Mathematics Level 8

Extended tasks

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Contents

Task

Content description VC2M8ST04: plan and conduct statistical investigations involving samples of a population; use ethical and fair methods to make inferences about the population and report findings, acknowledging uncertainty

In the 2021 Census, the Australian Bureau of Statistics counted 25,422,788 people in Australia — every one of them, one by one. But when anyone wants to know how Australians live from day to day — how they travel, how long they sleep, how they use electricity at home — asking tens of millions of people each time is far too slow and far too costly, so a sample is used instead. In this task it is your turn. You will pose a question that data can answer, plan a fair and ethical way to take a sample, actually collect the data, and report what it suggests — while honestly saying how much trust your answer deserves.

Source: Australian Bureau of Statistics, *2021 Census of Population and Housing*. Retrieved 20 August 2026.

Task I1 — Plan and conduct a statistical investigation from a sample

Marks: 20. This is a classroom task, not an exam.

Condition	Rule
Timing	About two lessons, as set by your teacher: the plan is written and checked in lesson 1, the data is collected and analysed across the two lessons, and the report is finished in lesson 2.
Working	Groups of 2 or 3; one submission per group. Share the work — your teacher may ask any group member to explain any part of it.
Calculators and digital tools	**Not permitted.** `VC2M8ST04` names no digital tools, and this book permits a scientific calculator only where a content description names one. The random draw is done with numbered slips, and all the arithmetic in this task is workable by hand.

Equipment

- this workbook — the seven-point plan card and the report card in Section 6D, and the ethical and fair checklists
- paper for the plan and the report
- survey slips or a ruled recording table, and a clipboard or firm writing surface
- pens or pencils
- small slips of paper, and a bag or hat for the random draw
- a ruler, for the axes of your display
- a watch or clock with a seconds hand — **question C only**

Safety controls

These controls are part of the task. The ethical checklist of Section 6D — consent, voluntary, privacy, no harm — is not just good mathematics here; it is how everyone taking part is kept safe.

1. **Ask about your chosen quantity only.** No question may ask about money, bodies, health, family or anything else personal or sensitive. If you pose your own question, your teacher approves it before your plan is submitted, and this is what they check first.
2. **No names.** Number the members of your population and use those numbers only. Results are reported for groups, never in a way that points at one person. Hand every sheet in to your teacher at the end of the lesson.
3. **Anyone may say no.** A person asked may decline or skip any question, for any reason. A declined question is recorded as missing — never filled in, never pressured.
4. **Question C only:** the pulse is counted seated and at rest, by the student themselves. There is no exercise in this task. Any student who feels unwell, or who has a medical reason not to take part, tells the teacher and takes a recording role instead.
5. **Collect calmly.** Stay in the areas your teacher sets, under supervision, and do not enter other classes without permission.

Choose your question

Choose **one** of the three questions below, or pose your own.

- **A — Screen time.** How many minutes of recreational screen time do Year 8 students at our school have on a usual school day? *Population: all Year 8 students at the school.* (Recreational means for fun — not schoolwork.)
- **B — Hours of electricity use at home.** For how many hours on a usual weekday evening are the lights, the television or streaming on in students' households? *Population: the households of the school's students — one*

answer per household. Note that two students in your sample may share one household — your plan must say how you will handle that.

- **C — Resting heart rate.** What is the resting heart rate, in beats per minute, of the students at our school? *Population: all students at the school.* Count your own pulse, seated and at rest — for a full 60 seconds, or for 30 seconds doubled. See safety control 4.
- **Your own question** about the school community is welcome. It must be statistical (answers vary, so data is needed), numerical, answerable in the time available, and free of personal or sensitive matters. Your teacher approves it before Part A is submitted.

Your sample is to have **20 to 30 members** (or as your teacher sets). Section 6C showed why a bigger sample varies less — and why it must still be a size you can collect and analyse in two lessons.

Part	What your group does	Marking guide section	Marks
A — Plan	Write the plan, before any data is collected	1 and 2	10
B — Collect	Draw the sample and collect the data	3 (with C)	5 together
C — Analyse	Organise, display and summarise the data	3 (with B)	
D — Report	Report the findings with the uncertainty stated	4	5
		Total	**20**

Part A — Plan (marking guide sections 1 and 2, 10 marks)

Write your plan **before any data is collected**, so the method cannot be bent to suit the results. Use the seven-point plan card of Section 6D. Your plan must say:

1. the question, and the population it asks about;
2. census or sample — and, for a sample, exactly how it will be chosen and how large it will be;
3. what will be measured or asked, in what units, with what instrument, and to what precision (Section 6A);
4. how the data will be recorded;
5. how the method will be **ethical** and **fair** — use both checklists of Section 6D, and do not just list them: say what your group will actually do for each check;
6. how the data will be organised, displayed and summarised;
7. what will count as an answer to the question.

For point 2, the gold standard at this level is a **simple random sample** (Section 6B): number the members of the population from the lists your teacher provides, write each number on a slip, mix the slips in a bag, and draw them without looking. Every member then has a real chance of being chosen, and no person decides. Say in your plan why your method is fair.

When the plan is complete, your teacher checks it and signs below. **No collection begins before the plan is signed.**

Teacher approval of the plan — signature and date: _____

Part B — Collect (marking guide section 3, with Part C)

Carry out the draw exactly as planned. Then collect the data, with the safety controls and the ethical checklist at point of use:

- Before anyone answers, tell them what the data is for and let them say no (consent, voluntary). Ask the question in the same neutral way to everyone (fair wording).
- Record each answer exactly as given, against the student number — no names. Record to the precision your plan states: no more, no less.
- A declined or skipped answer stays **blank**. Count the blanks and report how many there were. Never invent a value to fill a gap.

- Check every value for sense as you go (a screen time of 300 hours is a mistake to chase up, not a number to average). Say in your report what you checked and what you did.
- If a chosen student is away or declines, do not simply swap in a friend. Either leave the place empty, or draw a replacement the same random way your plan describes — and say which you did.

Student number	Answer (with units)	Checked for sense?

Rule more rows as needed. Missing answers stay blank and are counted.

Part C — Analyse (marking guide section 3, with Part B)

- Order the data and check the count against your planned sample size.
- Draw the display your plan chose — a **dot plot** or a **stem-and-leaf plot** — with every value shown and the axis (or key) labelled with the units.
- Find the **mean**, the **median** and the **range**, with written working shown. Round the mean to one decimal place if it does not come out exact.

Part D — Report (marking guide section 4, 5 marks)

Write the report for a reader who was not there. Use the report card of Section 6D, in order:

1. the question that was asked;
2. the population, the sample, and how the sample was chosen;
3. the ethical steps that were taken;
4. the data, the display and the summary statistics;
5. the findings, in the words of the question, **with the uncertainty stated** — a sample gives an estimate, not an exact figure, and your report says so ("suggests", "about", the sample size named);
6. the **limitations** of the method — at least two, and at least one about the sampling method itself: who might have been missed, or how the sample could tilt the result;
7. the **review**: one thing the data could not say, and one thing you would change next time.

