle sits two marks past the 5 label.

- (a) What mass does the scale show?
- (b) A helper writes the mass down as “7.4 kg”. Why can this scale not show 7.4 kg?
- (c) Is this platform scale the right tool for weighing 400 g of flour? Give a reason.

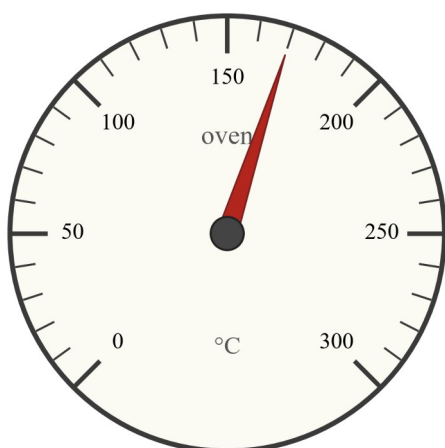
Q11. A student measures a shelf bracket with a ruler whose zero end is chipped. She holds the 5 cm mark at one end of the bracket; the other end reads 38.2 cm.

- (a) Find the true length of the bracket.
- (b) Why is starting at the 5 cm mark better than starting at the chipped zero?
- (c) How fine is her reading — to what nearest unit?

Q12. A large jug is labelled at 0, 250, 500, 750 and 1000 mL, and has no marks at all between the labels.

- (a) Can this jug measure exactly 350 mL? Answer yes or no.
- (b) Give a reason for your answer to (a).
- (c) Between which two labels does 350 mL lie?

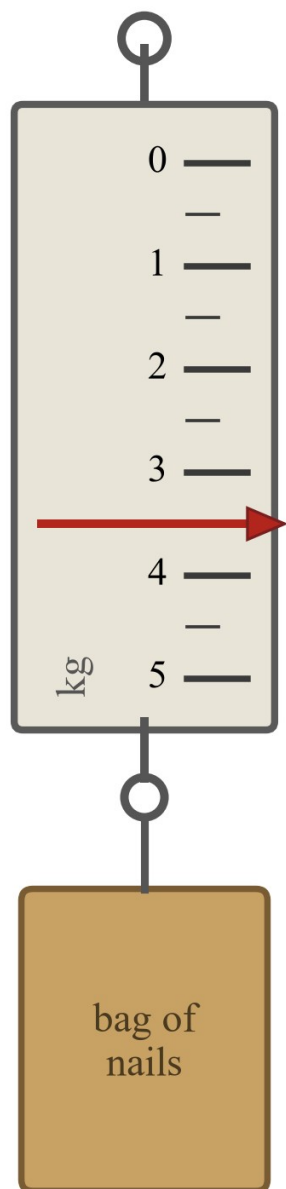
Q13. Cleo’s oven has the dial below. It runs from 0 to 300 °C, is labelled every 50 °C, and has five small spaces between each pair of labels. The needle sits two spaces past the 150 label. The recipe needs 180 °C.



Made-up data: the oven dial and its reading are made up for this section.

- (a) What is one small space worth?
- (b) What temperature is the oven set to?
- (c) How many degrees is the oven away from 180 °C, and which way must Cleo turn the dial?

Q14. At a market stall, a bag of nails hangs from the spring balance below. Marlo has never seen this tool before. It is labelled every 1 kg, with two small marks between each pair of labels, and the pointer sits one mark past the 3 label.



Made-up data: the spring balance, the bag and the reading are made up for this section.

- (a) What is each small mark worth?
- (b) How heavy is the bag?
- (c) Which of the four steps did you use, and why do they still work on a tool you have never seen before?

Q15. A roster says Jasmine's shift finishes at 18:30.

- (a) Write this finish time in 12-hour time.
- (b) Why is writing just "6:30" unclear?
- (c) Name two ways to write the finish time so nobody can mistake it.

Q16. Think about a tailor, a chef and a gardener at work.

- (a) Name one measuring tool each of them uses on the job.
- (b) What quantity does each tool you named measure?
- (c) Trade tools usually have finer marks than the same tool at home. Give one reason why that matters.

Q17. Dinh estimates that a doorway is 2 m high, then measures it with a tape and gets 178 cm.

- (a) Write the measured height in metres, correct to 2 decimal places.
- (b) Was his estimate above or below the measured height?
- (c) How many cm was the estimate away from the measurement?

Q18. Rafi measures an alcove for a shelf. His tape's zero end is worn, so he holds the 50 cm mark at one end of the alcove; the other end reads 132.5 cm. He will cut the shelf from a board that is 84 cm long.

- (a) How wide is the alcove?
 - (b) How much must Rafi cut off the board, in cm and in mm?
 - (c) Rafi cuts and the board ends up 82.4 cm long. By how many mm is the board now too short for the alcove?
-

Answers

Q1. (a) 1 mm. (b) 74 mm. (c) 7.4 cm. **Q2.** (a) 50 g. (b) 600 g. (c) $1800\text{ g} = 1.8\text{ kg}$. **Q3.** (a) 100 mL. (b) 500 mL. (c) 300 mL. **Q4.** (a) °C (degrees Celsius). (b) 1 °C. (c) -18 °C . **Q5.** (a) 3:45 pm. (b) 45 minutes — the minute hand at 9 means 9×5 . (c) 5:35 pm. **Q6.** (a) the worn zero no longer lines up, so readings from it are too long; starting at a clear mark and subtracting removes that error. (b) 84 cm. (c) 0.84 m . **Q7.** (a) no. (b) the right end. (c) lower the right end (or raise the left) until the bubble sits between the two centre lines. **Q8.** (a) 7 h 30 min. (b) 11:40. (c) 19:10. **Q9.** (a) measuring jug — milk is a liquid measured in mL; a bathroom scale measures mass. (b) spirit level — a tape measures length, not straight up and down. (c) the 3 m tape — it spans the bed in one pull; the 30 cm ruler needs many shifts and each shift adds error. **Q10.** (a) 7 kg. (b) the smallest mark is 1 kg, so the scale cannot show tenths of a kg. (c) no — 400 g is less than one smallest mark ($1\text{ kg} = 1000\text{ g}$); use a kitchen scale marked in grams. **Q11.** (a) 33.2 cm. (b) the chipped zero does not line up with the end of the bracket, so a reading from it is wrong; starting at a clear mark and subtracting gives the true length. (c) to the nearest millimetre. **Q12.** (a) no. (b) with no marks between the labels, the finest step is 250 mL, and 350 is not a multiple of 250. (c) between 250 mL and 500 mL. **Q13.** (a) 10 °C. (b) 170 °C. (c) 10 °C too cold; turn the dial up. **Q14.** (a) 0.5 kg. (b) 3.5 kg. (c) the four steps: labels first, then gap $\div$ marks, then count, then add — they work on any scale because every scale has labels and marks, seen before or not. **Q15.** (a) 6:30 pm. (b) “6:30” could be 6:30 in the morning or 6:30 in the evening. (c) write 18:30 (24-hour time), or write “6:30 pm”. **Q16.** (a) any sensible three, e.g. tailor — soft tape measure; chef — kitchen scales; gardener — measuring wheel. (b) length; mass; length. (c) finer marks mean smaller error, and trade work (a hem, a recipe batch, a bed edge) must come out right. **Q17.** (a) 1.78 m. (b) above. (c) 22 cm. **Q18.** (a) 82.5 cm. (b) $1.5\text{ cm} = 15\text{ mm}$. (c) 1 mm.

Fully-worked solutions

Q1. (a) Between each pair of cm labels there are ten small marks, so each smallest mark is **1 mm**. (b) The nail ends at the seventh small mark past 7 cm, which is 7 cm and 4 mm: $7 \times 10 + 4 = 74\text{ mm}$. (c) Divide by 10: $74 \div 10 = 7.4\text{ cm}$, to the nearest millimetre.

Q2. (a) Between the labels 250 and 500 there are five small spaces, so one space is $(500 - 250) \div 5 = 50\text{ g}$. (b) The needle is two spaces past 500: $500 + 2 \times 50 = 600\text{ g}$. (c) Three parcels: $3 \times 600 = 1800\text{ g}$. In kg: $1800 \div 1000 = 1.8\text{ kg}$.

Q3. (a) Between the labels 200 and 400 there are two small marks, so one mark is $(400 - 200) \div 2 = 100\text{ mL}$. (b) The level sits on the 500 label line: **500 mL**. (c) $800 - 500 = 300\text{ mL}$ more.

Q4. (a) Degrees Celsius, written °C. (b) Between -15 and -10 there are five small marks, so one mark is $(-10 - (-15)) \div 5 = 1\text{ °C}$. (c) Three marks below -15 counts down: $-15 - 3 = -18\text{ °C}$.

Q5. (a) The minute hand points at 9 ($9 \times 5 = 45$ minutes) and the hour hand has passed 3 but not reached 4, so the clock shows **3:45 pm**. (b) **45 minutes** — each big number on the clock face is worth 5 minutes, and $9 \times 5 = 45$. (c) Count on 1 h 50 min: $3:45\text{ pm} + 15\text{ min} = 4:00\text{ pm}$; $1\text{ h } 50\text{ min} - 15\text{ min} = 1\text{ h } 35\text{ min left}$; $4:00\text{ pm} + 1\text{ h } 35\text{ min} = \textbf{5:35 pm}$.

Q6. (a) The worn zero end no longer lines up with the start of the board, so any reading taken from it is too long. Holding a clear mark instead and subtracting it removes that error. (b) $184 - 100 = 84\text{ cm}$. (c) $84 \div 100 = 0.84\text{ m}$, correct to 2 decimal places.

Q7. (a) **No** — the bubble is not between the two centre lines. (b) The bubble has drifted to the **right**, so the right end is the higher end. (c) Lower the right end (or pack up the left end) and check again until the bubble sits between the two centre lines.

Q8. (a) Count on: 11:40 am to 12:00 noon is 20 min; 12:00 noon to 7:00 pm is 7 h; 7:00 pm to 7:10 pm is 10 min. Total: $20 + 10 = 30\text{ min}$ plus 7 h, so **7 h 30 min**. (b) 11:40 am is before midday, so the hour does not change: **11:40**. (c) 7:10 pm is after midday: $7 + 12 = 19$, so **19:10**.

Q9. (a) **Measuring jug** — milk is a liquid, and the quantity is a capacity in mL; the jug is marked in mL, while a bathroom scale measures mass in kg and cannot pour anything. (b) **Spirit level** — the job is checking straight up and down, which is what the bubble shows; a tape measure only gives lengths. (c) **The 3 m tape** — it reaches the whole

2.5 m bed in one pull; the 30 cm ruler would need at least nine shifts along the bed, and every shift adds a little more error.

Q10. (a) Marks are every 1 kg and the needle is two marks past 5: $5 + 2 \times 1 = 7$ **kg**. (b) The finest mark on the scale is 1 kg, so the needle can never be *read* between 7 and 8 as a tenth — 7.4 kg claims a fineness this tool cannot show. (c) **No** — 400 g is smaller than one smallest mark (1 kg = 1000 g), so the needle would barely move. A kitchen scale marked in grams is the right tool.

Q11. (a) $38.2 - 5 = 33.2$ **cm**. (b) The chipped zero is damaged, so it no longer lines up with the true start of the ruler; a reading taken from it carries that damage as error. Starting at the clean 5 cm mark and subtracting it uses only undamaged marks. (c) The reading has one decimal place in cm, so it is to the **nearest millimetre**.

Q12. (a) **No**. (b) With no marks between the labels, the only amounts the jug can show are multiples of 250 mL (0, 250, 500, 750, 1000). 350 is not one of them — the finest step is 250 mL. (c) 350 lies between the **250 mL** and **500 mL** labels.

Q13. (a) Between the labels 150 and 200 there are five small spaces: $(200 - 150) \div 5 = 10$ °C. (b) Two spaces past 150: $150 + 2 \times 10 = 170$ °C. (c) $180 - 170 = 10$ °C **too cold**; Cleo must turn the dial **up** to 180 °C.

Q14. (a) Between the labels 3 and 4 there are two small marks: $(4 - 3) \div 2 = 0.5$ **kg**. (b) One mark past 3: $3 + 0.5 = 3.5$ **kg**. (c) The four steps — find the labels either side of the pointer, divide the gap by the number of marks, count the marks past the smaller label, then add. They work on an unseen tool because every analogue scale is built from labels and marks, so once you know what one small mark is worth, the scale can be read whatever it measures.

Q15. (a) $18 - 12 = 6$, so **6:30 pm**. (b) On its own, “6:30” could be half past six in the **morning** or half past six in the **evening** — 12-hour time repeats every number twice a day. (c) Write it in 24-hour time as **18:30**, or write “**6:30 pm**” with the am/pm tag.

Q16. (a) Any sensible set, for example: tailor — a soft tape measure; chef — kitchen scales (a measuring jug or oven thermometer also works); gardener — a measuring wheel (a long tape also works). (b) The tailor’s tape measures **length**; the kitchen scales measure **mass**; the measuring wheel measures **length**. (c) Finer marks mean smaller error. A tailor’s hem must be right to the millimetre or the garment sits wrong; a chef’s batch fails if the mass is far out; a gardener’s bed edge must line up. Trade work is judged on accuracy, so the tools must read finer than a home tool needs to.

Q17. (a) $178 \div 100 = 1.78$ **m**, correct to 2 decimal places. (b) 2 m is greater than 1.78 m, so the estimate was **above** the measurement. (c) $200 - 178 = 22$ **cm** — and because the estimate and the measurement are this close, Dinh can trust the measurement.

Q18. (a) $132.5 - 50 = 82.5$ **cm**. (b) $84 - 82.5 = 1.5$ **cm**, and $1.5 \times 10 = 15$ **mm**. (c) $82.5 - 82.4 = 0.1$ cm, and 0.1 cm = 1 **mm** too short. The cut was read a mark early — exactly the kind of small error the finest mark on the tool sets a limit on.

