Mathematics Level 8

End-of-year review

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End-of-year review

Paper R8 — End-of-Level-8 review · all 29 content descriptions · all six strands · **80 marks** · **90 minutes**

This paper looks back over the whole of Level 8 — every chapter, every strand. It is a classroom review, not an exam: its job is to show what you can do now, and to show you (and your teacher) what to tighten before Year 9. Answer every question, show your working, and keep a few minutes at the end to check.

How this paper works

- The paper has two parts. **Part 1 (27 marks): no digital tools at all** — no calculator, phone, tablet or computer. **Part 2 (53 marks): digital tools are permitted or required** — each question says whether a tool is permitted or required, and which one.
- The questions are grouped by the six strands, so you can see your result strand by strand.
- **Show all your working.** Marks are given for correct working as well as correct answers. Where a question asks for a reason, explanation or description, a correct number with no stated reason does not score the mark.
- **Equipment for the whole paper:** pens, pencil, eraser, ruler.
- In Part 2 a scientific calculator is permitted on every question. Questions 26, 28 and 29 **require** the named digital tool and cannot be done with a hand-drawn substitute. A CAS (computer algebra system) is not permitted anywhere in this paper.
- Marks are shown in brackets after each question number. With 80 marks and 90 minutes, allow about one minute per mark.

Part 1 — No digital tools (27 marks)

Answer every question in Part 1 without any digital tool. Show your working.

Number (6 marks)

> *Diagnostic extracts from the Level 8 achievement standard, quoted verbatim:* `VC2M8N04` — "Students solve problems involving the 4 operations with integers and positive rational numbers." · `VC2M8N02` — "They apply the exponent laws to calculations with numbers involving positive integer exponents." · `VC2M8N01`, `VC2M8N03` — "students recognise irrational numbers as numbers that cannot develop from the division of integer values by natural numbers and terminating or recurring decimals." · `VC2M8N05` — "They use mathematical modelling to solve practical problems involving ratios, percentages and rates in measurement and financial contexts."

Q1 (1 mark). Find the value of $(-8+2)\times\frac{3}{4}-(-7)$.

Q2 (1 mark). Simplify $(3^2)^3 \div 3^4 \times 5^0$, giving your answer as a single number.

Q3 (1 mark). $\frac{7}{8}$ converts to the terminating decimal 0.875, while $\frac{5}{11}$ converts to the recurring decimal $0.\overline{45}$. Explain the difference by looking at the prime factorisation of each denominator.

Q4 (1 mark). Which of these numbers are irrational? $\sqrt{16}$, $\sqrt{12}$, π, 0.7 ◌̄

Q5 (2 marks). No calculator.

a. A jacket is priced at $90. The store takes 20% off. Find the sale price. (1)
b. A game's price with GST is $99. Find the GST inside it. (1) (GST, the goods and services tax, is 10%.)

Algebra (5 marks)

> *Diagnostic extracts from the Level 8 achievement standard, quoted verbatim:* `VC2M8A01` — "Students apply algebraic properties to simplify, rearrange, expand and factorise linear expressions." · `VC2M8A03` — "Students use mathematical modelling to solve problems using linear relations, interpreting and reviewing

the model in context." · `VC2M8A04` — "They make and test conjectures involving linear relations by developing algorithms and using digital tools."

Q6 (2 marks).

a. Expand and simplify $3(2x-4)+5x$. (1)
b. Factorise $12x+8$ completely. (1)

Q7 (1 mark). A tank starts with 400 L of water and loses 5 L each hour through a slow leak, modelled by $V=400-5t$, where V is the volume in litres and t is the time in hours. Explain why this model is only appropriate for $t\leq 80$.

Q8 (2 marks). A student writes this procedure for finding the mean of three numbers.