A report that acknowledges its uncertainty is a *stronger* report than one that claims an exact answer — that honesty is what `VC2M8ST04` asks for, and it is where the final marks of this task are won.

Marking guide

20 marks. Four sections of 5 marks each, one per rubric area of the assessment plan: formulating · choosing with justification · executing · interpreting, communicating and reviewing. Each row is one observable student action worth **1 mark**; award the mark when the action is present in the group's submission (or, where a row says so, seen by the teacher during collection). The section totals add to the task mark out of 20.

Section 1 — Formulating the question (from Part A). 5 marks.

Mark	Observable action
1	The question is written as one that data can answer, and its answers are expected to vary — a statistical question (or one of questions A–C is chosen and stated).
2	The population is named exactly — the whole group the question asks about, not just the people who will be asked.
3	A sample is chosen over a census, with a reason that fits the population: a census of the whole group is too slow, too costly or impossible in the lessons available.
4	The plan says what will be measured or asked, in what units, with what instrument, and what will count as an answer (for example, times rounded to the nearest minute).
5	The plan is complete — all seven points of the plan card are addressed — and it is written before any data is collected, with the teacher approval dated.

Section 2 — Choosing the sampling method and the displays, with justification (from Part A). 5 marks.

Mark	Observable action
1	The sampling method is named and described as steps (for example: number the list, write the numbers on slips, mix, draw without looking) — not "ask people around".
2	The plan states, with a reason, why the method gives every member of the population a real chance of being included.
3	The sample size is stated and justified — large enough to be useful, small enough to collect and analyse in the time available.
4	The display and the summary statistics are chosen with a reason (dot plot or stem-and-leaf plot; mean, median or both).
5	The wording of the question is fair — neutral, with no push — and the plan avoids collecting only where it is easiest, with a reason given.

Section 3 — Executing the mathematics accurately (from Parts B and C). 5 marks.

Mark	Observable action
1	The sample is drawn as planned — as the

Mark	Observable action
	teacher can confirm during collection — and the data is recorded in a table against student numbers, with the number of entries matching the planned sample size or any shortfall honestly reported.
2	Missing answers are kept blank and counted, no value is invented, and impossible values are chased up before use, with that stated.
3	The display is drawn correctly from the data — every value shown, and the axis (or key) labelled with the units.
4	The mean and the median are both calculated correctly, with written working shown.
5	The range is calculated correctly, and every numerical answer carries the correct units.

Section 4 — Interpreting, communicating and reviewing (from Part D). 5 marks.

Mark	Observable action
1	The report answers the question that was posed, in the words of that question.
2	The finding is stated as an inference about the population — the sample "suggests", the figure is "about" — not as an exact fact.
3	The uncertainty is acknowledged: the report names the sample size next to the population size, and says that another sample would give a somewhat different estimate.
4	At least two limitations are named, and at least one is about the sampling method itself — who might have been missed, or how the sample could tilt the result.
5	The review is present: one thing the data could not say, and one change for next time; and the report follows the order of the report card.

Marking notes.

- The rows in sections 2 and 4 are earned by the reason, the inference and the acknowledgement — a correct number on its own does not earn them.
- An arithmetic slip is penalised once only, in section 3; rows that then follow the slipped value consistently are not penalised again.
- A plan or report copied from the sample plans in Section 6D without being fitted to the group's own question does not earn the rows that need the specifics of this investigation.
- Group members who cannot explain their own submission when asked may be marked on what they can show.

Task

Task I2 — Formulate, solve and review a linear model in a real context · Modelling task · 20 marks · Chapter 2 (2C, supported by 2A and 2B)

Codes: `VC2M8A03` (`.E01`, `.E02`, `.E03`) · supported by `VC2M8A01` (2A) and `VC2M8A02` (2B)

> *use mathematical modelling to solve applied problems involving linear relations, including financial contexts involving profit and loss; formulate problems with linear functions, and choose a representation; interpret and communicate solutions in terms of the context, and review the appropriateness of the model* — VC2M8A03

Task I2 is a modelling task. It is not a test. You choose one real situation, turn it into a **linear model** — a rule, a table and a graph that stand in for the situation — solve a question about it, and then judge whether the model is a good description of real life. You follow the same five steps you learned in 2C, shown in Figure 1.

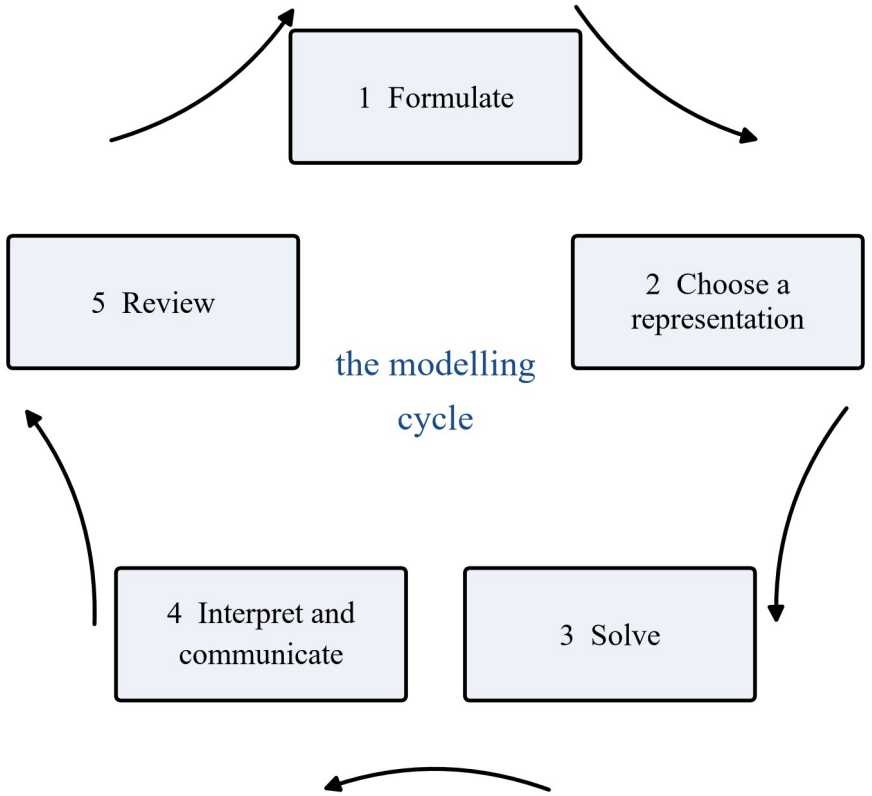

Figure 1. Diagram of the modelling cycle: five boxes in a ring joined by arrows going around — 1 formulate, 2 choose a representation, 3 solve, 4 interpret and communicate, 5 review.