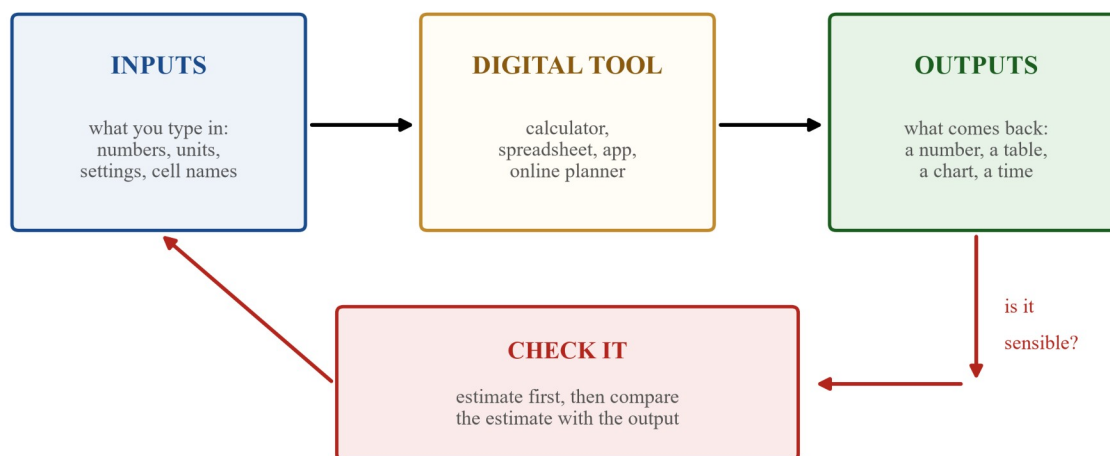
Chapter 1 The problem-solving cycle and mathematical toolkit — 1F The digital toolkit: calculators, spreadsheets, apps and online safety

Theory

About the data in this section. The calculator screens, pay sheets, order sheets, timetables, app screens and chart figures here are **made up** (not real): pretend businesses, pretend apps 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.

Almost every maths job at work or at home ends the same way: a person puts numbers into a digital tool, and reads an answer back. This section is about doing that well — choosing a tool that suits the job, putting the right inputs in, reading the output carefully, and checking the answer makes sense before anyone acts on it. It also covers the settings and conventions that change what a screen shows, and the safety habits that go with using online tools.

What every digital tool does. A calculator, a spreadsheet, an app and an online planner all work the same way. You supply **inputs** — numbers, units, settings, cell names. The tool follows fixed rules and returns **outputs** — a number, a table, a chart, a time. The picture below is the whole idea, including the habit that makes it safe to rely on.



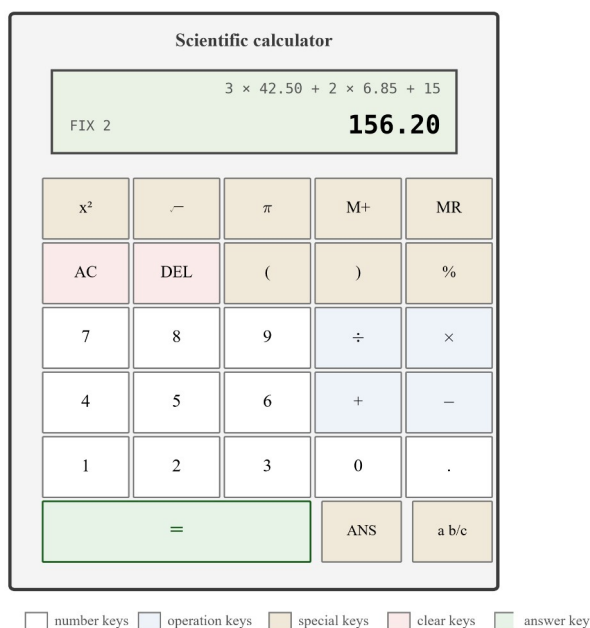
The tool does exactly what you **typed**, not what you **meant**. A missing bracket, a slipped decimal point or a wrong setting all produce a confident-looking screen that is wrong. That is why the red loop matters: estimate first (the way section 1C teaches), then compare the estimate with the output. If they disagree, the input or the setting is the first place to look.

Four families of tools. Most jobs in this book use one of four families.

Tool	Good at	Output you read
Scientific calculator	Quick number jobs in the correct order	A single number on a screen
Spreadsheet	Long lists where the same calculation repeats	A grid of numbers that updates when an input changes
App on a phone or tablet	Conversions, measures and counts on the go	A converted value, a chart or a total
Online calculator or planner	Times, routes and fares from inputs like a departure time	Departure and arrival times, distances, costs

Everything in this section can be done with pen, paper and a basic calculator. The screens are printed here so you can practise **reading** them; no question needs software you might not have.

The scientific calculator: keys first. The keypad below is a typical scientific calculator. The keys this book uses most are the number keys, the four operation keys, the bracket keys, AC (clear everything), DEL (delete the last thing typed) and =.



The screen shows what you typed, then the answer.

Refresher — order of operations. Work brackets first, then $\times$ and $\div$ (left to right), then $+$ and $-$ (left to right). A calculator follows this order by itself, so your keying has to say what you mean: $8 + 5 \times 4 = 8 + 20 = 28$, but $(8 + 5) \times 4 = 13 \times 4 = 52$, and $20 - 3 \times 4 = 20 - 12 = 8$. Same numbers, different brackets, different answer — the two screens below show it.

Same numbers, two answers — the keys you press decide which

$6 + 4 \times 3 =$ 18	$(6 + 4) \times 3 =$ 30
-------------------------------------	---

multiplication is done first,
so $4 \times 3 = 12$, then $6 + 12$

brackets are done first,
so 10×3

Refresher — percentages and the % key. “Per cent” means out of 100, so 10% of a number is the number $\div 10 \times 1$, or simply $\times 0.10$. On \$45: 10% is $\$45 \times 0.10 = \$4.50$, 20% is $\$45 \times 0.20 = \$9.00$, and 5% is $\$45 \times 0.05 = \$2.25$. Most calculators have a % key that does this step for you once the number and the rate are keyed in.

Settings change what you see — not what is stored. Calculators have a display setting for how many decimal places to **show**. The three screens below all hold the same value, $125 \div 7$; only the setting differs.

Every screen shows $125 \div 7$ — the setting changes what you see

Normal 17.85714286	FIX 2 17.86	FIX 0 18
----------------------------------	---------------------------	------------------------

as many places
as fit

2 decimal places
(money)

whole numbers
(counting things)

The calculator still stores the full value — the screen only shows part of it.

Money jobs want 2 decimal places (cents). Counting jobs want whole numbers — a screen that offers 17.85714286 buses is showing a value you must round before you use it. The calculator keeps the full value inside either way, so rounding on the screen does not spoil the next step unless you re-type the rounded number.

Refresher — rounding to a stated precision. Round only at the step the question asks for, and always to the precision named in the question. Look at the next digit: 5 or more, round up; 4 or less, leave it. For $12 \div 7 = 1.714286\dots$ (shown to 6 decimal places): to 2 decimal places the next digit is 4, so 1.71; to 1 decimal place the next digit is 1, so 1.7; to the nearest whole number the next digit is 7, so 2. For money, \$45.675 to the nearest cent looks at the third decimal (5), so it rounds up to \$45.68.

Accuracy and error: four ways a good tool gives a bad answer. The tool is rarely the problem. The four slips below cause almost every wrong screen, and each has a cheap check.

How the error gets in	What the screen shows	The cheap check
Missing or misplaced brackets	$3 \times 42.50 + 2 \times (6.85 + 15)$ shows \$171.20 instead of \$156.20	Estimate: about $3 \times 42 + 2 \times 7 + 15 = \$155$, so \$171.20 is out
A slipped digit or decimal point in an input	38 hours at \$25.40 an hour shows \$9652.00	Estimate: $40 \times 25 = \$1000$ — the screen is ten times that
The wrong display setting	FIX 0 shows 18 for $125 \div 7$	Know the setting you need before you read the screen
Rounding too early	Using 1.7 (1 d.p.) gives $1.7 \times 7 = 11.9$, while the full value gives exactly 12	Carry the full value; round only in the final answer

Spreadsheets: cells, formulas, and outputs that follow inputs. A spreadsheet is a grid of **cells**. Each cell has a name: its column letter then its row number, so B2 is the cell in column B, row 2. A cell can hold a typed number, text, or a **formula** — a calculation that always begins with =. Formulas usually point at cells by name (called **cell references**) instead of typing the numbers in, so when an input changes, every output that depends on it updates by itself. The screen below holds five made-up shift lengths; the third column shows the formula sitting in each result cell.

B7

=SUM(B2:B6)

name box formula bar

	A	B	C
1	Day	Hours worked	Formula in this cell
2	Mon	6	
3	Tue	7.5	
4	Wed	5	
5	Thu	8	
6	Fri	6	
7	Total	32.5	=SUM(B2:B6)
8	Mean hours	6.5	=AVERAGE(B2:B6)
9	Longest shift	8	=MAX(B2:B6)
10	Shortest shift	5	=MIN(B2:B6)

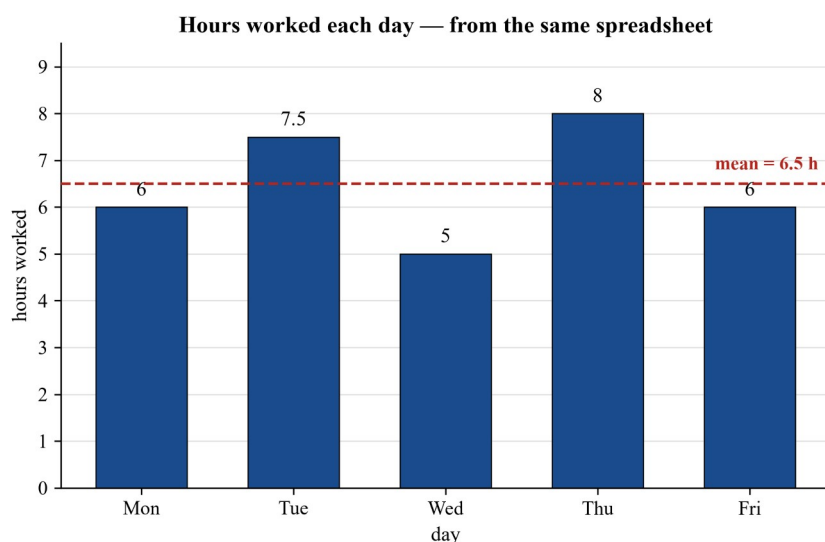
Made-up data: the shifts and every number here are made up.

The four formulas this book uses are =SUM (. . .) (add a block of cells), =AVERAGE (. . .) (the mean of a block), =MAX (. . .) (the largest) and =MIN (. . .) (the smallest). Type the formula once, then **fill down** to copy it through the rows below — that is how one formula, =B2*C2, becomes the whole pay column in a pay sheet.

Refresher — the mean and the range. The **mean** is the total shared equally over the count: mean = total ÷ how many. The **range** is the spread: biggest – smallest. For the shifts above (6, 7.5, 5, 8 and 6 hours): the total is $6 + 7.5 + 5 + 8 + 6 = 32.5$ hours, so the mean is $32.5 \div 5 = 6.5$ hours — exactly what =AVERAGE (B2 : B6) shows — and the range is $8 - 5 = 3$ hours, which =MAX (B2 : B6) minus =MIN (B2 : B6) agrees with.

Refresher — minutes and decimal hours. Pay sheets and pay calculators usually want hours as a decimal, so minutes become a fraction of an hour: minutes ÷ 60. Then 20 min = $20 \div 60 = 0.33$ h (2 d.p.) and 45 min = $45 \div 60 = 0.75$ h. Going back, the 0.75 of 2.75 h is $0.75 \times 60 = 45$ min, so 2.75 h is 2 h 45 min.

Visualise: the same numbers as a chart. Spreadsheets and apps can turn a column of numbers into a picture. A **column chart** compares sizes across categories (which day was busiest); a **line chart** shows change over time (is the walking distance growing?). Read the title, the axis labels and the scale **before** reading any number off the chart.



Apps and online tools. A unit-converter app takes a number and a unit as inputs and returns the same size in another unit. The screen below converts 2.4 m to centimetres.

Unit converter

From m
metres
2.4

↓ swap

To cm
centimetres
240

The same length in other units

2.4 m	2400 mm
2.4 m	0.0024 km

Check it by hand:
 bigger unit to smaller unit
 means multiply by 100

Made-up screen, made-up numbers.

Refresher — metric units. Each step down the metric ladder multiplies by 1000 for kilometres–metres, and by 100 or 1000 within a metre, a gram or a litre: 1 m = 100 cm = 1000 mm; 1 kg = 1000 g; 1 L = 1000 mL; 1 km = 1000 m. So 1.5 m = 150 cm, 2.4 m = 240 cm (the screen above), 850 g = 0.85 kg, 3.75 L = 3750 mL and 1.6 km = 1600 m. Bigger unit to smaller unit means multiply; smaller to bigger means divide — that one rule is the check for any converter screen.

Online planners work the same way with time: you input a departure time or an address and a walking time, and the planner outputs arrival times or a route distance. A bus timetable screen is an output you read, and the inputs behind it are the route’s stopping times.

Reading the language of screens. Screens write maths in their own shorthand, and the conventions are worth knowing before you trust a read: * means $\times$ and / means $\div$ in formulas; ^ means a power; a formula always starts with =; units belong in the column **heading** (“Hours”, “Rate \$/h”) rather than inside every cell; and a cell showing 17.86 under a FIX 2 setting is a rounded view, not a rounded value.

Choosing the tool for the job. No tool is best at everything; the job picks the tool.

Job	Sensible tool	Why
Total of six prices on a docket	Calculator	One short sum — keying it is fastest
Pay for 24 staff, each with different hours	Spreadsheet	The same calculation repeats 24 times, and one formula fills down
Convert 2.4 m to cm in a hardware aisle	Converter app on a phone	The phone is already in your hand and knows the rates
Last train home and its arrival time	Online planner or timetable	The times come from the route, not from your arithmetic

Inputs, outputs and the decisions in between. The tool cannot choose its inputs: which numbers go in, which settings are on, which cells a formula points at — all of those are your decisions, and each one is a place an error can enter. The same is true at the output end. Read the units the screen assumes, compare the output with your estimate, and round it for the **purpose**: whole numbers when you count people or buses, cents when you handle money. An output that passes those checks is an output you can act on and report.

Online safety. Online tools are useful and mostly harmless, but they run on devices that hold your personal life, so a few habits are non-negotiable. The card below is the short version; every line of it comes up again in the practice questions.

Using online tools safely

- ✓
 Use a calculator or planner site your school or work gives you.
- ✓
 Check the output against an estimate you did in your head.
- ✓
 Log out on a computer or phone that other people use.
- ✗
 Never type your address, birth date, bank or card details into a calculator site — it does not need them.
- ✗
 Never click a pop-up that says you have won a prize or that your phone has a virus.
- ✗
 Never pay to “unlock” a free calculator, and never share your password.

If a site asks for something a calculator does not need,
 stop and ask your teacher or supervisor.

A calculator or converter site has no reason to ask for your address, birth date, bank or card details — a site that asks is not doing the job it claims. Pop-ups announcing prizes or viruses are traps, not messages. On a shared computer or phone, log out when you finish. And when something feels wrong, stopping and asking costs nothing.

Worked examples

Example 1 — scaffolded

Priya sends this booking request to Redgum Tool Hire.

“I need 3 items for one day each. Hire is \$42.50 a day per item. Add a protective stand pack for 2 of the items — stands are \$6.85 a pack. I know there is a \$15 booking fee charged once per booking. What is my bill?”