Step 1: Add the three numbers. Step 2: Divide the total by 2.

a. Trace the procedure on the numbers 4, 8 and 9. Write down the result the procedure gives. (1)
b. Identify the error in the procedure, correct it, and use your correction to find the mean of 4, 8 and 9. (1)

Measurement (7 marks)

Diagnostic extracts from the Level 8 achievement standard, quoted verbatim: `VC2M8M02` — "Students use appropriate metric units when solving measurement problems involving the perimeter and area of composite shapes, and volume of right prisms." · `VC2M8M03` — "Students use formulas to solve problems involving the area and circumference of circles." · `VC2M8M06` — "They use Pythagoras' theorem to solve measurement problems involving unknown lengths of right-angled triangles." · `VC2M8M04` — "They solve problems of duration involving 12- and 24-hour cycles across multiple time zones." · `VC2M8M05`, `VC2M8M07` — "They use mathematical modelling to solve practical problems involving ratios, percentages and rates in measurement and financial contexts."

Q9 (1 mark). A juice carton is a right prism with base area 50 cm² and height 12 cm. Find its volume, and give its capacity in mL.

Q10 (1 mark). A circle has radius 10 cm. Using $\pi\approx 3.14$, find (a) its circumference and (b) its area. Both answers are needed for the mark.

Q11 (2 marks).

a. A right-angled triangle has shorter sides 6 cm and 8 cm. Find the hypotenuse. (1)
b. A triangle has sides 5 cm, 7 cm and 9 cm. Is it right-angled, acute or obtuse? Justify your answer by comparing a^2+b^2 with c^2. (1)

Q12 (1 mark). It is 09:15 on 21 July in Melbourne. What is the time in Perth? Give your answer in 12-hour time, and state which side of Victoria's daylight-saving changeover 21 July sits on. (Melbourne: AEST — Australian Eastern Standard Time, UTC+10 — outside daylight saving, AEDT — Australian Eastern Daylight Time, UTC+11 — from the first Sunday in October to the first Sunday in April. Perth: AWST — Australian Western Standard Time, UTC+8, all year.)

Q13 (1 mark). A cyclist travels 45 km in 1.5 hours at a constant speed. Find the cyclist's speed in km/h.

Q14 (1 mark). On a map with scale 1:25,000, two towns are 8 cm apart. Find the actual distance between the towns, in km.

Space (3 marks)

Diagnostic extracts from the Level 8 achievement standard, quoted verbatim: `VC2M8SP01`, `VC2M8SP04` — "They identify conditions for congruency and similarity in triangles and other common shapes, and design and test algorithms to test for congruency and similarity." · `VC2M8SP02` — "Students apply the properties of quadrilaterals to solve problems."

Q15 (1 mark). Triangle ABC has side lengths 4 cm, 6 cm and 7 cm. Triangle DEF also has side lengths 4 cm, 6 cm and 7 cm. Are the two triangles necessarily congruent? Name the condition that decides it.

Q16 (1 mark). $ABCD$ is a parallelogram, and its diagonals AC and BD meet at O. The sides AB and CD are equal (opposite sides of a parallelogram), and AB is parallel to DC. A proof that the diagonals bisect each other uses these three steps, listed here in no particular order.

(i) $AO = CO$ and $BO = DO$ (matching sides of congruent triangles), so the diagonals bisect each other.
(ii) Triangle AOB is congruent to triangle COD (ASA).
(iii) Angle $ABO =$ angle CDO and angle $BAO =$ angle DCO, because alternate angles are equal.

Write the steps in a valid order.

Q17 (1 mark). Triangle X has sides 6 cm, 8 cm and 10 cm. Triangle Y has sides 3 cm, 4 cm and 5 cm, and the angles of X match the angles of Y. A flow chart tests for congruence and similarity by comparing the ratios of corresponding sides. Find the three ratios, and state what the flow chart reports — congruent, similar, or neither — and the decision it uses.

Statistics (3 marks)

Diagnostic extracts from the Level 8 achievement standard, quoted verbatim: `VC2M8ST01`, `VC2M8ST04` — “Students conduct statistical investigations and explain the implications of obtaining data through sampling.” · `VC2M8ST02` — “Students analyse and describe the distribution of data.” · `VC2M8ST03` — “They compare the variation in distributions of random samples of the same and different size from a given population with respect to shape, measures of central tendency and range.”

Q18 (1 mark). Both parts are needed for the mark.

a. A principal asks all 1,200 students at a school to complete a survey about canteen prices. Is this data collection a census or a sample?
b. At another school, 120 students are listed alphabetically, and every 10th student on the list is selected, giving 12 students. Name this sampling method.