A relation is **linear** when the output changes by the **same amount** each time the input goes up by 1 (2B). Two numbers describe every linear relation completely: the **initial value** — the output when the input is 0 — and the **constant rate of change** — the amount added to, or subtracted from, the output for each increase of 1 in the input. Read both numbers **in the context**: the flag fall of a taxi fare, the water already in a tank, the stall fee paid before anything is sold (2C).

This task is worth 20 marks, in four parts of 5 marks each. It runs over about two lessons, and nothing in it is timed: lesson 1 for choosing your context and for Parts A and B and the start of Part C, and lesson 2 for finishing Part C and for Part D. This is a classroom task, not an exam.

Equipment and rules. You will need the spaces in Parts A to D (they are your record sheets), a pencil, a ruler and grid paper. **No calculator is needed or permitted** — every number on the context cards is chosen so you can work it

by hand; the skill being marked is the modelling, not the arithmetic (2C). Graphing or spreadsheet software is permitted, not required, for drawing your graph; a hand-drawn graph on grid paper is a complete response (2B). No other software or calculator may be used.

Choose your context

Choose **one** of the four context cards below, or propose your own. Each card describes a situation that changes in a constant pattern — a starting amount, with the same amount added or lost at each step. Cards 1 to 3 are made-up situations written for this task; Card 4 uses a real Australian rate.

Card 1 — the tradesperson's bill (the cost grows). A handyman charges a $85 call-out fee just to attend, and then $60 for each hour of work.

Card 2 — the farm tank (the volume shrinks). A farm tank starts with 3600 L of water. Through a dry spell, a drip irrigation line draws 45 L from the tank each day.

Card 3 — the class fundraiser (profit and loss). A class sells badges at a fundraiser. The materials cost a fixed $35, each badge costs $1.50 to make, and each badge sells for $4.

Card 4 — pay at the minimum wage (a real rate). From 1 July 2026, the national minimum wage in Australia is $26.44 per hour. A student works some hours at this rate and is paid for exactly the hours worked.

Source: Fair Work Ombudsman, *Minimum wages*. Retrieved 19 August 2026.

Your own context — you may propose a situation of your own instead: a saving goal, a growing plant, a draining pool, a stall of your own design. It must have a starting amount and a rate that truly stays constant. Your teacher must approve it before you start Part A.

How I2 will be marked

Shown to students before the task begins.

I2 is marked with a **rubric** — a marking guide that describes what you must do to earn each mark. It has four **criteria** (parts that are marked separately), 5 marks each. Your teacher scores only what they can see you do or hear you say.

1. **Formulating** the problem or question — Part A (5 marks). To *formulate* a problem is to turn the situation into mathematics: name the quantities, pull out the two key numbers, and ask a question the model can answer.
2. **Choosing** a representation and a model, with the choice justified — Part B (5 marks). Your *representation* is how you will show the relation — a table, a rule or a graph (Figure 2); your *model* is the rule you write. To *justify* a choice is to give a reason for it.
3. **Executing** the mathematics accurately — Part C (5 marks). To *execute* the mathematics is to carry it out: build the table, draw the graph, solve the question, check the answer.
4. **Interpreting, communicating and reviewing** the solution in terms of the context — Part D (5 marks).

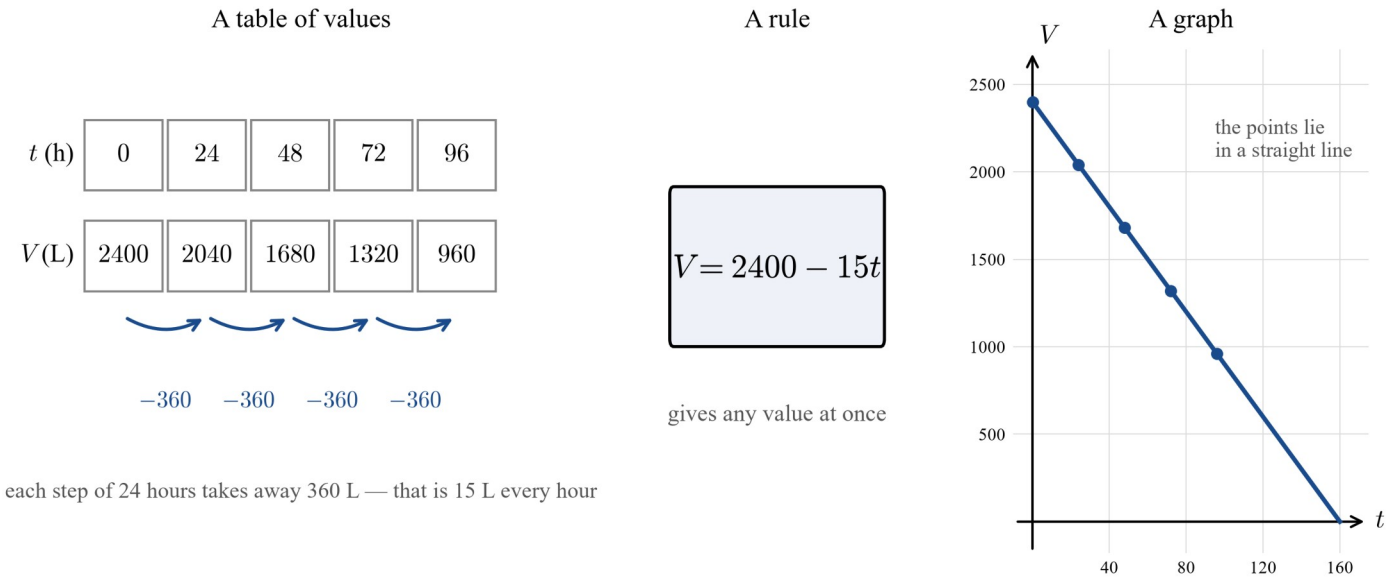

Figure 2. The same situation shown three ways: a table of values with the same difference between entries, a rule, and a graph whose points sit in a straight line.

Part D is where the marks are actually won. `VC2M8A03` requires the appropriateness of the model to be **reviewed**, so a response that stops at a correct answer sits at the middle of the rubric, not the top. The descriptors for Part D are written out in full here:

- **D a.** You state your answer in a full sentence, in terms of your situation, with the right units — not "n = 4" but "the job took 4 hours".
- **D b.** You say what each of the two numbers in your rule stands for in your situation — the initial value and the constant rate of change.
- **D c.** You say which inputs your rule makes sense for, and why — not before the start, not past the end, and in the right kind of numbers (2C).
- **D d.** You give one reason why the constant-rate assumption might not hold exactly in real life.
- **D e.** You substitute one input that lies outside your sensible range, show what the rule gives, and explain why that answer does not fit the context.

Words you need

Every mathematical word here was introduced in Chapter 2. This is a quick look-back, plus the few new words this task uses.