Made-up data: the booking request and every price in it are made up for this section.

Working	Comment
Purpose and question(s): cost Priya’s booking. Question: what is the bill, to the cent?	One question, three price lines behind it.
Mathematics in the context: needed — 3 items at \$42.50 a day for 1 day, 2 stand packs at \$6.85, one \$15 fee.	The fee is charged once , whatever the number of items.

Working	Comment
Operations and tools: multiply (3×42.50), multiply (2×6.85), add the fee. Tool: calculator.	Two multiplies, then one add.
Step 1: hire = $3 \times \$42.50 = \$127.50$.	One day each, so the day rate is used once per item.
Step 2: stands = $2 \times \$6.85 = \$13.70$.	Only 2 of the 3 items take a stand pack.
Step 3: bill = $\$127.50 + \$13.70 + \$15.00 = \$156.20$.	The fee is added once, at the end.
Keying: $3 \times 42.50 + 2 \times 6.85 + 15$ — no brackets needed, because $\times$ is done before $+$.	Refresher: order of operations.
Estimate: $3 \times 42 + 2 \times 7 + 15 = \$155$, close to $\$156.20$, so sensible.	The estimate is the safety net.

Priya's first keying was $3 \times 42.50 + 2 \times (6.85 + 15)$, which shows $\$171.20$. The brackets put the booking fee inside the stand price, so the fee is charged twice instead of once — exactly one extra $\$15.00$ — and her own estimate of about $\$155$ is what caught it.

The bill is **$\$156.20$** .

Example 2 — scaffolded

Grace keeps the Ferry Stop Cafe pay sheet in a spreadsheet. Each day's pay is hours $\times$ rate in column D, and her total cell adds the pay column. This week her total cell reads $=\text{SUM}(D2:D5)$ and shows $\$710.20$, which looks low to her. Check the sheet below and find the slip. The rate is $\$26.80$ an hour all week.

Day	Hours (B)	Rate \$/h (C)	Pay (D)
Mon	5.5	26.80	147.40
Tue	7	26.80	187.60
Wed	6	26.80	160.80
Thu	8	26.80	214.40
Fri	7.5	26.80	201.00

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

Working	Comment
Purpose and question(s): check the week's pay total. Questions: what is the true total? Where is Grace's slip?	Two questions — answer both.
Mathematics in the context: five rows of hours at $\$26.80$ an hour; pay column D2:D6; Grace's total uses $=\text{SUM}(D2:D5)$.	The pay column is already correct; only the total cell is suspect.
Operations and tools: add the pay column (spreadsheet $=\text{SUM}$), cross-check by hand (multiply). Tools: spreadsheet, then pen and paper.	Two independent routes to the same number.
Step 1: true total = $=\text{SUM}(D2:D6)$ = $\$147.40 + \$187.60 + \$160.80 + \$214.40 + \$201.00 =$.	The range D2:D6 covers all five days.
Step 2: by hand, total hours = $=\text{SUM}(B2:B6) = 34$ h, and $34 \times \$26.80 = \$911.20$ — the same.	A hand check that agrees is a total you can trust.
Step 3: Grace's $=\text{SUM}(D2:D5) = \$710.20$; the gap is $\$911.20 - \$710.20 = \$201.00$, which is exactly Friday's row, D6.	Her formula stops one row early.
Step 4: the sheet also gives mean hours $=\text{AVERAGE}(B2:B6) = 6.8$ h, and range = $8 - 5.5 = 2.5$	Extra outputs, read straight off the sheet.

h from =MAX and =MIN.

Estimate: $34 \times 27 = \$918$, close to \$911.20 — and nowhere near \$710.20.

The estimate sides with the corrected total.

The true total is **\$911.20**; Grace's formula missed the last row, D6, worth \$201.00.

Example 3 — unscaffolded

Owen plans a delivery run with an online route planner, which gives the route as 186 km. His van's card says it uses 9.5 L of fuel per 100 km, fuel is \$1.94 a litre today, and the tank gauge shows 12 L left. Show that the run needs 17.67 L of fuel, find what that fuel costs to the nearest cent, and decide whether the 12 L in the tank is enough — if it is not, say how much he is short by.

Made-up data: the route, the fuel figures and every number here are made up for this section.

The planner's 186 km and the van's 9.5 L per 100 km are the inputs; the fuel needed is the output Owen has to check. Work in hundreds of kilometres first: $186 \div 100 = 1.86$, so the run is 1.86 hundreds of kilometres. Each of those hundreds uses 9.5 L, so the fuel needed is $1.86 \times 9.5 = 17.67$ L, which is the 17.67 L the question asked for. At \$1.94 a litre that fuel costs $17.67 \times \$1.94 = \$34.2798$, and to the nearest cent (the precision asked for) that is \$34.28. The tank holds 12 L and the run needs 17.67 L, so 12 L is not enough; the shortfall is $17.67 - 12 = 5.67$ L. A quick estimate backs the size up: 186 km is close to 200 km, and 200 km at 9.5 L per 100 km is about 19 L, so an answer near 17–19 L is sensible.

∴ The run needs 17.67 L of fuel, costing \$34.28 to the nearest cent, and the 12 L in the tank is 5.67 L short.

Example 4 — unscaffolded

Tessa checks her week's pay on a free online pay calculator at her library computer. She keys in 38 hours and her rate of \$25.40 an hour, and the site shows \$9 652.00. Before she does anything else, a pop-up appears: "Unlock the full version — enter your card details now." Decide what the pay should be, use an estimate to judge the screen, name the likely input slip, and say what Tessa should do about the pop-up and about the shared computer.

The pay should be $\text{hours} \times \text{rate} = 38 \times \$25.40 = \$965.20$. The estimate comes first: 38 h is close to 40 h and \$25.40 is close to \$25, so the pay should be near $40 \times 25 = \$1000$ — and \$9 652.00 is not near \$1000 at all, it is exactly ten times the true pay. A ten-times error is the signature of a slipped decimal point: with the rate typed as 254 instead of 25.40, the site computes $38 \times 254 = \$9\,652.00$, the screen she is looking at. So the output is wrong because an **input** was wrong, not because the site's arithmetic failed. As for the pop-up, a pay calculator has no need of card details: Tessa should close the pop-up without typing anything, never enter card numbers into a site like this, and tell her supervisor or the library staff what appeared. And because the computer is shared, she should log out of the site and any account before she walks away.

∴ The pay should be \$965.20; the screen's \$9 652.00 is ten times too big because the rate was keyed as 254, and Tessa should close the pop-up, enter no card details, report it, and log out of the shared computer.

Practice questions

Scaffolded

Q1. Match each job to the tool that suits it best: scientific calculator, spreadsheet, converter app, or online planner/timetable. (a) Adding six prices on a shopping docket at the checkout. (b) Working out the weekly pay of 24 staff who each worked different hours. (c) Changing 2.4 m to centimetres while standing in the hardware aisle. (d) Finding the last train home and what time it arrives. Then: (e) for job (b), say in one sentence why the tool you chose beats a calculator; (f) for job (d), name two inputs the tool needs.

Q2. Work these out by hand using the order of operations, then check each on a calculator. (a) $8 + 5 \times 4$. (b) $(8 + 5) \times 4$. (c) $60 \div 4 + 3 \times 2$.

Q3. A calculator is set to Normal display and shows $12 \div 7 = 1.714286$ (6 decimal places). (a) Write that value to 2 decimal places, to 1 decimal place, and to the nearest whole number. (b) Round \$45.675 to the nearest cent. (c) Write 2.75 h in hours and minutes.

Q4. The order sheet below is shown in formula view, so each cell displays its formula instead of its value.

Order sheet, shown in formula view (each cell displays its formula)

	A	B	C	D
1	Item	Qty	Unit price (\$)	Total
2	Nails	3	12.40	=B2*C2
3	Hinges	5	4.60	=B3*C3
4	Hooks	2	18.75	=B4*C4
5			Total	=SUM(D2:D4)

Made-up data: the items and every number here are made up.

- (a) Name the cell that holds the unit price of hinges. (b) Write the formula in cell D2.
 (b) State the values the sheet shows in D2, D3, D4 and D5 when it switches back to normal view.

Q5. A garden-water app lists the litres used each day for five days in cells B2:B6: 24, 31, 27, 35 and 28 L. (a) Write the spreadsheet formula for the mean and state its value in litres. (b) Find the range in litres, and say in one sentence what the range tells you about the five days. (c) State what =MAX (B2 : B6) and =MIN (B2 : B6) show, and use them to check your range.

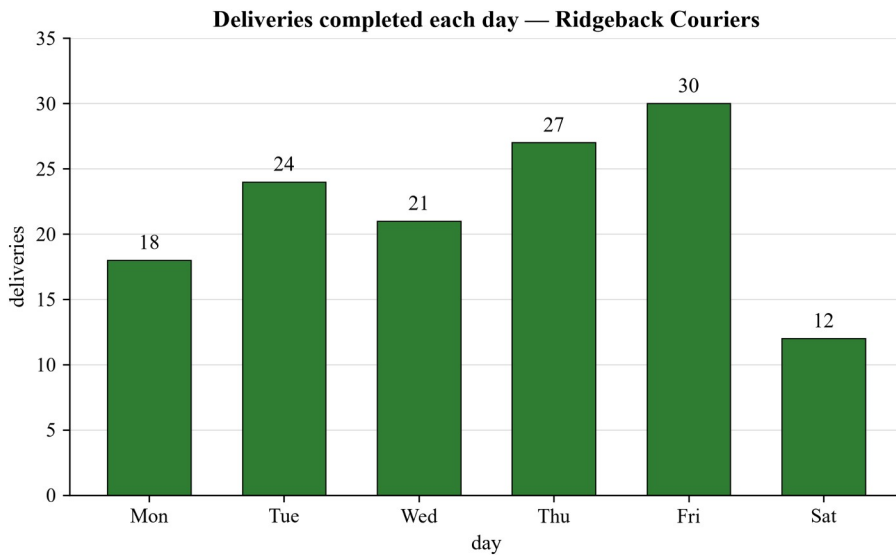
Q6. Here are six habits for using digital tools. Sort them into safe and not safe. (i) Keeping the school's calculator site in a bookmark list and using only that site. (ii) Typing your birth date into a calculator site that asks for it "to prove you are human". (iii) Checking a screen's answer against an estimate done in your head. (iv) Clicking a pop-up that says your phone has a virus and offers to clean it. (v) Logging out of the pay calculator on the shared computer at work. (vi) Saving your password in the browser of a work phone that other staff also use. (a) List the three safe habits. (b) List two of the not-safe habits and name the rule from the safety card that each one breaks. (c) Rewrite one not-safe habit as a safe one.

Un scaffolded

Q7. Mali orders plants online: 6 plants at \$14.20 each, plus postage of \$9.90 charged once per order. Her calculator keying is $6 \times (14.20 + 9.90)$, which shows \$144.60. (a) Find the correct total, to the nearest cent. (b) Say what her keying charges for postage, and why that is wrong. (c) Find the difference in dollars between her keying and the correct total.

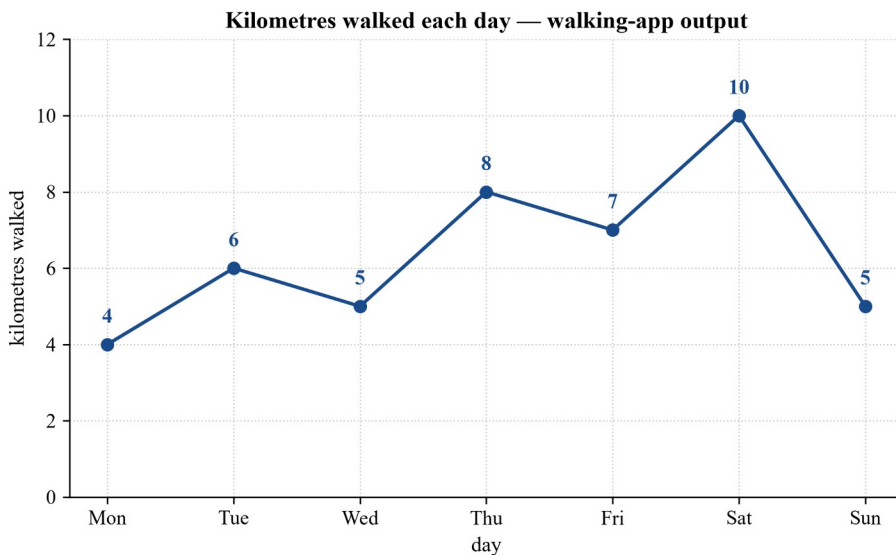
Q8. A pay sheet holds these hours for one week in cells B2:B6: 4, 6.5, 5, 7 and 6. The rate in C2 is \$24.60 an hour, and column D multiplies hours by rate. (a) State the total hours and the week's pay, to the nearest cent. (b) The Wednesday entry is corrected from 5 hours to 8 hours. State the new total hours, the new week's pay to the nearest cent, and the extra pay the correction adds. (c) State the mean hours before and after the correction, each to 1 decimal place.

Q9. The column chart below shows the deliveries a courier business completed each day last week.



- (a) Which day had the most deliveries, and how many? (b) Find the total deliveries for the six days. (c) Find the mean deliveries per day, and the range across the week.

Q10. The line chart below is a walking app's output for one week.



- (a) Find the total kilometres walked in the week. (b) Find the mean kilometres per day, to 1 decimal place. (c) Find the range, and name the longest day with its distance.

Q11. The converter app screen in the theory notes shows 2.4 m converted to other units. (a) Check the screen by hand: write 2.4 m in centimetres and in millimetres, and 850 g in kilograms. (b) A different screen claims $1.6 \text{ km} = 160 \text{ m}$. Is that true? Give the correct value in metres and name the likely slip behind the wrong one.

Q12. Nathan uses an online timetable planner, shown below. He walks 8 minutes from home to the Ferry Stop, and he must be at work in Northfield by 8:45 am.

Bus 350 — Ferry Stop to Northfield	
Departs Ferry Stop	Arrives Northfield
7:35 am	8:02 am
8:05 am	8:32 am
8:35 am	9:02 am

Nathan walks 8 minutes from home to the Ferry Stop.

Nathan must be at work in Northfield by 8:45 am.

Made-up timetable: the bus numbers and every time are made up.

- (a) Which is the latest bus Nathan can catch, and what is the latest time he can leave home? (b) How many minutes is the ride on that bus? (c) Find his total travel time from home to work, and how many minutes he has to spare before 8:45 am.