Q19 (1 mark). Two students each draw many random samples from the same population — one uses samples of size 10, the other uses samples of size 50. Whose sample means vary less from sample to sample? Give a reason.

Q20 (1 mark). From a sample of 30 households, a student concludes: “The mean quarterly electricity bill in our town is \$182.” Rewrite this conclusion so that it acknowledges uncertainty.

Probability (3 marks)

Diagnostic extract from the Level 8 achievement standard, quoted verbatim: `VC2M8P01`, `VC2M8P02` — “Students represent the possible combinations of 2 events with tables and diagrams, and determine related probabilities to solve practical problems.”

Q21 (1 mark). In a raffle, the probability that a ticket wins a prize is 0.04. Find the probability that a ticket does not win.

Q22 (2 marks). In a class of 30 students, 12 walk to school, and 19 have a pet. Of the students who walk to school, 7 have a pet.

a. Copy and complete the two-way table. (1)

	Has a pet	No pet	Total
Walks to school	7		12
Does not walk to school			
Total	19		30

b. One student is chosen at random. Find the probability that the student walks to school and has a pet. (1)

Part 2 — Digital tools (53 marks)

In Part 2, digital tools are permitted or required as stated on each question, following each question's content description. A scientific calculator is permitted on every question in this part. Questions 26, 28 and 29 require the named digital tool — a hand-drawn substitute does not deliver the question. A CAS is not permitted anywhere in this paper.

Number (13 marks)

> *Diagnostic extract from the Level 8 achievement standard, quoted verbatim (carried on both codes assessed here):* `VC2M8N05`, `VC2M8N06` — "They use mathematical modelling to solve practical problems involving ratios, percentages and rates in measurement and financial contexts."

Q23 (4 marks). You may use a calculator or a spreadsheet. Victoria's population was 7,004,600 on 31 December 2024 and 7,121,900 on 31 December 2025.

a. How many people were added during the year? (1)
b. Find the percentage increase over the year, to one decimal place. (1)
c. A forecast made early in the year predicted a population of 7,150,000 at 31 December 2025. Find the percentage error of this forecast, compared with the actual value, to one decimal place. (2)

Source: Australian Bureau of Statistics, "National, state and territory population", December 2025, released 18 June 2026; retrieved 20 August 2026.

Q24 (9 marks). You may use a calculator or a spreadsheet. Jordan is an Australian resident for tax purposes, with a taxable income (the income the tax table applies to) of $52,000 in 2026–27. Use the real 2026–27 table below.

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.

a. Find the income tax payable on $52,000. (2)
b. Find the overall percentage of Jordan's taxable income that goes to tax, to one decimal place. (1)
c. Jordan says: "About 30% of my income goes to tax, because my marginal rate — the rate paid on each extra dollar I earn — is 30%." Is Jordan's claim correct? Explain. (2)
d. Jordan considers extra shifts that would raise the taxable income from $52,000 to $60,000. Find the extra tax on the extra $8,000, and the percentage of the extra income that goes to tax. (2)
e. This tax table is a model of income tax only. Give one reason why the amount of money Jordan actually keeps may differ from what this model predicts. (2)

Algebra (14 marks)

> *Diagnostic extracts from the Level 8 achievement standard, quoted verbatim:* `VC2M8A02` — "They graph linear relations and solve linear equations with rational solutions and one-variable inequalities, graphically and algebraically." · `VC2M8A05` — "They make and test conjectures involving linear relations by developing algorithms and using digital tools."