- A **model** is a mathematical version of a real situation — a rule, table or graph that stands in for it (2C).
- A **linear relation** is a relation whose output changes by the same amount each time the input goes up by 1 (2C, 2B).
- The **initial value** is the output when the input is 0; the starting amount (2C).
- The **constant rate of change** is the amount added to, or subtracted from, the output for each increase of 1 in the input (2C).
- A **rule** is a formula, like $C = 85 + 60n$, giving the output for any input (2C).
- **Costs** are what a venture spends: fixed amounts plus amounts per item; **income** is what it receives: price times number of items sold; **profit** is income minus costs — a negative profit is a **loss** (2C).
- The **break-even point** is the input where the profit is exactly 0 (2C).
- A **representation** is one way of showing a relation: a table, a rule or a graph (2C).
- A **criterion** is one part of a task that is marked separately. A **rubric** is a marking guide written as things you can be seen doing. To **justify** a choice is to give a reason for it.

How to run I2

Teacher-facing. I2 is a classroom task, not an exam.

- **When** — after subtopics 2A, 2B and 2C of Chapter 2 have been taught. Test T2 covers all five Chapter 2 subtopics, so I2 may sit before or after T2; it does not depend on 2D or 2E.
- **Format** — each student models one context: Card 1 to 4, or their own approved situation. Students may talk through their ideas in pairs, but Parts A to D are each student's own work. Score what you can see and hear as you move between students, and check each student's sheets at the end of lesson 2.
- **Own contexts** — approve or redirect before Part A begins. The situation must have a starting amount and a genuinely constant rate; redirect anything that cannot be modelled linearly at Level 8 (no gradient, no y = mx + c, no named intercepts — D5), anything raising the safety points below, and anything that would need a published source the student cannot supply.
- **Timing** — nothing is timed; there is no time limit on the students. The guidance here is for your planning, per the assessment plan (§7.2): about two lessons — lesson 1 for choosing a context and for Parts A, B and the start of Part C; lesson 2 for finishing Part C and for Part D.
- **Calculator and software** — no calculator is required or permitted; `VC2M8A03` names no digital tools and every card's numbers are workable by hand (D10). Graphing or spreadsheet software is permitted, not required, for drawing graphs — `VC2M8A02` permits digital tools where appropriate (D10). No CAS.
- **Marking** — use the marking guide at the end of this file.
- **If a student is absent** — the full formulate–solve–review cycle of `VC2M8A03` is evidenced only by this task (T2's 30 minutes cannot reach those verbs; §7.2), so run the task again at a makeup session.

Equipment

Teacher. One set per student, or per pair where noted.

Everyone

- a printed copy of this task — the spaces in Parts A to D are the students' record sheets
- pencils, rulers and erasers
- grid paper for the graph and for rough working
- a scientific calculator is **not** needed and is not permitted — the card numbers are chosen to be workable by hand (D10)

Where graphing software is used (optional)

- devices with spreadsheet or graphing software, one between two (permitted where appropriate via `VC2M8A02`; hand-drawn graphs are a complete response)

Own-context students

- whatever their approved situation needs to measure or time — for example, a tape measure, a metre ruler or a stopwatch (see Safety)

Safety

Controls at the point of use. Read these to the class before the task starts. Students modelling Cards 1 to 4 work at their desks; these controls apply to students who propose their own context.

For students:

- **Measuring and timing.** Ask before you measure or time anyone or anything. Anyone may say no — thank them and move on. Record numbers, not names.
- **Moving around the school.** Walk, stay in the areas your teacher has agreed to, and keep doorways and walkways clear while you measure.
- **Water.** Use only taps and containers your teacher has approved. Wipe up any spill straight away — water on the floor is a slipping hazard — and keep water away from power points and electrical equipment.

- **Outdoors.** Hat on and sunscreen on before you go out — the sun can be strong even on cloudy days. Drink water, and stay off roads and out of car parks.
- **Rulers and equipment.** Carry rulers and tape measures pointing down, and never throw or swing them.

For the teacher:

- Approve each own-context situation before lesson 1 ends, and keep all measurement inside the school grounds. Redirect any proposal that would need mains electricity, gas, chemicals or open flame to a water-, distance- or time-based context.
- Check outdoor sites before use — glass, holes, and traffic at edges.
- Keep the school's first-aid kit with you, and know the school's sun protection policy.

Part A — Formulating the problem (5 marks)

a. Record your context, and say what changes. (1 mark)

Write which card you have chosen (or your own approved situation), and in one sentence say what is changing and what stays the same.

My context: ……

What changes, and what stays the same: ……
……

b. Choose letters for the two quantities. (1 mark)

Choose a letter for the input and a letter for the output, and write what each letter stands for, **with its unit**.

Input: the letter …….. stands for …….. , measured in …… .

Output: the letter …….. stands for …….. , measured in …… .

c. State the initial value, and what it means here. (1 mark)

The initial value is the output when the input is 0 (2C).

Initial value: ……..

In my situation, this number is …….. .

d. State the constant rate of change, and what it means here. (1 mark)

The rate of change is the amount added to — or subtracted from — the output for each increase of 1 in the input. Watch the sign: positive if the quantity grows, negative if it shrinks (2C).

Rate of change: ……..

In my situation, this number is …….. .

e. Write the question your model will answer. (1 mark)

Your question must need the rule: it either gives an input and asks for the output, or gives an output and asks for the input.

My question: …… ……

Part B — Choosing the model and the representation (5 marks)

a. Write your rule. (1 mark)

Write the rule connecting your two letters, in the form output = initial value + rate of change × input (2C). Use letters that stand for your quantities — no other letters. Card 3 students answering a profit or break-even question need all three rules: costs, income and profit (2C, 2A).

My rule(s):

……

b. Choose your main representation. Circle one. (1 mark)

table · rule · graph

Your chosen representation is the one you will use to answer the question of Part A e. You will still produce all three in Part C — each shows something the others do not (Figure 2).

c. Give one reason why that representation suits your question. (1 mark)

…… ……

d. Choose a sensible range of inputs for your working, with a reason. (1 mark)

Say which input values your table and graph will run between, and why that range fits your situation — think about where the situation starts and where it must end (2C).

My inputs will run from …….. to …….. , because

…… ……

e. Say how you will check the relation really is linear. (1 mark)

…… ……

Part C — Executing the mathematics (5 marks)

No calculator — work by hand. Show every step.

a. Make your table of values. (1 mark)

Use at least five entries, starting at input 0, all inside the range you chose in Part B d.

Input (……..)	
Output (……..)	

b. Show the constant difference. (1 mark)

Find the difference between each output and the one before it. The differences must all be the same — that is the check you planned in Part B e (2B).

Differences: ……

c. Draw the graph of your rule. (1 mark)

On grid paper, or with graphing or spreadsheet software where you prefer. Label both axes with the letter and the unit, plot the points of your table, and draw the straight line through them. Every plotted point must sit at its stated coordinates (2B).