Q13. An online pay calculator asks for hours as a decimal. The rate is \$31.20 an hour. (a) Write 7 h 45 min as decimal hours and find the pay for that shift, to the nearest cent. (b) For a 6 h 20 min shift the calculator shows \$193.44. Work out what decimal hours it actually used, and say how that slip happens. (c) Find the correct pay for 6 h 20 min, to the nearest cent, and the dollars the slip would have cost.

Q14. A spreadsheet cell shows `=AVERAGE (B2 : B31 )` with the value 18.4. (a) How many numbers does that average use? (b) Find the total of those numbers. (c) One number in the list is corrected from 10 to 20. State the new mean the sheet will show, to 1 decimal place.

Q15. The turf order calculator below shows a total for an order of 24 rolls. The true price is \$11.75 a roll.

Turf order calculator	
Rolls of turf	24
Price per roll	117.5
Delivery	0
Total	\$2 820.00

Made-up screen and made-up prices.

- (a) Find the correct total for 24 rolls, to the nearest cent. (b) Use an estimate to show the screen's total cannot be right. (c) Name the likely input slip, and check it by recomputing the screen's total with that slip in place.

Q16. A party-hire site takes the number of days as its input and outputs a price: \$85 a day plus a \$40 delivery charge added once per booking. Kirra's budget is \$300. (a) State the site's output for 3 days and for 4 days. (b) What is the most days she can hire for within her budget? (c) How much of the budget is left on that booking?

Q17. Say what each person should do, and name the safety rule from the card that applies. (a) Kirra’s free converter app starts asking for her card details to “unlock” conversions she has already used twice. (b) Bilal finishes his pay check on the shared computer at work and walks away still logged in. (c) While Mali uses a fuel-price site, a message appears: “You have won a fuel voucher — enter your card number to claim it.”

Q18. Dana’s garden-centre order sheet is shown below in formula view. Her budget is \$200, and the garden centre adds a \$22.50 delivery charge to the items total when the bill is made.

Dana's order sheet, shown in formula view

	A	B	C	D
1	Item	Qty	Unit price (\$)	Total
2	Seedling punnets	14	4.85	=B2*C2
3	Bags of compost	6	9.30	=B3*C3
4	Garden stakes	25	1.60	=B4*C4
5			Items total	=SUM(D2:D4)
6	Delivery		22.50	<i>not in the SUM range</i>

Made-up data: the items and every number here are made up.

- (a) State the values the sheet shows in D2, D3, D4 and D5 in normal view. (b) Find the bill including delivery, to the nearest cent. (c) Use an estimate to check the bill, then say whether the order fits the \$200 budget and how much is left over.

Answers

Q1. (a) calculator. (b) spreadsheet. (c) converter app. (d) online planner/timetable. (e) e.g. the same calculation (hours $\times$ rate, then a total) repeats 24 times, and one formula filled down does all of them and updates when an hour changes. (f) e.g. the departure station and the time he wants to arrive (or his address and the station). **Q2.** (a) 28. (b) 52. (c) 21. **Q3.** (a) 1.71; 1.7; 2. (b) \$45.68. (c) 2 h 45 min. **Q4.** (a) C3. (b) $=B2 * C2$. (c) D2 \$37.20, D3 \$23.00, D4 \$37.50, D5 \$97.70. **Q5.** (a) $=AVERAGE (B2 : B6)$, 29 L. (b) 11 L; e.g. the daily use varies by 11 L between the lightest and heaviest day. (c) 35 and 24; $35 - 24 = 11$ L, which matches. **Q6.** (a) (i), (iii), (v). (b) e.g. (ii) breaks “never type your address, birth date, bank or card details into a calculator site”; (iv) breaks “never click a pop-up that says you have won a prize or that your phone has a virus”; (vi) breaks “never share your password”. (c) e.g. (vi) as: use a password only you know, and log out of the shared phone after each use. **Q7.** (a) \$95.10. (b) $6 \times \$9.90 = \$59.40$ — the brackets make the postage part of each plant’s price, so it is charged 6 times instead of once. (c) \$49.50. **Q8.** (a) 28.5 h; \$701.10. (b) 31.5 h; \$774.90; extra \$73.80. (c) 5.7 h before, 6.3 h after. **Q9.** (a) Friday, 30 deliveries. (b) 132. (c) mean 22 per day; range 18. **Q10.** (a) 45 km. (b) 6.4 km. (c) range 6 km; day 6 (Saturday), 10 km. **Q11.** (a) 240 cm; 2400 mm; 0.85 kg. (b) no — $1.6 \text{ km} = 1600 \text{ m}$; the slip is multiplying by 100 (as for metres to centimetres) instead of by 1000. **Q12.** (a) the 8:05 am bus; leave home by 07:57. (b) 27 minutes. (c) 35 minutes; 13 minutes to spare. **Q13.** (a) 7.75 h; \$241.80. (b) 6.2 h — the 20 minutes were typed as “.20” instead of $20 \div 60 = 0.33$. (c) \$197.60; \$4.16. **Q14.** (a) 30 numbers. (b) 552. (c) 18.7. **Q15.** (a) \$282.00. (b) e.g. $24 \times 12 = \$288$, so a total near \$288 is sensible and \$2 820.00 is about ten times too big. (c) the price was keyed as 117.5 instead of 11.75; $24 \times 117.5 = \$2\,820.00$, the screen’s figure. **Q16.** (a) \$295.00 and \$380.00. (b) 3 days. (c) \$5.00. **Q17.** (a) close the app or refuse the request — a converter does not need card details; tell a teacher or supervisor. (b) log out before walking away — anyone at that computer could see or change his pay details. (c) enter nothing and close the message — prizes that ask for card numbers are traps; report it. **Q18.** (a) D2 \$67.90, D3 \$55.80, D4 \$40.00, D5 \$163.70. (b) \$186.20. (c) estimate about \$186.50, which matches; yes it fits, with \$13.80 left.

Fully-worked solutions

Q1. (a) A single short sum of six prices is quickest on a **calculator**. (b) Twenty-four rows of the same calculation is a **spreadsheet** job. (c) A **converter app** on the phone does it in the aisle. (d) Train times come from an **online planner or timetable**. (e) In a spreadsheet one formula ($=B2 * C2$) filled down computes all 24 pays, and $=SUM$ totals them; if one hour changes, every output updates — a calculator would redo all 24 by hand. (f) Any two of: the departure station or stop, the destination, the date, the time he wants to arrive by.

Q2. (a) Multiply first: $5 \times 4 = 20$, then $8 + 20 = 28$. (b) Brackets first: $8 + 5 = 13$, then $13 \times 4 = 52$. (c) Divide and multiply first: $60 \div 4 = 15$ and $3 \times 2 = 6$, then $15 + 6 = 21$.

Q3. (a) To 2 decimal places: the third decimal is 4, so 1.71. To 1 decimal place: the second decimal is 1, so 1.7. To the nearest whole number: the first decimal is 7, so 2. (b) The third decimal is 5, so round the cent up: \$45.68. (c) The 0.75 of an hour is $0.75 \times 60 = 45$ min, so 2.75 h is 2 h 45 min.

Q4. (a) Column C, row 3: **C3**. (b) Quantity $\times$ unit price for row 2: $=B2 * C2$. (c) $D2 = 3 \times \$12.40 = \$37.20$; $D3 = 5 \times \$4.60 = \$23.00$; $D4 = 2 \times \$18.75 = \$37.50$; $D5 = =SUM (D2 : D4) = \$37.20 + \$23.00 + \$37.50 = \$97.70$.

Q5. (a) $=AVERAGE (B2 : B6)$. Total $= 24 + 31 + 27 + 35 + 28 = 145$ L over 5 days, so the mean is $145 \div 5 = 29$ L. (b) Range $= 35 - 24 = 11$ L. It says the heaviest day used 11 L more than the lightest day, so daily use is not steady. (c) $=MAX (B2 : B6)$ shows 35 and $=MIN (B2 : B6)$ shows 24; $35 - 24 = 11$ L, the range from (b).

Q6. (a) Safe: (i), (iii), (v). (b) (ii) is not safe — a calculator site never needs a birth date, so the rule is “never type your address, birth date, bank or card details into a calculator site”. (iv) is not safe — it breaks “never click a pop-up that says you have won a prize or that your phone has a virus”. (vi) is not safe — it breaks “never share your password”. (c) Any one rewritten, e.g. (ii) as: close the site and use the bookmarked school calculator that asks for nothing personal.

Q7. (a) Plants: $6 \times \$14.20 = \$85.20$. Add the postage once: $\$85.20 + \$9.90 = \$95.10$. (b) Her brackets make each plant cost ($\$14.20 + \$9.90$), so postage is charged six times: $6 \times \$9.90 = \$59.40$ instead of \$9.90. (c) $\$144.60 - \$95.10 = \$49.50$ — which is the five extra postage charges, $5 \times \$9.90$.

Q8. (a) Total hours = $4 + 6.5 + 5 + 7 + 6 = 28.5$ h. Pay = $28.5 \times \$24.60 = \$701.10$. (b) New total hours = $4 + 6.5 + 8 + 7 + 6 = 31.5$ h. New pay = $31.5 \times \$24.60 = \$774.90$. Extra pay = $\$774.90 - \$701.10 = \$73.80$. (c) Before: $28.5 \div 5 = 5.7$ h. After: $31.5 \div 5 = 6.3$ h.

Q9. (a) The tallest column is Friday, 30 deliveries. (b) $18 + 24 + 21 + 27 + 30 + 12 = 132$ deliveries. (c) Mean = $132 \div 6 = 22$ per day. Range = $30 - 12 = 18$.

Q10. (a) $4 + 6 + 5 + 8 + 7 + 10 + 5 = 45$ km. (b) Mean = $45 \div 7 = 6.4286\dots$ km, so 6.4 km to 1 decimal place. (c) Range = $10 - 4 = 6$ km. The longest day is day 6 (Saturday), 10 km.

Q11. (a) $2.4 \times 100 = 240$ cm and $2.4 \times 1000 = 2400$ mm, both as the screen shows; $850 \div 1000 = 0.85$ kg. (b) Not true. $1.6 \times 1000 = 1600$ m. The wrong 160 m comes from multiplying by 100 — the metres-to-centimetres rate — instead of the kilometres-to-metres rate of 1000.

Q12. (a) The 8:35 am bus arrives at 9:02 am, after 8:45 am, so the latest bus he can catch is the **8:05 am** bus (arrives 8:32 am). He walks 8 minutes to the stop, so he must leave home 8 minutes before 8:05 am, at **07:57**. (b) From 8:05 am to 8:32 am is 27 minutes. (c) Walk plus ride = $8 + 27 = 35$ minutes. He arrives at 8:32 am, which is 13 minutes before 8:45 am, so he has 13 minutes to spare.

Q13. (a) $45 \div 60 = 0.75$, so 7 h 45 min is 7.75 h. Pay = $7.75 \times \$31.20 = \$241.80$. (b) $\$193.44 \div \$31.20 = 6.2$, so the calculator used 6.2 h: the 20 minutes were typed straight in as “.20” instead of being converted ($20 \div 60 = 0.33$). (c) 6 h 20 min is 6.3333... h; pay = $6.3333\dots \times \$31.20 = \$197.60$ to the nearest cent. The slip costs $\$197.60 - \$193.44 = \$4.16$.

Q14. (a) Cells B2 to B31 inclusive is $31 - 2 + 1 = 30$ numbers. (b) Mean $\times$ count = total: $18.4 \times 30 = 552$. (c) New total = $552 - 10 + 20 = 562$; new mean = $562 \div 30 = 18.7333\dots$, so the sheet shows 18.7 to 1 decimal place.

Q15. (a) $24 \times \$11.75 = \$282.00$. (b) 24 rolls at about \$12 is $24 \times 12 = \$288$, so the total should be a little under \$288 — the screen’s \$2 820.00 is about ten times that and cannot be right. (c) The price per roll was keyed as 117.5 (decimal point missed). Check: $24 \times 117.5 = \$2\,820.00$, exactly the screen’s total.

Q16. (a) 3 days: $3 \times \$85 + \$40 = \$295.00$. 4 days: $4 \times \$85 + \$40 = \$380.00$. (b) \$295.00 fits the \$300 budget and \$380.00 does not, so the most is **3 days**. (c) $\$300.00 - \$295.00 = \$5.00$ left.

Q17. (a) She should close the request (or the app) and enter no card details — the rule is that a converter never needs bank or card details — and tell a teacher or supervisor. (b) He should log out before leaving the shared computer; still logged in, anyone at that computer can read or change his pay details. The rule is to log out on a computer other people use. (c) She should enter nothing and close the message — prizes that ask for a card number are traps — and report it. The rule is never to click pop-ups offering prizes.

Q18. (a) $D2 = 14 \times \$4.85 = \$67.90$; $D3 = 6 \times \$9.30 = \$55.80$; $D4 = 25 \times \$1.60 = \$40.00$; $D5 = =SUM(D2:D4) = \$67.90 + \$55.80 + \$40.00 = \$163.70$. (b) Bill = $\$163.70 + \$22.50 = \$186.20$ — the delivery sits outside the SUM range, so it must be added after. (c) Estimate: $14 \times 5 + 6 \times 9 + 25 \times 1.60 + 22.50 = 70 + 54 + 40 + 22.50 = \$186.50$, which matches \$186.20 closely. The order fits the \$200 budget with $\$200.00 - \$186.20 = \$13.80$ left.

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, price cards, timetables, panels and tables in this section are **made up** (not real): pretend places 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. The study design sorts the situations where you do maths using words like *familiar*, *unfamiliar* and *routine*. Its Unit 2, Outcome 1 says you will select, interpret and use your maths in situations that are familiar or routine, and in some that are less familiar.

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

Once you know the words, three things get easier:

- you can see what kind of task is coming;
- you can pick a sensible way to start;
- you can watch yourself grow — a less familiar task today becomes a familiar task with practice.

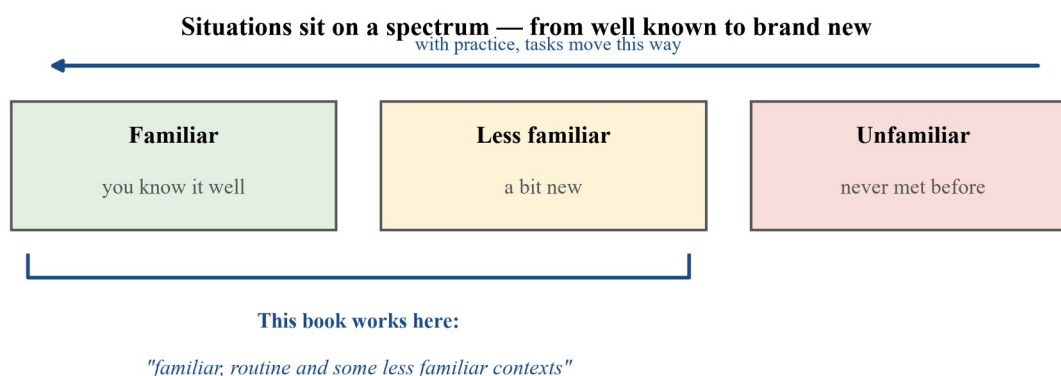
The words describe tasks and situations. They never describe you or your ability.

