

VCE VM Numeracy Unit 2

Chapter 5 — Systematics

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Contents

Section	Page
5A Inputs and outputs	2
5B Tables and sorting with technology	18
5C Planning and scheduling	29
5D Maps, timetables and online planners	41
5E Adjusting inputs to optimise outputs	53
Chapter 05 — Test A (multiple choice)	66
Test A — Answers	69
Test A — Fully-worked solutions	70
Chapter 05 — Test B (written response)	73
Test B — Answers	77
Test B — Fully-worked solutions	78

Chapter 5 Systematics — 5A Inputs and outputs

Theory

About the data in this section. The shops, machines, screens, receipts and numbers in this section are **made up** (not real). They are invented businesses and invented numbers, created for this book so that the maths can be practised safely. None of this is real data about real businesses, real people or real places.

You push a \$2 coin into a drinks machine, press a button, and the machine drops a can and hands back 20 c. It did not feel like maths, but it was: you gave the machine some **inputs**, the machine followed its own fixed rule, and it gave you some **outputs**. This chapter is about systems like that one — the machines, screens and apps you meet every day. This first section teaches the two words the whole chapter is built on, and how to read them.

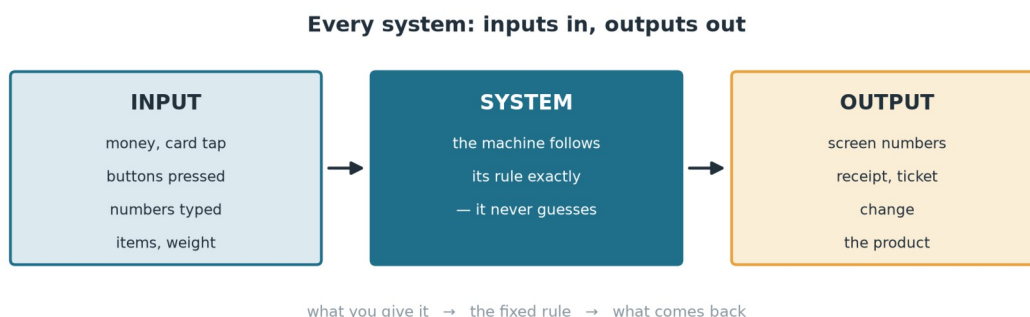
In the study design (Unit 2, Area of Study 8), this section is about the information and data that go into and come out of everyday systems: reading what goes in, and making sense of what comes out — for example from public transport timetables, interactive maps, and online calculators, apps and planners.

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

What this section covers. How to spot the inputs and outputs of familiar everyday systems; how to read inputs such as prices, weights, button presses and meter numbers; how to interpret outputs such as totals, change, receipts, ticket times and app summaries; and how to check that an output actually makes sense. The rest of the chapter builds on this: making and sorting tables with technology is section 5B, planning and scheduling is section 5C, interactive maps, timetables and online planners is section 5D, and adjusting inputs to get better outputs is section 5E.

Inputs and outputs.

A **system** is any machine, screen or process that takes things in, follows a fixed rule, and sends things out. What you put in is called an **input**. What comes back out is called an **output**.



Three boxes joined by arrows: INPUT, SYSTEM, OUTPUT, with examples of each

Push a \$2.00 coin into a drinks machine and press the button for a \$1.80 can. The coin and the button press are the inputs. The machine’s rule gives the outputs: the can, and $\$2.00 - \$1.80 = \$0.20$ in change.

- **Inputs** are the things you give the system: coins, notes, a card tap, groceries on the scale, a weight in kilograms, numbers you type, buttons you press.
- **Outputs** are the things the system gives back: the drink, the toast, the fuel in your tank, the numbers on the screen, the printed receipt, the printed ticket, your change.

A machine never guesses and never “does its best”. It follows its rule exactly. That has one big consequence, and it runs through this whole chapter: **a wrong input always gives a wrong output**. Type 12 when you meant 2, and the machine happily charges you for 12. Section 1F made the same point about digital tools. Here you will see it with machines you can walk up to.

Everyday systems and what they show.

Four everyday systems and the numbers they show (made-up data)

DRINKS VENDING MACHINE

CAN · button A1\$1.80

COIN IN\$2.00

CHANGE OUT\$0.20

FUEL BOWSER DISPLAY

PRICE/LITRE\$1.84

LITRES30.5

TOTAL\$56.12

PARKING TICKET · ROSE ST

HOURS BOUGHT3

RATE\$2.40/h

PRICE PAID\$7.20

WASHING MACHINE PANEL

TEMP40 °C

SPIN1200

TIME32 MIN

Four panels showing a drinks vending machine, a fuel bowser display, a parking ticket and a washing machine panel

Each panel shows the numbers one familiar system works with. The vending machine takes the \$2.00 coin and the button press for the \$1.80 can, and gives back the can plus \$0.20 change. The bowser display shows three numbers: the price per litre (\$1.84), the litres pumped (30.5) and the total (\$56.12). The parking ticket records the hours bought (3), the rate (\$2.40 per hour) and the price paid (\$7.20). The washing machine panel shows the program chosen: a temperature, a spin speed and a 32-minute wash time. In every case, the numbers going in and the numbers coming back tell one story.

Made-up data: the machines, prices and numbers above were made up for this section.

Money in, money out.

Most everyday systems end in money, and two calculations cover nearly all of it:

- **total** = price $\times$ quantity — what the items cost together
- **change** = amount paid – total — what the machine hands back

Refresher: multiplying money. A line total is the price of one item times how many you bought:

$3 \times \$4.80 = \$14.40$. The same idea works for fuel, pages and minutes — the price per unit times the number of units.

Refresher: subtracting money (giving change). Change = amount paid – total. If your lunch costs \$6.45 and you hand over a \$10 note, the change is $\$10.00 - \$6.45 = \$3.55$. You can also count up from the price: \$6.45 up to \$7.00 is 55 c, and \$7.00 up to \$10.00 is \$3.00, so \$3.55 altogether. Counting up is a quick way to check what a machine gives you.

Receipts: outputs you can read line by line.

A receipt is the machine's written summary of what just happened. Each item line shows what you bought and what it cost. The block at the bottom shows the total, what you paid, and the change.

your inputs:
the items and quantities you scanned

CORNER CRATE	
SELF-CHECKOUT	
MILK 2 L	\$3.85
BREAD 2@2.80	\$5.60
EGGS 1 DN	\$6.50
TOTAL	\$15.95
CASH	\$20.00
CHANGE	\$4.05

machine outputs:
amounts it worked out

Reading a receipt (made-up data)

An annotated self-checkout receipt with the item lines, total, cash and change

Read a receipt in two passes. First pass, the item lines: the names and quantities are your inputs (you chose them), and the amounts beside them are outputs the machine calculated. Second pass, the bottom block: TOTAL, CASH and CHANGE are all outputs, and together they let you check the machine. On the receipt above, $\$3.85 + \$5.60 + \$6.50 = \$15.95$, and the change from a \$20 note is $\$20.00 - \$15.95 = \$4.05$. Both agree with the printed numbers, so the output makes sense.

Made-up data: the receipt above was made up for this section.

Weight and price-per-kilogram outputs.

Deli scales, self-checkouts and parcel machines measure weight, usually in kilograms with decimals. When a price is set **per kilogram**, the cost calculation is:

$$\text{cost} = \text{weight in kg} \times \text{price per kg}$$

If cheese costs \$9.00 a kilogram, then 0.75 kg costs $0.75 \times \$9.00 = \$6.75$.

Refresher: grams and kilograms. 1 kg = 1000 g. Kilograms to grams: multiply by 1000, so 0.65 kg = 650 g and 1.2 kg = 1200 g. Grams to kilograms: divide by 1000, so 250 g = 0.25 kg. Bigger unit to smaller unit, multiply; smaller unit to bigger unit, divide.

Multiplying a weight by a price can land between two whole cents, and then the machine has to round:

Refresher: rounding money to the nearest cent. Keep two decimal places and look at the third decimal. If it is 0, 1, 2, 3 or 4, round down. If it is 5 or more, round up. Exactly halfway rounds up (the rule from §1C). So $\$3.642 \rightarrow \$3.64$, and $\$9.475 \rightarrow \$9.48$. Whenever a question in this section needs rounding, it says so explicitly — for example, “to the nearest cent”.

Time outputs.

Parking tickets, laundromats and booking machines print times. A parking ticket shows the **entry** time (when you drove in) and the hours you paid for. The **expiry** time is the moment the ticket stops being valid. Find it by adding the hours and minutes you paid for to the entry time.

Refresher: adding minutes to a clock time. Add the minutes, and every 60 minutes becomes one more hour. Start at 9:40 am and add 35 minutes: $40 + 35 = 75$ minutes past 9, and 75 minutes is 1 hour 15 minutes, so the time is 10:15 am. Watch for crossing midday — times after 12 noon are pm.

Input–output tables.

Some systems follow one simple rule: an input goes in, an output comes out, and the rule never changes. A table of input–output pairs shows that rule at work. A soft-serve machine that charges \$2.50 a cone turns “how many cones” into “how much it costs”:

Cones ordered (input)	1	2	3	4
Cost (output)	\$2.50	\$5.00	\$7.50	\$10.00

Made-up data: the soft-serve prices above were made up for this section.

Reading the table: for 3 cones, find the 3 column, and the output below it is \$7.50. With a \$10 note, the change is $\$10.00 - \$7.50 = \$2.50$.

Refresher: dividing money (working backwards). An output can tell you the input. Each cone adds \$2.50 to the cost, so an output of \$10.00 came from an input of $\$10.00 \div \$2.50 = 4$ cones. Division undoes multiplication: $\$4.50 \div \$0.90 = 5$.

Summary outputs from apps.

Phone apps are systems too. Your steps, rides or sales are the inputs, and the app’s summary numbers are the outputs. Apps usually show a **total** — everything added up — and often a **mean**, the average day ($\text{mean} = \text{total} \div \text{number of days}$, from §3C). Interpreting an app means reading those summary numbers and checking them against the day-by-day data, the same way you check a receipt.

Check every output before you trust it.

Three habits, all built earlier in this book:

1. **Estimate first** (§1C). Round the numbers and do it in your head. Two hours of parking at about \$2.50 an hour is about \$5 — so a ticket that prints \$28.80 is telling you something went wrong on the input side.
2. **Check the units.** Is that number litres, kilograms, minutes or dollars? The label on the window tells you: a bowser window reading 30.5 is litres, not dollars.
3. **Check it answers the question asked.** The expiry time is not the entry time, and the change is not the total. Read what the output actually says.

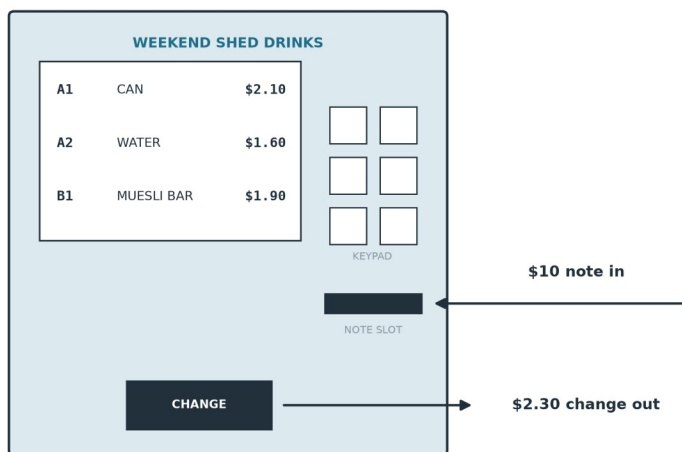
Machines follow their rule exactly, so when an output looks wrong the slip is almost always in the input. Example 4 shows what that costs.

About technology. This section shows machine screens, apps and printed tickets, but you never need a device to answer anything here. Every screen you need is printed in the book, and every calculation can be done with a pen, paper and a basic calculator. Section 1F is where the devices themselves are covered.

Worked examples

Example 1 — scaffolded

Harvey buys drinks for the crew at The Weekend Shed from the vending machine below. He puts a \$10 note into the machine, then presses A1 (can), A1 (can), A2 (water) and B1 (muesli bar).



Example 1 · Harvey's order (made-up data)

A vending machine with a price panel: A1 can 2.10, A2 water 1.60, B1 muesli bar 1.90, a note slot and a change cup

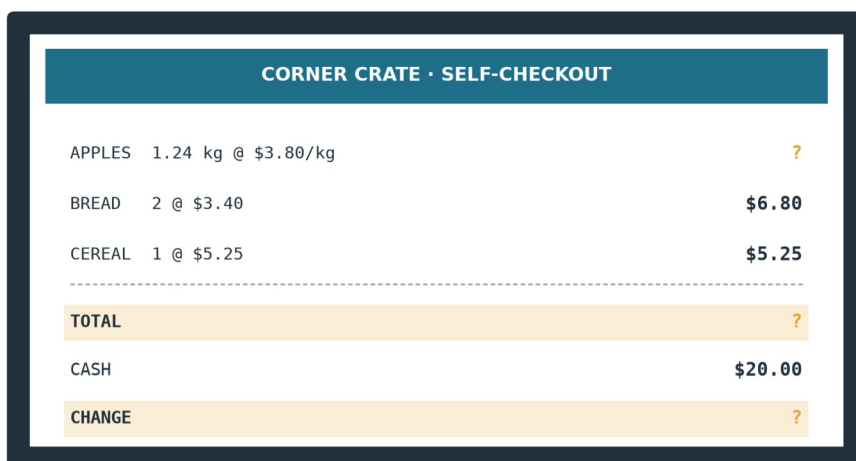
Check the total with an estimate first, then find the total the machine charges and the change Harvey receives.

Working	Comment
Estimate: $2 \times \$2.00 + \$1.50 + \$2.00 = \$7.50$	Round each price to a friendly number: can \$2.10 to \$2.00, water \$1.60 to \$1.50, bar \$1.90 to \$2.00. Expect a total near \$7.50.
Inputs: \$10 note; presses A1, A1, A2, B1	What goes into the system: the money and the choices.
Cans: $2 \times \$2.10 = \$4.20$	Total = price $\times$ quantity.
Total: $\$4.20 + \$1.60 + \$1.90 = \$7.70$	Add the four item costs. This is the machine's own output, and it sits near the estimate.
Change: $\$10.00 - \$7.70 = \$2.30$	Change = amount paid – total.
Outputs: 4 items and \$2.30 in change	What the system hands back.

Made-up data: the machine and prices above were made up for this section.

Example 2 — scaffolded

Patty uses the self-checkout at Corner Crate. Her apples are weighed by the machine: 1.24 kg at \$3.80 per kg. The screen below is missing three numbers.



Example 2 · the screen with three numbers missing (made-up data)

A self-checkout screen showing an apples line at 1.24 kg at 3.80 per kg, bread 2 at 3.40, cereal 1 at 5.25, cash 20.00, with the apples total, the TOTAL and the CHANGE blank

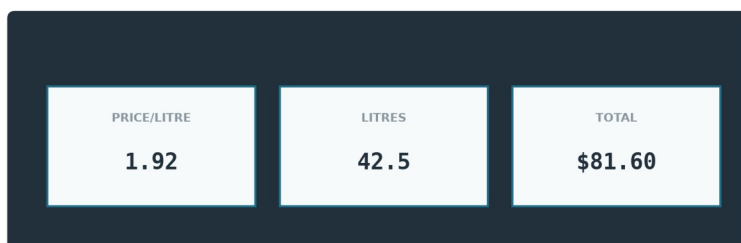
Find the missing cost of the apples **to the nearest cent**, then the TOTAL and the CHANGE.

Working	Comment
Apples: $1.24 \times \$3.80 = \$4.712$	Cost = weight in kg $\times$ price per kg. The product lands between whole cents.
Apples line: \$4.71	Round to the nearest cent: the third decimal is 2, so round down (\$4.712 to \$4.71).
Bread: $2 \times \$3.40 = \$6.80$	Total = price $\times$ quantity.
Cereal: \$5.25	Already printed on the screen.
TOTAL: $\$4.71 + \$6.80 + \$5.25 = \$16.76$	Add the three line outputs. Use the rounded apple figure — that is what the machine prints.
CHANGE: $\$20.00 - \$16.76 = \$3.24$	Change = amount paid – total.
Check: $1.25 \times \$3.80 = \$4.75$, near \$4.71	Estimate the apples line with 1.25 kg: the exact figure is reasonable.

Made-up data: the shopping and prices above were made up for this section.

Example 3 — unscaffolded

Lloyd fills his ute at the Cobble Creek fuel bowser below. Before he started, the tank held 8 L.



Example 3 · the bowser display (made-up data)

A fuel bowser display with three windows: PRICE/LITRE 1.92, LITRES 42.5, TOTAL 81.60

Start with an estimate, then show that the TOTAL on the display is correct, and find how much fuel is in the tank now.

Solution.

Estimate first. Round the price up to \$2.00 a litre:

$$42.5 \times 2.00 = 85.00$$

The display reads \$81.60, which is a little under \$85.00 — as it should be, because \$1.92 is a little under \$2.00. So the total is worth checking exactly.

Show the display total is correct:

$$42.5 \times 1.92 = 81.60$$

The TOTAL window reads \$81.60, which matches the calculation, so the display is correct.

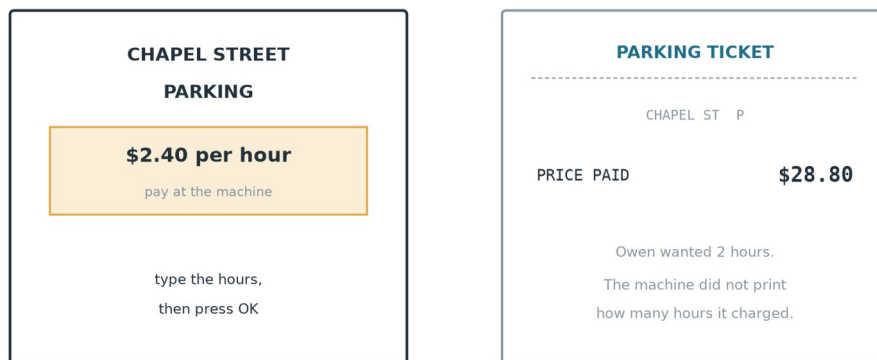
Fuel in the tank now:

$$42.5 + 8 = 50.5$$

∴ the TOTAL is correct, because $42.5 \times \$1.92 = \$81.60$, and the tank now holds 50.5 L.

Example 4 — unscaffolded

Owen parks on Chapel Street. The sign says \$2.40 per hour. He wants 2 hours, so he types the hours into the machine and presses OK. The machine prints the ticket below.



Example 4 · the sign and the ticket that printed (made-up data)

A Chapel Street parking sign at 2.40 per hour beside a printed ticket showing PRICE PAID 28.80

Use an estimate to show that something has gone wrong, work out how many hours the machine actually charged for, and find how much more Owen paid than he needed to.

Solution.

Estimate first. Two hours at about \$2.50 an hour is about \$5. The ticket says \$28.80, which is nowhere near \$5, so the input must have been wrong. The machine did exactly what it was typed to do.

How many hours did the machine charge for? The price paid is an output, and it can be worked backwards:

$$\$28.80 \div \$2.40 = 12$$

The machine charged for 12 hours. Owen meant to type 2 — his finger added a 1 in front of the 2.

The correct price for 2 hours:

$$2 \times \$2.40 = \$4.80$$

How much more he paid:

$$\$28.80 - \$4.80 = \$24.00$$

∴ the machine charged for 12 hours instead of 2; the correct price was \$4.80, so Owen paid \$24.00 more than he needed to.

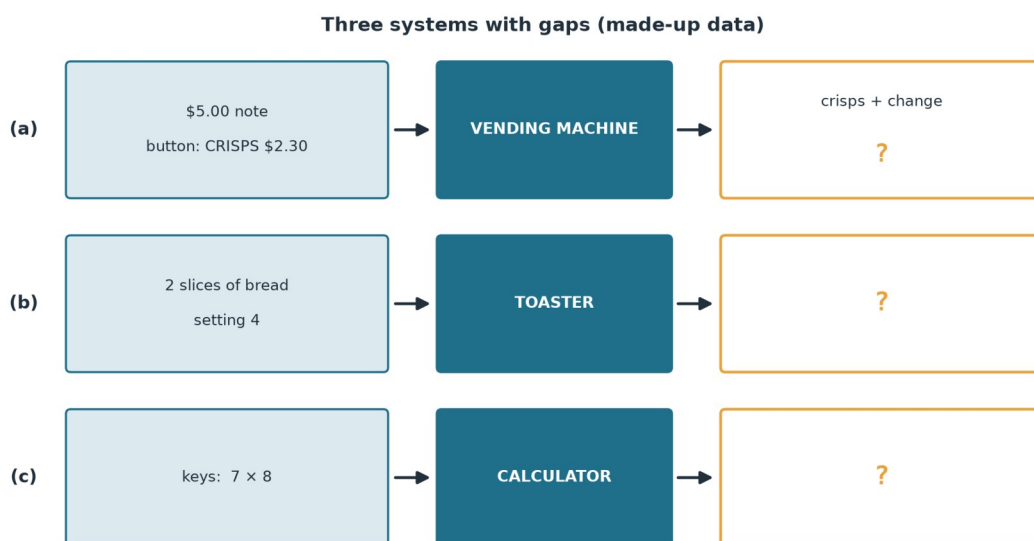
Practice questions

Scaffolded

Q1. Each system below takes inputs and gives outputs. For each one, name **one input** and **one output**.

- (a) a bread toaster
- (b) a washing machine
- (c) a fuel bowser

Q2. The flow diagrams below each have gaps.



Three flow diagrams with gaps: a vending machine taking a 5.00 note and a 2.30 crisps button; a toaster taking 2 slices of bread on setting 4; a calculator taking the keys 7 times 8

- (a) In flow (a), the \$5.00 note and the button press are the inputs. Find the change — the money output.
- (b) In flow (b), name the output.
- (c) In flow (c), the keys are the input. What number appears on the display?

Q3. Alec orders at the Sunny Sips kiosk — a small touch-screen machine that makes coffee drinks. The menu is below.

Drink	Price
Small coffee	\$3.80
Medium coffee	\$4.50
Large coffee	\$5.20
Extra shot	\$0.90

Made-up data: the kiosk and prices above were made up for this section.

Alec orders one medium coffee with an extra shot, and one small coffee.

- Read from the table: what does a large coffee cost?
- Find the total for Alec's order.
- Alec pays with a \$10 note. How much change does the kiosk give?

Q4. At the Corner Crate deli, Patty's cheese is weighed on the scale: 0.65 kg. The cheese costs \$14.60 per kg.

- Find the cost of the cheese. Give your answer exactly, in dollars.
- Write 0.65 kg in grams.
- Patty swaps to a 1.2 kg block of the same cheese. Find its cost.

Q5. Franky's receipt from the Ferry Stop Cafe is below. One number is missing.