(Graph space — use grid paper.)

d. Answer your question from Part A e, showing each step. (1 mark)

If your question gives an input, substitute into the rule. If it gives an output, undo the steps of the rule — remove the initial value first, then divide by the rate of change (2C, 2B).

Working:

…… ……
……

e. Check your answer. (1 mark)

Verify your answer by substituting it back into the rule (2B), or show that your table, your graph and your rule all give the same value.

Check:

…… ……

Part D — Interpreting, communicating and reviewing (5 marks)

The descriptors below are the ones you were shown before the task.

a. State your answer in terms of the situation. (1 mark)

Write one full sentence, with the right units. "n = 4" is not an answer; "the job took 4 hours" is (2C).

…… ……

b. Say what the two numbers in your rule stand for. (1 mark)

Read both numbers in the context: what is the initial value here, and what does the rate of change add or take away at each step?

…… ……

c. Say which inputs your rule makes sense for. (1 mark)

Give the range of inputs the rule can sensibly take, and why — an empty tank stays empty; you can sell 14 badges but not 14.5 (2C).

…… ……

d. Give one reason why the constant rate might not hold exactly in real life. (1 mark)

…… ……

e. Test your model outside its sensible range. (1 mark)

Substitute one input that lies **outside** the range you gave in Part D c. Show what the rule gives, and explain why that answer does not fit the context.

Input used: …….. The rule gives: ……..

Why this does not fit: …… ……

Total for this task: □ out of 20 marks

Marking guide

Teacher-facing. Score only what you can see the student do, or hear the student say. Contexts will differ — mark the action against the student's own context and numbers, not against any particular card. A spoken answer counts the same as a written one. If you have to tell a student what to do before an action, do not give the mark for that action — record the prompt instead, so you know what to teach next.

Task I2 carries 20 marks in the four criteria of the assessment plan (§7.2), 5 marks each: **formulating the problem or question · choosing a representation, model or sampling method, with justification · executing the mathematics accurately · interpreting, communicating and reviewing the solution in terms of the context**. It assesses `VC2M8A03`, supported by `VC2M8A01` (2A) and `VC2M8A02` (2B). The fourth criterion's descriptors were shown to students in full before the task, as §7.2 requires: all three modelling CDs at this level name the review step explicitly, so a response that stops at a correct answer sits at the middle of the rubric, not the top (D9).

The rubric below is written against the achievement-standard extract carried on `VC2M8A03` in the authority file (`maths_8.json`), quoted verbatim, so a teacher's judgement maps to the VCAA wording without translation.

> *Students use mathematical modelling to solve problems using linear relations, interpreting and reviewing the model in context.* — VC2M8A03, achievement-standard extract

Criterion A — Formulating the problem or question — 5 marks

Mark	What you can see the student do	Accept
a (1)	Records the chosen card (or approved own situation) and states in one sentence what changes and what stays the same.	Card 1: "The total cost changes with the hours of work; the call-out fee and the hourly rate stay the same." Card 2: "The volume of water changes — it drops by the same amount each day." A sentence that only retells the card without naming what changes does not.
b (1)	Chooses letters for the input and the output, and writes what each stands for with its unit.	"n = number of hours of work; C = total cost in dollars"; "t = days; V = volume of water left, in litres". Letters without units, or units without letters, is incomplete.
c (1)	States the initial value and its meaning in the situation.	Card 1: 85 — the call-out fee, charged even for 0 hours of work. Card 2: 3600 — the starting volume, in litres. Card 3: profit model — −35, the \$35 spent on materials before any badge is sold (accept the student who says "35 spent" with the negative sign correct in the rule); costs model — 35. Card 4: 0 — no hours worked, no pay (VC2M8A03.E01 — interpreting the initial value in context).
d (1)	States the constant rate of change with the correct sign, and its meaning.	Card 1: 60 — dollars added for each hour. Card 2: −45 — litres drawn out each day. Card 3: profit model — 2.5, the dollars added per badge sold after costs. Card 4: 26.44 — dollars paid per hour. A shrinking quantity with a positive sign loses this mark.

Mark	What you can see the student do	Accept
e (1)	Writes a question the rule can answer — it substitutes an input, or works backwards from an output.	"What does a 4-hour job cost?"; "When is the tank empty?"; "How many badges must be sold to break even?"; "How many hours of work earn $449.48?" A question answered directly by the card ("What is the call-out fee?") does not — redirect.

Criterion B — Choosing a representation and a model, with the choice justified — 5 marks

Mark	What you can see the student do	Accept
a (1)	Writes a correct rule in letters that stand for the quantities.	Card 1: $C = 85 + 60n$. Card 2: $V = 3600 - 45t$. Card 3 profit question: costs $= 35 + 1.5n$, income $= 4n$, profit $= 4n - (35 + 1.5n) = 2.5n - 35$ — the expansion of the brackets is the 2A support skill (`VC2M8A01`). Card 4: $P = 26.44h$. Own context: mark against the approved situation. No gradient or y = mx + c form is required or expected (D5).
b (1)	Circles one of table, rule, graph as the main representation.	Any of the three may be main; the student still produces all three in Part C.
c (1)	Gives one reason tying the representation to the question.	"The rule gives the exact cost for any number of hours, and my question asks for an exact value."; "The graph shows when the line reaches 0, so I can read off when the tank is empty."; "The table steps through the days, and my question asks about a listed day." A bare preference ("I like tables") does not (VC2M8A03 — choose a representation).
d (1)	Chooses a range of inputs that fits the situation, with a reason.	Card 1: 0 to 6 hours, "a job this size is done in a day". Card 2: 0 to 80 days, "the tank is empty after 3600 ÷ 45 = 80 days". Card 3: 0 to about 40 badges, "more than the class can realistically sell". Card 4: 0 to 20 hours, "a student's weekend hours". Any reasoned range earns the mark, including one the student revises in Part D c.
e (1)	States the constant-difference check for linearity.	"The difference between each output and the one before must be the same every time" (2B). Accept equivalent wording.

Criterion C — Executing the mathematics accurately — 5 marks

Mark	What you can see the student do	Accept
a (1)	Builds a table of at least five entries starting at input 0, all values correct, inside the chosen range.	Card 2 example: $t = 0, 20, 40, 60, 80$ gives $V = 3600, 2700, 1800, 900, 0$. Check every entry against the student's own rule.
b (1)	Shows the differences between successive outputs, and they are constant.	Card 1: 60 each step; Card 2: −45 each step. Accept differences taken over equal input steps (for example, −900 per 20 days on Card 2) provided the student states the step size.
c (1)	Draws the graph: both axes labelled with letter and unit, the table's points plotted at their stated coordinates, and a straight line through them (VC2M8A02).	Hand-drawn or software-drawn both count. Scale may be chosen freely but must be consistent on each axis; points visibly on the line.
d (1)	Answers the Part A e question correctly, with each step shown.	Forward: Card 1 at $n = 4$: $C = 85 + 60 \times 4 = 325$. Backward: Card 1 with $C = 325$: $325 - 85 = 240$, $240 \div 60 = 4$ hours. Card 2 empty: $3600 \div 45 = 80$ days. Card 3 break-even: $35 \div 2.5 = 14$ badges. Card 4: $449.48 \div 26.44 = 17$ hours. Own context: check against the student's own numbers.
e (1)	Checks the answer — substitutes back into the rule, or shows table, graph and rule agree.	Card 1 backward question: $85 + 60 \times 4 = 325$ ✓ (verification by substitution is the 2B support skill, `VC2M8A02`). A bare "it checks" with no substitution or comparison does not.