Two words you need first: context and task. The **context** is the real-life situation a problem sits in — a shop, a workplace, a sports club, a home. The **task** is what you are asked to do — find a total, compare two prices, work out a time. The words in this section sort both.

Familiar. A situation is **familiar** when it is well known to you — you have met it before, at school or outside school. Your own weekly roster. The shop you use every week. Doing maths in familiar situations shows you how the maths connects to real life.

Unfamiliar — and less familiar. A situation is **unfamiliar** when you have not met it before. New situations stretch you: the goal is to find the maths inside a new setting and carry your skills across. Unit 2 also works in **some less familiar** contexts — situations that are a bit new: a different brand of timetable, a new store's layout. Three things to remember:

- **Familiar is personal.** A roster is familiar to a classmate who works every weekend. The same roster may be unfamiliar to you. Neither of you is wrong.
- **Unfamiliar does not mean impossible.** It only means *new to you*.
- **A new story does not mean new maths.** The setting can be brand new while the maths inside it is maths you already know. At this level the maths is usually easy to see: it is given clearly, or shown in a table or picture, with few **distractors** — extra facts placed in the task that you do not need.

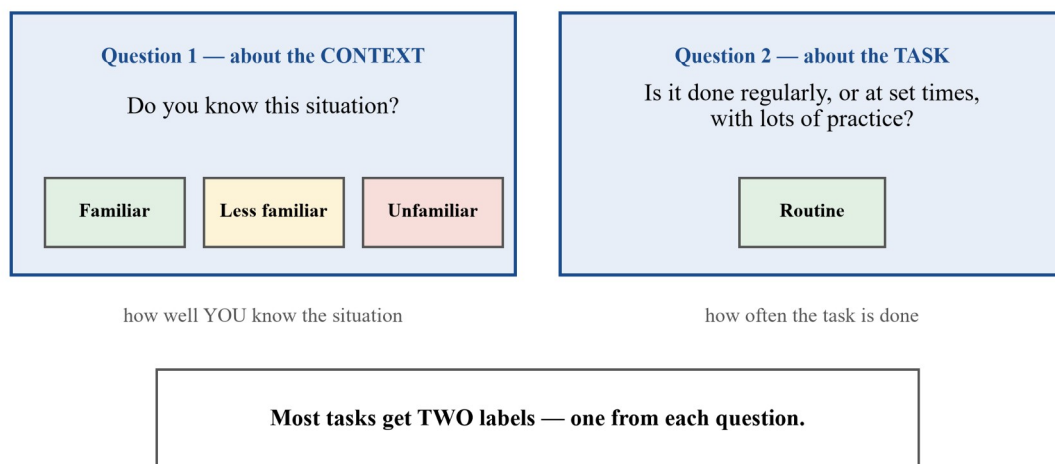


Routine. A **routine** task is one that people commonly meet and do in life and work — a procedure done **regularly**, or **at set times**, with **lots of practice**. Entering a meter reading into the same form every second Tuesday. Filling in a

timesheet at the end of every shift. Routine says how *often* something is done. It does not say whether you enjoy it, or whether it is easy.

Two questions sort almost every task. One question sorts the situation, the other sorts the task. Most tasks pick up two labels — one from each question.

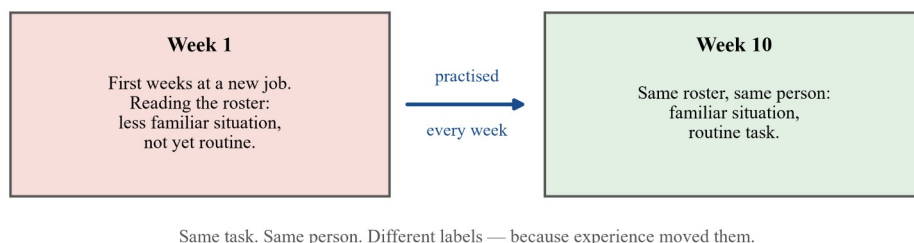
Two questions sort almost every task



Two labels at once. Adding up dockets at the shop where you work every week is *familiar* (you know the place) and *routine* (you do it every week). A task can also be routine inside a less familiar situation: on your first day at a new job, the timesheet may be the same one you filled in at your last job — new place, known procedure. That mix is normal, and it is the point of this section.

Labels change as you gain experience. Something that is less familiar in week 1 of a job can be familiar by week 10 — same task, same person, different labels. That change is what learning in this subject looks like.

Labels change as you gain experience

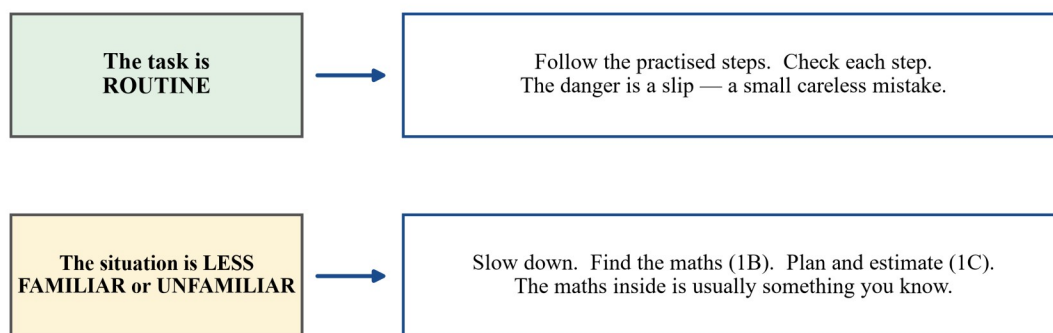


A fourth word: specialised. The study design also names a fourth word, **specialised**: a situation that belongs to one particular purpose or area of knowledge, and needs that area's own special words and procedures before the maths can be used. This book defines the word so you know it when you see it. You will not be asked to sort tasks into that band here.

Unit 3/4 preview. Specialised contexts — and non-routine tasks — belong to the Unit 3 and 4 band; every task in this book sits in the band of familiar, routine and some less familiar contexts.

How the labels help you start.

The labels tell you how to start



- **Routine task:** follow the practised steps and check each step as you go. The danger is a **slip** — a small careless mistake — not a new idea.
- **Less familiar or unfamiliar situation:** slow down at the start. Find the maths (Section 1B). Write a short plan and estimate first (Section 1C). Then ask: *what do I already know that works here?*

In this book every task runs in one or two steps, so the labels tell you where to put your care — not that a task is beyond you.

The words across the six numeracies. Outcome 1 uses maths across six kinds of real-life context, called **numeracies**. Your school picks three of them to study; this book covers all six (Chapter 6).

Numeracy	Example situation	Words that fit
Personal	Checking your own weekly roster for your hours	Familiar, routine
Civic	Reading your street's new bin calendar for the first time	Less familiar situation; the weekly calendar check is still a routine read
Financial	Comparing the price per kilogram of two brands at the supermarket	Routine for a regular shopper; less familiar in a new store
Health	Reading a nutrition panel (the food information table on a packet) to find the sugars per serve	Less familiar the first time; routine for someone who checks panels
Vocational	Filling in a timesheet at the end of every shift	Routine — done at set times
Recreational	Reading a fixture (a list of game days, venues and start times) to find your team's next game	Familiar, routine

Worked model — sorting three tasks.

Task	Words	Why
Splitting a \$48 takeaway order equally between 3 friends	Familiar, routine	A situation most people know; one short division: $48 \div 3 = \$16$ each
Taking a water-meter reading and entering it into the same online form every second Tuesday	Familiar, routine	Done at set times, with lots of practice
Reading a different brand of bus timetable (same layout, new routes) for the first time	Less familiar situation, routine task	The timetable is new to you; finding a departure time is a practised timetable read. The bus leaves at

Task	Words	Why
		7:52 am and arrives at 8:15 am, so the trip is 23 min

Refresher — the four operations with money.

Nearly every calculation in this section is built from the four operations. **Addition** (+) puts amounts together: $\$6.20 + \$3.80 = \$10.00$. **Subtraction** (−) takes one amount away from another, as in change: $\$20.00 - \$13.75 = \$6.25$. **Multiplication** (×) repeats the same amount: $4 \times \$3.25 = \$13.00$. **Division** (÷) shares an amount into equal parts: $\$12.60 \div 3 = \$4.20$.

Refresher — unit prices.

A **unit price** is a price “per” something: per kilogram, per hour, per item. Find it by dividing the price by the number of units: 2 kg for \$4.80 means $\$4.80 \div 2 = \$2.40$ per kg. The same operations work for grams and minutes: 2 serves at 12.4 g each is $2 \times 12.4 = 24.8$ g.

Refresher — time in hours and minutes.

One hour is 60 minutes, so part of an hour is a decimal: 15 min = 0.25 h, 30 min = 0.5 h, 45 min = 0.75 h. To find how long a trip takes, count on or subtract: 8:05 am to 8:38 am is 33 min. Timetables often use 24-hour time, where hours run from 00 to 23: 15:48 means 3:48 pm.

Refresher — metric mass.

Labels and recipes mix grams and kilograms, so keep this swap in your head: 1 kg = 1000 g. Going from kg to g means multiplying: 4 kg = 4000 g.

Worked examples

Example 1 — scaffolded

Priya’s week holds four maths tasks (cards below). For each card: sort the situation (familiar, less familiar or unfamiliar), say whether the task is routine, and do the small calculation inside it.

Priya's four tasks this week

Card A — Sunday night, budget book Priya adds up the week's spending: \$18.40, \$26.15 and \$15.45. Same book, same steps, every Sunday.	Card B — first shift, Wattle Street Milk Bar A customer orders 2 toasted sandwiches at \$4.60 each and a drink at \$3.20, and pays with a \$20 note. Priya used a cash register every week at her old job.
Card C — every morning, bus app The bus leaves at 8:05 am and arrives at 8:38 am. Same app, same trip, every day.	Card D — Friday, timesheet Priya enters her hours: Wed 3.5 h, Fri 4 h, Sat 5.5 h, at \$21.50 per hour. Same timesheet, every Friday.

Made-up data: Priya, the milk bar and every number on the cards are made up for this section.

Card A — familiar and routine. Priya knows her own budget book well (familiar), and she does this every Sunday with the same steps (routine). Spending:
 $\$18.40 + \$26.15 + \$15.45 = \$60.00$.

Both labels sit at the “known” end: a well-known situation and a practised task. Follow the steps and check each one — the only danger is a slip.

Card B — unfamiliar situation, routine task. Priya has never worked at this milk bar, so the situation is unfamiliar. But she rang up sales every week at her old job, so using the cash register is routine for her. Order:
 $2 \times \$4.60 = \$9.20$, then $\$9.20 + \$3.20 = \$12.40$.
 Change: $\$20.00 - \$12.40 = \$7.60$.

New place, known procedure — the key idea of this section. For a classmate who has never used a cash register, the procedure on this same card would be new too: labels are personal.

Card C — familiar and routine. The same app, the same trip, every morning. From 8:05 am to 8:38 am is **33 min**.

8:05 → 8:38: count on 33 minutes. Done every day, with lots of practice, so the task is routine.

Card D — familiar and routine. The same timesheet, every Friday — a set time. Hours: $3.5 + 4 + 5.5 = 13$ h.
 Pay: $13 \times \$21.50 = \$279.50$.

Two steps: add the hours, then multiply by the rate. 3.5 h is 3 h 30 min. “Every Friday” is the clue that the task is routine.

Example 2 — scaffolded

Cory has worked at Gear & Go Bike Shop for two years. Hana is on her first day. Both are handed the same job: two bikes each need a puncture repair, and one of those bikes also needs a brake adjustment. Use the repair price card to find the total cost of the job.

Gear & Go Bike Shop	
Repair price card	
Puncture repair	\$12 per bike
Brake adjustment	\$18 per bike
Gear tune	\$45

Made-up data: the shop, the price card and the prices are made up for this section.

Sort the job for Cory: the shop, the card and the steps are all well known to him — **familiar**. He has done this job every week for two years — **routine**.

Two years of practice puts both of Cory’s labels at the “known” end.

Sort the job for Hana: it is her first day, so the shop and the card are **unfamiliar**. The job is not yet routine for her — it will become routine as she practises it each week.

Same task, two people, different labels. Labels are personal, and they move with experience.

Pick out the numbers that matter: puncture repair \$12 for each of the 2 bikes; brake adjustment \$18 for the 1 bike.

The gear tune (\$45) is a distractor — no bike in this job needs one, so leave it out.

$$2 \times \$12 = \$24$$

The two puncture repairs.

$$\$24 + \$18 = \$42$$

Plus the one brake adjustment. The job costs **\$42** — for Cory and for Hana, the maths is identical.

Example 3 — unscaffolded

Jesse catches the same bus every school day. Today the bus leaves at 7:42 am and arrives at 8:17 am. Jesse then walks for 10 min to class, and class starts at 8:30 am. Is Jesse late? Sort the task as well.

Solution. The bus ride runs from 7:42 am to 8:17 am: $7:42 \rightarrow 8:00$ is 18 min and $8:00 \rightarrow 8:17$ is 17 min, so the ride is $18 + 17 = 35$ min. The 10 min walk starts at 8:17 am, so Jesse reaches class at 8:27 am. Class starts at 8:30 am, which is after 8:27 am. The same bus and the same walk happen every school day, so the situation is familiar and the task is routine — Jesse’s only risk is a slip, so he checks the two times as he goes. $\therefore$ Jesse is not late: he arrives at 8:27 am, 3 min before the 8:30 am start, on a familiar and routine task.

Example 4 — unscaffolded

Nina is shopping at a supermarket she has never used before. She needs dishwasher tablets, and the same brand comes in two box sizes (shelf labels below). Which box is cheaper per tablet, and by how much per tablet? Sort the task as well.

The same brand, in two box sizes

DISHWASHER TABLETS 40 pack \$9.60	DISHWASHER TABLETS 25 pack \$6.75
---	---

Made-up data: the store, the product and the prices are made up for this section.

Solution. The store is new to Nina, so the situation is unfamiliar. But Nina has compared unit prices many times, so a price-per-tablet is a routine calculation for her. Box of 40: $\$9.60 \div 40 = \$0.24$ per tablet. Box of 25: $\$6.75 \div 25 = \$0.27$ per tablet. Compare the two unit prices: $\$0.27 - \$0.24 = \$0.03$. $\therefore$ the box of 40 is cheaper, by \$0.03 per tablet. New story, known maths: Nina’s care goes into reading the unfamiliar shelf labels slowly, not into the division she already knows.