Item	Quantity	Price	Line total
Flat white	2	\$4.80	?
Toastie	1	\$7.50	\$7.50
Orange juice	1	\$3.90	\$3.90
TOTAL			?

Made-up data: the cafe order above was made up for this section.

- Find the missing line total for the flat whites.
- Find the TOTAL of the receipt.
- Franky pays with a \$30 note. Find the change.

Q6. The library printing machine charges 20 c a page. Pages typed in (input) and the price printed on the ticket (output) follow this table.

Pages (input)	5	10	20
Price (output)	\$1.00	\$2.00	\$4.00

Made-up data: the printing prices above were made up for this section.

- Petra types in 10 pages. Read the price from the table.
- Petra types in 35 pages. Find the price.
- On another day, Petra's ticket says \$6.00. Work backwards to find how many pages she printed.

Unscaffolded

Q7. Grace fills her car at a bowser. The display shows PRICE/LITRE \$1.87 and LITRES 38.4.

- (a) Find the TOTAL the display shows when the pump stops. Round to the nearest cent.
- (b) Grace pays with an \$80 note. Find her change.
- (c) Grace estimates with $40 \times \$1.90 = \$76.00$. Does her estimate suggest your answer to part (a) is reasonable? Answer in one sentence.

Q8. Mali uses the Cobble Creek Laundromat. The machine panel and the price sign are below.

Cobble Creek Laundromat (made-up data)

WASHING MACHINE PANEL

TEMP

30

40

60

°C

SPIN

800

1200

rpm

TIME 32 MIN

start button below the display

PRICES

WASHER

\$4.30 a load

DRYER

\$3.50 for 45 min

coins or card

A washing machine panel with TEMP buttons 30, 40 and 60, SPIN buttons 800 and 1200 and a TIME display of 32 min, beside a price sign: washer 4.30 a load, dryer 3.50 for 45 min

- (a) Name two inputs Mali sets on the washing machine panel before it starts.
- (b) Mali uses one washer and one dryer. Find the total cost.
- (c) Mali starts the washer at 10:45 am. The wash takes 32 minutes and the dryer takes 45 minutes, and she moves the clothes straight across. Find the time everything finishes.

Q9. Faye's shopping goes through the self-checkout: bananas 0.86 kg at \$3.45 per kg, one loaf of bread at \$3.20, and 2 cartons of milk at \$2.45 each.

- (a) Find the cost of the bananas. Round to the nearest cent.
- (b) Find the total Faye owes.
- (c) Faye pays with a \$20 note. Find her change.

Q10. Nathan's ticket from the Rose Street car park machine is below. The machine charges \$3.50 per hour. The **expiry** time is the moment the ticket stops being valid.

ROSE STREET CAR PARK	
ENTRY	9:50 AM
HOURS PAID	3
RATE	\$3.50/h
PRICE	\$10.50
EXPIRY	?

Q10 · Nathan's ticket (made-up data)

A Rose Street car park ticket: ENTRY 9:50 AM, HOURS PAID 3, RATE 3.50/h, PRICE 10.50, EXPIRY blank

- (a) Find the expiry time the machine should print on the ticket.
- (b) Nathan comes back to his car at 1:15 pm. Find how many minutes past expiry he is.
- (c) Nathan buys one more hour at the machine. Find the new expiry time.

Q11. Wanda's workroom has two drinks machines. Machine A: cans \$2.20, water \$1.80. Machine B: cans \$2.00, water \$1.75. She buys 3 cans and 1 water.

- (a) Find the total at machine A.
- (b) Find the total at machine B.
- (c) Which machine is cheaper for Wanda's order, and by how much?

Q12. Tess uses a recipe app. The recipe card says: serves 2 — flour 300 g, milk 250 mL. The app takes the number of serves as its input and shows the quantities as its outputs. Tess wants to cook for 2, but her screen looks like this.

Q12 · the screen Tess sees (made-up data)

A recipe app screen with SERVES 6 typed in, showing FLOUR 900 g and MILK 750 mL, with the recipe card values flour 300 g and milk 250 mL for 2 serves

- For 2 serves, how much flour does the recipe card say to use?
- Compare the app's flour and milk outputs with the recipe card. What multiple are they, and what input slip did Tess make?
- Tess fixes the input. For 4 serves, find the flour and the milk the app should show.

Q13. The entry machine at the Cobble Creek pool charges: adult \$6.50, child \$4.00, concession \$5.20 (a cheaper entry for students and pensioners). Priya's group is 2 adults, 2 children and 1 concession.

- Find the total the entry machine shows.
- Priya pays with a \$40 note. Find the change.
- Name one input and one output of the entry machine.

Q14. A parcel machine prices by weight **bands** — the weight ranges in the table.

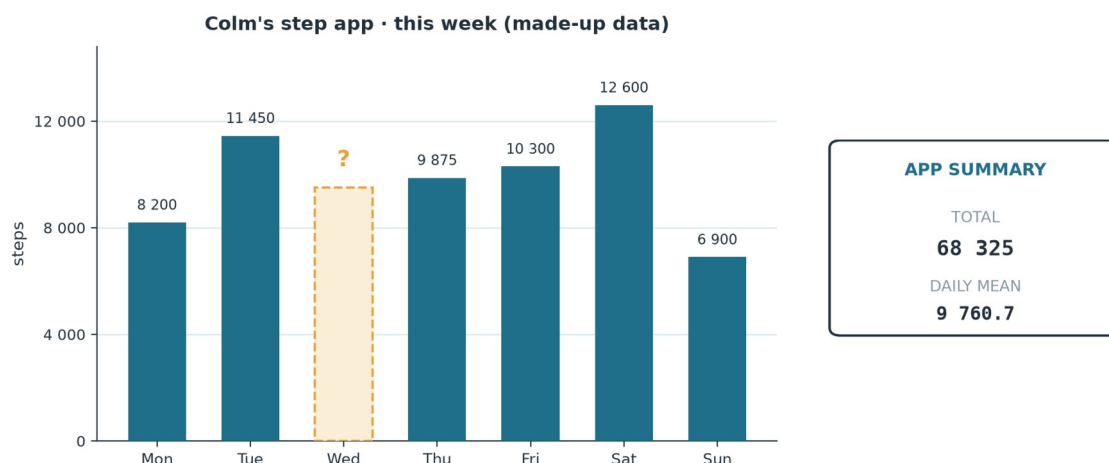
Parcel weight	Price
up to 500 g	\$8.95
over 500 g up to 1 kg	\$11.45
over 1 kg up to 2 kg	\$14.95
over 2 kg up to 3 kg	\$18.20

Made-up data: the parcel bands and prices above were made up for this section.

Dana posts two parcels: one weighs 480 g and the other weighs 1.35 kg.

- Find the price of the 480 g parcel.
- Write 1.35 kg in grams, and find the price of that parcel.
- Dana decides to send both items together in one box. Find the total weight in grams, and the price of the one parcel.

Q15. Colm's step app counts his steps each day — the inputs — and shows summary outputs. The bars below are this week's steps, but Wednesday's bar failed to draw. The app's own summary card reads TOTAL 68 325 steps and DAILY MEAN 9 760.7 steps.



A bar chart of Colm's steps: Mon 8 200, Tue 11 450, Wed missing, Thu 9 875, Fri 10 300, Sat 12 600, Sun 6 900, beside an app summary card reading TOTAL 68 325 and DAILY MEAN 9 760.7

- (a) Add up the six days that did draw. Find their total.
- (b) Use the app's TOTAL output to find Colm's steps on Wednesday.
- (c) The mean is total $\div$ number of days (§3C). Check the app's DAILY MEAN output for the full week. Round to 1 decimal place.

Q16. At the self-checkout, these six things happen:

- i. scanning the groceries · ii. the TOTAL appearing on the screen · iii. tapping the card · iv. the printed receipt · v. the coins returned in change · vi. feeding a \$50 note into the slot
- (a) List the three **inputs**.
 - (b) List the three **outputs**.
 - (c) Which single output tells you the cost of the whole shop?

Q17. Kirra's electricity meter counts **kilowatt hours (kWh)** — the units of electricity her flat uses. The meter read 41 286 kWh at the last bill and 41 962 kWh now. The company charges \$0.285 per kWh.

- (a) Find how many kWh Kirra used.
- (b) Find the cost of the electricity used. Give your answer exactly, in dollars.
- (c) The company's billing system uses the two meter readings to work out the bill. Are the meter readings inputs or outputs of that billing system?

Q18. Bridie orders at the Sunny Sips kiosk. The menu is the same as in Q3: small \$3.80, medium \$4.50, large \$5.20, extra shot \$0.90. She orders one large coffee with an extra shot, and two small coffees. The kiosk screen is below.

The Sunny Sips kiosk (made-up data)

SUNNY SIPS · MENU	
SMALL	\$3.80
MEDIUM	\$4.50
LARGE	\$5.20
EXTRA SHOT	\$0.90

YOUR ORDER	
1 large + extra shot	
2 smalls	
TOTAL	\$14.60

the screen shows this total

The Sunny Sips kiosk menu beside an order screen showing 1 large with extra shot and 2 smalls with a TOTAL of 14.60

- Find the cost of the large coffee with its extra shot.
- Find the correct total for the whole order, and the change from a \$20 note.
- The screen says \$14.60. Find the difference between the screen total and your correct total, and use it to name the input slip the kiosk made.

Answers

Q1. Sample answers. (a) Input: bread (or the browning setting); output: toast. (b) Input: the clothes (or the detergent, or the program chosen); output: the washed clothes. (c) Input: the card or money (or the litres chosen); output: the fuel in the tank (or the litres and total on the display).

Q2. (a) \$2.70 · (b) toast · (c) 56

Q3. (a) \$5.20 · (b) \$9.20 · (c) \$0.80

Q4. (a) \$9.49 (exact) · (b) 650 g · (c) \$17.52

Q5. (a) \$9.60 · (b) \$21.00 · (c) \$9.00

Q6. (a) \$2.00 · (b) \$7.00 · (c) 30 pages

Q7. (a) \$71.81 (to the nearest cent) · (b) \$8.19 · (c) yes — \$71.81 is close to the \$76.00 estimate, and a little under it because the estimate rounded both numbers up

Q8. (a) any two of: the temperature, the spin speed · (b) \$7.80 · (c) 12:02 pm

Q9. (a) \$2.97 (to the nearest cent) · (b) \$11.07 · (c) \$8.93

Q10. (a) 12:50 pm · (b) 25 minutes · (c) 1:50 pm

Q11. (a) \$8.40 · (b) \$7.75 · (c) machine B, by \$0.65

Q12. (a) 300 g · (b) 3 times the card amounts; she typed serves 6 instead of 2 · (c) flour 600 g, milk 500 mL

Q13. (a) \$26.20 · (b) \$13.80 · (c) input: the money or card (or the ticket-type buttons); output: the price on the display (or the change, or the gate opening)

Q14. (a) \$8.95 · (b) 1 350 g, \$14.95 · (c) 1 830 g = 1.83 kg, \$14.95

Q15. (a) 59 325 steps · (b) 9 000 steps · (c) $68\,325 \div 7 = 9\,760.7$ steps to 1 decimal place, which matches the app's output

Q16. (a) i, iii, vi · (b) ii, iv, v · (c) the TOTAL on the screen

Q17. (a) 676 kWh · (b) \$192.66 (exact) · (c) inputs — the billing system reads them to work out the bill

Q18. (a) \$6.10 · (b) total \$13.70, change \$6.30 · (c) the gap is \$0.90 — the price of one extra shot, so the kiosk counted the extra shot twice

Fully-worked solutions

Q1. Sample answers. (a) Toaster — input: two slices of bread and the browning setting; output: the toast. (b) Washing machine — input: the clothes, the detergent and the program chosen on the panel; output: the washed clothes. (c) Fuel bowser — input: the card or money and the litres chosen; output: the fuel in the tank, with the litres and the total on the display.

Q2. (a) $\text{Change} = \$5.00 - \$2.30 = \$2.70$. (b) The output is the toast. (c) The calculator shows $7 \times 8 = 56$.

Q3. (a) The table reads \$5.20 for a large coffee. (b) Medium + extra shot + small: $\$4.50 + \$0.90 + \$3.80 = \$9.20$. (c) $\$10.00 - \$9.20 = \$0.80$.

Q4. (a) $\text{Cost} = 0.65 \times \$14.60 = \$9.49$ exactly — no rounding needed. (b) $0.65 \text{ kg} = 0.65 \times 1000 = 650 \text{ g}$. (c) $1.2 \times \$14.60 = \$17.52$.

Q5. (a) $2 \times \$4.80 = \$9.60$. (b) $\$9.60 + \$7.50 + \$3.90 = \$21.00$. (c) $\$30.00 - \$21.00 = \$9.00$.

Q6. (a) The 10-page column of the table reads \$2.00. (b) $35 \times \$0.20 = \$7.00$. (c) Work backwards: $\$6.00 \div \$0.20 = 30$, so Petra printed 30 pages.

Q7. (a) $38.4 \times 1.87 = 71.808$. To the nearest cent, the third decimal is 8, so round up: the TOTAL is \$71.81. (b) $\$80.00 - \$71.81 = \$8.19$. (c) Yes — \$71.81 is close to her \$76.00 estimate, and a little under it because the estimate rounded both the litres and the price up.

Q8. (a) Any two of: the temperature button (30, 40 or 60) and the spin button (800 or 1200). (b) $\$4.30 + \$3.50 = \$7.80$. (c) Wash: 10:45 am plus 32 minutes is 11:17 am. Dry: 11:17 am plus 45 minutes — $17 + 45 = 62$ minutes, which is 1 hour 2 minutes — so everything finishes at 12:02 pm.

Q9. (a) $0.86 \times 3.45 = 2.967$. To the nearest cent, the third decimal is 7, so round up: \$2.97. (b) Milk: $2 \times \$2.45 = \$4.90$. Total: $\$2.97 + \$3.20 + \$4.90 = \$11.07$. (c) $\$20.00 - \$11.07 = \$8.93$.

Q10. (a) 9:50 am plus 3 hours is 12:50 pm. (b) From 12:50 pm to 1:15 pm is 25 minutes. (c) With a fourth hour paid: 9:50 am plus 4 hours is 1:50 pm.

Q11. (a) Cans: $3 \times \$2.20 = \$6.60$. Total: $\$6.60 + \$1.80 = \$8.40$. (b) Cans: $3 \times \$2.00 = \$6.00$. Total: $\$6.00 + \$1.75 = \$7.75$. (c) Machine B is cheaper, by $\$8.40 - \$7.75 = \$0.65$.

Q12. (a) The recipe card says 300 g of flour for 2 serves. (b) $900 \div 300 = 3$ and $750 \div 250 = 3$: both outputs are 3 times the card, so the input was 3 times too big. Tess typed serves 6 instead of 2, because $6 = 3 \times 2$. (c) 4 serves is 2 times the card: flour $2 \times 300 = 600$ g, milk $2 \times 250 = 500$ mL.

Q13. (a) Adults: $2 \times \$6.50 = \$13.00$. Children: $2 \times \$4.00 = \$8.00$. Concession: $1 \times \$5.20 = \$5.20$. Total: $\$13.00 + \$8.00 + \$5.20 = \$26.20$. (b) $\$40.00 - \$26.20 = \$13.80$. (c) Input: the money or card tapped, and the ticket-type buttons; output: the price on the display, the change, and the gate opening.

Q14. (a) 480 g sits in the “up to 500 g” band, so the price is \$8.95. (b) $1.35 \text{ kg} = 1350 \text{ g}$, which sits in the “over 1 kg up to 2 kg” band, so the price is \$14.95. (c) Together: $480 + 1350 = 1830 \text{ g} = 1.83 \text{ kg}$. That still sits in the “over 1 kg up to 2 kg” band, so the one parcel also costs \$14.95.

Q15. (a) $8200 + 11450 + 9875 + 10300 + 12600 + 6900 = 59325$ steps. (b) Wednesday = $68325 - 59325 = 9000$ steps. (c) Mean = $68325 \div 7 = 9760.7$ steps to 1 decimal place, which matches the app’s DAILY MEAN output.

Q16. (a) Inputs: i (scanning the groceries), iii (tapping the card), vi (feeding in the note). (b) Outputs: ii (the TOTAL on the screen), iv (the printed receipt), v (the coins in change). (c) The TOTAL on the screen.

Q17. (a) $41962 - 41286 = 676 \text{ kWh}$. (b) $676 \times \$0.285 = \$192.66$ exactly — no rounding needed. (c) The readings are inputs: the billing system reads them and uses them to work out the bill, and the bill itself is the output.

Q18. (a) $\$5.20 + \$0.90 = \$6.10$. (b) Correct total: $\$6.10 + \$3.80 + \$3.80 = \$13.70$. Change: $\$20.00 - \$13.70 = \$6.30$. (c) $\$14.60 - \$13.70 = \$0.90$, exactly the price of one extra shot — so the kiosk counted the extra shot twice when the order was typed in. The slip was on the input side.

Chapter 5 Systematics — 5B Tables and sorting with technology

Theory

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

Every club, shop and workplace runs on small systems: a sheet that catches the day's numbers, and a routine that puts them in order when someone needs an answer. A **system** is a set of parts working together to get a job done — something goes in (the **input**), a job is done on it (the **process**), and something useful comes out (the **output**). This section is about two of those jobs: getting data into a table, and putting the rows of that table in order. In the study design (Unit 2, Area of Study 8), this section covers:

- **key knowledge** — the everyday digital tools and apps that collect data, and how technology is used to gather information, organise it, sort it into groups and build tables from it (planning and scheduling with technology belong to the same part of the study design; they are Section 5C);
- **key skills** — using technology, such as a spreadsheet, other software, a phone or an app, to set up tables that gather, organise and record everyday data and information, and to arrange and sort simple, familiar data.

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

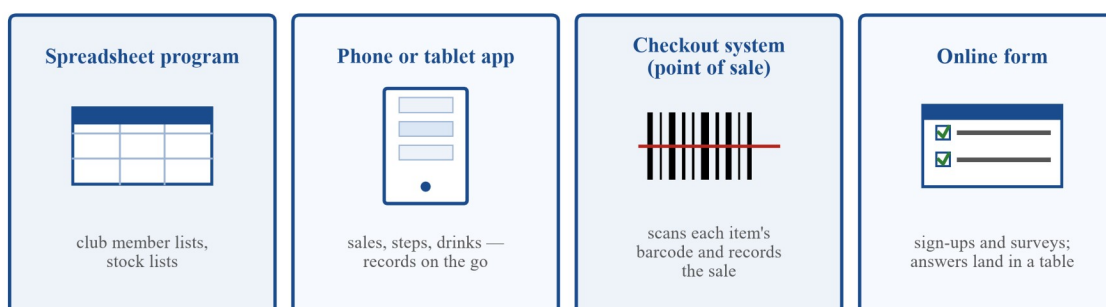
Tools that collect data for us.

A **computational** tool is any device or program that catches data as numbers or text and keeps it for you. Four turn up everywhere in everyday life.

Tool	What it collects	Where the data lands
Spreadsheet program	lists typed in at a computer — members, stock, sales	rows and columns on screen, ready to sort
Phone or tablet app	records tapped in on the go — steps, drinks sold, jobs done	a table inside the app
Checkout system (point of sale)	each sale, as the item's barcode is scanned	a sales table the system keeps
Online form	answers people type themselves — sign-ups, surveys	one row per form handed in

Made-up data: the four tools and their descriptions are everyday examples, not real products or real records.

Four computational collection tools — each captures data straight into a table



Two words worth knowing: the **point of sale** is the counter where a customer pays, and a **barcode** is the pattern of thick and thin lines on a product that a scanner reads as the product's code. Scanning a barcode is data collection too — every scan adds one row to the shop's sales table.

Everything in this section can be done with pen, paper and a basic calculator. The technology is shown because it does the same jobs faster and keeps the table safe — never because it is needed to do the maths.

Tables technology can keep.

A table is rows and columns: each **column** holds one kind of value, each **row** is one **record** (one person, one item, one day), and each **cell** holds one single value. Four rules make a table that technology — or a person — can actually use:

- every column has a **heading** that says what is in it, with the unit (years, kg, cups, dollars) in the heading itself;
- one row = one record, so the number of rows is the number of records;
- one cell = one value — never two numbers squeezed into one cell;
- the same unit runs all the way down a column, so every value can be compared.

A table technology can keep: one record per row, one value per cell

heading row — every column has a name, with the unit in the heading

one row = one record (one item)

	A		C
	Item	Number in stock	Shelf
1	Pens	40	B
2	Mugs	12	A
3	Notebooks	25	C

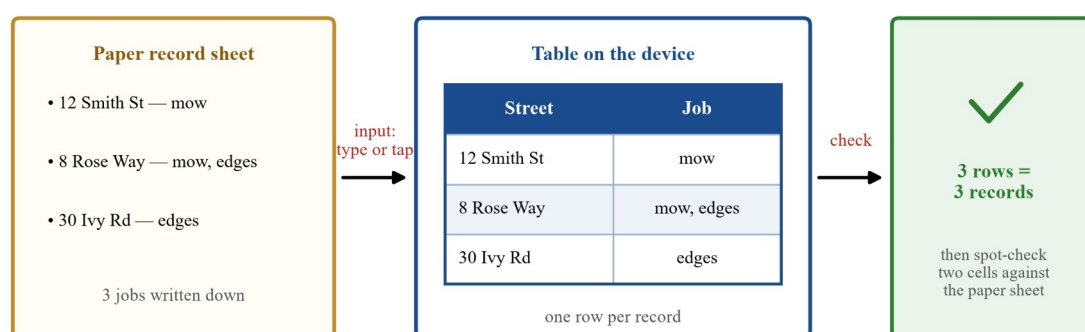
one cell = one value

columns hold one kind of value:
names · numbers · labels

Getting records in: input.

Input means typing or tapping each record into the table, one row at a time, in any order — order can be fixed later by sorting. Two checks follow every input job: count the rows against the records on the paper (they must match), and spot-check two or three cells against the original sheet.

Getting records into a table: record → input → check



Putting rows in order: sorting.

To **sort** a table is to put its rows in a chosen order. Sorting moves **whole rows**: when a row moves, every value in it moves with it, so each record stays true. The order you choose has a direction, and the words depend on what the column holds.

If the column holds ...	first-to-last is called	last-to-first is called
words (names, items)	A to Z	Z to A
numbers	smallest to largest (ascending)	largest to smallest (descending)

If the column holds ...
dates

first-to-last is called
earliest to latest

last-to-first is called
latest to earliest

One table, three orders — sorting moves whole rows, never values alone

As entered		Sorted smallest to largest (ascending)		Sorted largest to smallest (descending)	
Day	Loaves sold		Day	Loaves sold	
Tue	22	→	Mon	17	→
Mon	17		Tue	22	
Thu	31		Wed	26	
Wed	26		Thu	31	
				</	

Same 4 rows in every panel — only the order changes.

Sorting one column on its own is the classic mistake: the values line up nicely, but each one now sits beside the wrong record. Sort whole rows, always.