Criterion D — Interpreting, communicating and reviewing the solution in terms of the context — 5 marks

Descriptors shown to students in full before the task (§7.2).

Mark	What you can see the student do	Accept
a (1)	States the answer in one full sentence, in terms of the situation, with units.	"A 4-hour job costs $325."; "The tank is empty after 80 days."; "The class must sell 14 badges to break even." The sentence must answer the student's own Part A e question (VC2M8A03 — interpret and communicate solutions in terms of the context).
b (1)	Says what both numbers in the rule stand for in the situation.	Card 2: "3600 is the water in the tank at the start; 45 is the litres drawn out each day." Card 3: "−35 is the money spent on materials before any badge is sold; 2.50 is the profit added by each badge sold." One number read, one not — no mark (VC2M8A03.E01).

Mark	What you can see the student do	Accept
c (1)	States which inputs the rule makes sense for, with a reason.	Card 2: “t from 0 to 80 — once the tank is empty, no more water can flow from it” (VC2M8A03.E02). Card 3: “whole numbers of badges only — you cannot sell half a badge.” Card 1: “n from 0 upward, and realistically whole hours if the handyman bills by the hour.” Card 4: “h from 0 up to the hours actually worked.”
d (1)	Gives one reason why the constant-rate assumption might not hold exactly in real life.	Card 1: weekend or overtime rates; a job running over several days. Card 2: the crack or the drippers may clog, or rain may refill the tank. Card 3: some badges may not sell; materials may cost more than $1.50 each. Card 4: weekend and late rates, overtime, and tax are not in the base rate. Any real, situation-specific reason earns the mark; “because real life is different” does not (VC2M8A03 — review the appropriateness of the model).
e (1)	Substitutes one input outside the sensible range, shows the result, and explains why it does not fit.	Card 2 at $t = 100$: $V = 3600 - 4500 = -900$ — negative litres are not possible; the tank has been empty since day 80 (VC2M8A03.E02). Card 3 at $n = 2.5$: half a badge cannot be sold. Card 4 at $h = -3$: negative hours make no sense. The explanation must name what is wrong in the context, not only “it is negative”.

How the marks map to the curriculum

Curriculum words	Marks
Formulate problems with linear functions (VC2M8A03)	A a, A b, A c, A d, A e
Situations with an initial value and a constant rate of change, interpreted in context (VC2M8A03.E01)	A c, A d, B a, D b
Choose a representation (VC2M8A03)	B b, B c
Values of the model within a given range (VC2M8A03.E01)	B d, D c
The constant-difference test for a linear relation (VC2M8A02, support; 2B)	B e, C b
Executing: tables of values and graphing linear relations on the Cartesian plane (VC2M8A02, support; 2B)	C a, C c
Executing: substituting and undoing the rule; expanding income − (costs) for profit (VC2M8A01, support; 2A)	B a, C d
Verifying solutions by substitution (VC2M8A02, support; 2B)	C e

Curriculum words	Marks
Interpret and communicate solutions in terms of the context (VC2M8A03)	D a, D b
Review the appropriateness of the model — suitability and units (VC2M8A03.E02)	D c, D d, D e
Financial contexts involving profit and loss (VC2M8A03)	Card 3 throughout; B a, C d where chosen
Pay rates, table of values and graph (VC2M8A03.E03)	Card 4 throughout, where chosen

Teacher recording sheet

Part	Criterion	Marks	Action notes
A	Formulating the problem or question	/5	
B	Choosing a representation and a model, with the choice justified	/5	
C	Executing the mathematics accurately	/5	
D	Interpreting, communicating and reviewing the solution in terms of the context	/5	
		/20	

What the marks say

The marks use the words VCAA carries on VC2M8A03: *formulate problems … choose a representation … interpret and communicate solutions in terms of the context, and review the appropriateness of the model*. A student who scores across all four criteria has run the whole modelling cycle of 2C on a situation of their own choosing — and has done the two things a 30-minute written item cannot show: choosing and justifying the model, and reviewing whether the model deserves trust. A mark not scored here is a gap to teach next; the full cycle is evidenced only by this task (T2 carries 2C's timed items but cannot reach the formulate–review verbs; §7.2), so an absent student completes it at a makeup session.

Record the total: □ out of 20

Task I3 — The part-time contract and the trip budget

Content description VC2M8M07: use mathematical modelling to solve practical problems involving ratios and rates, including distance-time problems for travel at a constant speed and financial contexts; formulate problems; interpret and communicate solutions in terms of the situation, reviewing the appropriateness of the model

Content description VC2M8N06: use mathematical modelling to solve practical problems involving rational numbers and percentages, including financial contexts involving profit and loss; formulate problems, choosing efficient mental and written calculation strategies and using digital tools where appropriate; interpret and communicate solutions in terms of the context, reviewing the appropriateness of the model

Two offers of weekend work are on the table. One pays a higher hourly rate; the other pays a lower hourly rate but adds a fixed travel allowance every week. Which offer is really better — per week, over the year, and after tax? And once the pay starts, how long will it take to save the US-dollar spending money for a trip? In this extended task you build one model out of rates, ratios and percentages, use it all the way from the weekly pay to the savings goal, and then do what every good modeller does: you review whether the model deserves the trust the numbers seem to give it.

The task at a glance

Instrument	Extended task I3 (TOC §7.2): formulate, solve and review a rate, ratio or percentage model in a financial context
Draws on	4C (VC2M8M07) and 1F (VC2M8N06), supported by 1E (VC2M8N05) and 4B (VC2M8M05)
Working time	About two lessons, paced by your teacher. This is a classroom task, not an exam: there is no time limit, and you may ask for help.
Marks	20 — four criteria at 5 marks each (see the Marking guide)
What to hand in	All of your working and writing, together. The task is marked from the modelling you show, not from a final number.

Equipment

- Pen or pencil, and paper or your workbook.
- A ruler, for the tidy table or graph of Part 2(f).
- Grid paper (optional), if you choose to draw a graph.
- The ATO tax table and the exchange rate are printed on this sheet — you do **not** need the internet, and you should not look up live rates.

Calculator and digital tool rules

- No calculator is needed: VC2M8M07 names no digital tools, and every number in this task is chosen so the working is doable by hand.
- VC2M8N06 permits digital tools where appropriate: you **may** use a spreadsheet for your table of pay and tax, and a scientific calculator for checking, but every mark is reachable without either.
- Computer algebra software is not permitted anywhere in this book.