Practice questions

Scaffolded

Q1. Say whether each situation is familiar or unfamiliar to the person named, and give a reason. (a) Zara follows a muffin recipe she has baked every week for two years. (b) Oli reads a ferry timetable for a town he has never visited. (c) Josh buys his usual items at the corner store he uses every day. The total is \$27.60 and he pays with a \$50 note. Find his change as well.

Q2. Say whether each task is routine, and use the definition (done regularly, or at set times, with lots of practice) to give a reason. (a) Dex enters a water-meter reading into the same online form every second Tuesday. (b) Jesse checks the bus app every morning before school. (c) Once a year, Priya’s family helps at a school garden day, and Priya works out how many trailer loads of soil the garden needs. She does this once a year, with no set steps.

Q3. (a) In your own words, what is a context? (b) In your own words, what is a task? (c) For “adding up dockets at the shop where you work every week”, name the context and name the task, and give a label for each.

Q4. Put each situation below on the spectrum for Riley — familiar, less familiar or unfamiliar — and say whether the task is routine for her. (i) Riley reads her own weekly roster every Monday. (ii) Riley uses a different brand of bus timetable (same layout, new routes) for the first time. (iii) Riley has never been to this school fete. At the end of the night she counts the cake stall’s takings (the money taken) — she counts cash every week at her job. The stall sold 24 cupcakes at \$1.50 each; find the takings. (iv) At her usual supermarket, Riley uses the new self-checkout machine for the first time. (a) Sort (i)–(iv). (b) For (iii), explain how the situation can be unfamiliar while the task is routine. (c) Do the cupcake calculation in (iii).

Q5. Tahlia works every weekend at a supermarket. Ash has never had a job. They are each handed the same weekly supermarket roster to read. (a) Sort the roster for Tahlia and give a reason. (b) Sort the same roster for Ash. (c) Tahlia's Saturday shows 6 h at \$23.50 per hour. Find her pay for Saturday.

Q6. In week 1 at the Wattle Street Milk Bar, Kurt checked the till (the money drawer) slowly, step by step. By week 10 he does the same check without stopping to think. (a) Sort the till check for week 1, with a reason. (b) Sort it for week 10 and say what changed. (c) The till holds $3 \times \$50$ notes, $8 \times \$20$ notes and $5 \times \$10$ notes. Find the total in the till.

Un scaffolded

Q7. Dex's week at Wombat Creek Community Garden holds five tasks: 1. switch on the same watering timer every morning; 2. read the spacing grid on a new packet of seeds for the first time; 3. split a 4 kg bag of potting mix into 500 g sample bags; 4. total the week's seed orders on the same order form every Friday; 5. read the rain gauge every Monday and record it in the same log book. (a) Sort each task as routine or not yet routine, and give a reason for one of them. (b) How many 500 g sample bags does task 3 make? (c) After a month at the garden, which of your labels changes for task 2? Explain why.

Q8. Marlee has never ordered supplies before. She reads a catalogue and orders 3 boxes of gloves at \$14.50 each, plus \$8.95 delivery. (a) Sort the task for Marlee and give a reason. (b) Find the total cost of the order. (c) Marlee's brother says, "If it is unfamiliar, the maths must be hard." Use this task to explain in one sentence why he is wrong.

Q9. Hana reads a nutrition panel for the first time. Her mum checks panels at every shop.

Cocoa Crunch — breakfast cereal	
Nutrition information	
Serving size	40 g
Servings per pack	8
Sugars, per serve	12.4 g
Sugars, per 100 g	31 g

Made-up data: the product, the panel and every number on it are made up for this section.

- (a) Find the sugars in 2 serves of Cocoa Crunch.
- (b) Sort "reading this panel" for Hana and for her mum.
- (c) A second cereal, Oat Pops, has 9.6 g of sugars per serve. A person eats 3 serves. Which has more sugars in total for that person — 2 serves of Cocoa Crunch or 3 serves of Oat Pops — and by how many grams?

Q10. Write your own examples. (a) Write one task from your own life that is familiar and routine. (b) Write one task that is less familiar for you. (c) Write one task you do at set times. (d) Compare your list with a classmate's list. Explain how your two lists can be different even though you both followed the same definitions.

Q11. Riley has two tasks this week: (i) total her hours in the same timesheet app she has used all year — Monday 4.5 h, Tuesday 6 h, Wednesday 5.5 h; and (ii) use a new brand of timesheet app for the first time, because her boss switched — the screens are new, the hours are the same. (a) Say how Riley should start each task, and why the two starts are different. (b) Total Riley's hours for the three days. (c) Riley is paid \$24.20 per hour. Estimate her pay for the three days first (think "about \$24 per hour"), then calculate it exactly and check it against your estimate.

Q12. (a) In one sentence, what does the study design mean by a specialised context? (b) Which words describe the band that every task in this book sits in? (c) Oli says, "If the situation is unfamiliar, the maths must be hard too." Do you agree? Use one example from this section to explain your answer.

Q13. Ash rides a new train line for the first time. The 24-hour timetable shows: depart 15:48, arrive 16:31. (a) How long is the trip? (b) Sort the task for Ash: the situation, and the timetable read. (c) Ash leaves home at 3:20 pm and walks 12 min to the station. Does Ash arrive before the 15:48 departure? Show the two times you compare.

Q14. Zara compares two boxes of muesli bars at the supermarket: Trailtime, 6 bars for \$4.50; OatyGo, 10 bars for \$7.00. (a) Find the price per bar for each box. (b) Which box is cheaper per bar, and by how much per bar? (c) Zara has never bought either brand. Sort the situation and the calculation.

Q15. Match each description to the correct word — familiar, less familiar, unfamiliar, routine. (i) done regularly, or at set times, with lots of practice (ii) well known to you; you have met it many times before (iii) completely new to you; you have never met it before (iv) a bit new — not completely new, but not well known yet (a) Give your four matches. (b) Which word sorts a task by how often it is done, and which words sort a situation by how well you know it? (c) Give one example of your own for the word routine.

Q16. Marlee plays for Rivergum Football Netball Club and checks the fixture every Thursday.

Rivergum Football Netball Club — fixture

Round	Date	Home/Away	Opponent	Venue	Start
1	Sat 4 Apr	Home	Oakvale Roos	Rivergum Oval	10:00 am
2	Sat 11 Apr	Away	Springdale Saints	Springdale Park	1:00 pm
3	Sat 18 Apr	Away	Merrick Mustangs	Merrick Park	2:00 pm
4	Sat 2 May	Home	Clifton Hawks	Rivergum Oval	10:00 am

Made-up data: the club, the fixture and every number in it are made up for this section.

- Find the day, the venue and the start time of the round 3 game.
- For round 3, the club bus leaves at 12:20 pm and the trip takes 45 min. What time does the bus arrive, and how long before the 2:00 pm start is that?
- Sort “checking the fixture” for Marlee and give a reason.

Q17. It is Josh’s first time voting in a council election. His voting card is below.

VOTING CARD

Council election

Election day: Saturday

Polling place: Merrick Hall

Open: 8:00 am to 6:00 pm

Bring this card with you.

Made-up data: the card, the place and the times are made up for this section.

- How many hours is the polling place (the place you vote) open on election day?
- Sort the situation and the task for Josh — he has read times like these before, but he has never voted.
- Josh arrives at 5:20 pm and voting takes him 25 min. Does he finish before the polling place closes? Show the two times you compare.

Q18. Tahlia says, “A task is routine only if it is easy.” (a) Do you agree? Use the definition of routine to give your reason. (b) Give one example of a routine task that still needs careful checking, and say what the danger is. (c) Give one example from this section of a less familiar or unfamiliar task where the maths inside is something you already know.

Answers

Q1. (a) Familiar — she has baked it every week for two years. (b) Unfamiliar — a town he has never visited and a timetable he has never read. (c) Familiar — his usual store and his usual items; change $\$50.00 - \$27.60 = \$22.40$.

Q2. (a) Routine — every second Tuesday is a set time, with lots of practice. (b) Routine — every morning, regular and practised. (c) Not routine — once a year is not regular or at set times, and there is no frequent practice.

Q3. (a) The context is the real-life situation the problem sits in. (b) The task is what you are asked to do. (c) Context: the shop where you work every week — familiar. Task: adding up dockets — routine.

Q4. (a) (i) Familiar situation, routine task. (ii) Less familiar situation; the timetable read is routine. (iii) Unfamiliar situation (a fete she has never been to); counting cash is routine (she does it every week). (iv) Familiar store; the new machine is less familiar, and using it will become routine with practice. (b) The two labels sort different things: how well you know the situation, and how often the procedure is done. Riley knows the counting procedure well even though the fete is new to her. (c) $24 \times \$1.50 = \$36.00$.

Q5. (a) Familiar and routine — she works there every weekend and reads a roster each week. (b) Unfamiliar — Ash has never had a job and has never read a roster. (c) $6 \times \$23.50 = \$141.00$.

Q6. (a) Week 1: the milk bar is new (unfamiliar situation) and the check is not yet routine — little practice yet, so it is slow and step-by-step. (b) Week 10: familiar situation and routine task — the same check, done every week for ten weeks; practice moved the labels. (c) $\$150 + \$160 + \$50 = \$360$.

Q7. (a) Tasks 1, 3, 4 and 5 are routine (every morning, a regular garden job, every Friday, every Monday — regular and practised); task 2 is not yet routine (first time). Example reason: task 4 is done on the same form every Friday — at set times, with frequent practice. (b) $4 \text{ kg} = 4000 \text{ g}$; $4000 \div 500 = 8$ bags. (c) Task 2 becomes routine (and the seed packets become familiar): after a month of reading a grid every week, the labels move with experience.

Q8. (a) Unfamiliar — she has never ordered from a catalogue before; the maths inside (multiply, then add) is something she knows. (b) $3 \times \$14.50 = \$43.50$; $\$43.50 + \$8.95 = \$52.45$. (c) Unfamiliar means new to her, not hard: the same calculation is routine for someone who orders supplies every month.

Q9. (a) $2 \times 12.4 = 24.8 \text{ g}$. (b) Hana: unfamiliar (or less familiar) — her first panel. Her mum: familiar and routine — she checks panels at every shop. (c) $3 \times 9.6 = 28.8 \text{ g}$; $28.8 - 24.8 = 4.0 \text{ g}$, so 3 serves of Oat Pops has 4.0 g more sugars.

Q10. Answers vary. (d) Labels are personal: they depend on what each person has met and practised before, so two honest lists can differ.

Q11. (a) Task (i) is routine: follow the practised steps and check each step — the danger is a slip. Task (ii) is less familiar: slow down, find the maths first, and estimate — the maths inside is the addition she already knows. (b) $4.5 + 6 + 5.5 = 16 \text{ h}$. (c) Estimate: $16 \times 24 = \$384$; exact: $16 \times \$24.20 = \$387.20$ — close to the estimate, so it is sensible.

Q12. (a) A situation that belongs to one particular purpose or area of knowledge and needs that area's own special words and procedures before the maths can be used. (b) Familiar, routine and some less familiar contexts. (c) Disagree — in Example 4 the store is unfamiliar to Nina, but the price-per-tablet division is a routine calculation she knows. Unfamiliar sorts the situation, not the difficulty of the maths.

Q13. (a) $15:48 \rightarrow 16:00$ is 12 min and $16:00 \rightarrow 16:31$ is 31 min, so the trip is $12 + 31 = 43$ min. (b) The line and its timetable are new to Ash — an unfamiliar (or less familiar) situation; reading a timetable is a routine task. (c) $3:20 \text{ pm} + 12 \text{ min} = 3:32 \text{ pm}$; the departure is 15:48, which is 3:48 pm; 3:32 pm is before 3:48 pm, so yes — 16 min to spare.

Q14. (a) Trailtime: $\$4.50 \div 6 = \$0.75$ per bar. OatyGo: $\$7.00 \div 10 = \$0.70$ per bar. (b) OatyGo, by $\$0.75 - \$0.70 = \$0.05$ per bar. (c) The brands (and the decision) are less familiar to Zara; the unit-price calculation is routine.

Q15. (a) (i) routine; (ii) familiar; (iii) unfamiliar; (iv) less familiar. (b) Routine sorts a task by how often it is done; familiar, less familiar and unfamiliar sort a situation by how well you know it. (c) Answers vary — for example, entering the same seed order form every Friday.

Q16. (a) Saturday, Merrick Park, 2:00 pm. (b) $12:20 \text{ pm} + 45 \text{ min} = 1:05 \text{ pm}$; that is 55 min before the 2:00 pm start. (c) Familiar and routine — Marlee knows the fixture well and checks it every Thursday.

Q17. (a) 8:00 am to 6:00 pm is 10 h. (b) The situation is unfamiliar (his first election); reading opening times is a routine task — he has read times like these before. (c) $5:20 \text{ pm} + 25 \text{ min} = 5:45 \text{ pm}$; closing is 6:00 pm; 5:45 pm is before 6:00 pm, so yes — 15 min to spare.

Q18. (a) Disagree — routine means done regularly, or at set times, with lots of practice; it says nothing about easy or hard. (b) For example, Kurt's Friday till check (Q6): routine, but a slip would miscount the money, so every step still needs checking. (c) For example, Example 4 (Nina's new supermarket) or Q13 (Ash's new train line): the setting is new, the maths inside (a unit-price division, a time difference) is known.

Fully-worked solutions

Q1. (a) Zara has met this situation many times — two years of weekly baking — so it is **familiar**. (b) Oli has never visited the town and never read its ferry timetable, so the situation is **unfamiliar**. (c) Josh uses this store every day for his usual items: **familiar**. Change: $\$50.00 - \$27.60 = \$22.40$.

Q2. (a) **Routine**: the same form, every second Tuesday — done at set times with frequent practice. (b) **Routine**: the same check every morning — regular and practised. (c) **Not routine**: once a year is not regular and not at set times, and there is no frequent practice to build on.

Q3. (a) A **context** is the real-life situation a problem sits in — a shop, a workplace, a club, a home. (b) A **task** is what you are asked to do — find a total, compare, measure, work out a time. (c) Context: the shop where you work every week; you know it well, so **familiar**. Task: adding up dockets; you do it every week, so **routine**.

Q4. (a) (i) **Familiar** situation (her own roster), **routine** task (every Monday). (ii) **Less familiar** situation (same layout, new routes); finding a departure time is a **routine** timetable read. (iii) **Unfamiliar** situation (a fete she has never been to); counting cash is **routine** — she counts it every week at her job. (iv) **Familiar** store; the new machine is **less familiar**, and using it will become routine with practice. (b) The words sort two different things. “Unfamiliar” says how well Riley knows the situation; “routine” says how often she has practised the procedure. She has practised counting cash every week, so the task is routine even inside a situation she has never met. (c) $24 \times \$1.50 = \$36.00$ in takings.