Sort whole rows — a single column sorted on its own breaks every record

RIGHT — rows move together

Player	Points
Ben	8
Ada	12
Gus	15

✓ each name keeps its own points

WRONG — only the Points column sorted

Player	Points
Ada	8
Ben	12
Gus	15

✗ Ada really has 12 points, Ben 8

Sorting is done for a reason, and the reason chooses the direction:

- to find the biggest or smallest value — it lands on the top row;
- to count the rows above or below a cut-off, because those rows sit together;
- to spot doubles, because two identical rows end up side by side;
- to put a report in the order a reader expects.

Sorting **changes nothing but the order**: the same rows, with the same values, in a new order. So the check after any sort is easy — count the rows before and after, and the counts must match. One last habit for times: in a race the **smallest** time is the best time, so sorting times smallest to largest puts the winner on top.

Refresher — alphabetical order.

A-to-Z order is the alphabet's own order, read letter by letter from the left. Compare first letters; if they match, compare second letters, and so on. A shorter word that spells the start of a longer word comes first: Ada comes before Adam, because Ada runs out of letters while Adam still has more.

The alphabet runs A to Z — A-Z order is the alphabet's own order

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

A-Z (ascending): earlier letters first

Amir comes before Ana — second letters: m before n. Zoe comes last of Ada and Zoe — Z is near the end.

Refresher — ordering numbers.

Whole numbers with different many digits: the one with fewer digits is smaller, so $9 < 12 < 105$. Decimals: compare the whole parts first, then tenths, then hundredths — so $3.08 < 3.2$, because 0 tenths is less than 2 tenths. Trailing zeros change nothing: $7.5 = 7.50$. For practice, 2.8, 2.45 and 3.1 in order smallest to largest are 2.45, 2.8, 3.1.

Refresher — ordering dates (day/month/year).

Dates written day/month/year are ordered by the **year** first, then the **month**, then the **day**. So 5/2/2026 comes before 12/3/2026: same year, and February (month 2) comes before March (month 3). Never order dates by the day number alone: 9/4 comes before 28/5 in the year, because April (month 4) comes before May (month 5), even though 28 is the bigger day number.

Refresher — adding money.

Line up the decimal points and add column by column, cents then dollars: $\$2.30 + \$1.45 + \$3.25 = \$7.00$. Money totals in this section are always simple addition like this — no rounding is needed, because every price is given in exact cents.

Where to next.

Sorting a table is usually the step before something else: Section 5C uses systems to plan and schedule actions, Section 5D reads timetables and planners, and Section 5E adjusts a system's inputs to improve its output. Finding a single typical value from a sorted column (the mean and the range) is Section 3C's job.

Worked examples

Example 1 — scaffolded

The Yarran Vale Netball Club leaves a sign-up sheet on the desk at its open day. Eight members write their details on it. The finished sheet is shown below.

Yarran Vale Netball Club
New members — sign-up sheet

Write your details in the table. One line per person.

Member	Age (years)	Training night
Tomas Rivera	15	Wed
Ada Vella	13	Mon
Noah Baxter	14	Mon
Zoe Kruger	16	Tue
Sam Whitby	14	Wed
Mila Dunne	13	Mon
Jack Olsen	15	Tue
Eli Tame	16	Wed

8 members signed up on the day

Made-up data: the club, its members and every line of the sign-up sheet are made up for this section.

- (a) The sheet is typed into a spreadsheet, one row per member. How many rows should the table have, and how do you check?

- (b) The Name column is sorted A to Z. Which name sits on the top row, and which on the bottom row?
- (c) How many of the members train on Monday?

Working	Comment
Purpose and question(s): turn a paper sign-up sheet into a table, then sort and read it. Questions: how many rows and how to check; the top and bottom names after an A-to-Z sort; how many members train on Monday.	One record per row, then sort whole rows.
Rows: the sheet lists 8 members — Tomas Rivera, Ada Vella, Noah Baxter, Zoe Kruger, Sam Whitby, Mila Dunne, Jack Olsen, Eli Tame — so the table needs 8 rows.	Count the names on the paper: one row per record.
Check: count the rows in the finished table: 8 rows = 8 names on the sheet, so nothing was missed and nothing was typed twice.	The row check is the habit after every input job.
A to Z: compare first letters — A, E, J, M, N, S, T, Z. Top row: Ada Vella. Bottom row: Zoe Kruger.	Alphabetical order, letter by letter (refresher above).
Monday: read the Training night column: Ada Vella, Noah Baxter and Mila Dunne train on Monday — 3 members.	Counting rows that match one value; no sorting needed.

The table needs 8 rows, and the check passes because 8 rows match the 8 names on the sheet; after an A-to-Z sort the top row is Ada Vella and the bottom row is Zoe Kruger; and 3 members train on Monday.

Example 2 — scaffolded

The Wonga Community Garden counts the tools in its shed at the end of working bee day. The counts, in the order the tools were counted, are: Spade 7, Rake 5, Hose 4, Trowel 12, Wheelbarrow 3, Gloves (pairs) 18.

Made-up data: the garden and every tool count are made up for this section.

- (a) Write the tool names in A-to-Z order.
- (b) Sort the counts smallest to largest, and name the tool with the smallest count.
- (c) Which tools have a count under 5?

Working	Comment
Purpose and question(s): organise a short stock list by sorting it two different ways. Questions: the names in A-to-Z order; the counts smallest to largest and the smallest one; the tools with a count under 5.	Same records, two different sort columns.
Names A to Z: Gloves (pairs), Hose, Rake, Spade, Trowel, Wheelbarrow.	First letters G, H, R, S, T, W are already all different, so first letters decide it.
Counts smallest to largest: 3, 4, 5, 7, 12, 18. The smallest count is 3, which belongs to the Wheelbarrow.	Whole rows move: the 3 travels with “Wheelbarrow”.
Under 5: the counts under 5 are 4 and 3 — the Hose and the Wheelbarrow.	A sorted count column keeps the small values together at the top.

In A-to-Z order the tools run Gloves (pairs), Hose, Rake, Spade, Trowel, Wheelbarrow; the counts smallest to largest are 3, 4, 5, 7, 12, 18 with the Wheelbarrow smallest at 3; and the two tools with a count under 5 are the Hose and the Wheelbarrow.

Example 3 — unscaffolded

Marrabel Produce weighs Saturday’s vegetable sales. The masses sold, in kg, are: Apples 46, Potatoes 38, Carrots 25, Tomatoes 52, Zucchini 17, Broccoli 31.

Made-up data: the produce shop and every mass are made up for this section.

Write the vegetables in order of mass sold, largest to smallest. Name the top seller, and find the total mass sold.

Sorting the mass column largest to smallest moves whole rows, so each vegetable keeps its own mass: Tomatoes 52, Apples 46, Potatoes 38, Broccoli 31, Carrots 25, Zucchini 17. The top row of that sort is the top seller: Tomatoes, at 52 kg. The total is simple addition down the mass column: $46 + 38 + 25 + 52 + 17 + 31 = 209$ kg, and the same six numbers in sorted order give $52 + 46 + 38 + 31 + 25 + 17 = 209$ kg — the total is unchanged by the sort, as it must be.

∴ the descending order is Tomatoes 52, Apples 46, Potatoes 38, Broccoli 31, Carrots 25, Zucchini 17 kg; the top seller is Tomatoes at 52 kg; and the total mass sold is 209 kg.

Example 4 — unscaffolded

The Coolibah Creek Fun Run keeps its finish times in a spreadsheet. The sheet has already been sorted on the Time (min) column, smallest to largest, and it is shown below together with the sort menu used to sort it.

Coolibah Creek Fun Run — times spreadsheet		
	A	B
	Runner	Time (min)
1	Ravi Selby	24.6
2	Joel Trask	26.8
3	Ava Santos	27.9
4	Emma Yarrow	29.3
5	Dan Petty	31.4
6	Tia Wills	33.1

Sort menu

Sort A to Z

Sort Z to A

Sort smallest to largest ✓

Sort largest to smallest

This sheet was sorted on the Time (min) column, smallest to largest.

Made-up data: the fun run, its runners and every time are made up for this section.

- Who won the fun run, and in what time?
- How many runners finished in under 30 minutes?
- If the sheet were sorted largest to smallest instead, which runner would sit on the top row?

In a race the smallest time is the best time, and the sheet is sorted smallest to largest, so the winner is the top row: Ravi Selby, in 24.6 minutes. Times under 30 minutes sit together at the top of this sort: 24.6, 26.8, 27.9 and 29.3 — that is 4 runners (the next time, 31.4, is over the cut-off). Sorting largest to smallest puts the biggest time on top, and the biggest time in the list is Tia Wills' 33.1 minutes.

∴ the winner is Ravi Selby in 24.6 minutes; 4 runners finished in under 30 minutes; and a largest-to-smallest sort would put Tia Wills on the top row.

Practice questions

Scaffolded

Q1. Name the computational collection tool that best fits each job: a spreadsheet program, a phone or tablet app, a checkout system (point of sale), or an online form. (a) A market stall holder records each sale while walking between customers. (b) Club members sign up from home, on their own devices, in their own time. (c) A supermarket records each product as it passes the counter where customers pay.

Q2. The Lark Swim School keeps one table of every student in its classes. Each student's record holds their name, their age in years, and their swimming level (Beginner, Intermediate or Advanced). (a) Write the three column headings the table needs, including the unit. (b) What does one row of the table hold? (c) State the rule for what goes in a single cell.

Q3. The Tarrin Neighbourhood House lunch club records how many guests each member brings on Friday. The paper notes, in the order they came in, are: Iris Boyd 1 guest, Gus Meyer 3, Nell Verity 2, Jed Faber 1, Holly Gale 4, Lena Hopper 2. Four rows have been typed into the table so far.

Member	Guests
Iris Boyd	1
Nell Verity	2
Holly Gale	4
Lena Hopper	2

Made-up data: the lunch club, its members and every guest count are made up for this section.

- (a) Which two records are still missing from the table?
- (b) Finish the table, then check the total guests and count the rows in the finished table.
- (c) If the Member column is sorted A to Z, which name sits on the top row?

Q4. Put each list of names in order, using the alphabet refresher in the theory. (a) A to Z: Tan, Ali, Mora, Zhu, Diaz. (b) A to Z: Ana, Amir, Ada, Abe. (c) Z to A: which of Summer and Sonia comes first?

Q5. Five stalls at a fair count their jars of jam. The counts are: 24, 9, 31, 17, 40. (a) Write the counts in order, smallest to largest. (b) Write the counts in order, largest to smallest. (c) How many stalls have more than 20 jars?

Q6. An art club writes its next four meeting dates on the board: 12/3/2026, 5/2/2026, 28/5/2026 and 9/4/2026 (day/month/year). (a) Write the four dates in order, earliest first. (b) Which meeting is the latest? (c) How many of the meetings fall in March or April?

Un scaffolded

Q7. Jarrah Hardware counts its stock on Monday morning: Hammers 14, Screwdrivers 23, Paint brushes 9, Tape measures 17, Drill bits 31, Sandpaper sheets 45. (a) Sort the items by count, smallest to largest, and write the item names in that order. (b) Which items have a count of 15 or fewer? Write those item names in A-to-Z order. (c) After the sort in (a), which item sits in row 4, and what is its count?

Q8. The Waratah Basketball Club lists six players' surnames on a teams sheet, in the order they arrived: Caruso, Brooks, Adams, Abbott, Marsh, Marsden. (a) Write the surnames in A-to-Z order. (b) Sorted Z to A, which surname sits on the top row? (c) In the A-to-Z order, Marsden comes before Marsh. Explain why, letter by letter.

Q9. A school fete stall prices its food: Hot dog \$4.50, Ice cream \$3.20, Pie \$5.00, Juice \$2.80, Muffin \$3.75. (a) Sort the items by price, smallest to largest, and write the items in that order. (b) Which item is the dearest? (c) A customer buys a hot dog and a juice. What is the total?

Q10. Priya keeps the homework club points in a spreadsheet. Before her sort, the sheet read: Vera 40, Seth 25, Jade 35, Kira 50, Ivy 30. She sorted **only the Points column**, smallest to largest, and the names stayed where they were. The before and after sheets are shown below.

Homework club points — before and after Priya's sort

Before (correct)

Student	Points
Vera	40
Seth	25
Jade	35
Kira	50
Ivy	30

After (broken)

Student	Points
Vera	25
Seth	30
Jade	35
Kira	40
Ivy	50

Priya sorted **ONLY** the Points column, smallest to largest

The names did not move — most names now sit beside somebody else's points. (Jade's 35 landed back beside Jade by luck.)

Made-up data: the homework club and every points value are made up for this section.

- Read the Points column of the broken sheet from the top row down.
- How many points did Vera really score?
- Name the one sorting rule Priya broke, and say how the sheet should be fixed.

Q11. A student’s phone fitness app lists this week’s steps, already sorted largest first. The screen is shown below.

Day	Steps
Sat	12 480
Wed	10 230
Fri	9 875
Mon	8 410
Sun	7 960
Tue	6 540
Thu	5 980

Sorted: largest first

Made-up data: the step counts on the app screen are made up for this section.

- Which day had the most steps, and how many?
- How many days reached 10 000 steps or more?
- How many steps were walked on Tuesday and Thursday together?

- Q12.** Jarrah Hardware writes down four delivery dates for May and June 2026: 3/6/2026, 21/5/2026, 9/6/2026 and 17/5/2026 (day/month/year). (a) Write the four dates in order, earliest first. (b) How many of the deliveries fall in June? (c) Which delivery is the latest?
- Q13.** The Singing Kettle cafe counts its takeaway coffees for a week: Mon 38, Tue 45, Wed 41, Thu 52, Fri 63, Sat 71, Sun 29. (a) Write the two column headings a table of this data needs, including the unit. (b) Sort the days by coffees sold, smallest to largest. Which day is first, and which is last? (c) How many coffees were sold in total over the week?
- Q14.** A games night sheet lists five players' scores, sorted largest first: Jory 190, Nina 185, Lark 179, Tom 172, Mia 168. (a) Who has the highest score, and what is it? (b) How many players scored 175 or more? (c) If the sheet were sorted smallest to largest instead, who would sit on the top row?
- Q15.** A supermarket self-checkout screen lists five prices: Milk \$3.40, Bread \$4.20, Eggs \$6.15, Butter \$5.50, Bananas \$3.75. (a) A shopper buys milk, eggs and bread. Write the three prices for those items. (b) What is the total of those three prices? (c) Which of the five items is the dearest?
- Q16.** A coding club collects sign-ups on an online form. Twelve forms come in, in this order: Tom Boyd, Amy Marsh, Holly Wong, Jed Faber, Nina Ellery, Seth Diaz, Amy Marsh, Ivy Mercer, Vera Harrow, Gus Meyer, Lena Zemek, Dan Petty. (a) The Name column is sorted A to Z. Write the first four names of the sorted list. (b) One name was submitted twice. Which name, and how does the sort make it easy to spot? (c) How many different students signed up?
- Q17.** The garden club's raffle ticket numbers come back in a jumble: 107, 94, 118, 86, 131, 99. (a) Write the six numbers in order, smallest to largest. (b) Name one technology that could do this sort for you. (c) State one check that shows the sort did not lose or add a ticket.
- Q18.** The Coolibah Creek Pool kiosk counts its icy poles for a week: Mon 24, Tue 31, Wed 28, Thu 45, Fri 62, Sat 78, Sun 57. (a) How many icy poles were sold in total over the week? (b) Sort the days by icy poles sold, smallest to largest, and write the days in that order with their counts. (c) Write the sort you would ask a spreadsheet to do to put the busiest day on the top row.
-

Answers

Q1. (a) a phone or tablet app. (b) an online form. (c) a checkout system (point of sale). **Q2.** (a) Name, Age (years), Level. (b) one student — one record. (c) one value per cell. **Q3.** (a) Gus Meyer 3 and Jed Faber 1. (b) total 13 guests; 6 rows. (c) Gus Meyer. **Q4.** (a) Ali, Diaz, Mora, Tan, Zhu. (b) Abe, Ada, Amir, Ana. (c) Summer. **Q5.** (a) 9, 17, 24, 31, 40. (b) 40, 31, 24, 17, 9. (c) 3 stalls. **Q6.** (a) 5/2/2026, 12/3/2026, 9/4/2026, 28/5/2026. (b) 28/5/2026. (c) 2 meetings. **Q7.** (a) Paint brushes, Hammers, Tape measures, Screwdrivers, Drill bits, Sandpaper sheets. (b) Hammers, Paint brushes. (c) Screwdrivers, 23. **Q8.** (a) Abbott, Adams, Brooks, Caruso, Marsden, Marsh. (b) Marsh. (c) the first four letters Mars match; the fifth letters are d and h, and d comes first. **Q9.** (a) Juice, Ice cream, Muffin, Hot dog, Pie. (b) Pie, \$5.00. (c) \$7.30. **Q10.** (a) 25, 30, 35, 40, 50. (b) 40 points. (c) she sorted one column on its own — sorting must move whole rows; re-sort moving whole rows (or re-type from the original) and spot-check two rows. **Q11.** (a) Saturday, 12 480 steps. (b) 2 days. (c) 12 520 steps. **Q12.** (a) 17/5/2026, 21/5/2026, 3/6/2026, 9/6/2026. (b) 2 deliveries. (c) 9/6/2026. **Q13.** (a) Day and Coffees sold (cups). (b) Sun 29, Mon 38, Wed 41, Tue 45, Thu 52, Fri 63, Sat 71; first Sun, last Sat. (c) 339 coffees. **Q14.** (a) Jory, 190. (b) 3 players. (c) Mia, 168. **Q15.** (a) \$3.40, \$6.15, \$4.20. (b) \$13.75. (c) Eggs, \$6.15. **Q16.** (a) Amy Marsh, Amy Marsh, Dan Petty, Gus Meyer. (b) Amy Marsh; the two identical rows sit side by side after the sort. (c) 11 students. **Q17.** (a) 86, 94, 99, 107, 118, 131. (b) any one, e.g. a spreadsheet program on a computer, or a phone app with a sort button. (c) count the rows before and after: still 6 rows holding the same six numbers. **Q18.** (a) 325 icy poles. (b) Mon 24, Wed 28, Tue 31, Thu 45, Sun 57, Fri 62, Sat 78. (c) sort the Sales column largest to smallest (descending), moving whole rows.

Fully-worked solutions

Q1. (a) Records are tapped in on the move, between customers, so **a phone or tablet app** fits — the table travels with the stall holder. (b) Members type their own answers from home, so **an online form** fits — each form handed in becomes one row. (c) Items are recorded as they pass the paying counter, so **a checkout system (point of sale)** fits — each barcode scan adds one sale row.

Q2. (a) The headings are **Name, Age (years)** and **Level** — the unit (years) lives in the heading. (b) One row holds **one student**: their name, their age and their level — one record. (c) **One value per cell** — never two numbers or two words squeezed into one cell.

Q3. (a) The paper lists six members and the table holds four rows, so the missing records are **Gus Meyer 3** and **Jed Faber 1**. (b) Adding both rows gives six rows; the Guests column then reads 1, 3, 2, 1, 4, 2 and totals $1 + 3 + 2 + 1 + 4 + 2 = 13$ guests. The finished table has **6 rows**, which matches the six members on the paper — the row check passes. (c) First letters: G, H, I, J, L, N. The top row is **Gus Meyer**.

Q4. (a) First letters A, D, M, T, Z give **Ali, Diaz, Mora, Tan, Zhu**. (b) All four start with A, so compare second letters: b, d, m, n — **Abe, Ada, Amir, Ana**. (c) Z to A runs backwards through the alphabet: Su- comes after So-, so **Summer** comes first.

Q5. (a) Smallest to largest: **9, 17, 24, 31, 40**. (b) Largest to smallest: **40, 31, 24, 17, 9**. (c) Counts over 20 are 24, 31 and 40 — **3 stalls**. A sorted list keeps them together at the top of a largest-to-smallest sort.

Q6. (a) Same year, so compare months, then days: February, March, April, May — **5/2/2026, 12/3/2026, 9/4/2026, 28/5/2026**. (b) The latest meeting is the last of that order: **28/5/2026**. (c) March holds 12/3 and April holds 9/4 — **2 meetings**.

Q7. (a) Counts smallest to largest are 9, 14, 17, 23, 31, 45, and whole rows move with them: **Paint brushes, Hammers, Tape measures, Screwdrivers, Drill bits, Sandpaper sheets**. (b) Counts of 15 or fewer are 14 (Hammers) and 9 (Paint brushes); in A-to-Z order, **Hammers, Paint brushes**. (c) Row 4 of the sorted sheet holds the fourth-smallest count, 23: **Screwdrivers, 23**.

Q8. (a) First letters A, A, B, C, M, M; the two A names split on second letters (b before d) and the two M names on fifth (see (c)): **Abbott, Adams, Brooks, Caruso, Marsden, Marsh**. (b) Z to A puts the latest alphabet first: of the two M surnames, Marsh beats Marsden backwards, so the top row is **Marsh**. (c) Marsden and Marsh match on M-a-r-s; the **fifth letters are d and h**, and d comes before h in the alphabet, so **Marsden comes first**.

Q9. (a) Prices smallest to largest are \$2.80, \$3.20, \$3.75, \$4.50, \$5.00, so the items run **Juice, Ice cream, Muffin, Hot dog, Pie**. (b) The dearest is the top of a largest-to-smallest sort: **Pie, \$5.00**. (c) Hot dog plus juice: $\$4.50 + \$2.80 = \$7.30$ — line up the decimal points.

Q10. (a) Only the Points column moved, so it now reads smallest to largest on its own: **25, 30, 35, 40, 50**. (b) Vera's row on the original sheet holds **40** points; the broken sheet's 25 beside her name is really Seth's. (c) Priya sorted **one column on its own**, which splits every record from its values; sorting must move **whole rows**. Fix: re-sort the original sheet on Points with whole rows moving (or re-type the five rows), then spot-check two rows against the original — and note that a row count alone would not catch this error, since the broken sheet still has 5 rows.

Q11. (a) The sheet is sorted largest first, so the top row is the most: **Saturday, 12 480 steps**. (b) Days at 10 000 or more sit together at the top: 12 480 and 10 230 — **2 days** (the next value, 9 875, is under the cut-off). (c) Tuesday plus Thursday: $6\,540 + 5\,980 = 12\,520$ — **12 520 steps**.

Q12. (a) Same year, so months then days: May before June — **17/5/2026, 21/5/2026, 3/6/2026, 9/6/2026**. (b) June dates are 3/6 and 9/6 — **2 deliveries**. (c) The latest is the last of that order: **9/6/2026**.

Q13. (a) **Day and Coffees sold (cups)** — the unit (cups) belongs in the heading. (b) Smallest to largest: **Sun 29, Mon 38, Wed 41, Tue 45, Thu 52, Fri 63, Sat 71**; the first day is **Sun** and the last is **Sat**. (c) Total: $38 + 45 + 41 + 52 + 63 + 71 + 29 = 339$ — **339 coffees**. Sorting changes the order, not the total.