Safety controls

- **Privacy.** Every amount in this task about the worker is made up. You are not asked for — and must not share — anyone's real pay, tax, savings or family finances. Class discussion stays with the numbers on this sheet.
- **Real data stays as printed.** The only real figures are the ATO tax table and the Reserve Bank exchange rate below, each with its source line. Use them as printed; do not chase live versions online.

- **Equipment.** Standard classroom equipment only (pen, paper, ruler). Nothing sharp, hot, powered or chemical is used in this task.

The scenario

A part-time worker is choosing between two offers of weekend work. Both offers are for **52 weeks** of the year at **15 hours per week**. The worker, the offers and the pay figures are made up for this task; the tax table and the exchange rate further down are real, and are cited where they appear.

- **Offer A — a flat rate of pay:** $24 per hour, and nothing else.
- **Offer B — a lower hourly rate plus an allowance:** $20 per hour, plus a travel allowance of $75 per week. (An **allowance** is a fixed extra amount added to the pay each week, here to cover the cost of getting to work.)

The worker will take **one** offer, work all 52 weeks, and receive the whole year's pay as their **taxable income** — the amount of income the tax table applies to — for the 2026–27 financial year (the year that runs from 1 July to 30 June). The worker is also saving for a trip and will need spending money in US dollars.

Work through the five steps of the modelling cycle you used in 4C and 1F: **formulate, choose a representation, solve, interpret and communicate, review.** Each part of the task names the step it belongs to.

Part 1 — Formulate

(Evidence for Criterion 1 of the marking guide.)

(a) Write down, in your own words, the question this task will answer.

(b) List the quantities your model needs, and choose a letter for each one. Start with these two, then add your own:

- h = the number of hours worked each week (here, $h = 15$)
- T = the taxable income for the whole year

(c) State one **assumption** your model will make — one thing it takes as fixed or true, such as how the hours or the allowance behave — and say in one sentence why that is a fair thing to assume.

Part 2 — Choose a representation and solve

(Evidence for Criteria 2 and 3.)

(a) Find the **gross pay** for one week under each offer. (The gross pay is the pay before anything is taken out.)

(b) Compare the two weekly pays: write the comparison as a **ratio** in simplest form, and find how much more per week the better offer pays, as a **percentage** of Offer A's weekly pay.

(c) Find the taxable income for the whole year (52 weeks) under each offer.

(d) Use the Australian Taxation Office table below for **2026–27** to find the income tax payable on each taxable income, and then find the **overall share** of each income that goes to tax. Give each overall share to one decimal place. (The overall share is tax payable ÷ taxable income, written as a percentage.)

Taxable income	Income tax payable
0 – $18,200	Nil
$18,201 – $45,000	15c for each $1 over $18,200
$45,001 – $135,000	$4,020 plus 30c for each $1 over $45,000
$135,001 – $190,000	$31,020 plus 37c for each $1 over $135,000
$190,001 and over	$51,370 plus 45c for each $1 over $190,000

Source: Australian Taxation Office, "Tax rates for Australian residents", last updated 13 August 2026; retrieved 20 August 2026. The rates do not include the Medicare levy, a separate charge on most taxable income.

(e) Find the **take-home pay** for the year under each offer. (The take-home pay is the pay left after the income tax is taken out.)

(f) Choose one representation — a table, a graph or a set of rules — that shows the two offers side by side. Draw it, and justify your choice in one sentence.

Part 3 — Interpret and communicate

(Evidence for Criterion 4, with supporting calculations for Criterion 3.)

(a) Write two sentences to the worker: which offer do you recommend at 15 hours per week, and why? Use your own numbers.

(b) The worker wants **USD $1,060.50** of spending money for the trip. The **exchange rate** — the amount of foreign money one Australian dollar buys (4C) — published by the Reserve Bank of Australia on 19 August 2026 was

$$1\,\text{AUD} = 0.7070\,\text{USD}$$

Source: Reserve Bank of Australia, Exchange Rates (Table F11.1), rate for 19 August 2026. Retrieved 20 August 2026.

How many Australian dollars does the worker need to set aside to receive that amount?

(c) The worker takes the offer you recommended and saves **10% of the weekly gross pay** every week. How many weeks of saving will it take to reach the Australian-dollar amount from part (b)?

Part 4 — Review

(Evidence for Criterion 4.)

(a) Review the tax model: name one thing the ATO table leaves out of real take-home pay. (The review step in 1F names one of these.)

(b) Review the pay model: give one reason the worker's real pay for the year might differ from your calculation.

(c) Explain in one sentence why the Australian-dollar amount in Part 3(b) is a guide, not a promise.

(d) In the holidays the worker could take **20 hours per week** instead of 15. Find the weekly gross pay for each offer at 20 hours, and say whether your recommendation from Part 3(a) changes.

(e) At how many hours per week would the two offers pay exactly the same weekly amount? Show how you found it, and say what your answer in (d) and this answer together tell you about your recommendation.

Marking guide

This is a classroom task, not an exam. It is marked against the four criteria of TOC §7.2, at 5 marks each, for **20 marks** in total. Award each mark when the listed student action is visible anywhere in the work handed in; the actions may appear in any order. Per §7.2, a response that stops at correct numbers without interpreting, communicating and reviewing sits at the **middle** of the rubric, not the top: full marks require the review step in the student's own words.

How the 20 marks are allocated

Criterion (TOC §7.2)	Marks	Evidence in the task
1. Formulating the problem or question	5	Part 1
2. Choosing the representation or model, with justification	5	Part 2(f); the choice of methods throughout
3. Executing the mathematics accurately	5	Parts 2(a)–(e), 3(b)–(c)
4. Interpreting, communicating and reviewing the solution in terms of the context	5	Parts 3(a), 4(a)–(e)
Total	**20**	

Criterion 1 — Formulating the problem or question (5 marks)

One mark for each observable action:

1. Writes the task's question in their own words, covering **both** halves: which offer pays better, and whether the savings goal can be met.
2. Names the key quantities and gives each one a letter: hours per week, each hourly rate, the weekly allowance, weeks in the year, taxable income, tax payable.
3. States at least one assumption — for example, the hours stay at 15 per week, all 52 weeks are worked, or the allowance is part of the taxable income — and gives a one-sentence reason it is fair.
4. Identifies the two real inputs the model must use: the ATO table for 2026–27, and the exchange rate for 19 August 2026.
5. Plans an order of attack (weekly pay → yearly pay → tax → take-home pay → savings), visible as a list, a flow or the layout of the working.