Q5. (a) For Tahlia the roster is **familiar** and reading it is **routine**: she works there every weekend and has read this roster many times. (b) For Ash the same roster is **unfamiliar**: he has never had a job, so rosters are new to him. Same document, two people, different labels — familiar is personal. (c) Saturday pay: $6 \times \$23.50 = \$141.00$.

Q6. (a) Week 1: the milk bar is new, so the situation is **unfamiliar**, and the check is **not yet routine** — Kurt has little practice, so he goes slowly, step by step. (b) Week 10: the situation is **familiar** and the check is **routine** — the same check, done every week for ten weeks. What changed is Kurt's experience, not the task. (c) Notes: $3 \times \$50 = \$150$; $8 \times \$20 = \$160$; $5 \times \$10 = \$50$. Total: $\$150 + \$160 + \$50 = \$360$.

Q7. (a) Task 1 **routine** (same timer every morning). Task 2 **not yet routine** (first time reading a spacing grid). Task 3 **routine** (a regular garden job, done the same way each time). Task 4 **routine** (same form every Friday — at set times, with frequent practice). Task 5 **routine** (same gauge and log book every Monday). (b) $4 \text{ kg} = 4000 \text{ g}$. Bags: $4000 \div 500 = 8$ sample bags. (c) Task 2's label changes from *not yet routine* to **routine** (and the situation becomes familiar): after a month of reading a spacing grid every week, Dex has the frequent practice the definition asks for.

Q8. (a) **Unfamiliar**: Marlee has never ordered from a catalogue before. The maths inside — multiply a price, then add delivery — is something she knows, so the label describes the situation, not her maths. (b) Gloves: $3 \times \$14.50 = \$43.50$. Total: $\$43.50 + \$8.95 = \$52.45$. (c) The calculation is two short steps anyone who knows multiplication and addition can do, so “unfamiliar” is telling Marlee the *situation* is new — not that the maths is hard.

Q9. (a) Sugars in 2 serves: $2 \times 12.4 = 24.8$ g. (b) For Hana, reading the panel is **unfamiliar** (her first one); for her mum it is **familiar and routine** — she checks a panel at every shop. (c) Oat Pops: $3 \times 9.6 = 28.8$ g. Compare: $28.8 - 24.8 = 4.0$ g, so 3 serves of Oat Pops has **4.0 g more** sugars than 2 serves of Cocoa Crunch.

Q10. Answers vary. A model set: (a) “Adding up my own phone spend every Sunday” — familiar and routine. (b) “Reading my first payslip” — less familiar. (c) “Taking the bin out on collection night” — at set times, so routine. (d) Your classmate has met and practised different situations from you, and familiar is personal, so two honest lists can differ while both follow the definitions.

Q11. (a) Task (i) is **routine**: Riley should follow the practised steps in the app and check each entry, because the danger in a routine task is a slip. Task (ii) is **less familiar**: she should slow down, find the maths first (the same addition), and estimate before trusting the new screens. The starts differ because the labels differ. (b) Hours: $4.5 + 6 + 5.5 = 16$ h. (c) Estimate: 16 h at about \$24 is $16 \times 24 = \$384$. Exact: $16 \times \$24.20 = \$387.20$. The exact pay sits close to the estimate, so it is sensible.

Q12. (a) A **specialised** context belongs to one particular purpose or area of knowledge and needs that area’s own special words and procedures before the maths can be used. (b) Every task in this book sits in the band of **familiar, routine and some less familiar contexts**. (c) Disagree. In Example 4 the supermarket is unfamiliar to Nina, yet the maths is a unit-price division she uses often — routine for her. So “unfamiliar” sorts the situation; the difficulty of the maths is a separate question.

Q13. (a) $15:48 \rightarrow 16:00$ is 12 min; $16:00 \rightarrow 16:31$ is 31 min; trip = $12 + 31 = 43$ min. (b) The train line and its timetable are new to Ash — an **unfamiliar** (or less familiar) situation — while reading a timetable is a **routine** task for anyone who has read one before. (c) Walk: $3:20$ pm + 12 min = $3:32$ pm. Departure: $15:48 = 3:48$ pm. $3:32$ pm is before $3:48$ pm, so **yes**, Ash arrives with 16 min to spare.

Q14. (a) Trailtime: $\$4.50 \div 6 = \$0.75$ per bar. OatyGo: $\$7.00 \div 10 = \$0.70$ per bar. (b) OatyGo is cheaper per bar by $\$0.75 - \$0.70 = \$0.05$. (c) The brands are new to Zara, so the situation is **less familiar**; dividing a price by a count is a **routine** calculation she has done before.

Q15. (a) (i) $\rightarrow$ routine; (ii) $\rightarrow$ familiar; (iii) $\rightarrow$ unfamiliar; (iv) $\rightarrow$ less familiar. (b) **Routine** sorts a *task*, by how often it is done. **Familiar, less familiar and unfamiliar** sort a *situation*, by how well you know it. (c) Answers vary — for example, “totaling the seed order form every Friday” is routine: same form, set time, frequent practice.

Q16. (a) Round 3: **Saturday** (Sat 18 Apr), **Merrick Park**, start **2:00 pm**. (b) Bus: $12:20$ pm + 45 min = **1:05 pm**. From 1:05 pm to the 2:00 pm start is **55 min**, so the team arrives with time to spare. (c) For Marlee, checking the fixture is **familiar and routine**: she knows the fixture well and reads it every Thursday — a set time, with frequent practice.

Q17. (a) 8:00 am to 6:00 pm: $8:00$ am $\rightarrow 12:00$ pm is 4 h and $12:00$ pm $\rightarrow 6:00$ pm is 6 h, so the polling place is open $4 + 6 = 10$ h. (b) The situation is **unfamiliar** — Josh has never voted — while reading opening times is a **routine** task for him, because he has read times like these before. (c) Finish: $5:20$ pm + 25 min = $5:45$ pm. Closing: 6:00 pm. $5:45$ pm is before 6:00 pm, so **yes**, Josh finishes with 15 min to spare.

Q18. (a) Disagree. The definition of routine is about *how often*: done regularly, or at set times, with lots of practice. Easy and hard are not part of it, so a routine task can be tricky and a first-time task can be easy. (b) Kurt’s Friday till check (Q6) is routine, but one miscounted note would give a wrong total — the danger in a routine task is a slip, so each step still needs checking. (c) Example 4: Nina’s supermarket is unfamiliar, but the maths inside is a unit-price division she knows. (Equally, Q13: Ash’s train line is new, but a time difference is something he can already work out.)

Chapter 1 — Test A (multiple choice)

Chapter 1: 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 in this test is **made up** (not real). The businesses and situations are pretend, built for this book so you can practise the maths. Nothing here is real data about a real business, person or place.

Section A — Multiple-choice questions

Question 1

Dara has worked out that hiring the hall costs $4 \times \$38.50 = \$154.00$. She now asks herself whether \$154.00 passes her estimate of \$160, and whether it is a sensible amount to pay for four hours.

Which stage of the problem-solving cycle is Dara in?

- A. stage 1, identify the mathematics
- B. stage 2, act on and use mathematics
- C. stage 3, evaluate and reflect
- D. stage 4, communicate and report

Question 2

A team manager orders 48 drink bottles at \$3.15 each. Before she works out the exact total, she estimates by swapping both numbers for friendly numbers.

Which is the best estimate of the total cost?

- A. $48 \times \$3 = \$144$
- B. $50 \times \$3 = \$150$
- C. \$151.20, the exact total
- D. $50 \times \$3.15 = \$157.50$

Question 3

A rectangular vegetable plot is 3.2 m long and 1.5 m wide. A fence goes all the way around it.

What length of fence is needed?

- A. 4.7 m
- B. 4.8 m
- C. 9.4 m
- D. 12.8 m

Question 4

Pip buys 6 trays of strawberries at \$4.50 a tray at the market. The stall sells about 200 trays on a Saturday, and Pip's bus home leaves at 4 pm.

How much does Pip pay for her 6 trays?

- A. \$ 10.50
- B. \$ 27.00
- C. \$ 270.00
- D. \$ 900.00

Question 5

A school camp has 58 campers. Each tent sleeps 8 campers, and a tent cannot be shared with another group.

How many tents does the camp need?

- A. 7
- B. 7.25
- C. 7.3
- D. 8

Question 6

Vili orders 24 bottles of floor cleaner at \$13.75 each for his cleaning work. His calculator display reads $24 \times 13.75 = 3\,300$.

Which statement is correct?

- A. The display is right: \$3 300 is a whole-dollar amount, and whole-dollar totals are always exact.
- B. The display is right: $\$3\,300 \div 24 = \$137.50$, so the backwards check passes.
- C. The display is wrong: the estimate $25 \times 14 = 350$ puts the total near \$350, but \$3 300 is about nine times that. The true total is $24 \times \$13.75 = \$330.00$ — the decimal point has slipped one place.
- D. The display is right: 24 is more than 20 and \$13.75 is more than \$13, so the total must be more than $20 \times \$13 = \$260$ — and \$3 300 is more than \$260.

Question 7

A teacher cuts a 4 m roll of ribbon into 55 cm pieces for craft work.

How many full pieces can she cut?

- A. 7
- B. 7.27
- C. 8
- D. 72.7

Question 8

A neighbourhood committee spent \$1 200 across five activities. It wants a display that shows each activity's share of the whole \$1 200.

Which display is the best choice?

- A. a table of the five amounts
- B. a bar chart of the five amounts
- C. a line graph of the five amounts
- D. a pie chart of the five shares

Question 9

A jacket is marked at \$85. A sale takes 20% off the marked price.

How much money comes off the price of the jacket?

- A. \$ 8.50
- B. \$ 68.00
- C. \$ 17.00
- D. \$ 8.05

Question 10

The zero end of Anika's tape measure is worn away and cannot be read. To measure a bench, she lines the 10 cm mark up with one end and reads 92 cm at the other end.

How long is the bench?

- A. 102 cm
- B. 82 cm
- C. 92 cm
- D. 72 cm

Question 11

Ruth buys 3 shirts at \$24 each and 2 caps at \$9 each. She types $3 \times 24 + 2 \times 9$ into her calculator as one line.

What value does the calculator show?

- A. 90
- B. 165
- C. 666
- D. 702

Question 12

A 25-pack of coffee sachets costs \$10.00. A 40-pack of the same sachets costs \$14.00.

Which pack is the better buy per sachet, and by how much per sachet?

- A. the 25-pack, by \$0.05 a sachet
- B. the 40-pack, by \$0.05 a sachet
- C. the 25-pack, by \$4.00 a sachet
- D. the 40-pack, by \$4.00 a sachet

End of Section A

Test A — Answers

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

Test A — Fully-worked solutions

Q1. C. Dara has already found the exact value, \$154.00, from $4 \times \$38.50$. She is now testing that value against her estimate ($4 \times \$40 = \$160$) and against real life, and testing an answer this way is stage 3, evaluate and reflect (§1A). A is the stage where she finds the mathematics, which she has already done. B is the stage where she does the mathematics. D is the stage where she writes or says the final answer so somebody else can follow it.

Q2. B. Friendly-number estimating swaps each number for a nearby number that is easy to calculate with (§1C): 48 becomes 50, and \$3.15 becomes \$3, so the best estimate is $50 \times \$3 = \$150$. The exact total is $48 \times \$3.15 = \$151.20$, so \$150 sits only \$1.20 away from it. A rounds only the price and keeps 48, D rounds only the count and keeps \$3.15, and C is the exact value — an estimate is the rough number you find before the exact one, not after it.

Q3. C. The fence runs around the plot, so the mathematics is the perimeter of a rectangle:
 $2 \times (3.2 + 1.5) = 2 \times 4.7 = 9.4$ m (§1B). A adds the length and the width once only, which is half the perimeter. B finds $3.2 \times 1.5 = 4.8$ m², the area — the space inside, not the distance around. D finds $4 \times 3.2 = 12.8$ m, the perimeter of a square with 3.2 m sides, which this plot is not.

Q4. B. “6 trays at \$4.50 each” means multiply: $6 \times \$4.50 = \$27.00$ (§1B). The 200 trays the stall sells and the 4 pm bus are extra information — they play no part in this calculation. A adds instead of multiplying: $6 + \$4.50 = \$10.50$. C lets the decimal point slip one place — \$270.00 is ten times \$27.00. D uses the extra number: $200 \times \$4.50 = \$900.00$ is the stall’s whole Saturday takings from trays, not Pip’s purchase.

Q5. D. $58 \div 8 = 7.25$ tents. Seven tents sleep only $7 \times 8 = 56$ campers, which leaves $58 - 56 = 2$ campers without a bed, and eight tents sleep $8 \times 8 = 64$ campers, which covers all 58 — so round **up**: 8 tents (§1B, §1C). A rounds down and leaves two campers out in the cold. B is the raw calculator value, and nobody can sleep in 0.25 of a tent. C rounds 7.25 to 1 decimal place (7.3), which is still not a whole number of tents.

Q6. C. Estimate first with friendly numbers: 24 becomes 25, \$13.75 becomes \$14, and $25 \times 14 = 350$, so the total belongs near \$350. The display reads \$3 300, which is about nine times the estimate: $3\,300 \div 350 = 9.43$ (to 2 decimal places). That cannot be right, so the decimal point has slipped one place: $24 \times \$13.75 = \$330.00$, and \$3 300 is exactly ten times \$330.00 (§1C, §1F). A is wrong because whole-dollar totals are not automatically exact — this one is ten times too big. B’s backwards check actually fails: $\$3\,300 \div 24 = \$137.50$ a bottle is ten times the \$13.75 price, and a check only helps if you judge the answer it gives. D’s direction check is too weak: the total really is more than $20 \times \$13 = \$260$, but so is a number ten times too big, which is why the estimate check is the one that catches this slip.

Q7. A. Change to the same units first: 4 m = 400 cm (§1E). Then $400 \div 55 = 7.27$ (correct to 2 decimal places). Seven full pieces use $7 \times 55 = 385$ cm of ribbon and leave $400 - 385 = 15$ cm — too short for another 55 cm piece — while 8 pieces would need $8 \times 55 = 440$ cm, more ribbon than the roll holds, so round **down**: 7 full pieces (§1C). B is the raw calculator value, C needs 40 cm of ribbon that does not exist, and D divides by 5.5 instead of 55, which gives 72.7 (to 1 decimal place) — another slipped decimal point.

Q8. D. Each activity’s share of one whole \$1 200 is what a pie chart shows — slices of one whole (§1D). A table gives the exact five amounts but does not show the shares at a glance. A bar chart compares the five amounts as separate bars, not as parts of one whole. A line graph is for a quantity changing over time, and there is nothing changing over time here.