Q14. (a) The sheet is sorted largest first, so the top row is the highest: **Jory, 190**. (b) Scores of 175 or more sit together at the top: 190, 185, 179 — **3 players** (172 and 168 are under the cut-off). (c) Smallest to largest puts the lowest score on top: **Mia, 168**.

Q15. (a) Milk **\$3.40**, Eggs **\$6.15**, Bread **\$4.20**. (b) Total: $\$3.40 + \$6.15 + \$4.20 = \$13.75$ — cents column $40 + 15 + 20 = 75$. (c) The dearest of all five is **Eggs, \$6.15** — the top row of a largest-to-smallest sort.

Q16. (a) Sorted A to Z the list begins **Amy Marsh, Amy Marsh, Dan Petty, Gus Meyer**. (b) The doubled name is **Amy Marsh**; after an A-to-Z sort the two identical rows sit **side by side** at the top, which is exactly how sorting exposes doubles. (c) Twelve forms minus the one double entry: $12 - 1 = 11$ — **11 different students**.

Q17. (a) Smallest to largest: **86, 94, 99, 107, 118, 131** — three-digit numbers all, so compare hundreds first, then tens. (b) Any one: **a spreadsheet program** on a computer (sort the column smallest to largest), or a phone app with a sort button. Pen and paper works too. (c) **Count the rows before and after**: 6 rows before, 6 rows after, holding the same six numbers — sorting changes order only.

Q18. (a) Total: $24 + 31 + 28 + 45 + 62 + 78 + 57 = 325$ — **325 icy poles**. (b) Smallest to largest: **Mon 24, Wed 28, Tue 31, Thu 45, Sun 57, Fri 62, Sat 78** — note that Wednesday (28) sorts before Tuesday (31) even though Tuesday comes first in the week. (c) Sort the **Sales column largest to smallest (descending)**, moving whole rows, and the busiest day (Saturday, 78) lands on the top row.

Chapter 5 Systematics — 5C Planning and scheduling

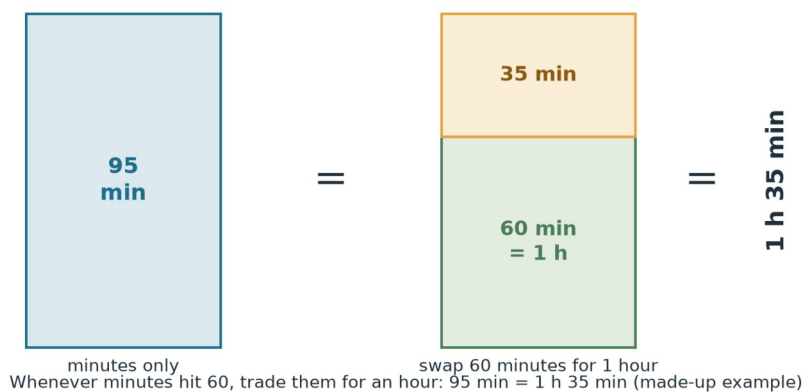
Theory

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

Plans, schedules and systems. A **plan** is a list of the jobs that need doing, put in the order they need doing, with how long each job takes. The time a job takes is its **duration**. A **schedule** is a plan with clock times on it: what time each job starts and what time it finishes. A **system** is the method or tool you use to keep the plan going: a paper list, a table, a spreadsheet, or a calendar app on a phone. A **deadline** is a time something must be finished by. A **roster** is a schedule of shifts — who works when, and for how long.

Refresher — time runs in 60s. One hour is 60 minutes, not 100. So whenever your minutes reach 60, trade them for one extra hour:

- $50 + 25 = 75$ min, and 75 min = 1 h 15 min.
- Counting on from 8:45 to 9:20 is 35 min (15 min to 9:00, then 20 more).
- $185 \text{ min} = 3 \text{ h } 5 \text{ min}$, because $3 \times 60 = 180$ and 5 are left over.
- $95 \text{ min} = 1 \text{ h } 35 \text{ min}$.

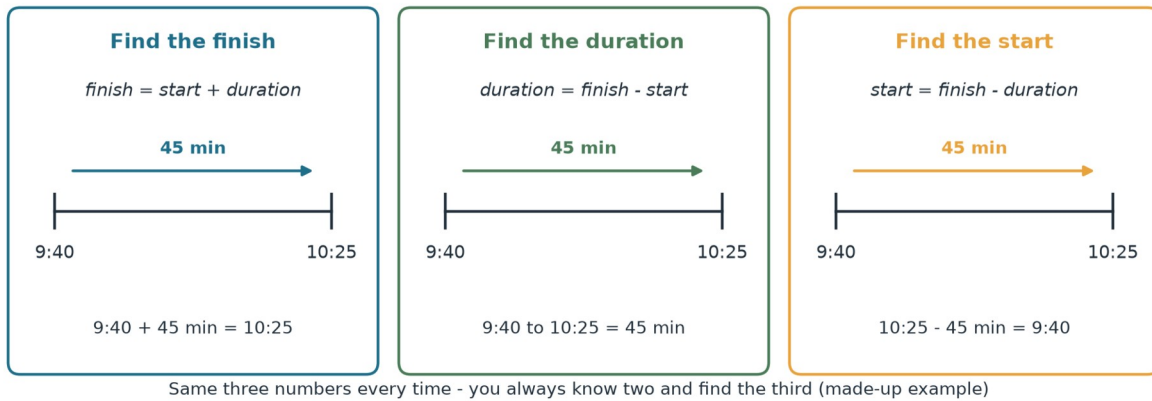


Trading 60 minutes for one hour

The three time facts. Every job in this section uses the same three numbers — a start time, a finish time and a duration. You always know two of them and find the third:

1. **finish = start + duration** (count on)
2. **duration = finish – start** (count the gap)
3. **start = finish – duration** (count back)

For example, a job that starts at 9:40 and finishes at 10:25 ran for 45 min. The same three numbers give $9:40 + 45 \text{ min} = 10:25$ and $10:25 - 45 \text{ min} = 9:40$.



The three time facts

Refresher — minutes and decimal hours. Rosters and pay use decimal hours, so you need to swap between the two. Minutes become decimal hours by dividing by 60; decimal hours become minutes by multiplying by 60:

- 30 min = 0.5 h, 15 min = 0.25 h, 45 min = 0.75 h (because $45 \div 60 = 0.75$).
- 1 h 45 min = 1.75 h — never 1.45 h. The part after the dot is a fraction of an hour, not minutes.
- 0.4 h = 24 min (because $0.4 \times 60 = 24$), and 2.5 h = 150 min.
- When it does not divide neatly, round and say so: 10 min = $10 \div 60 = 0.17$ h (to 2 decimal places).

Refresher — 24-hour time. After midday, 24-hour time keeps counting past 12 instead of starting again at 1. Add 12 to an afternoon time: 3:45 pm = 15:45 (because $3 + 12 = 15$). Subtract 12 to go back: 19:20 = 7:20 pm. Morning times get a zero in front: 8:20 am is written 08:20. Midday is 12:00 and midnight is 00:00.



The 24-hour ring: afternoon times just keep counting past 12 (made-up example)

The 24-hour ring

Putting a plan in order. Trevor is setting up Boxwood Community Hall for a market morning. His plan lists four jobs in the order they must happen, with each duration:

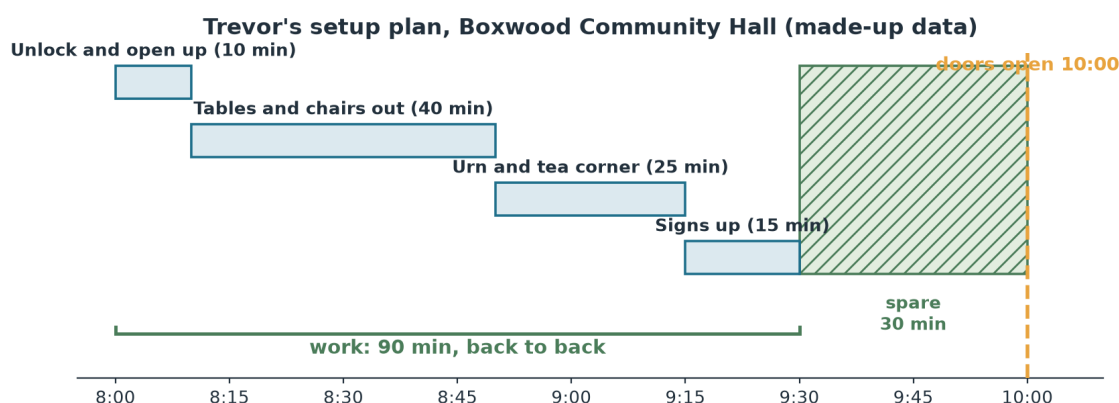
Step	Job	Duration
1	Unlock and open up	10 min
2	Tables and chairs out	40 min
3	Urn and tea corner	25 min
4	Signs up	15 min

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

Trevor starts at 8:00 and works straight through, each job starting as the one before finishes. Counting on each duration:

- unlock finishes $8:00 + 10 \text{ min} = 8:10$;
- tables and chairs finish $8:10 + 40 \text{ min} = 8:50$;
- urn and tea corner finish $8:50 + 25 \text{ min} = 9:15$;
- signs finish $9:15 + 15 \text{ min} = 9:30$.

The whole setup takes $10 + 40 + 25 + 15 = 90 \text{ min}$, which is 1 h 30 min. The doors open at 10:00, so Trevor has 30 min spare — time he can use for whatever comes up.

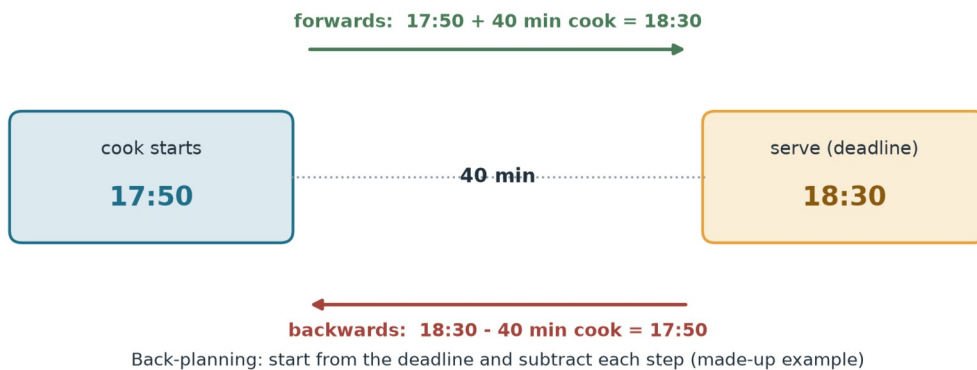


Trevor's setup plan as a timeline

Wait steps and gaps. Not every step in a plan is someone working. Paint has to dry, floors have to dry, bread has to prove. A **wait step** still takes time on the schedule even though nobody is doing anything, so it gets a duration and a finish time just like a work step. Gaps you leave between jobs on purpose are spare time: they absorb the things that run late.

Does it fit? To check a plan fits inside a window of time, add the durations (including wait steps and breaks) and compare with the window. If the total is smaller than the window, the plan fits and the difference is spare time. If the total is bigger, something has to move to another day or start earlier.

Back-planning from a deadline. When you know the deadline, plan backwards: start at the deadline and subtract each duration, last job first. If dinner must be served at 18:30 and cooking takes 40 min, the latest cooking start is $18:30 - 40 \text{ min} = 17:50$. Counting back gives you the *latest* time each step can start — starting any later means missing the deadline.



Back-planning from a deadline

Rosters and pay. A roster gives shifts as start and finish times. Turn each shift into decimal hours with fact 2 (finish – start), add the shifts, then multiply by the hourly rate to find the pay. Round the pay to the nearest cent and say that is what you did.

Using technology. A system can do the adding for you. In a spreadsheet, Trevor’s minutes sit in column D and one formula totals them: typing `=SUM(D2:D5)` in cell D6 returns 90. A calendar app does the counting on for you: make an event starting 9:00 am with length 90 min and the app shows it ending 10:30 am, and an alert set to 15 min before pings at 8:45 am.

	B	C	D	E
1	Task	Start	Minutes	Finish
2	Open up	8:00	10	8:10
3	Tables and chairs out	8:10	40	8:50
4	Urn and tea corner	8:50	25	9:15
5	Signs up	9:15	15	9:30
6	Total		<code>=SUM(D2:D5)</code>	

A spreadsheet adds the Minutes column for you: `=SUM(D2:D5)` gives 90 (made-up data)

A spreadsheet totalling the minutes column

Calendar - Saturday

Hall setup

Start 9:00 am

Length 90 min

Ends 10:30 am

Alert 15 min before

What the app works out:

9:00 am + 90 min -> ends 10:30 am

90 min = 1 h 30 min, so 9:00 + 1:30 = 10:30

Alert 15 min before 9:00 am -> 8:45 am

The phone pings at 8:45 am so Trevor is not late.

A calendar app can add the duration and set the alert - but you can do both on paper (made-up data)

A calendar app event with its end time and alert

Everything in this section can be done with pen, paper and a basic calculator. Spreadsheets and calendar apps are shown because they are useful systems for planning and scheduling — never because a question needs them.

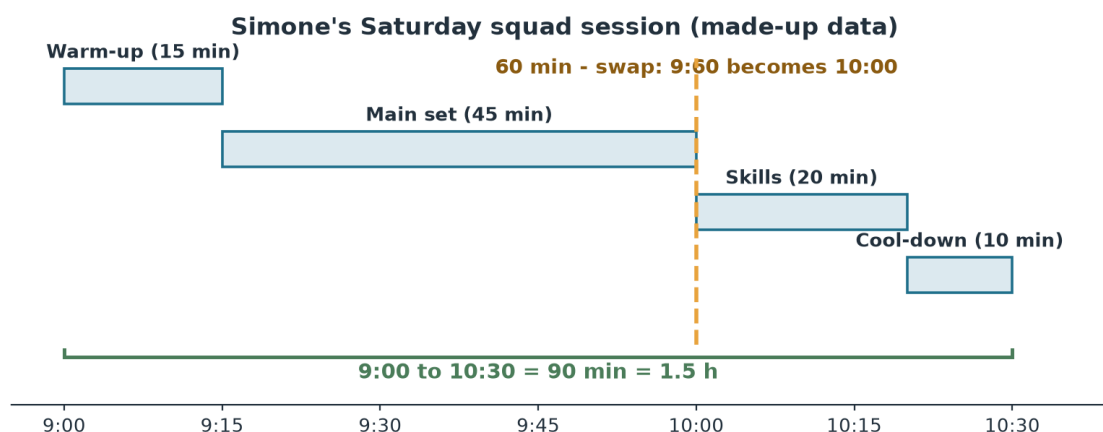
Worked examples

Example 1 — scaffolded

Simone runs the Saturday squad session at the Quarry Hill swim club. The session starts at 9:00 and runs these parts back to back: warm-up 15 min, main set 45 min, skills 20 min, cool-down 10 min.

- What time does each part finish?
- What time does the session end?
- How long is the session, in decimal hours?

Working	Comment
$9:00 + 15 \text{ min} = 9:15$	Warm-up finishes at 9:15.
$9:15 + 45 \text{ min} = 10:00$	$15 + 45 = 60 \text{ min}$, and 60 min trades for 1 h: 9:60 becomes 10:00.
$10:00 + 20 \text{ min} = 10:20$	Skills finishes at 10:20.
$10:20 + 10 \text{ min} = 10:30$	Cool-down finishes at 10:30, so the session ends at 10:30.
$15 + 45 + 20 + 10 = 90 \text{ min}$	Total duration, adding the four parts.
$90 \div 60 = 1.5$	90 min as decimal hours.
- The parts finish at 9:15, 10:00, 10:20 and 10:30. - The session ends at 10:30. - The session runs for 1.5 h.	



Simone's session on a timeline

Example 2 — scaffolded

Hetty is cooking for her birthday barbecue at Saltbush Park. The food must be served at 12:30. Cooking the food takes 30 min. The fire must be going for 40 min before cooking starts. Setting up the tables and the drinks takes 20 min, and must be finished before the fire is lit.

- What is the latest time cooking can start?
- What is the latest time the fire can be lit?
- What is the latest time Hetty can start setting up?

Working	Comment
$12:30 - 30 \text{ min} = 12:00$	Count back the cooking time from the serve time.
$12:00 - 40 \text{ min} = 11:20$	Count back the fire time from when cooking starts.
$11:20 - 20 \text{ min} = 11:00$	Count back the setup time from when the fire is lit.
$11:00 + 20 + 40 + 30 = 12:30$	Check forwards: the plan lands exactly on the serve time.

- Cooking must start by 12:00.

- (b) The fire must be lit by 11:20.
- (c) Hetty must start setting up by 11:00.

Example 3 — unscaffolded

Tilly works a weekend-and-evening roster at Brindley's Garden Centre. Last week her shifts were:

- Thursday 16:00 to 18:30
- Saturday 9:00 to 13:00
- Sunday 10:00 to 14:15

Her rate is \$21.40 per hour.

- (a) How long was each shift, in decimal hours?
- (b) How many hours did Tilly work in total? Give your answer in decimal hours and in hours and minutes.
- (c) How much was Tilly paid for the week, to the nearest cent?

Solution.

Thursday: $18:30 - 16:00 = 2 \text{ h } 30 \text{ min} = 2.5 \text{ h}$. Saturday: $13:00 - 9:00 = 4 \text{ h}$, so 4 h. Sunday: $14:15 - 10:00 = 4 \text{ h } 15 \text{ min}$, and $15 \div 60 = 0.25$, so 4.25 h.

Total: $2.5 + 4 + 4.25 = 10.75 \text{ h}$. As hours and minutes, $0.75 \text{ h} = 45 \text{ min}$, so 10 h 45 min.

Pay: $10.75 \times \$21.40 = \$230.05$ exactly, so no rounding is needed.

$\therefore$ Tilly worked 10.75 h (10 h 45 min) and was paid \$230.05.

Example 4 — unscaffolded

Ruben is painting the fence at his place. He starts at 8:20 and his plan is:

Step	What happens	Duration
1	Prep: sand and wash the fence	45 min
2	Wait: fence dries	60 min
3	First coat of paint	50 min
4	Wait: first coat dries	90 min
5	Second coat of paint	40 min

Made-up data: Ruben, his fence and every number in this table are made up for this section.

- (a) What time is the second coat finished?
- (b) How much time passed from when Ruben started to when the fence was finished? Give your answer in hours and minutes.

Solution.

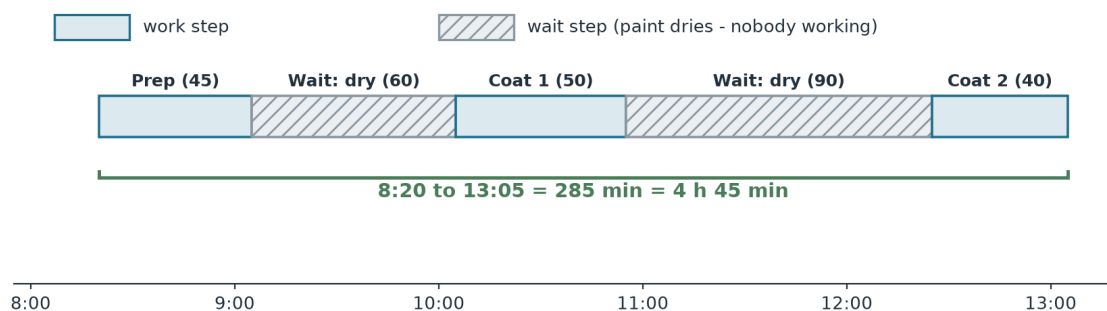
Count on through every step, wait steps included:

- prep finishes at $8:20 + 45 \text{ min} = 9:05$;
- drying finishes at $9:05 + 60 \text{ min} = 10:05$;
- first coat finishes at $10:05 + 50 \text{ min} = 10:55$;
- drying finishes at $10:55 + 90 \text{ min} = 12:25$;
- second coat finishes at $12:25 + 40 \text{ min} = 13:05$.

Total time passed: $45 + 60 + 50 + 90 + 40 = 285 \text{ min}$. $285 \div 60 = 4 \text{ remainder } 45$, so 4 h 45 min. Check: $8:20 + 4 \text{ h } 45 \text{ min} = 13:05$.

∴ The fence is finished at 13:05, 4 h 45 min after Ruben started.

Ruben's fence plan - wait steps still take time (made-up data)



Ruben's fence plan with its wait steps

Practice questions

Scaffolded

Q1. Change each time to the form asked for.

- (a) 2.5 h to minutes
- (b) 185 min to hours and minutes
- (c) 3:45 pm to 24-hour time

Q2. Simone runs an evening squad session starting at 17:30: warm-up 10 min, main set 35 min, stretching 15 min, back to back. What time does each part finish?

Q3. Find the duration of each job.

- (a) starts 9:40, finishes 10:25
- (b) starts 11:50, finishes 12:15
- (c) starts 14:05, finishes 15:30 (give hours and minutes)

Q4. Hetty is cooking for another barbecue. The food must be served at 13:00. Cooking takes 35 min, the fire must be going for 45 min before cooking starts, and setting up takes 25 min before the fire is lit.

- (a) What is the latest time cooking can start?
- (b) What is the latest time the fire can be lit?
- (c) What is the latest time Hetty can start setting up?

Q5. Dane books three jobs in a row at Marron Motors, starting at 8:00. The first row of his table is done for him.

Job	Duration	Start	Finish
Oil change	40 min	8:00	8:40
Rotate tyres	35 min		
Fit battery	25 min		

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

- (a) What time is the tyre rotation finished?
- (b) What time is the battery finished?
- (c) How long do the three jobs take altogether, in hours and minutes?

Q6. Tilly checks one of her shifts at Brindley's Garden Centre.

- (a) How many decimal hours is 16:00 to 18:30?
- (b) Write 45 min as decimal hours.
- (c) How much is 6 h of work at \$19.80 per hour, to the nearest cent?

Unscaffolded

Q7. Dane's day at Marron Motors runs from 8:00 to 15:00. He has four jobs to fit in, in this order: 90 min, 75 min, 100 min and 60 min. He takes a 30 min lunch break straight after the second job.

- (a) How many minutes of job time does Dane have?
- (b) If he starts at 8:00 and works straight through with the lunch break in its place, what time does his last job finish?
- (c) How many spare minutes are left before 15:00?