Criterion 2 — Choosing the representation or model, with justification (5 marks)

One mark for each observable action:

1. Chooses a representation suited to a side-by-side comparison: a two-column table, a paired bar graph, or a pair of rules for the weekly pay.
2. Justifies the choice in one sentence tied to the question, such as "a table shows both offers step by step, so I can compare them at each step".
3. Constructs the chosen representation correctly: headings or labels, units, and values consistent with the student's own calculations.
4. Chooses the correct operation for the currency conversion — **divide** by 0.7070 to change USD into AUD — and says why (each AUD is worth only 0.7070 USD, so more AUD are needed).
5. Chooses sound methods elsewhere: the income is sliced by bracket before applying 15% (not 15% of the whole income), and 10% is taken of the weekly **gross** pay as the task states.

Criterion 3 — Executing the mathematics accurately (5 marks)

One mark for each cluster; allow consistent follow-through (a cluster earns its mark if the method is right and the arithmetic follows from the student's earlier values):

1. Weekly gross pays: Offer A $360; Offer B $375.

2. The ratio 375:360 simplified to 25:24, and the percentage difference $15 \div 360 \approx 4.2\%$ (accept 4.17%).
3. Taxable incomes: \$18,720 and \$19,500.
4. Tax payable: \$78 and \$195; overall shares 0.4% and 1.0% (one decimal place).
5. Take-home pays \$18,642 and \$19,305; AUD \$1,500 for the spending money; saving of \$37.50 per week; 40 weeks.

Criterion 4 — Interpreting, communicating and reviewing the solution in terms of the context (5 marks)

One mark for each observable action:

1. Recommends an offer to the worker in full sentences, in context, with the right numbers: at 15 hours per week, Offer B pays \$15 more per week and \$663 more per year after tax. (A recommendation that contradicts the student's own numbers earns no mark here.)
2. Communicates the savings result in context: "AUD \$1,500 must be set aside" and "saving \$37.50 a week, the goal takes 40 weeks".
3. Reviews the tax model with a real omission: the Medicare levy, deductions or offsets, or that the table applies only to the 2026–27 financial year.
4. Reviews the pay model with a real limit: the hours may change, shifts may be missed, the allowance or the hourly rates may change, or the worker may not work all 52 weeks.
5. Reviews the comparison itself: the exchange rate moves from day to day, so the AUD amount is a guide; and the recommendation depends on the hours — at 20 hours per week Offer A pays more, and the offers are equal at 18.75 hours.

Sample solution

A model response a marker can compare against. Students are not expected to match it word for word; the review sentences are samples, as throughout the book.

Part 1. The question: *Which offer should the worker take, and how long will the savings for the trip take?* Quantities: $h = 15$ hours per week; the hourly rates are 24 dollars (Offer A) and 20 dollars (Offer B); the allowance is 75 dollars per week; 52 weeks in the year; T is the yearly taxable income. Assumption (sample): the worker works every one of the 52 weeks at 15 hours, because the offers are steady weekend work.

Part 2. (a) Offer A: $15 \times 24 = 360$. Offer B: $15 \times 20 = 300$, then $300 + 75 = 375$.

(b) Ratio $375 : 360 = 25 : 24$. Difference $375 - 360 = 15$, and $15 \div 360 \approx 0.0417 = 4.2\%$: Offer B pays about 4.2% more per week than Offer A.

(c) Offer A: $360 \times 52 = 18\,720$. Offer B: $375 \times 52 = 19\,500$.

(d) Both incomes sit above the tax-free threshold of 18,200 dollars — the amount of income on which no tax is paid — and inside the 15c bracket (the slice of income taxed at 15c for each dollar), so only the slice over 18,200 dollars is taxed. Offer A: $18\,720 - 18\,200 = 520$, and $15\% \times 520 = 78$. Offer B: $19\,500 - 18\,200 = 1\,300$, and $15\% \times 1\,300 = 195$. Overall shares: $78 \div 18\,720 \approx 0.4\%$; $195 \div 19\,500 = 1.0\%$.

(e) Offer A: $18\,720 - 78 = 18\,642$. Offer B: $19\,500 - 195 = 19\,305$.

(f) Sample table, which is the representation chosen here because it shows both offers at every step of the model:

Quantity	Offer A	Offer B
Weekly gross pay	\$360	\$375
Taxable income (52 weeks)	\$18,720	\$19,500
Tax payable, 2026–27	\$78	\$195
Overall share going to tax	0.4%	1.0%
Yearly take-home pay	\$18,642	\$19,305

∴ Offer B pays \$15 more per week, \$780 more per year before tax, and \$663 more per year after tax.

(Check: the extra 780 dollars is itself taxed at 15%, and $780 - 15\% \times 780 = 780 - 117 = 663$ ✓.)

Part 3. (a) Sample: "Take Offer B. At 15 hours a week it pays \$15 more every week, which is \$663 more for the year after tax."

(b) Change USD into AUD by dividing by the rate: $1\,060.50 \div 0.7070 = 1\,500$. Check: $1\,500 \times 0.7070 = 1\,060.50$ ✓. AUD \$1,500 must be set aside.

(c) $10\% \times 375 = 37.50$ per week. $1\,500 \div 37.50 = 40$.

∴ saving \$37.50 a week from Offer B, the spending money takes **40 weeks**.

Part 4. (a) Sample: the table leaves out the Medicare levy (and any deductions or offsets), and it applies only to 2026–27.

(b) Sample: the worker's hours may change from week to week, or the allowance may not be paid every week, so the real yearly pay may sit below the model.

(c) Sample: exchange rates move every trading day, so the rate on the day the money is changed will not be exactly 0.7070.

(d) At 20 hours: Offer A $20 \times 24 = 480$; Offer B $20 \times 20 + 75 = 475$. Offer A now pays \$5 more per week, so the recommendation **changes** to Offer A.

(e) The offers are equal when $24h = 20h + 75$, so $4h = 75$, so $h = 18.75$: at 18 hours 45 minutes per week the two pay the same. Together with (d): below 18.75 hours Offer B is better, above it Offer A is better — the recommendation depends on the hours, which is exactly the kind of thing the review step exists to catch.

Moderation notes

- **Middle of the rubric, not the top (§7.2).** A response with every number right but no interpretation or review can earn Criterion 3 in full and part of the others, but cannot reach the top of Criterion 4. Do not lift such a response.
- **Common observations.** Taxing the whole income at 15% instead of the slice over \$18,200; multiplying by 0.7070 when USD must become AUD; taking the 10% saving from the take-home pay when the task says gross; writing that the worker "pays 15% of their income" when the overall shares are 0.4% and 1.0%.
- **Wrong recommendation, honest working.** A student who recommends Offer A at 15 hours against their own numbers earns nothing for Criterion 4 action 1, but their calculations still earn Criterion 3.
- **Consistent follow-through.** Where an early slip runs through the working, award each later cluster mark if the method is right for the values the student has.
- **Access.** As a classroom instrument, extra time, a reader or a scribe may be arranged by the teacher without changing the marks. The task is the student's own work: discussion is welcome, submissions are individual.

Mark total for Task I3: 20.