Q9. C. Build from 10%: 10% of \$85 is $\$85 \div 10 = \$8.50$, and 20% is two of those, so $2 \times \$8.50 = \$17.00$ comes off the price (§1D). A is 10% only — half the discount asked for. B, \$68.00, is the sale price, $\$85 - \$17.00$ — the answer to a different question, which is the two-questions-in-one trap (§1B). D swaps the digits of \$8.50 — a slipped-digit slip (§1F).

Q10. B. When the zero end is worn, start at a clear mark and subtract (§1E): the bench runs from the 10 cm mark to the 92 cm mark, so its length is $92 - 10 = 82$ cm. A adds the 10 cm instead of subtracting it. C reads 92 cm straight off the tape and forgets that the tape did not start at zero. D subtracts 20 cm — the wrong starting mark.

Q11. A. The calculator does the multiplications before the addition, with or without brackets (§1F): it finds $3 \times 24 = 72$ and $2 \times 9 = 18$ first, then adds them, so the display shows $72 + 18 = 90$. That is also the correct total for

Ruth's shirts and caps: $\$72.00 + \$18.00 = \$90.00$. B adds first: $(3+2) \times (24+9) = 5 \times 33 = 165$. C works strictly left to right: $3 \times 24 = 72$, then $72 + 2 = 74$, then $74 \times 9 = 666$. D treats the line as $3 \times (24+2) \times 9 = 702$.

Q12. B. Unit price = price $\div$ number of units (\$1G). The 25-pack: $\$10.00 \div 25 = \$0.40$ a sachet. The 40-pack: $\$14.00 \div 40 = \$0.35$ a sachet. The 40-pack is cheaper, by $\$0.40 - \$0.35 = \$0.05$ a sachet. A and C pick the dearer pack, and C and D quote \$4.00, which is the difference between the total prices, $\$14.00 - \$10.00$ — not the price of one sachet.

Chapter 1 — Test B (written response)

Chapter 1: The problem-solving cycle and mathematical toolkit (Sections 1A to 1G). Answer all eight questions in the spaces provided. Section B is worth 39 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 in this test is **made up** (not real). The businesses and situations are pretend, built for this book so you can practise the maths. Nothing here is real data about a real business, person or place.

Section B

Question 1 (5 marks)

A tennis club buys 9 cans of balls for a coaching day. Each can costs \$6.40. Use the four stages of the problem-solving cycle to answer parts a to d below.

a. Stage 1, *identify the mathematics*: write the calculation that finds the total cost. 1 mark

b. Stage 2, *act on and use mathematics*: estimate the total cost by rounding the price of one can to the nearest whole dollar. 1 mark

c. Stage 2, *act on and use mathematics*: work out the exact total cost. 1 mark

d. Stage 3, *evaluate and reflect*: use your estimate to say whether your exact total is reasonable, and explain why. 2 marks

Question 2 (5 marks)

A youth group is taking 54 members and leaders on an excursion. Each minibus seats 12 people, and a minibus cannot be shared with another group.

a. Write the **Purpose** line for a plan of this task. 1 mark

b. Write the **Mathematics** line for the plan: the calculation that must be done. 1 mark

c. Work out how many minibuses the group needs. 1 mark

d. Explain why the answer to part c is not 4.5 minibuses. Use calculations in your explanation. 2 marks

Question 3 (6 marks)

In each part, decide whether to round **up**, round **down** or round to the **nearest**, and say which you used.

- a. A school camp needs 27 L of juice for a weekend. Juice is sold in 4 L casks, and a cask cannot be split. How many casks must the camp buy? 2 marks

- b. A 5 m length of pine is cut into 60 cm stakes for a garden bed. How many full stakes can be cut? 2 marks

- c. A delivery app shows the postage for a parcel as \$12.638. The app charges to the nearest cent. How much postage does it charge? 2 marks

Question 4 (4 marks)

Each task below cannot be solved. Explain why not.

- a. Fleur wants the total cost of 5 concert tickets from a website. The site shows one \$2.10 booking fee for the order, but the ticket price will not load. 2 marks

- b. A builder is asked to carry 9 crates of tiles, each crate 85 kg, in one trip in a goods lift with a load limit of 600 kg. 2 marks

Question 5 (5 marks)

A supermarket sells pasta two ways: a 2 kg box for \$5.60, and a 3 kg box for \$7.80.

- a. Find the unit price, per kg, of the 2 kg box. 1 mark

- b. Find the unit price, per kg, of the 3 kg box, and say which box is the best buy. 2 marks

- c. The 3 kg box saves \$0.20 per kg. Write \$0.20 as a fraction of \$1.00, and as a percentage. 1 mark

- d. Write a **result sentence** reporting which box is the best buy. It must include the units and say whether your value is exact or rounded. 1 mark

Question 6 (5 marks)

Elsa works at a courier depot — a place where parcels are sorted and loaded. She uses analogue tools every day.

- a.** Elsa checks a shelf height of 1.75 m. Write this height in centimetres. 1 mark

- b.** The depot's luggage scale is marked from 0 kg to 20 kg, with a label every 5 kg and five small spaces between labels. The needle for a parcel sits three spaces past the 10 kg label. Read the mass of the parcel, and show how you found the value of one small space. 2 marks

- c.** Elsa catches the 19:40 train home, and the trip takes 55 minutes. Write her arrival time in 12-hour time. 2 marks

Question 7 (5 marks)

A market-stall owner keeps her daily takings in a spreadsheet. Column B holds the number sold, column C the price each and column D the total. Every cell in column D holds a formula like $=B2 * C2$, and cell D7 holds $=SUM(D2 : D6)$. The price list on the stall wall says muffins are \$3.20 each, but \$3.02 was typed into C3.

Row	Item	Number sold (B)	Price each (C)	Total (D)
2	Scones	12	\$2.50	\$30.00
3	Muffins	8	\$3.02	\$24.16
4	Lamingtons	6	\$2.75	\$16.50
5	Cupcakes	10	\$2.20	\$22.00
6	Brownies	9	\$1.95	\$17.55
7				\$110.21

Made-up data: the stall's takings and every number in this table are made up for this test.

- a.** Explain why D3 and D7 both change as soon as C3 is corrected, without anybody retyping them. 1 mark

- b.** Use the price list to find the input error. Name the cell that is wrong, and write the value it should hold. 2 marks

- c.** Write the corrected values of D3 and D7. 2 marks

Question 8 (4 marks)

- (i) Every Saturday for two years, Dawn has stacked the same shelves at the same supermarket, following the same stacking steps each time.
- (ii) Dawn has worked at the supermarket for two years. This week the manager asks her to plan and cost a new display of garden pots, using the supplier's catalogue — something she has never done before.

a. For each of (i) and (ii), sort the situation as **familiar** or **unfamiliar**, and the task as **routine** or **not yet routine**, for Dawn. 2 marks

b. The display uses 2 bags of potting mix at \$8.50 each and 1 bag of gravel at \$6.00. Find the cost of the materials for the display. 1 mark

c. In one sentence, explain what the word **routine** tells you about a task. 1 mark

End of Section B

Test B — Answers

Q1. (a) $9 \times \$6.40$. (b) \$54 — estimate $9 \times \$6$. (c) \$57.60. (d) reasonable — \$57.60 is \$3.60 above the \$54 estimate, and the estimate rounded the price down, so the exact total should sit a little higher.

Q2. (a) e.g. “Work out how many minibuses are needed so that all 54 people have a seat.” (b) minibuses = $54 \div 12$. (c) 5 minibuses. (d) $4 \times 12 = 48$ seats leaves $54 - 48 = 6$ people without a seat; $5 \times 12 = 60$ seats covers all 54.

Q3. (a) 7 casks, rounded **up**. (b) 8 full stakes, rounded **down**. (c) \$12.64, rounded to the **nearest** cent.

Q4. (a) It cannot be solved — the ticket price is missing, and the total is $5 \times \text{price} + \$2.10$. (b) It cannot be done — $9 \times 85 = 765$ kg is 165 kg over the 600 kg limit; at most 7 crates fit in one trip.

Q5. (a) \$2.80 per kg. (b) \$2.60 per kg; the 3 kg box is the best buy. (c) $\frac{1}{5}$ (one fifth); 20%. (d) e.g. “The 3 kg box is the best buy at \$2.60 per kilogram; this value is exact.”

Q6. (a) 175 cm. (b) one space = $(15 - 10) \div 5 = 1$ kg, so the reading is $10 + 3 \times 1 = 13$ kg. (c) 8:35 pm.

Q7. (a) Column D holds formulas that refer to other cells, so the outputs follow the inputs. (b) C3; it should hold \$3.20. (c) D3 = \$25.60; D7 = \$111.65.

Q8. (a) (i) familiar situation, routine task; (ii) familiar situation, task not yet routine. (b) \$23.00. (c) It tells you how regularly, or how often at set times, a task is done with lots of practice — not whether the task is easy or hard.

Test B — Fully-worked solutions

Q1. (a) Stage 1 finds the mathematics: the total is 9 lots of \$6.40, so the calculation is $9 \times \$6.40$. (b) Rounding \$6.40 to the nearest whole dollar gives \$6, so the estimate is $9 \times \$6 = \$54$. (c) The exact working is $9 \times \$6.40 = \$57.60$. (d) Stage 3 compares the two: \$57.60 is $\$57.60 - \$54 = \$3.60$ above the estimate of \$54, and the exact total should sit a little above the estimate because the price was rounded down — so \$57.60 is reasonable. The 9 cans cost \$57.60 (§1A).

Q2. (a) Purpose — e.g. “Work out how many minibuses the group needs so that all 54 people have a seat on the excursion.” (b) Mathematics — minibuses $= 54 \div 12$. (c) $54 \div 12 = 4.5$, and half a minibus cannot be hired, so round **up**: 5 minibuses are needed. (d) Four minibuses would seat $4 \times 12 = 48$ people, which leaves $54 - 48 = 6$ people without a seat, and five minibuses seat $5 \times 12 = 60$ people, which covers all 54 with six seats spare. Rounding down would leave six people behind, so 4.5 cannot be the answer (§1B).

Q3. (a) $27 \div 4 = 6.75$ casks. Six casks hold only $6 \times 4 = 24$ L, which is 3 L short, and seven hold $7 \times 4 = 28$ L, which covers 27 L — so round **up**: the camp must buy 7 casks. (b) Change to the same units first: 5 m = 500 cm. Then $500 \div 60 = 8$ remainder 20: eight stakes use $8 \times 60 = 480$ cm and leave 20 cm over, while nine would need $9 \times 60 = 540$ cm, more than the length of pine holds — so round **down**: 8 full stakes can be cut. (c) The app charges to the **nearest** cent: the third decimal digit of \$12.638 is 8, which is 5 or more, so the cent rounds up and the app charges \$12.64. In each part the rounding follows what happens in real life — buying short, cutting short, charging to the cent — not the arithmetic alone (§1C).

Q4. (a) It cannot be solved. The total Fleur needs is $5 \times (\text{ticket price}) + \$2.10$, and the ticket price never loads, so a number she needs is missing (§1C). Fleur must find that price — on the site, by phoning the ticket line, or at the door — before any working can start. (b) It cannot be done in one trip: the conditions are impossible. Nine crates at 85 kg each weigh $9 \times 85 = 765$ kg, which is $765 - 600 = 165$ kg over the lift’s 600 kg limit. The most crates the lift can carry is $600 \div 85 = 7$ remainder 5, and $7 \times 85 = 595$ kg fits, while 8 crates would weigh $8 \times 85 = 680$ kg — so one trip cannot do the job: it needs two trips, or a lighter load (§1C).

Q5. (a) Unit price = price $\div$ units: $\$5.60 \div 2 = \$2.80$, so the 2 kg box costs \$2.80 per kg. (b) $\$7.80 \div 3 = \$2.60$ per kg. \$2.60 is less than \$2.80, so the 3 kg box is the best buy — it saves $\$2.80 - \$2.60 = \$0.20$ per kg (§1G). (c) \$0.20 of \$1.00 is one fifth, $\frac{1}{5}$, of a dollar, and $\frac{1}{5} = 0.2 = 20\%$ (§1D). (d) A result sentence carries the units and says whether the value is exact or rounded — e.g. “The 3 kg box is the best buy at \$2.60 per kilogram; this value is exact.”

Q6. (a) $1.75 \times 100 = 175$, so 1.75 m is 175 cm (§1E). (b) Use the four steps for any scale (§1E). Two labelled values either side of the needle are 10 kg and 15 kg; there are five small spaces between them; so one space $= (15 - 10) \div 5 = 1$ kg. The needle sits three spaces past 10 kg: $10 + 3 \times 1 = 13$, so the parcel is 13 kg. (c) Count on from 19:40: 20 minutes brings 20:00, then 35 more minutes brings 20:35. In 12-hour time, 20:35 is 8:35 pm, so Elsa arrives home at 8:35 pm (§1E).

Q7. (a) Column D holds formulas rather than typed numbers: D3 holds $=B3 \times C3$ and D7 holds $=SUM(D2:D6)$. A formula refers to cells, so correcting C3 recalculates D3, and the new D3 flows straight into D7 — the outputs follow the inputs, and nothing is retyped (§1F). (b) Check the prices in column C against the price list: scones \$2.50, lamingtons \$2.75, cupcakes \$2.20 and brownies \$1.95 all agree, but the list says muffins are \$3.20 each while C3 holds \$3.02 — the digits were typed the wrong way around. Every formula in column D agrees with its own inputs ($12 \times \$2.50 = \$30.00$, $8 \times \$3.02 = \$24.16$, $6 \times \$2.75 = \$16.50$, $10 \times \$2.20 = \$22.00$, $9 \times \$1.95 = \$17.55$), so the error is an input: C3 should hold \$3.20. (c) Corrected D3 $= 8 \times \$3.20 = \$25.60$, and corrected D7 $= \$30.00 + \$25.60 + \$16.50 + \$22.00 + \$17.55 = \$111.65$. Check: the old total of \$110.21 rises by \$1.44, which is $8 \times \$0.18$ — the eight muffins at \$0.18 more each. So D3 = \$25.60 and D7 = \$111.65.

Q8. (a) (i) The shelves and the steps are well known to Dawn — she has done this every Saturday for two years — so the situation is **familiar** and the task is **routine**. (ii) The supermarket itself is **familiar**, because Dawn has worked there for two years, but she has never planned and costed a display before, so the task is **not yet routine** for her — it will become routine as she practises it (§1G). (b) Multiplication before addition: $2 \times \$8.50 = \$17.00$, then $\$17.00 + \$6.00 = \$23.00$. The materials cost \$23.00 (§1F). (c) Routine tells you how regularly a task is done — regularly, or at set times, with lots of practice. It says nothing about whether the task is easy or hard: a routine task can still need careful checking (§1G).