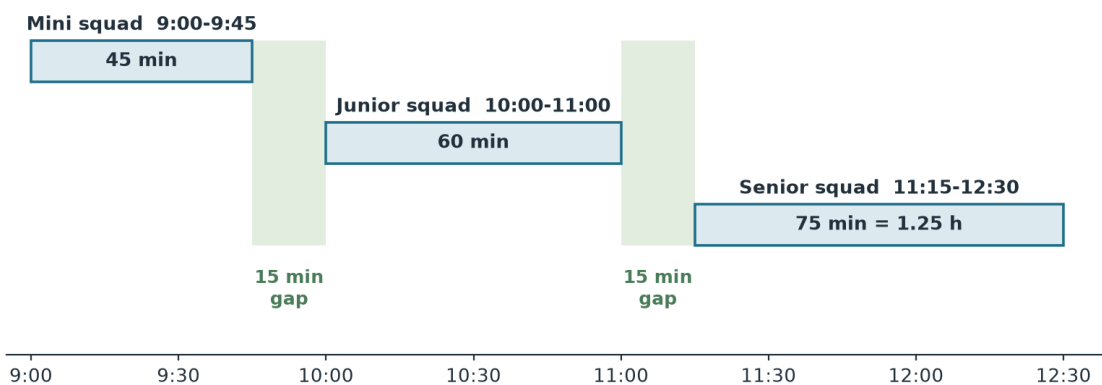
Q8. After an event at Boxwood Community Hall, Trevor packs up in this order from 16:00: stack the chairs (20 min), mop the floor (30 min), wait for the floor to dry (15 min), set out the tables for tomorrow (40 min).

- (a) What time is the floor dry?
- (b) What time is the hall ready for tomorrow?
- (c) How long did the pack-up take altogether, in hours and minutes?

Q9. The swim club open day runs three sessions in the pool, shown below.

- (a) How long is the mini squad session and the junior squad session?
- (b) How long is the senior squad session, in minutes and in decimal hours?
- (c) How long is the gap between the mini squad finishing and the junior squad starting?

Swim club open day - three sessions and the gaps between (made-up data)



Swim club open day sessions

Q10. Marron Motors has an afternoon window from 13:00 to 17:00 for bookings. Four bookings come in: 55 min, 40 min, 75 min and 80 min.

- (a) How many minutes of bookings is that altogether?
- (b) Do the four bookings fit in the window? Show your working and say by how many minutes they fit or do not fit.
- (c) If the 80 min booking is moved to another day, how many spare minutes are left in the window?

Q11. At Brindley's Garden Centre, watering the display beds takes 35 min. Filling the watering tank takes 15 min and must be finished before the watering starts. Tilly wants the watering done by 17:00.

- (a) What is the latest time the watering can start?
- (b) What is the latest time Tilly can start filling the tank?
- (c) If Tilly starts filling the tank at 16:00, does the watering finish by 17:00? How many minutes to spare, if any?

Q12. Adele’s weekend roster at Brindley’s Garden Centre is: Friday 15:30 to 18:30, Saturday 9:00 to 13:30, Sunday 10:00 to 14:00. Her rate is \$20.60 per hour.

- How long is each shift, in decimal hours?
- How many hours did Adele work in total?
- How much was Adele paid for the weekend, to the nearest cent?

Q13. Trevor’s week planner for the hall is shown below.

- Which day has two things booked at the same time?
- The working bee planning meeting is moved to Friday at 17:00 and runs for 75 min. What time does it finish?
- How many days of the six have nothing planned?

Mon	Tue	Wed	Thu	Fri	Sat
18:00 Committee meeting	7:30 Delivery pick-up	nothing planned	18:00 Hall inspection 18:00 Working bee planning	nothing planned	9:00 Working bee

clash: two things at 18:00

Trevor's week planner for the hall (made-up data)

Trevor’s week planner

Q14. Simone’s carnival prep spreadsheet is shown below. Column D holds the minutes each job takes.

- Which cell holds the total formula, and what is the formula?
- What number does that cell show?
- Write that total in hours and minutes, and as decimal hours.

	B	C	D
1	Job	Day	Minutes
2	Print programmes	Fri	25
3	Set up tables	Sat	40
4	Make signs	Sat	15
5	Pack gear bags	Sat	50
6	Fill goodie bags	Sun	20
7	Total		=SUM(D2:D6)

150

minutes
= 2 h 30 min

Simone's carnival prep sheet - column D holds the minutes (made-up data)

Simone’s carnival prep spreadsheet

Q15. The Boxwood Community Hall working bee starts at 9:00. The plan is three work blocks — 75 min, 90 min and 60 min — with morning tea (15 min) straight after the first block and lunch (30 min) straight after the second block.

- How many minutes of work are in the plan? Give your answer in hours and minutes as well.
- Counting the breaks, how much time passes from the start to the finish? Give your answer in hours and minutes.
- What time does the working bee finish?

Q16. Adele adds two job times and writes: 1 h 40 min + 50 min = 1 h 90 min.

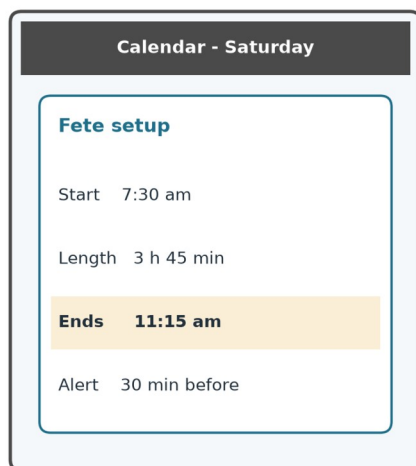
- Explain what is wrong with her answer and fix the minutes part.
- What is the correct total, in hours and minutes?
- Write the correct total as decimal hours.

Q17. The swim club carnival runs three events in the morning: freestyle finals 10:00 to 10:35, relay finals 10:45 to 11:30, and presentation 11:45 to 12:00.

- How long is the freestyle finals and the relay finals?
- How long is the gap between the relay finals finishing and the presentation starting?
- How much time passes from the start of the first event to the end of the presentation? Give your answer in hours.

Q18. Hetty makes a calendar app event for the fete setup: start 7:30 am, length 3 h 45 min, with an alert 30 min before the start.

- What time does the event end? Give your answer in 24-hour time.
- What time does the alert go off?
- Hetty actually arrives at 8:05 am. How many minutes after the planned start is that?



The app fills in Ends and Alert - you can reproduce both with pen and paper (made-up data)

Check the app with your own maths:

3 h 45 min = 225 min

7:30 + 3 h = 10:30, then + 45 min = 11:15

In 24-hour time the app shows the end as 11:15.

Alert: 7:30 am - 30 min = 7:00 am

The fete setup event in a calendar app

Answers

Q1. (a) 150 min (b) 3 h 5 min (c) 15:45

Q2. Warm-up 17:40; main set 18:15; stretching 18:30.

Q3. (a) 45 min (b) 25 min (c) 85 min = 1 h 25 min

Q4. (a) 12:25 (b) 11:40 (c) 11:15

Q5. (a) 9:15 (b) 9:40 (c) 100 min = 1 h 40 min

Q6. (a) 2.5 h (b) 0.75 h (c) \$118.80

Q7. (a) 325 min (b) 13:55 (c) 65 min

Q8. (a) 17:05 (b) 17:45 (c) 105 min = 1 h 45 min

Q9. (a) 45 min; 60 min (b) 75 min = 1.25 h (c) 15 min

Q10. (a) 250 min (b) no — the window is 240 min, so the bookings are 10 min over (c) 70 min spare

Q11. (a) 16:25 (b) 16:10 (c) yes — watering ends 16:50, with 10 min to spare

Q12. (a) 3 h; 4.5 h; 4 h (b) 11.5 h (c) \$236.90

Q13. (a) Thursday (b) 18:15 (c) 2 days (Wednesday and Friday)

Q14. (a) D7, =SUM(D2:D6) (b) 150 (c) 2 h 30 min; 2.5 h

Q15. (a) 225 min = 3 h 45 min (b) 270 min = 4 h 30 min (c) 13:30

Q16. (a) 90 min is not allowed — 60 of them trade for 1 h, giving 1 h + 1 h 30 min (b) 2 h 30 min (c) 2.5 h

Q17. (a) 35 min; 45 min (b) 15 min (c) 120 min = 2 h

Q18. (a) 11:15 (b) 7:00 am (c) 35 min

Fully-worked solutions

Q1. (a) $2.5 \times 60 = 150$ min. (b) $185 = 180 + 5$ and $180 \div 60 = 3$, so 3 h 5 min. (c) $3 + 12 = 15$, so 3:45 pm is 15:45.

Q2. Warm-up: $17:30 + 10$ min = 17:40. Main set: $17:40 + 35$ min = 18:15. Stretching: $18:15 + 15$ min = 18:30, and $15 + 15 = 30$ min stays under 60 so the hour does not change again.

Q3. (a) 9:40 to 10:00 is 20 min, 10:00 to 10:25 is 25 min, total 45 min. (b) 11:50 to 12:00 is 10 min, 12:00 to 12:15 is 15 min, total 25 min. (c) 14:05 to 15:05 is 60 min, 15:05 to 15:30 is 25 min, total 85 min = 1 h 25 min.

Q4. (a) $13:00 - 35$ min = 12:25. (b) $12:25 - 45$ min = 11:40. (c) $11:40 - 25$ min = 11:15. Check forwards: $11:15 + 25 + 45 + 35 = 13:00$.

Q5. (a) Tyres start when the oil change finishes, 8:40: $8:40 + 35$ min = 9:15. (b) Battery starts at 9:15: $9:15 + 25$ min = 9:40. (c) $40 + 35 + 25 = 100$ min = 1 h 40 min.

Q6. (a) $18:30 - 16:00 = 2$ h 30 min, and $30 \div 60 = 0.5$, so 2.5 h. (b) $45 \div 60 = 0.75$ h. (c) $6 \times \$19.80 = \$118.80$ exactly, so to the nearest cent it is \$118.80.

Q7. (a) $90 + 75 + 100 + 60 = 325$ min of jobs. (b) Job 1: $8:00 + 90$ min = 9:30. Job 2: $9:30 + 75$ min = 10:45. Lunch: $10:45 + 30$ min = 11:15. Job 3: $11:15 + 100$ min = 12:55. Job 4: $12:55 + 60$ min = 13:55. (c) $15:00 - 13:55 = 65$ min spare.

Q8. (a) Chairs 16:00 to 16:20; mop 16:20 to 16:50; drying $16:50 + 15$ min = 17:05. (b) Tables: $17:05 + 40$ min = 17:45. (c) $20 + 30 + 15 + 40 = 105$ min = 1 h 45 min. Check: $16:00 + 1$ h 45 min = 17:45.

Q9. (a) Mini: $9:00$ to $9:45 = 45$ min. Junior: $10:00$ to $11:00 = 60$ min. (b) Senior: $11:15$ to $12:30 = 75$ min, and $75 \div 60 = 1.25$ h. (c) Mini ends $9:45$, junior starts $10:00$: gap = 15 min.

Q10. (a) $55 + 40 + 75 + 80 = 250$ min. (b) The window $13:00$ to $17:00$ is 4 h = 240 min. $250 > 240$, so the bookings do not fit: they are $250 - 240 = 10$ min over. (c) Without the 80 min job the bookings are $250 - 80 = 170$ min, leaving $240 - 170 = 70$ min spare.

Q11. (a) $17:00 - 35$ min = $16:25$. (b) $16:25 - 15$ min = $16:10$. (c) Filling: $16:00 + 15$ min = $16:15$; watering: $16:15 + 35$ min = $16:50$. $16:50$ is before $17:00$, so yes, with $17:00 - 16:50 = 10$ min to spare.

Q12. (a) Friday: $18:30 - 15:30 = 3$ h = 3 h. Saturday: $13:30 - 9:00 = 4$ h 30 min = 4.5 h. Sunday: $14:00 - 10:00 = 4$ h = 4 h. (b) $3 + 4.5 + 4 = 11.5$ h. (c) $11.5 \times \$20.60 = \$236.90$ exactly, so to the nearest cent it is \$236.90.

Q13. (a) Thursday has the hall inspection and the working bee planning both at $18:00$ — a clash. (b) $17:00 + 75$ min = $18:15$ (75 min = 1 h 15 min). (c) Wednesday and Friday have nothing planned: 2 days.

Q14. (a) The total sits in cell D7 as =SUM(D2:D6). (b) $25 + 40 + 15 + 50 + 20 = 150$, so D7 shows 150. (c) $150 \div 60 = 2$ remainder 30, so 2 h 30 min; as decimal hours, 2.5 h.

Q15. (a) $75 + 90 + 60 = 225$ min of work = 3 h 45 min. (b) Breaks: $15 + 30 = 45$ min; elapsed $225 + 45 = 270$ min = 4 h 30 min. (c) Block 1: $9:00$ to $10:15$; tea to $10:30$; block 2: $10:30$ to $12:00$; lunch to $12:30$; block 3: $12:30$ to $13:30$. The working bee finishes at $13:30$. Check: $9:00 + 4$ h 30 min = $13:30$.

Q16. (a) Minutes cannot go past 59 on a clock-style answer: 90 min must trade 60 min for 1 h, leaving 30 min, so her 1 h 90 min becomes 1 h + 1 h 30 min. (b) 1 h 40 min = 100 min and $100 + 50 = 150$ min = 2 h 30 min. (c) $150 \div 60 = 2.5$ h.

Q17. (a) Freestyle: $10:00$ to $10:35 = 35$ min. Relay: $10:45$ to $11:30 = 45$ min. (b) Relay ends $11:30$, presentation starts $11:45$: gap = 15 min. (c) First start $10:00$, presentation ends $12:00$: $12:00 - 10:00 = 120$ min = 2 h.

Q18. (a) 3 h 45 min = 225 min. $7:30 + 3$ h = $10:30$, then + 45 min = $11:15$. In 24-hour time the end is 11:15. (b) $7:30 - 30$ min = $7:00$ am. (c) $8:05 - 7:30 = 35$ min late.

Chapter 5 Systematics — 5D Maps, timetables and online planners

Theory

About the data in this section. The timetables, trip planners, map screens, calculators and fares here are **made up** (not real): pretend routes, pretend stops, pretend times and pretend prices, built for this book so you can practise the maths. Nothing here is real data about a real transport company, app, person or place.

Refresher — 24-hour time. After midday, 24-hour time keeps counting past 12 instead of starting again at 1. Add 12 to an afternoon or evening hour: 4 pm is 16 (because $4 + 12 = 16$), so 4:20 pm is written 16:20. Subtract 12 to go back: 15:54 is 3:54 pm (because $15 - 12 = 3$). Before midday the hour number stays the same and gets a zero in front: 7:40 am is written 07:40. Midday is 12:00 and midnight is 00:00.

12-hour	24-hour
7:40 am	07:40
4:20 pm	16:20
11:15 pm	23:15
12:40 am	00:40
1:30 pm	13:30

And back the other way: 09:05 is 9:05 am, and 15:54 is 3:54 pm.

12-hour	12 am	1 am	2 am	3 am	4 am	5 am	6 am	7 am	8 am	9 am	10 am	11 am	12 pm	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm	7 pm	8 pm	9 pm	10 pm	11 pm
24-hour	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23

← after midday: add 12 (4 pm → 16) →

midnight = 00:00 midday = 12:00

Before midday the hour number stays the same: 7:40 am is 07:40. To go back, subtract 12: 15:54 is 3:54 pm.

The 24-hour strip: add 12 after midday, subtract 12 to go back

Reading a timetable. A timetable is a table: each **row** is one trip (one vehicle running the route once), and each **column** is one stop. The cell where a row and a column meet is the time that trip is at that stop. Read **along a row** to follow one trip from stop to stop. Read **down a column** to see every trip that leaves or arrives at one stop.

The Route 212 bus below runs from Bay Esplanade to North Shore Shops, six stops. Follow the row of the 07:40 trip: Bay Esplanade 07:40, Ferry Terminal 07:44, Cormorant Bay Station 07:50, Market Square 07:55, Hill Street 07:58, North Shore Shops 08:05. Read down the first column and you see trips leaving Bay Esplanade at 07:10, 07:40, 08:10 and 08:40 in the morning, then 15:20, 15:50 and 16:20 in the afternoon.

Route 212 — weekdays

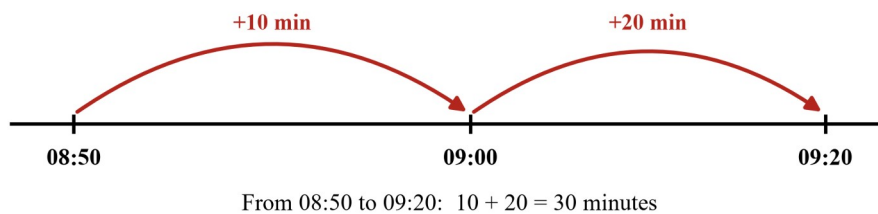
Cormorant Bay Transit · Bay Esplanade to North Shore Shops

Bay Esplanade	Ferry Terminal	Cormorant Bay Station	Market Square	Hill Street	North Shore Shops
07:10	07:14	07:20	07:25	07:28	07:35
07:40	07:44	07:50	07:55	07:58	08:05
08:10	08:14	08:20	08:25	08:28	08:35
08:40	08:44	08:50	08:55	08:58	09:05
15:20	15:24	15:30	15:35	15:38	15:45
15:50	15:54	16:00	16:05	16:08	16:15
16:20	16:24	16:30	16:35	16:38	16:45

Times are 24-hour time. Every trip takes the same time between stops.

Route 212 bus timetable, weekdays

How long does a trip take? The time from one stop to another is a **duration**: count on from the first time to the second. On the 08:40 trip the bus is at Hill Street at 08:58 and at North Shore Shops at 09:05. Counting on: 08:58 to 09:00 is 2 min, 09:00 to 09:05 is 5 min, so the bus takes $2 + 5 = 7$ min between those stops. Every row gives the same 7 min, because every trip takes the same time between the same two stops — only the start time changes.



Counting on from 08:50 to 09:20: 10 min then 20 min makes 30 min

Count on in pieces that reach the next whole hour first. From 08:50 to 09:20: 10 min to 09:00, then 20 more, so $10 + 20 = 30$ min. **Watch the trap:** from 15:45 to 16:15 is also 30 min (15 min to 16:00, then 15 more) — it is *not* 1 h 30 min. Time runs in 60s, so you cannot subtract the minutes as if they were ordinary decimal numbers.

Interactive maps and trip planners. A map app on a phone gives a distance and a time for each way to travel. The screen below offers three ways from Ferry Terminal to North Shore Shops: walk 31 min (2.4 km), bus 27 min (2.6 km, and the small print says that includes a 6 min wait, so the bus ride itself is $27 - 6 = 21$ min), or cycle 9 min (2.4 km). Notice the screen agrees with the paper timetable: 2.4 km is 2400 m, and the 21 min bus ride is exactly the Ferry Terminal to North Shore Shops time in the Route 212 table.

Map app — Ferry Terminal to North Shore Shops

	Walk	31 min	2.4 km
	Bus (Route 212)	27 min	2.6 km
<i>includes 6 min wait · the bus follows one-way streets via Market Square</i>			
	Cycle	9 min	2.4 km

The map app gives a distance and a time for each way to travel.

Times are estimates. Made-up screen: the places and every number are made up.

A map-app screen comparing walk, bus and cycle

A trip planner joins several legs into one door-to-door trip, including the walks and the waits. The screen below plans Bay Esplanade to Wynalla: walk 5 min to the stop (16:12 to 16:17), wait 3 min, catch the 16:20 Route 212 bus (10 min ride, at Cormorant Bay Station 16:30), wait 8 min, catch the Bay Line train (53 min, 16:38 to 17:31), then walk 3 min to arrive at 17:34.

Cormorant Bay Transit — trip planner

From: Bay Esplanade

To: Wynalla

Depart after: 16:10

Suggested trip

	Walk 5 min to Bay Esplanade stop	16:12 → 16:17
	Wait 3 min	
	Route 212 bus (10 min)	16:20 → 16:30
	Change at Cormorant Bay Station — wait 8 min	
	Bay Line train (53 min)	16:38 → 17:31
	Walk 3 min — arrive Wynalla	17:31 → 17:34

Depart 16:12 Arrive 17:34

Total 82 min = 1 h 22 min

Made-up screen: the trip and every time are made up for this book.

A trip-planner screen with a suggested door-to-door trip

Add the legs to get the total: $5 + 3 + 10 + 8 + 53 + 3 = 82$ min, and $82 \text{ min} = 1 \text{ h } 22 \text{ min}$. Check by counting on: $16:12 + 1 \text{ h } 22 \text{ min} = 17:34$, the arrival time on the screen. The waits count even though nobody is moving — a missed connection is a new wait, so always read the wait rows too.

Online calculators. A calculator screen takes **inputs** and returns **outputs**. The fuel screen below takes three inputs — trip distance 260 km, fuel use 7.5 L per 100 km, fuel price \$1.83 per litre — and returns two outputs. The maths it does: $260 \div 100 = 2.6$, then $2.6 \times 7.5 = 19.5$ L of fuel, then $19.5 \times \$1.83 = \$35.685$, which rounds to **\$35.69** to the nearest cent. Say when you have rounded.

Trip fuel calculator

Type in the inputs — the calculator returns the outputs.

Trip distance

260 km

Fuel use

7.5 L per 100 km

Fuel price

\$1.83 per litre

Fuel needed: 19.5 L

Fuel cost: \$35.69

(cost rounded to the nearest cent)

Made-up screen: the trip and every number are made up for this book.

A trip fuel calculator screen: inputs in, outputs out

Always check a screen with an estimate: 260 km is about two and a half lots of 100 km, so about $2.5 \times 7.5 \approx 19$ L — the screen's 19.5 L is sensible; and 20 L at about \$1.80 is about \$36, so \$35.69 is sensible. If a screen ever disagrees badly with your estimate, trust your estimate and check the inputs first.

Fares and daily caps. Cormorant Bay Transit uses a Baycard: you tap on and off and each trip is charged, but once your charges for the day reach the **daily cap** you travel free for the rest of the day.

Trip	Fare	Daily cap
Adult	\$3.40	\$9.20
Concession	\$1.70	\$4.60

Made-up data: the Baycard, its fares and its caps are made up for this section.

Three adult trips in one day would be $3 \times \$3.40 = \$10.20$, but \$10.20 is over the \$9.20 cap, so the day costs \$9.20. The cap is the most you pay, never more.

Using technology. Timetables, map apps, trip planners and calculator screens all do the adding for you — and all of them are only as good as the inputs you give them. Everything in this section can be done with pen, paper and a basic calculator. The screens are shown because they are the tools real travel planning uses, never because a question needs them.

Worked examples

Example 1 — scaffolded

Kat uses the Route 212 timetable in the theory.

- What time is the 08:40 trip at Ferry Terminal?
- How long does any trip take from Bay Esplanade to North Shore Shops?
- What time does the 15:50 trip reach North Shore Shops? Give your answer in 12-hour time.

Working	Comment
Read along the 08:40 row to Ferry Terminal: 08:44	The second cell of the row.
$0 + 25 = 25$: Bay Esplanade to Shops is 25 min	Last cell minus first cell of any row.
Read along the 15:50 row to Shops: 16:15	The last cell of the row.
$16 - 12 = 4$, so 16:15 is 4:15 pm	Subtract 12 to go back to 12-hour time.

- (a) The 08:40 trip is at Ferry Terminal at 08:44.
- (b) Any trip takes 25 min from Bay Esplanade to North Shore Shops.
- (c) The 15:50 trip reaches North Shore Shops at 16:15, which is 4:15 pm.

Example 2 — scaffolded

Dane checks the trip-planner screen in the theory for his trip from Bay Esplanade to Wynalla.

- (a) What time does he leave and what time does he arrive?
- (b) How long is the whole trip, in hours and minutes?
- (c) How long does he wait at Cormorant Bay Station between the bus and the train?

Working	Comment
Leave 16:12, arrive 17:34	The screen shows both.
$5 + 3 + 10 + 8 + 53 + 3 = 82$ min	Add every leg, walks and waits included.
$82 = 60 + 22$, so 1 h 22 min	Trade 60 min for 1 h.
Bus in 16:30, train out 16:38: $16:38 - 16:30 = 8$ min	The wait row between the two legs.
(a) Dane leaves at 16:12 and arrives at 17:34.	
(b) The whole trip takes 82 min = 1 h 22 min.	
(c) He waits 8 min at Cormorant Bay Station.	

Example 3 — unscaffolded

Greta plans a 260 km trip. Her car's fuel use is 7.5 L per 100 km and fuel costs \$1.83 per litre. She types the three inputs into the fuel-calculator screen in the theory.

- (a) How many litres of fuel does the trip need?
- (b) What does that fuel cost, to the nearest cent?

Solution. (a) $260 \div 100 = 2.6$ lots of 100 km, and $2.6 \times 7.5 = 19.5$ L. (b) $19.5 \times \$1.83 = \$35.685$, which rounds to \$35.69 to the nearest cent. Check with an estimate: 20 L at about \$1.80 is about \$36, so \$35.69 is sensible.

Example 4 — unscaffolded

Ryan taps on and off with a Baycard and makes four adult trips in one day.

- (a) What would four trips cost with no cap?
- (b) What does Ryan actually pay for the day?
- (c) How much does the cap save him?

Solution. (a) $4 \times \$3.40 = \$13.60$. (b) \$13.60 is over the \$9.20 adult daily cap, so Ryan pays \$9.20. (c) The cap saves him $\$13.60 - \$9.20 = \$4.40$.

Practice questions

Scaffolded

Q1. Write each time in the other form.

- (a) 07:40 in 12-hour time
- (b) 16:20 in 12-hour time
- (c) 15:54 in 12-hour time

Q2. Use the Route 212 bus timetable.

- (a) What time is the 08:10 trip at Market Square?
- (b) What time does the 15:20 trip reach North Shore Shops?
- (c) How long does any trip take from Cormorant Bay Station to North Shore Shops?

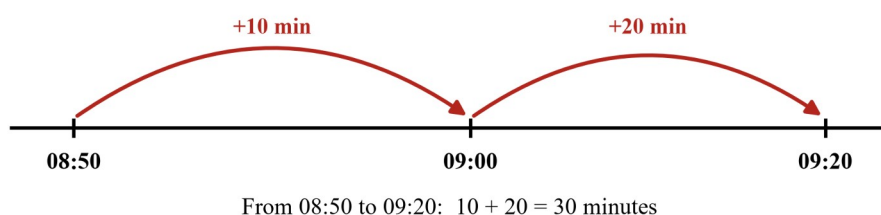
Route 212 — weekdays					
Cormorant Bay Transit · Bay Esplanade to North Shore Shops					
Bay Esplanade	Ferry Terminal	Cormorant Bay Station	Market Square	Hill Street	North Shore Shops
07:10	07:14	07:20	07:25	07:28	07:35
07:40	07:44	07:50	07:55	07:58	08:05
08:10	08:14	08:20	08:25	08:28	08:35
08:40	08:44	08:50	08:55	08:58	09:05
15:20	15:24	15:30	15:35	15:38	15:45
15:50	15:54	16:00	16:05	16:08	16:15
16:20	16:24	16:30	16:35	16:38	16:45

Times are 24-hour time. Every trip takes the same time between stops.

Route 212 bus timetable, weekdays

Q3. Count on to find each duration.

- (a) 08:50 to 09:20
- (b) 15:45 to 16:40
- (c) 14:10 to 16:40 (give hours and minutes)



Counting on in pieces that reach the next hour first

Q4. Use the map-app screen.

- How long does the walk take?
- How far is the bus trip?
- The bus time of 27 min includes a wait. How long is the wait?

Map app — Ferry Terminal to North Shore Shops

	Walk	31 min	2.4 km
	Bus (Route 212)	27 min	2.6 km
	includes 6 min wait · the bus follows one-way streets via Market Square		
	Cycle	9 min	2.4 km

The map app gives a distance and a time for each way to travel.
 Times are estimates. Made-up screen: the places and every number are made up.

A map-app screen comparing walk, bus and cycle

Q5. Use the trip-planner screen.

- How long is the Route 212 bus leg?
- How long is the first walk, from leaving home to reaching the stop?
- What is the arrival time in 12-hour time?

Cormorant Bay Transit — trip planner

From: Bay Esplanade

To: Wynalla

Depart after: 16:10

Suggested trip

	Walk 5 min to Bay Esplanade stop	16:12 → 16:17
	Wait 3 min	
	Route 212 bus (10 min)	16:20 → 16:30
	Change at Cormorant Bay Station — wait 8 min	
	Bay Line train (53 min)	16:38 → 17:31
	Walk 3 min — arrive Wynalla	17:31 → 17:34

Depart 16:12 Arrive 17:34

Total 82 min = 1 h 22 min

Made-up screen: the trip and every time are made up for this book.

A trip-planner screen with a suggested door-to-door trip

Q6. Use the Baycard fare table.

- What do two adult trips cost with no cap?
- Is that amount over the adult daily cap?
- Later the same day the Baycard meter shows \$10.20 of trips. What does the day cost?

Un scaffolded

Q7. Use the Bay Line train timetable.

- (a) What time does the 07:22 train reach Wynalla?
- (b) How long does any train take from Cormorant Bay Station to Cape View?
- (c) The 07:52 train's Wynalla time, in 12-hour time.

Bay Line — weekday mornings					
Cormorant Bay Station to Wynalla · Cormorant Bay Transit					
Cormorant Bay Station	Long Jetty	Marlin Quay	Beacon Hill	Cape View	Wynalla
06:52	07:00	07:07	07:18	07:33	07:45
07:22	07:30	07:37	07:48	08:03	08:15
07:52	08:00	08:07	08:18	08:33	08:45
08:22	08:30	08:37	08:48	09:03	09:15

Times are 24-hour time. Every train takes the same time between stops.

Bay Line train timetable, weekday mornings

Q8. Kat must be at North Shore Shops by 09:00. Use the Route 212 timetable.

- (a) What is the latest bus she can catch from Bay Esplanade?
- (b) What time does that bus reach North Shore Shops?
- (c) How many minutes before 09:00 is she there?

Q9. Kat and Simone both travel to North Shore Shops. Kat walks 12 min to Bay Esplanade, waits 5 min, then rides a bus the full run (25 min). Simone walks 4 min to Ferry Terminal, waits 3 min, then rides the bus from Ferry Terminal to North Shore Shops (21 min).

- (a) How long is Kat's trip, door to door?
- (b) How long is Simone's trip, door to door?
- (c) Who is quicker, and by how many minutes?

Q10. Greta makes a second trip of 256 km. Her fuel use is still 7.5 L per 100 km, and on this day fuel costs \$1.87 per litre.

- (a) How many litres does the trip need?
- (b) What does the fuel cost, to the nearest cent?
- (c) A shorter trip on the screen shows 16.0 L. What does 16 L cost at \$1.87 per litre? (This one is exact — no rounding needed.)

Q11. Use the Bay Ferry timetable and the ferry fares: adult single \$3.80, child single \$1.90.

- (a) What time does the 11:30 ferry from Ferry Terminal arrive at Old Saltworks?
- (b) How long is the crossing?
- (c) What do two adult singles and one child single cost?

Bay Ferry — weekdays			
Ferry Terminal (Cormorant Bay) to Old Saltworks			
From Ferry Terminal		From Old Saltworks	
Departs	Arrives	Departs	Arrives
07:30	07:50	08:15	08:35
09:00	09:20	10:00	10:20
11:30	11:50	12:30	12:50
14:00	14:20	15:00	15:20
16:45	17:05	17:30	17:50

The crossing takes 20 minutes each way. Times are 24-hour time.

Bay Ferry timetable, weekdays, both directions

Q12. Use the map-app screen.

- (a) Which way is fastest, and how long does it take?
- (b) How many minutes does the bus save compared with walking?
- (c) How long is the bus ride itself, without the wait?

Q13. A concession card holder makes six trips in one day on the Baycard.

- (a) What would six concession trips cost with no cap?
- (b) What does the day cost with the cap?
- (c) How much does the cap save?

Q14. Show that the 15:50 Route 212 trip takes 21 min from Ferry Terminal to North Shore Shops. Use the timetable: the trip is at Ferry Terminal at 15:54 and at North Shore Shops at 16:15. Count on in two pieces, through 16:00.

Q15. Vic says the time from 15:45 to 16:15 is 1 h 30 min, because “16 take away 15 is 1 and 45 take away 15 is 30”. Explain the mistake and give the correct duration.

Q16. Ryan’s train gets him to Cormorant Bay Station at 14:47. He wants a Route 212 bus towards North Shore Shops.

- (a) What time is the next bus from Cormorant Bay Station?
- (b) How long does Ryan wait?
- (c) What time does that bus reach Market Square?

Q17. Greta considers driving 48 km to a market day instead of taking the train. Her car uses 7.5 L per 100 km, fuel costs \$1.85 per litre, and all-day parking costs \$12.00. The train costs two adult fares for the day there and back.

- (a) How many litres does the drive need, and what does that fuel cost?
- (b) What does the drive cost altogether, fuel plus parking?
- (c) How much does the train save compared with driving?

Q18. A family of two adults and one concession card holder spends a day at Old Saltworks. They cross on the 11:30 ferry from Ferry Terminal and come back on the 17:30 ferry from Old Saltworks. Ferry fares: adult return \$7.60, concession return \$4.20.

- What time do they arrive at Old Saltworks?
- How long do they have at Old Saltworks, from arriving until their return ferry leaves? Give hours and minutes.
- What do their ferry fares cost altogether?

Bay Ferry — weekdays			
Ferry Terminal (Cormorant Bay) to Old Saltworks			
From Ferry Terminal		From Old Saltworks	
Departs	Arrives	Departs	Arrives
07:30	07:50	08:15	08:35
09:00	09:20	10:00	10:20
11:30	11:50	12:30	12:50
14:00	14:20	15:00	15:20
16:45	17:05	17:30	17:50

The crossing takes 20 minutes each way. Times are 24-hour time.

Bay Ferry timetable, weekdays, both directions

Answers

Q1. (a) 7:40 am (b) 4:20 pm (c) 3:54 pm

Q2. (a) 08:25 (b) 15:45 (c) 15 min

Q3. (a) 30 min (b) 55 min (c) 150 min = 2 h 30 min

Q4. (a) 31 min (b) 2.6 km (c) 6 min

Q5. (a) 10 min (b) 5 min (c) 5:34 pm

Q6. (a) \$6.80 (b) no — \$6.80 is under the \$9.20 cap (c) \$9.20

Q7. (a) 08:15 (b) 41 min (c) 8:45 am

Q8. (a) the 08:10 bus (b) 08:35 (c) 25 min

Q9. (a) 42 min (b) 28 min (c) Simone, by 14 min

Q10. (a) 19.2 L (b) \$35.90 (c) \$29.92

Q11. (a) 11:50 (b) 20 min (c) \$9.50

Q12. (a) cycle, 9 min (b) 4 min (c) 21 min

Q13. (a) \$10.20 (b) \$4.60 (c) \$5.60

Q14. 15:54 to 16:00 is 6 min, 16:00 to 16:15 is 15 min, and $6 + 15 = 21$ min

Q15. The hours and the minutes cannot be subtracted separately like that — 15:45 to 16:15 is 30 min (15 min to 16:00, then 15 more), not 1 h 30 min

Q16. (a) 15:30 (b) 43 min (c) 15:35

Q17. (a) 3.6 L, \$6.66 (b) \$18.66 (c) \$11.86

Q18. (a) 11:50 (b) 340 min = 5 h 40 min (c) \$19.40

Fully-worked solutions

Q1. (a) Before midday the hour stays the same: 07:40 is 7:40 am. (b) $16 - 12 = 4$, so 16:20 is 4:20 pm. (c) $15 - 12 = 3$, so 15:54 is 3:54 pm.

Q2. (a) Read along the 08:10 row to Market Square: 08:25. (b) Read along the 15:20 row to North Shore Shops: 15:45. (c) Any row: Station 07:50 to Shops 08:05 is 15 min (count on 10 min to 08:00, then 5 more).

Q3. (a) 08:50 to 09:00 is 10 min, 09:00 to 09:20 is 20 min: $10 + 20 = 30$ min. (b) 15:45 to 16:00 is 15 min, 16:00 to 16:40 is 40 min: $15 + 40 = 55$ min. (c) 14:10 to 16:10 is 2 h, 16:10 to 16:40 is 30 min: 2 h 30 min = 150 min.

Q4. (a) The walk row says 31 min. (b) The bus row says 2.6 km. (c) The small print says the 27 min includes a 6 min wait, so the wait is 6 min (and the ride itself is $27 - 6 = 21$ min).

Q5. (a) The bus leg runs 16:20 to 16:30: 10 min. (b) The first walk row says 5 min (16:12 to 16:17). (c) The screen arrives 17:34; $17 - 12 = 5$, so that is 5:34 pm.

Q6. (a) $2 \times \$3.40 = \$6.80$. (b) No: \$6.80 is under the \$9.20 cap, so the cap does not apply yet. (c) \$10.20 is over the \$9.20 cap, so the day costs the cap: \$9.20.

Q7. (a) Read along the 07:22 row to Wynalla: 08:15. (b) Any row: Station 06:52 to Cape View 07:33 is 41 min (8 min to 07:00, then 33 more). (c) The 07:52 row reaches Wynalla at 08:45, which is 8:45 am.

Q8. (a) The 08:40 bus arrives 09:05 — too late. The 08:10 bus arrives 08:35, so the latest bus is the 08:10. (b) 08:35. (c) 08:35 to 09:00 is 25 min.

Q9. (a) $12 + 5 + 25 = 42$ min. (b) $4 + 3 + 21 = 28$ min. (c) Simone is quicker by $42 - 28 = 14$ min.

Q10. (a) $256 \div 100 = 2.56$, and $2.56 \times 7.5 = 19.2$ L. (b) $19.2 \times \$1.87 = \$35.904$, which rounds to \$35.90 to the nearest cent. (c) $16 \times \$1.87 = \$29.92$ exactly.

Q11. (a) Read across the 11:30 departure: it arrives at 11:50. (b) Every crossing is 20 min ($11:50 - 11:30$). (c) $2 \times \$3.80 + \$1.90 = \$7.60 + \$1.90 = \$9.50$.

Q12. (a) Cycling, at 9 min. (b) Walk 31 min, bus 27 min: $31 - 27 = 4$ min saved. (c) $27 - 6 = 21$ min — the same 21 min the paper timetable gives for Ferry Terminal to North Shore Shops.

Q13. (a) $6 \times \$1.70 = \$10.20$. (b) \$10.20 is over the \$4.60 concession cap, so the day costs \$4.60. (c) $\$10.20 - \$4.60 = \$5.60$.

Q14. 15:54 to 16:00 is 6 min. 16:00 to 16:15 is 15 min. $6 + 15 = 21$ min, so the trip takes 21 min between those stops — the same as every other row of the table.

Q15. Clock time runs in 60s, so the hours and the minutes cannot be subtracted as two separate decimal numbers. Count on instead: 15:45 to 16:00 is 15 min, 16:00 to 16:15 is 15 min, so the duration is $15 + 15 = 30$ min. Vic's "1 h 30 min" (90 min) is three times too long.

Q16. (a) Read down the Cormorant Bay Station column: after 14:47 the next departure is 15:30. (b) 14:47 to 15:30 is 43 min (13 min to 15:00, then 30 more). (c) Read along that row to Market Square: 15:35.

Q17. (a) $48 \div 100 = 0.48$, and $0.48 \times 7.5 = 3.6$ L; $3.6 \times \$1.85 = \$6.66$ exactly. (b) $\$6.66 + \$12.00 = \$18.66$. (c) The train is $2 \times \$3.40 = \$6.80$; the saving is $\$18.66 - \$6.80 = \$11.86$.

Q18. (a) The 11:30 ferry arrives at 11:50. (b) 11:50 to 17:30 is 5 h 40 min (10 min to 12:00, 5 h to 17:00, 30 min to 17:30), which is 340 min. (c) $2 \times \$7.60 + \$4.20 = \$15.20 + \$4.20 = \$19.40$.

Chapter 5 Systematics — 5E Adjusting inputs to optimise outputs

Theory

About the data in this section. The shops, apps, fares, rates and prices 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.

The same parcel costs \$11.40 to post one minute and \$8.20 the next — same jumper, same post office, same service. What changed? Josie packed it in a lighter box, so the weight she typed into the postage calculator went down. A small change to what you put **in** can give you a much better answer coming **out**. That is what this section is about.

In the study design (Unit 2, Area of Study 8), this section builds one skill: changing the inputs you control (the variables) so that the output, or the answer, is as good as it can be, in everyday situations.

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

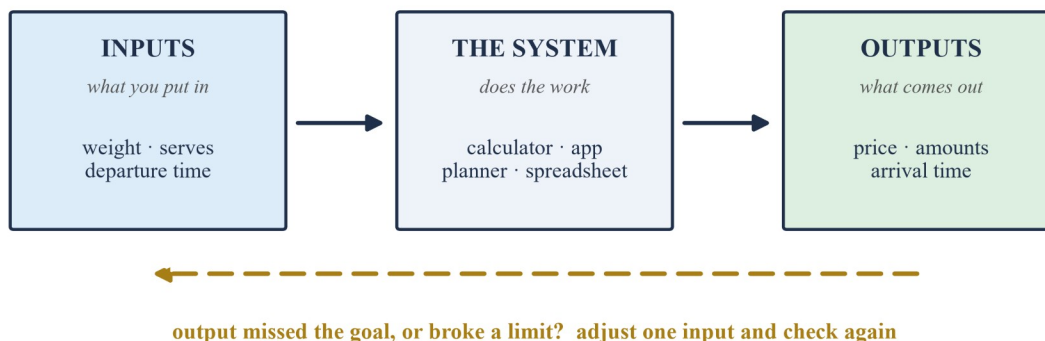
What this section covers.

Inputs, outputs and variables; what *adjust* and *optimise* mean; the adjust-and-check loop; trial tables for finding the best choice inside a limit; which way an output will move when you change an input; and why you should always ask whether an output is reasonable.

Inputs, outputs and variables.

A **system** is anything that takes what you give it and hands back an answer: an online postage calculator, a recipe app, a bus trip planner, a spreadsheet. What you put in is an **input**. What comes out is an **output**. An input that you are free to change is a **variable** — the weight you type, the number of serves you choose, the departure time you pick.

A system: inputs in, outputs out — and you can adjust



Adjust and optimise.

To **adjust** means to change the value of an input. To **optimise** means to adjust the inputs so the output is as good as it can be for your purpose. Your purpose is the **goal** — for example: the cheapest price, the fastest delivery, the best value, or just the right amount with nothing wasted.

Real problems usually come with a **limit** too: a most-you-can-spend (a **budget**), or a latest-you-must-arrive-by time. The best choice serves the goal *and* still fits inside every limit — it is not simply the smallest or the biggest number. The cheapest courier is no good if the parcel arrives after the birthday.

Every optimising job: a goal and its limits

GOAL — what you want

the cheapest price
the fastest delivery
the best value
just enough — nothing wasted

LIMIT — what you must stay inside

budget: a most you can spend
deadline: a latest you must
arrive by
*whole things only: no half-trays,
no 14.8 people*

The best choice serves the goal AND fits inside every limit.

The adjust-and-check loop.

Three steps, and you go around them as many times as you need:

1. Put in your inputs. Read the output.
2. If the output misses the goal, or breaks a limit, change **one** input.
3. Check the new output. Compare it with the old one. Better? Keep it. Worse? Change it back.

Change one input at a time. Then you know exactly which change did the work.

Trial tables.

When there are only a few values to choose from, lay the tries out in a table — one row per try. Say juice cartons cost \$3.50 each, your budget is \$20, and the goal is as many cartons as possible. The trial table in the figure tries 4 cartons (\$14.00 — fits), 5 cartons (\$17.50 — fits, and the most so far) and 6 cartons (\$21.00 — over budget). The best try is **5 cartons**: the most you can buy that still fits inside the limit.

Trial table: juice cartons at \$3.50 each, budget \$20

Try	Cartons	Total cost	Fits the \$20 budget?
1	4	\$14.00	yes — fits
2	5	\$17.50	yes — fits
3	6	\$21.00	no — over budget

Best try: 5 cartons — the most that still fits inside the limit.

A trial table needs no technology at all — pen, paper and a calculator do the same job.

Which way will the output move?

Everyday systems move in ways you can expect, so you can choose the right direction to adjust before you even try:

Adjust the input like this...

more pizzas, more guests, more copies

a heavier parcel

travel outside the busy peak times

fewer colour pages

a lighter box, a smaller size, pick-up instead of delivery

...and the output usually does this

total cost goes up

postage goes up

fare goes down

printing bill goes down

total cost goes down

Refresher — total cost.

Total cost = price for one $\times$ how many, plus any fixed extra. A **fixed extra** (like a delivery fee) does not change with the number you buy. Three pizzas at \$12.50 each, plus \$4.00 delivery: $3 \times \$12.50 = \$37.50$, then $\$37.50 + \$4.00 = \$41.50$ in total.

Refresher — unit price and best value.

To compare deals of different sizes, work out the price for **one** unit: total cost $\div$ number of units, usually to the nearest cent. Six eggs for \$4.80: $\$4.80 \div 6 = \$0.80$ per egg. The **better value** is the deal with the lower unit price. Rates work the same way: “\$2.80 per kg” is the price of one kilogram; “8 L/100 km” is the fuel a car uses for each 100 km.

Refresher — grams and kilograms.

1 kg = 1000 g. To change grams to kilograms, divide by 1000 (move the decimal point three places left): 500 g = 0.5 kg, 250 g = 0.25 kg, 1200 g = 1.2 kg. To change kilograms to grams, multiply by 1000: 2.25 kg = 2250 g.

Refresher — percentage off.

“20% off \$45” means: find 20% of \$45, then subtract it. $0.2 \times 45 = 9$, so you pay $\$45 - \$9 = \$36$. Shortcut: paying 20% less is paying 80% of the price, and $0.8 \times 45 = 36$ — the same answer.

Whole things only.

Some answers have to be whole numbers. You cannot buy 4.7 trays of seedlings, and you cannot cook for 14.8 people. When an answer must fit a limit, test the whole numbers on either side of your calculation and keep the best one that still fits.

Is the output reasonable?

A wrong input gives a wrong output — and apps do not warn you. Type 50 instead of 5 and a recipe app happily tells you to buy 6.25 kg of rice. Before you act on any output, ask: **does this make sense?** A silly output usually points back to a mistyped input.

Technology does the loop faster.

Online calculators, apps and spreadsheets are built for adjust-and-check. A spreadsheet keeps every try in one place: inputs down one column, a formula like $=A2 * 3.5$ in the next column copied down, and each row is one try — the outputs update themselves when you change an input. Planners and estimators do the same job on a phone. And remember: everything in this section can also be done with pen, paper and a basic calculator. The trial table is the same maths either way.

Units 3 & 4 preview. In Units 3 and 4, adjusting inputs grows into formal projects that weigh several limits against each other — not in this book, and not in its tests.

Worked examples

Example 1 — scaffolded

Josie is posting a winter jumper to her cousin. She uses the PostPal online postage calculator: she types in the parcel’s weight and picks a service, and PostPal shows the price and the delivery time.

PostPal postage calculator — same jumper, lighter box



Made-up data: the PostPal calculator and every price and time here are made up for this section.

Here is PostPal’s rate card. **Business days** are weekdays — Monday to Friday.

Parcel weight	Standard (4–6 business days)	Express (1–2 business days)
up to 500 g	\$8.20	\$13.50
over 500 g, up to 1 kg	\$11.40	\$18.20
over 1 kg, up to 2 kg	\$14.90	\$23.60

The jumper and its box weigh 950 g. (a) Josie picks Standard. What price does PostPal show? (b) She repacks the jumper in a lighter box, and the new weight is 480 g. What is the Standard price now, and how much does Josie save? (c) Her cousin needs the jumper within 2 business days. Which service must Josie pick for the 950 g parcel, and what does it cost?

Working	Comment
Purpose and question(s): post a parcel as cheaply as possible, then meet a time limit. Questions: the Standard price at 950 g; the Standard price at 480 g and the saving; the service and price for delivery within 2 business days.	The goal is the lowest cost; in (c) there is also a time limit.
Mathematics in the context: the input is the weight; the outputs are the price and the delivery time. Find the weight band, then read the price off the rate card.	Change one input at a time — in (b) only the weight changes.
Step 1: 950 g is over 500 g and up to 1 kg, so Standard costs \$11.40 .	Follow the weight across to the right band of the rate card.
Step 2: 480 g is up to 500 g, so Standard now costs \$8.20 . Saving: $\$11.40 - \$8.20 = \$3.20$.	A lighter parcel drops into a cheaper band.
Step 3: “within 2 business days” means Express. At 950 g, Express costs \$18.20 .	The time limit rules out Standard — it takes 4–6 business days.
Check: a lighter parcel on the same service gave a lower price — the output moved the way the rate card says it should. \$8.20, \$11.40 and \$18.20 all match their bands.	Re-read the band you land in before you write the answer.

At 950 g, Standard costs \$11.40; repacking to 480 g drops the price to \$8.20, saving \$3.20; delivery within 2 business days means Express, at \$18.20.

Example 2 — scaffolded

Bruno is cooking pasta bake for his footy club's dinner. He uses the MixBowl recipe app: the input is the number of serves, and the outputs are the ingredient amounts and an estimated cost.

MixBowl recipe app — pasta bake



Bruno adjusts the serves input — every output moves with it.

Made-up data: the MixBowl app and every amount and price here are made up for this section.

For 6 serves, the app shows 750 g of pasta and an estimated cost of \$24.30. The outputs scale with the input: double the serves and every output doubles. (a) Bruno types in 18 serves. How much pasta does the app show — in grams, and in kilograms? What is the estimated cost? (b) The club's food budget is \$90. Does 18 serves fit inside it? (c) For a smaller night, the budget is only \$60. What is the greatest whole number of serves Bruno can type in and stay inside the budget? Show your check.

Working

Comment

Purpose and question(s): scale a recipe up to a crowd, then fit it to a budget. Questions: pasta and cost for 18 serves; does \$90 cover it; the greatest whole serves inside \$60.

Goal: enough food for everyone. Limit: the budget.

Mathematics in the context: 6 serves → 750 g pasta and \$24.30. Cost for one serve: $\$24.30 \div 6 = \$4.05$.

The per-serve cost is the key number for the budget questions.

Step 1: $18 = 3 \times 6$, so every output times 3. Pasta: $3 \times 750 = 2250$ g, which is **2.25 kg**. Cost: $3 \times \$24.30 = \$72.90$.

Grams to kilograms: divide by 1000 (see the Refresher).

Step 2: \$72.90 is less than \$90, so **yes** — 18 serves fit, with \$17.10 to spare.

Compare the output with the limit.

Step 3: try 14 serves: $14 \times \$4.05 = \$56.70$ — fits, with \$3.30 to spare. Try 15 serves: $15 \times \$4.05 = \$60.75$ — over \$60. So the greatest whole number is **14 serves**.

Serves are whole things only — test the whole numbers on either side.

Check: 14 fits and 15 breaks the budget, so 14 really is the greatest whole number of serves. More serves always costs more, so nothing between 14 and 15 was missed.

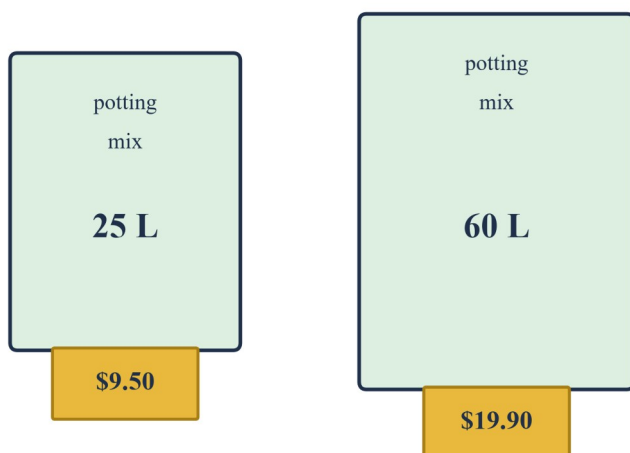
The outputs move in step with the input.

For 18 serves the app shows 2250 g (2.25 kg) of pasta at \$72.90, which fits the \$90 budget; with only \$60 to spend, 14 serves is the greatest whole number that fits, at \$56.70 — 15 serves would cost \$60.75.

Example 3 — unscaffolded

The Green Yards Garden Supply website lets Maree buy potting mix two ways: a 25 L bag for \$9.50, or a 60 L bag for \$19.90. (L stands for litres.)

Green Yards Garden Supply — potting mix



Made-up data: Green Yards and every price here are made up for this section.

- (a) Find the price per litre of each bag, to the nearest cent. (b) Which bag is the better value? (c) Maree needs 120 L, and bags are only sold whole. Find the cost of covering 120 L with only 25 L bags, and with only 60 L bags, and say which way she should buy.
- (b) Price per litre = total cost $\div$ number of litres. For the 25 L bag: $\$9.50 \div 25 = \$0.38$ per litre. For the 60 L bag: $\$19.90 \div 60 = \$0.3316\dots$, which is **\$0.33** per litre to the nearest cent.
- (c) \$0.33 per litre is less than \$0.38 per litre, so the **60 L bag** is the better value.
- (d) Only 25 L bags: $120 \div 25 = 4.8$, so Maree needs 5 whole bags ($5 \times 25 = 125$ L), and $5 \times \$9.50 = \$47.50$. Only 60 L bags: $120 \div 60 = 2$ bags exactly, and $2 \times \$19.90 = \$39.80$. \$39.80 is less than \$47.50 — by \$7.70.
- $\therefore$ (a) \$0.38 per litre for the 25 L bag and \$0.33 per litre for the 60 L bag (to the nearest cent); (b) the 60 L bag is the better value; (c) two 60 L bags for \$39.80 — \$7.70 cheaper than five 25 L bags.

Example 4 — unscaffolded

Huong catches the Creeklink bus to class. On the Creeklink trip planner, the input is the departure time and the outputs are the arrival time and the fare. The fare depends on when the bus leaves: a bus leaving between 7:00 am and 8:59 am costs the **peak** fare of \$6.40; a bus leaving at any other time costs the **off-peak** fare of \$4.10.

Creeklink trip planner

To: class · Morning services	
departs 7:55 am arrives 8:38 am	peak \$6.40
departs 9:10 am arrives 9:53 am	off-peak \$4.10
buses leaving 7:00–8:59 am cost the peak fare	

Made-up data: Creeklink Buses, its planner and every time and fare here are made up for this section.

Huong must be at class by 9:30 am. (a) Can she catch the cheaper 9:10 am bus? Explain. (b) Which bus does she catch, and what fare does she pay? (c) Next term, class starts at 10:00 am instead. Can Huong catch the 9:10 am bus then, and how much does she save each trip?

- (a) No. The 9:10 am bus arrives at 9:53 am, which is after 9:30 am — the cheaper fare is no use if the bus is late.
- (b) The 7:55 am bus arrives at 8:38 am, which is before 9:30 am, so Huong catches it. It leaves inside the 7:00–8:59 am peak window, so she pays the peak fare of \$6.40.
- (c) With a 10:00 am start, 9:53 am is before 10:00 am, so the 9:10 am bus now works. The saving each trip is $\$6.40 - \$4.10 = \$2.30$. One limit changed — the start time — and that changed which input was the best one.

∴ (a) no — it arrives at 9:53 am, after 9:30 am; (b) the 7:55 am bus, peak fare \$6.40; (c) yes — it arrives before 10:00 am, saving \$2.30 each trip.

Practice questions

Scaffolded

Q1. A system takes inputs and gives outputs. (a) Sort these four items into inputs and outputs: the parcel weight you type into a postage calculator; the price the calculator shows; the number of serves you choose in a recipe app; the arrival time a trip planner shows. (b) What is a variable? (c) Finish this sentence in your own words: “To optimise an output means to adjust the inputs so that ...”

Q2. An online pizza site takes the number of pizzas as an input and shows the total cost as an output. Today a banner offers \$5 off every order.

Made-up data: the pizza site and its \$5 offer are made up for this section.

- (a) You adjust the number of pizzas from 4 to 6. Does the total cost go up or down?
- (b) With the \$5-off banner, does the cost of the same 4 pizzas go up or down?
- (c) Name one other input change that would make the total cost lower.

Q3. Wave Mobile’s online estimator recommends a phone plan from the data you use each month. (GB is a measure of how much data you use — video uses lots of GB, messages use hardly any.)

Plan	Data each month	Cost each month
Small	up to 5 GB	\$19
Medium	up to 15 GB	\$29
Large	up to 30 GB	\$39

Made-up data: Wave Mobile, its plans and every price here are made up for this section.

Angus uses about 12 GB each month. (a) Which is the cheapest plan that covers 12 GB? (b) What does it cost each month? (c) Angus adjusts his habits — less video, more messages — and now uses only 5 GB a month. How much does he save each month by moving down to Small?

Q4. The MixBowl app shows this panel for an easy pasta recipe.

MixBowl recipe panel

Easy pasta

the app shows:

the app shows:

serves: 4

pasta400 g

sauce500 g

cheese120 g

Made-up data: the MixBowl app and every amount here are made up for this section.

- (a) Bruno adjusts the serves input to 8. How many grams of pasta does the app show? (b) Write that amount in kilograms. (c) What does the app show for pasta when the input is 2 serves?

Q5. At the Stone Oven Pizzeria online order page, each large pizza costs \$14.50 and delivery costs \$3.00.

Made-up data: the Stone Oven Pizzeria and every price here are made up for this section.

Vicki is ordering dinner. (a) Find the total cost of 2 large pizzas with delivery. (b) Find the total cost of 3 large pizzas with delivery. (c) Vicki has \$40. How much more money does she need for 3 large pizzas with delivery?

Q6. Paperbark Printers charges \$0.15 per page for black-and-white copies. Today the website banner shows 20% off every order.

Made-up data: Paperbark Printers and every price here are made up for this section.

Nell prints 100 pages. (a) Find the cost before the discount. (b) Find the value of the 20% discount. (c) Find the price after the discount.

Unscaffolded

Q7. Ivo posts a 1.6 kg parcel with PostPal, using the rate card from Example 1 (repeated below).

Parcel weight	Standard (4–6 business days)	Express (1–2 business days)
up to 500 g	\$8.20	\$13.50
over 500 g, up to 1 kg	\$11.40	\$18.20
over 1 kg, up to 2 kg	\$14.90	\$23.60

Made-up data: the PostPal rate card and every price here are made up for this section.

- (a) What does Standard postage cost? (b) What does Express cost? (c) How much does Ivo save by choosing Standard, and when would Express be the better choice?

Q8. The MixBowl app shows 125 g of rice per serve for Bruno’s favourite curry. He wants 5 serves, but he types the serves input as 50 by mistake.

Made-up data: the MixBowl app and every amount here are made up for this section.

- (a) What weight of rice does the app show for the input 50 — in grams, and in kilograms? (b) What is the correct output for 5 serves — in grams, and in kilograms? (c) Which number in the app’s output should have told Bruno about the mistake? Explain in one sentence.

Q9. The Cobble Creek supermarket sells rice two ways: a 2 kg bag for \$5.60, or a 500 g pack for \$1.75.

Made-up data: the supermarket and every price here are made up for this section.

- (a) Find the price per kilogram of the 2 kg bag. (b) Find the price per kilogram of the 500 g pack. (c) Which is the better value, and how much does it save per kilogram?

Q10. Green Yards sells seedling trays for \$8.50 a tray, with 10 seedlings in each tray. Josie has \$40 to spend, and trays are only sold whole.

Made-up data: Green Yards and every price here are made up for this section.

- (a) What is the greatest number of whole trays Josie can buy? (b) How many seedlings does she get? (c) How much of her budget is left over?

Q11. On Creeklink Buses, a peak single fare is \$6.40, and a weekly pass covering all peak rides from Monday to Friday costs \$24.00. Huong rides to work and back at peak times.

Made-up data: Creeklink Buses and every fare here are made up for this section.

- (a) Find the cost of 5 peak single fares. (b) Which is cheaper for 5 rides — singles or the weekly pass — and by how much? (c) In a week with only 3 rides, find the cost of 3 single fares, and say which is cheaper now.

Q12. Paperbark Printers charges \$0.45 per colour page and \$0.12 per black-and-white page. Maree prints a 40-page booklet; 8 of the pages are photos.

Made-up data: Paperbark Printers and every price here are made up for this section.

- (a) Find the cost of printing all 40 pages in black-and-white. (b) Find the cost of printing all 40 pages in colour. (c) Maree adjusts the order: the 8 photo pages in colour, the other 32 pages in black-and-white. Find the total cost, and the saving against all-colour.

Q13. Angus mows lawns. He prices each job with a spreadsheet: the charge is the hours times \$28, plus a \$9 call-out fee. His sheet looks like this.

Angus's mowing-price sheet

	A	B
1	hours	charge (\$)
2	1	37
3	2	?
4	3	93
5	4	121

the rule for column B is the same in every row — find it

Made-up data: Angus's rates and every number in the sheet are made up for this section.

- (a) Find the missing charge for a 2-hour job. (b) The same rule fills in every row of column B. Complete it: charge = hours $\times$... + ... (c) One customer will pay at most \$100. What is the greatest whole number of hours Angus can work for that customer?

Q14. The MixBowl app estimates a 6-serve vegetable risotto at \$15.30. Huong is cooking for her family.

Made-up data: the MixBowl app and every price here are made up for this section.

- (a) Find the estimated cost per serve. (b) Huong has \$20 to spend. What is the greatest whole number of serves she can cook? Check what the next whole number of serves would cost. (c) If Huong wants exactly 10 serves, find the estimated cost, and say whether \$20 is enough.

Q15. Bruno is planning a 250 km trip with an online trip calculator. The inputs are the distance (250 km), his car's fuel use (8 L/100 km — the car uses 8 litres for every 100 km) and the fuel price (\$1.86 per litre).

Trip calculator

Inputs	
distance	250 km
fuel use	8 L/100 km
fuel price	\$1.86 per litre
fuel needed: ? L fuel cost: \$?	

Made-up data: the trip calculator and every number here are made up for this section.

- (a) How many litres of fuel does the trip need? (b) Find the fuel cost of the trip. (c) After a service, the car uses only 7 L/100 km. Find the new fuel cost, and the saving.

Q16. The Cobble Creek Couriers website offers three delivery speeds: same-day \$15.00 (arrives today), next-day \$9.00 (arrives tomorrow), and 3-day \$5.50 (arrives in three days). Angus is posting a birthday present that must arrive within 2 days — today or tomorrow.

Made-up data: Cobble Creek Couriers and every price here are made up for this section.

- (a) Which option is the cheapest overall, and what does it cost? (b) Which options meet the 2-day limit? (c) Which is the cheapest option that meets the limit, and how much does it save against same-day?

Q17. At the Stone Oven Pizzeria order page: large pizza \$13.80, small pizza \$9.90, delivery \$3.50, pick-up \$0, garlic bread \$4.50. Nell's total is more than she wants to spend.

Made-up data: the Stone Oven Pizzeria and every price here are made up for this section.

- (a) From this list, choose two changes that would make the total lower: order one fewer pizza · change delivery to pick-up · add garlic bread · swap a large for a small. (b) Which change in that list makes the total higher? (c) Nell's cart holds 2 large pizzas with delivery. Find the total, then find the total with pick-up instead, and the saving.

Q18. The Cobble Creek Community Hall online booking form takes two inputs: the hours you hire the hall (\$35 per hour) and whether you add the kitchen (a flat \$20). The output is the total cost. Josie is booking for a market-day lunch.

Made-up data: the hall, its rates and every price here are made up for this section.

- (a) Find the cost of 3 hours without the kitchen. (b) Find the cost of 3 hours with the kitchen. (c) Josie's budget is \$150. Find the cost of 4 hours with the kitchen, say whether it fits the budget, and give the greatest whole number of hours with the kitchen that does fit.
-

Answers

Q1. (a) inputs: the weight you type, the number of serves you choose; outputs: the price shown, the arrival time shown. (b) an input you are free to change. (c) the output is as good as it can be for your goal (cheapest, fastest, best value, just enough) while still fitting your limits. **Q2.** (a) up. (b) down. (c) order fewer pizzas (or choose pick-up, or a smaller size). **Q3.** (a) Medium. (b) \$29 each month. (c) \$10.00 each month. **Q4.** (a) 800 g. (b) 0.8 kg. (c) 200 g. **Q5.** (a) \$32.00. (b) \$46.50. (c) \$6.50 more. **Q6.** (a) \$15.00. (b) \$3.00. (c) \$12.00. **Q7.** (a) \$14.90. (b) \$23.60. (c) \$8.70; Express is the better choice when the parcel must arrive within 1–2 business days. **Q8.** (a) $6250\text{ g} = 6.25\text{ kg}$. (b) $625\text{ g} = 0.625\text{ kg}$. (c) 6.25 kg of rice for 5 people is silly — an output far too big points to an input far too big. **Q9.** (a) \$2.80 per kg. (b) \$3.50 per kg. (c) the 2 kg bag, saving \$0.70 per kg. **Q10.** (a) 4 trays. (b) 40 seedlings. (c) \$6.00. **Q11.** (a) \$32.00. (b) the weekly pass, by \$8.00. (c) \$19.20 — singles are cheaper for 3 rides. **Q12.** (a) \$4.80. (b) \$18.00. (c) \$7.44; saving \$10.56. **Q13.** (a) \$65. (b) charge = hours $\times$ 28 + 9. (c) 3 hours (\$93; 4 hours would be \$121). **Q14.** (a) \$2.55. (b) 7 serves (\$17.85; 8 serves would cost \$20.40). (c) \$25.50 — no, \$20 is \$5.50 short. **Q15.** (a) 20 L. (b) \$37.20. (c) \$32.55, saving \$4.65. **Q16.** (a) 3-day, \$5.50. (b) same-day and next-day. (c) next-day, \$9.00 — \$6.00 less than same-day. **Q17.** (a) any two of: order one fewer pizza; change delivery to pick-up; swap a large for a small. (b) add garlic bread. (c) \$31.10; \$27.60; saving \$3.50. **Q18.** (a) \$105. (b) \$125. (c) \$160 — no, it does not fit; 3 hours with the kitchen (\$125) does.

Fully-worked solutions

Q1. (a) Inputs (what you put in): the parcel weight you type, the number of serves you choose. Outputs (what comes out): the price the calculator shows, the arrival time the planner shows. (b) A **variable** is an input you are free to change — like the weight, the serves or the departure time. (c) For example: “...the output is as good as it can be for your goal — the cheapest price, the fastest time, the best value, or just the right amount — while still fitting inside your limits.”

Q2. (a) **Up** — more pizzas means a bigger total. (b) **Down** — the banner takes \$5 off the total for the same order. (c) For example: order fewer pizzas, choose pick-up instead of delivery, or choose a smaller size. Any one of these lowers the total.

Q3. (a) 12 GB is more than 5 GB, so Small does not cover it. Medium covers up to 15 GB, and Large covers more than Angus needs — so **Medium** is the cheapest plan that covers 12 GB. (b) Medium costs **\$29** each month. (c) 5 GB fits inside Small (\$19). Saving: $\$29 - \$19 = \$10.00$ each month.

Q4. (a) The panel shows 400 g of pasta for 4 serves, so the app uses 100 g per serve. For 8 serves: $8 \times 100 = 800\text{ g}$ (double the serves, double the pasta: $2 \times 400 = 800$). (b) Grams to kilograms: divide by 1000. $800 \div 1000 = 0.8\text{ kg}$. (c) 2 serves is half of 4 serves: $400 \div 2 = 200\text{ g}$.

Q5. (a) $2 \times \$14.50 = \$29.00$; add the \$3.00 delivery: $\$29.00 + \$3.00 = \$32.00$. (b) $3 \times \$14.50 = \$43.50$; add delivery: $\$43.50 + \$3.00 = \$46.50$. (c) $\$46.50 - \$40.00 = \$6.50$ — Vicki needs \$6.50 more.

Q6. (a) $100 \times \$0.15 = \$15.00$. (b) 20% of \$15.00: $0.2 \times 15 = 3$, so the discount is **\$3.00**. (c) $\$15.00 - \$3.00 = \$12.00$.

Q7. (a) 1.6 kg is over 1 kg and up to 2 kg, so Standard costs **\$14.90**. (b) In the same band, Express costs **\$23.60**. (c) Saving: $\$23.60 - \$14.90 = \$8.70$. Express is the better choice when the parcel must arrive within 1–2 business days — when the time limit matters more than the price.

Q8. (a) For the input 50: $50 \times 125 = 6250\text{ g}$, and $6250 \div 1000 = 6.25\text{ kg}$ of rice. (b) For 5 serves: $5 \times 125 = 625\text{ g}$, which is **0.625 kg**. (c) The 6.25 kg — that much rice would feed about 50 people, not one family dinner. An output far too big points to an input far too big: Bruno typed one extra zero (50 instead of 5).

Q9. (a) $\$5.60 \div 2 = \$2.80$ per kg. (b) 500 g is 0.5 kg, so $\$1.75 \div 0.5 = \$3.50$ per kg. (Easier: two 500 g packs make 1 kg, so double the price — $2 \times \$1.75 = \$3.50$.) (c) \$2.80 per kg is less than \$3.50 per kg, so the **2 kg bag** is the better value. Saving: $\$3.50 - \$2.80 = \$0.70$ per kg.

Q10. (a) Try 4 trays: $4 \times \$8.50 = \$34.00$ — fits inside \$40. Try 5 trays: $5 \times \$8.50 = \$42.50$ — over \$40. So the greatest whole number is **4 trays**. (b) $4 \times 10 = 40$ seedlings. (c) $\$40.00 - \$34.00 = \$6.00$ left over.

Q11. (a) $5 \times \$6.40 = \$32.00$. (b) The weekly pass costs \$24.00, which is less than \$32.00 — the **pass** is cheaper, by $\$32.00 - \$24.00 = \$8.00$. (c) $3 \times \$6.40 = \$19.20$. \$19.20 is less than \$24.00, so with only 3 rides the **singles** are cheaper now — as the rides input drops, the best choice changes.

Q12. (a) $40 \times \$0.12 = \$4.80$. (b) $40 \times \$0.45 = \$18.00$. (c) Photos: $8 \times \$0.45 = \$3.60$. Rest: $32 \times \$0.12 = \$3.84$. Total: $\$3.60 + \$3.84 = \$7.44$. Saving against all-colour: $\$18.00 - \$7.44 = \$10.56$.

Q13. (a) $2 \times \$28 = \$56$; add the \$9 call-out fee: $\$56 + \$9 = \$65$. (b) charge = hours $\times$ **28** + **9** (in the sheet, a cell formula like =A2*28+9 copied down does this automatically). (c) 3 hours: $3 \times 28 + 9 = \$93$ — fits inside \$100. 4 hours: $4 \times 28 + 9 = \$121$ — over \$100. So the greatest whole number is **3 hours**.

Q14. (a) $\$15.30 \div 6 = \$2.55$ per serve. (b) Try 7 serves: $7 \times \$2.55 = \$17.85$ — fits inside \$20 (with \$2.15 to spare). The next whole number, 8: $8 \times \$2.55 = \$20.40$ — over \$20. So the greatest whole number is **7 serves**. (c) $10 \times \$2.55 = \$25.50$. \$25.50 is more than \$20, so **\$20 is not enough** — Huong is short by $\$25.50 - \$20.00 = \$5.50$.

Q15. (a) The trip is 250 km, and 8 L are used for each 100 km: $250 \div 100 = 2.5$, and $2.5 \times 8 = 20$ L. (b) $20 \times \$1.86 = \$37.20$. (c) At 7 L/100 km: $2.5 \times 7 = 17.5$ L, and $17.5 \times \$1.86 = \$32.55$. Saving: $\$37.20 - \$32.55 = \$4.65$ — adjusting one input (the fuel use) made the output (the cost) smaller.

Q16. (a) The **3-day** option is the cheapest overall, at **\$5.50**. (b) “Within 2 days” means the present arrives today or tomorrow: **same-day (\$15.00) and next-day (\$9.00)** meet the limit. The 3-day option arrives in three days — too slow. (c) Of the two options that fit, next-day (\$9.00) is cheaper: **next-day**, saving $\$15.00 - \$9.00 = \$6.00$ against same-day.

Q17. (a) Two of: **order one fewer pizza** (fewer pizzas, lower total); **change delivery to pick-up** (the \$3.50 delivery fee comes off); **swap a large for a small** (\$13.80 becomes \$9.90, so the total drops). (b) **Add garlic bread** — it adds \$4.50, so the total goes up. (c) Cart: $2 \times \$13.80 = \$27.60$; with delivery: $\$27.60 + \$3.50 = \$31.10$. With pick-up: $\$27.60 + \$0 = \$27.60$. Saving: $\$31.10 - \$27.60 = \$3.50$.

Q18. (a) $3 \times \$35 = \$105$. (b) $\$105 + \$20 = \$125$. (c) 4 hours with the kitchen: $4 \times \$35 = \$140$, and $\$140 + \$20 = \$160$. \$160 is more than \$150, so it **does not fit**. 3 hours with the kitchen costs \$125, which fits inside \$150 — so the greatest whole number of hours with the kitchen is **3 hours**.

Chapter 05 — Test A (multiple choice)

Chapter 5 Systematics (Sections 5A–5E). Allowed materials: pen, paper and a basic calculator. Section A: 12 questions (12 marks). Time: about 20 minutes.

About the data in this test. Every name, place, machine, timetable and number in this test is **made up** (not real). They are built for this book so you can practise the mathematics from Chapter 5. Nothing here is real data about a real person, business or place.

Section A — Multiple-choice questions

Choose the response that is correct for the question.

Question 1

At a self-order kiosk, a customer types an order on the screen, taps a card to pay, and collects a printed receipt. Which one of these is an output of the kiosk system?

- A. The order typed on the screen
- B. The card tapped on the reader
- C. The receipt printed by the kiosk
- D. The drink chosen from the menu

Question 2

At the Corner Crate deli, cheese costs \$4.70 per kg. Hana buys 0.85 kg of cheese. How much does the cheese cost, to the nearest cent?

- A. \$3.99
- B. \$4.00
- C. \$5.55
- D. \$39.95

Question 3

Owen parks at the Chapel Street car park at 10:40 am and pays for 3 hours. What expiry time should his ticket show?

- A. 1:40 pm
- B. 1:40 am
- C. 2:40 pm
- D. 7:40 am

Question 4

The Singing Kettle cafe keeps its weekly sales in a spreadsheet. Each row is one daily special, with its name and the number sold. Priya wants the best-selling special in the top row. Which sort should she use?

- A. Sort the Name column from A to Z
- B. Sort the number sold from smallest to largest, moving whole rows
- C. Sort only the number-sold column from largest to smallest, leaving the names where they are
- D. Sort the number sold from largest to smallest, moving whole rows

Question 5

Three bags of potting mix weigh 3.4 kg, 3.04 kg and 3.44 kg. Which list shows the bags in order from lightest to heaviest?

- A. 3.4 kg, 3.04 kg, 3.44 kg
- B. 3.04 kg, 3.4 kg, 3.44 kg
- C. 3.44 kg, 3.4 kg, 3.04 kg
- D. 3.04 kg, 3.44 kg, 3.4 kg

Question 6

The Coolibah Creek Fun Run results sheet is sorted by finish time, from smallest to largest: 23.8, 25.1, 27.6, 29.4, 30.3 and 32.0 minutes. How many runners finished in under 28 minutes?

- A. 2
- B. 4
- C. 6
- D. 3

Question 7

Sam starts a job at 14:40 and finishes at 15:25. How long did the job take?

- A. 15 minutes
- B. 45 minutes
- C. 75 minutes
- D. 85 minutes

Question 8

Rosa's Saturday shift at Brindley's Garden Centre runs from 9:00 am to 1:30 pm. How long is the shift, in decimal hours?

- A. 4.25 h
- B. 4.3 h
- C. 4.5 h
- D. 3.5 h

Question 9

The Route 47 bus timetable is shown below. Each trip takes the same time between stops. How long does a trip take from Harbour Pde to Summit Shops?

Service	Harbour Pde	Jetty Rd	Cliff St	Summit Shops
Trip 1	07:50	07:56	08:04	08:12
Trip 2	08:20	08:26	08:34	08:42
Trip 3	08:50	08:56	09:04	09:12

Made-up data: the bus route and the times in this table are made up for this test.

- A. 12 minutes
- B. 22 minutes
- C. 62 minutes
- D. 98 minutes

Question 10

In Cobble Creek, one adult bus trip costs \$2.60. A day card caps an adult's total fares at \$7.00 for one day. Ryan takes 3 bus trips on Tuesday. How much does he pay in fares on Tuesday?

- A. \$2.60
- B. \$5.20
- C. \$7.00
- D. \$7.80

Question 11

Muffins at the market cost \$3.20 each, and they are sold only as whole muffins. Nell has \$25 to spend. What is the greatest number of whole muffins Nell can buy?

- A. 6
- B. 7.81
- C. 8
- D. 7

Question 12

Cobble Creek Foods sells pasta in two sizes: a 3 kg bag for \$7.20, and a 1 kg box for \$2.90. Which is the better value, and what is its price per kg, to the nearest cent?

- A. The 3 kg bag — \$2.40 per kg
- B. The 1 kg box — \$2.90 per kg
- C. The 3 kg bag — \$7.20 per kg
- D. The 1 kg box — \$2.40 per kg

End of Section A

Test A — Answers

Que stio n	1	2	3	4	5	6	7	8	9	10	11	12
Ans wer	C	B	A	D	B	D	B	C	B	C	D	A

Test A — Fully-worked solutions

Question	Answer	Working
1	C	Inputs are what the customer puts in; outputs are what the system gives back. The typed order, the tapped card and the chosen drink are all inputs. The kiosk prints the receipt and hands it back, so the printed receipt is the output.
2	B	Cost = weight $\times$ price per kg: $\$4.70 \times 0.85 = \$3.995$. Round to the nearest cent — the third decimal digit is 5, so round up: \$4.00. Option A rounds down instead of up; option C adds the two numbers instead of multiplying them ($\$4.70 + \$0.85 = \$5.55$); option D puts the decimal point one place to the right.
3	A	Count on 3 hours from 10:40 am: 11:40 am, 12:40 pm, 1:40 pm. Option B is the wrong half of the day; option C converts 13:40 by subtracting 11 instead of 12; option D subtracts 3 hours instead of adding.
4	D	The biggest number sold must end up on top, so sort from largest to smallest — and a sort must move whole rows, so each number stays beside its special. Option A sorts the wrong column; option B puts the smallest sale on top; option C is the classic mistake — sorting one column on its own splits the numbers from their names.
5	B	Compare place by place. The whole numbers are all 3. The tenths are 0, 4 and 4, so 3.04 is the lightest. For the other two, 3.4 is 3.40, and 40 hundredths is less than 44 hundredths, so 3.4 comes before 3.44. Option A reads the decimals as whole numbers (34, 304, 344); option C is heaviest to lightest; option D compares the last digits instead of the place values.
6	D	The list is already sorted, so read down from the top and stop at the cut-off: 23.8, 25.1 and 27.6 are under 28, and 29.4 is not. That is 3 runners. Option A stops one row too early; option B counts 29.4 as well

Question	Answer	Working
7	B	(that is ‘under 30’, not ‘under 28’); option C counts all six runners. Count on in pieces: 14:40 to 15:00 is 20 minutes, and 15:00 to 15:25 is 25 minutes, so $20 + 25 = 45$ minutes. Option A subtracts the minute numbers only ($40 - 25 = 15$); option C does the hours and minutes separately and gets 1 h 15 min ($60 + 15 = 75$); option D keeps the arrival minutes as extra time and gets 1 h 25 min ($60 + 25 = 85$).
8	C	From 9:00 am to 1:30 pm is 4 hours 30 minutes. Minutes become decimal hours by dividing by 60: $30 \div 60 = 0.5$, so the shift is 4.5 h. Option A slips 30 minutes into 0.25; option B writes 30 minutes as 0.3 — the classic ‘1.45 h’ mistake; option D counts the hours one short.
9	B	Read along any trip: 07:50 to 08:12. Count on: 10 minutes to 08:00, then 12 more, so 22 minutes. Option A reads only the minutes digits of the arrival; option C treats the times as decimals — 8.12 minus 7.50 gives 0.62 — and calls it 62 minutes; option D does the hours and minutes separately — 1 hour and $50 - 12 = 38$ — and gets 1 h 38 min = 98 minutes.
10	C	Without the cap: $3 \times \\$2.60 = \\$7.80$. The cap is the most Ryan pays in one day, and \$7.80 is more than \$7.00, so the cap applies: he pays \$7.00. Option A is the fare for one trip; option B is the fare for two trips; option D ignores the cap.
11	D	Divide: $\\$25.00 \div \\$3.20 = 7.8125$. Muffins come whole, so test the whole numbers either side: $7 \times \\$3.20 = \\$22.40$ — that fits; $8 \times \\$3.20 = \\$25.60$ — that is over \$25. The greatest whole number is 7. Option B is the raw calculator value, which is not a whole number of muffins; option C rounds up and busts the budget; option A rounds down one too many.
12	A	Price per kg = total $\div$ kg. Bag: $\\$7.20 \div 3 = \\$2.40$ per kg. Box:

Question	Answer	Working
		$\\$2.90 \div 1 = \\$2.90$ per kg. \$2.40 is less than \$2.90, so the bag is the better value — a saving of $\\$2.90 - \\$2.40 = \\$0.50$ per kg. Option B picks the box even though its price per kg is higher; option C calls the bag's total price a per-kg price; option D pairs the box with the bag's price per kg.

Chapter 05 — Test B (written response)

Chapter 5 Systematics (Sections 5A–5E). Allowed materials: pen, paper and a basic calculator. Section B: 8 questions (39 marks). Time: about 35 minutes. Show your working for every part. Only round where the question tells you to, and give each rounded answer at the precision asked for.

About the data in this test. Every name, place, machine, timetable and number in this test is **made up** (not real). They are built for this book so you can practise the mathematics from Chapter 5. Nothing here is real data about a real person, business or place.

Section B — Written-response questions

Question 1 (4 marks)

The kiosk at Ferry Stop Cafe prints this receipt for one order. Some of the numbers are missing.

Item	Cost
2 flat whites at \$4.60 each	...
1 muffin	\$3.75
TOTAL	...
CASH	\$20.00
CHANGE	...

Made-up data: the prices in this table are made up for this test.

a. Find the cost of the 2 flat whites. 1 mark

b. Find the TOTAL. 1 mark

c. Find the CHANGE. 2 marks

Question 2 (5 marks)

The machine at the Elm Street car park charges \$3.20 per hour. Mia meant to pay for 2 hours, but she typed the wrong number of hours into the machine. Her ticket cost \$22.40.

a. How many hours did the machine charge Mia for? 2 marks

b. What should the ticket have cost for 2 hours? 1 mark

c. How much more did Mia pay than she needed to? 2 marks

Question 3 (5 marks)

The canteen at Yarran Vale keeps its prices in a spreadsheet.

Item	Price (\$)
Sausage roll	3.95
Iced pole	2.60
Sandwich	6.50
Meat pie	4.80
Coffee	4.20

Made-up data: the prices in this table are made up for this test.

a. Sort the prices from smallest to largest. Write the item names in that order.

2 marks

b. Which item is the dearest, and what does it cost?

1 mark

c. How many items cost \$4.50 or more?

1 mark

d. The sheet also lists three delivery dates: 6/8/2026, 23/7/2026 and 2/8/2026 (day/month/year). Write the dates in order, earliest first.

1 mark

Question 4 (5 marks)

Trevor helps set up Boxwood Community Hall for a Saturday market. The doors open at 10:00. Trevor starts at 07:45 and works through these steps in order.

Step	Job	Time it takes
1	Unlock and turn on the lights	15 minutes
2	Set up the tables and chairs	45 minutes
3	Wait — the mopped floor dries	30 minutes
4	Set out the goods	30 minutes

Made-up data: the jobs and times in this table are made up for this test.

a. At what time does Step 2 finish?

1 mark

b. At what time is the whole setup finished?

2 marks

c. How many spare minutes are there between the setup finishing and the doors opening? 2 marks

Question 5 (5 marks)

Adele works at Marron Motors. Her roster for one weekend is: Friday 17:00 to 20:30, and Saturday 09:00 to 14:00. Her pay rate is \$23.50 per hour.

a. Write the length of each shift in decimal hours. 2 marks

b. Find Adele's total hours for the weekend. 1 mark

c. Find Adele's pay for the weekend, to the nearest cent. 2 marks

Question 6 (5 marks)

Kat catches the Route 47 bus from Harbour Pde. The Monday morning timetable is shown below. Each trip takes the same time between stops.

Service	Harbour Pde	Jetty Rd	Cliff St	Summit Shops
Trip 1	07:50	07:56	08:04	08:12
Trip 2	08:20	08:26	08:34	08:42
Trip 3	08:50	08:56	09:04	09:12

Made-up data: the bus route and the times in this table are made up for this test.

a. Kat must be at Summit Shops by 9:00 am. What is the latest trip she can catch from Harbour Pde? Give the trip number and its departure time. 2 marks

b. Trip 3 arrives at Summit Shops at 09:12. Write this time in 12-hour form. 1 mark

c. How long does a trip take from Jetty Rd to Cliff St? 2 marks

Question 7 (5 marks)

Jo plans a trip with an online fuel calculator. She enters these inputs: distance 320 km, fuel use 6.5 L per 100 km, and fuel price \$1.92 per litre.

- a.** How many litres of fuel will the trip use? 2 marks

- b.** Find the fuel cost for the trip, to the nearest cent. 2 marks

- c.** Use friendly numbers to estimate the cost, and say whether your answer to part b is reasonable. 1 mark

Question 8 (5 marks)

Bruno uses a recipe app. For 4 servings, the app estimates the ingredients will cost \$18.60. Bruno's budget for the meal is \$40.

- a.** Find the estimated cost per serving. 1 mark

- b.** Find the greatest whole number of servings Bruno can make and stay within his \$40 budget. 2 marks

- c.** How much of the \$40 is left over at that number of servings? 1 mark

- d.** Bruno adjusts the servings from 4 to 12. Does the estimated cost go up or go down? Give a reason. 1 mark

End of Section B

Test B — Answers

Q1. (a) \$9.20. (b) \$12.95. (c) \$7.05.

Q2. (a) 7 hours. (b) \$6.40. (c) \$16.00.

Q3. (a) Iced pole, Sausage roll, Coffee, Meat pie, Sandwich. (b) Sandwich, \$6.50. (c) 2 items. (d) 23/7/2026, 2/8/2026, 6/8/2026.

Q4. (a) 08:45. (b) 09:45. (c) 15 min.

Q5. (a) Friday 3.5 h, Saturday 5 h. (b) 8.5 h. (c) \$199.75.

Q6. (a) Trip 2, departing 08:20. (b) 9:12 am. (c) 8 min.

Q7. (a) 20.8 L. (b) \$39.94. (c) About $20 \times \$2.00 = \$40.00$; \$39.94 is close to \$40.00, so the answer is reasonable.

Q8. (a) \$4.65. (b) 8 servings. (c) \$2.80. (d) Up — more servings needs more ingredients, so the estimated cost rises.

Test B — Fully-worked solutions

Question 1.

- a. Cost = number $\times$ price each: $2 \times \$4.60 = \$9.20$. The flat whites cost \$9.20.
- b. Add the item lines: $\$9.20 + \$3.75 = \$12.95$. The TOTAL is \$12.95.
- c. Change = amount paid – total: $\$20.00 - \$12.95 = \$7.05$. The CHANGE is \$7.05. Check by counting up: \$12.95 up to \$13.00 is 5 c, and \$13.00 up to \$20.00 is \$7.00, so \$7.05 altogether.

Question 2.

- a. Work backwards from the output: hours = price $\div$ rate, so $\$22.40 \div \$3.20 = 7$. The machine charged Mia for 7 hours. Check: $7 \times \$3.20 = \$22.40$.
- b. $2 \times \$3.20 = \$6.40$. The ticket should have cost \$6.40.
- c. $\$22.40 - \$6.40 = \$16.00$. Mia paid \$16.00 more than she needed to. A wrong input (7 hours instead of 2) gave a wrong output.

Question 3.

- a. Compare the prices place by place: 2.60, then 3.95, then 4.20, then 4.80, then 6.50. The order is Iced pole, Sausage roll, Coffee, Meat pie, Sandwich.
- b. After the sort, the last row holds the biggest price: the Sandwich, at \$6.50.
- c. \$4.80 and \$6.50 are \$4.50 or more, so the answer is 2 items.
- d. Sort by year, then month, then day — never by the day number on its own. July (month 7) comes before August (month 8), so 23/7/2026 is first. Then, within August, 2 comes before 6. The order is 23/7/2026, 2/8/2026, 6/8/2026.

Question 4.

- a. Step 1: $07:45 + 15 \text{ min} = 08:00$. Step 2: $08:00 + 45 \text{ min} = 08:45$. Step 2 finishes at 08:45.
- b. The wait counts — nobody is working, but the clock still runs. Step 3: $08:45 + 30 \text{ min} = 09:15$. Step 4: $09:15 + 30 \text{ min} = 09:45$. The setup finishes at 09:45.
- c. Count on from 09:45 to 10:00: that is 15 min. There are 15 spare minutes before the doors open.

Question 5.

- a. Finish – start, then minutes $\div$ 60. Friday: $20:30 - 17:00 = 3 \text{ h } 30 \text{ min}$, and $30 \div 60 = 0.5$, so 3.5 h. Saturday: $14:00 - 09:00 = 5 \text{ h}$.
- b. $3.5 + 5 = 8.5 \text{ h}$.
- c. Pay = hours $\times$ rate: $8.5 \times \$23.50 = \$199.75$. Rounded to the nearest cent, the pay is \$199.75 — this value is already exact to the cent.

Question 6.

- a. Read down the Summit Shops column and compare each arrival with 9:00 am. Trip 1 arrives 08:12 — in time. Trip 2 arrives 08:42 — in time. Trip 3 arrives 09:12 — too late. The latest trip Kat can catch is Trip 2, departing 08:20.
- b. 09:12 is before midday, so the 12-hour form is 9:12 am.
- c. Every trip takes the same time, so use any trip. Trip 1: 07:56 to 08:04. Count on: 4 min to 08:00, then 4 more, so 8 min.

Question 7.

- a.** $320 \div 100 = 3.2$ lots of 100 km. Litres = $3.2 \times 6.5 = 20.8$. The trip uses 20.8 L.
- b.** Cost = litres $\times$ price per litre: $20.8 \times \$1.92 = \$39.936$. Round to the nearest cent: the third decimal digit is 6, so round up — \$39.94.
- c.** Friendly numbers: about 20 L at about \$2.00 per litre gives $20 \times \$2.00 = \$40.00$. \$39.94 is close to \$40.00, so the answer to part b is reasonable.

Question 8.

- a.** $\$18.60 \div 4 = \$4.65$ per serving.
- b.** Adjust one input at a time and check the output. Try 8 servings: $8 \times \$4.65 = \$37.20$ — that fits under \$40. Try 9 servings: $9 \times \$4.65 = \$41.85$ — that is over budget. The greatest whole number of servings is 8.
- c.** $\$40.00 - \$37.20 = \$2.80$ left over.
- d.** Up. The number of servings is an input Bruno is free to change, and more servings means more ingredients, so the estimated cost rises. For example, 12 servings would cost $12 \times \$4.65 = \$55.80$, well above \$18.60.