Q25 (8 marks). You may use graphing software; if you do not have access to it, draw the graph by hand. Consider the relation $y = 3x - 2$.

a. Copy and complete the table of values. (2)

x	-1	0	1	2	3
y		-2	1		

b. Plot the points and draw the straight-line graph. (1)
c. Use your graph to solve $3x-2=10$, then verify your solution by substitution. (2)
d. Use your graph to find the values of x for which $3x-2<7$. (2)
e. Without drawing, decide whether the point $(8,21)$ lies on the line, and give your reason. (1)

Q26 (6 marks). You must use graphing software. A student graphs $y=-3x+2$ and writes this conjecture: *"If the coefficient of* x *is negative, the line falls from left to right, whatever the constant term."*

a. Test the conjecture with two more lines of your own choice. For each, record the equation you entered and what the software showed. (2)
b. A second student claims: *"If the coefficient of* x *is positive, the line rises from left to right."* Test this claim with one confirming line, and also test the edge case where the coefficient of x is 0. What do you conclude? (2)
c. Write one generalisation that combines both students' claims, including the edge case. (2)

Measurement (8 marks)

Diagnostic extract from the Level 8 achievement standard, quoted verbatim: `VC2M8M01` — "Students use appropriate metric units when solving measurement problems involving the perimeter and area of composite shapes, and volume of right prisms."

Q27 (8 marks). You may use a calculator. A garden bed is shaped like a rectangle with a triangle on top. The rectangle is 4 m long and 3 m wide. The triangle sits on one of the 4 m sides, has height 1.5 m, and its two other sides are each 2.5 m long.

a. Find the area of the rectangular part. (1)
b. Find the area of the triangular part. (1)
c. Find the total area of the garden bed. (1)
d. Find the perimeter of the garden bed, and explain which side you did not include. (2)
e. Fertiliser is spread at 250 g per square metre. How many grams of fertiliser does the whole bed need? (1)
f. Nearby, a pond is drawn on a 1 m grid. It covers 12 whole squares and 10 partial squares. Estimate the area of the pond, counting each partial square as half. (1)
g. Explain why a finer grid would give a better estimate of the pond's area. (1)

Space (8 marks)

Diagnostic extract from the Level 8 achievement standard, quoted verbatim: `VC2M8SP03` — "Students use 3 dimensions to locate and describe position."

Q28 (8 marks). You must use dynamic geometry software or another digital tool that plots in three dimensions. All coordinates in this question sit in the first octant, where x, y and z are all positive.

a. Plot the points $A(2,3,1)$, $B(6,3,1)$ and $C(6,7,4)$ in a three-dimensional Cartesian coordinate system. (2)
b. Describe the move from A to B as moves parallel to each axis. (1)
c. State one thing that is the same, and one thing that is different, when you compare locating a point in the two-dimensional Cartesian system with locating a point in this three-dimensional system. (2)
d. A drone takes off from the floor — the level where $z=0$ — at the point $(6,7,0)$, and climbs straight up 12 m. Write its coordinates. (1)
e. The table gives the real positions of four Victorian stations. Which station is furthest north, and which has the greatest elevation above sea level? Give your reasons from the table. (2)

Station	Latitude	Longitude	Elevation above sea level
Melbourne Airport	37.67° S	144.83° E	113 m

Station	Latitude	Longitude	Elevation above sea level
Moorabbin Airport	37.98° S	145.10° E	12 m
Mildura Airport	34.24° S	142.09° E	50 m
Mount Buller	37.15° S	146.44° E	1707 m

Source: Bureau of Meteorology, climate statistics for Australian locations, station pages 086282, 086077, 076031 and 083024; retrieved 20 August 2026.

Probability (10 marks)

> *Diagnostic extract from the Level 8 achievement standard, quoted verbatim:* `VC2M8P03` — "They conduct experiments or simulations using digital tools to determine related probabilities of compound events."

Q29 (10 marks). You must use a digital tool that generates random numbers, such as a spreadsheet or a simulation tool. Two standard six-sided dice are rolled, and the event is *the two numbers add to 8*.

a. List all the outcomes that give a sum of 8, and find the theoretical probability of the event. (2)
b. Design a simulation to estimate this probability. State what one trial is, and how you will use random numbers to stand for the two dice. (2)
c. Run your simulation for 100 trials. Record how many times the event happened, and find the relative frequency. (2)
d. Compare your relative frequency with the theoretical probability from part a. What do you expect to happen to the relative frequency as the number of trials grows to 1,000? (2)
e. The class combines all groups' results, reaching 3,000 trials, with the event happening 431 times. Find this relative frequency to three decimal places and compare it with the theoretical probability. (2)

Marking guide

R8 is a classroom review paper, not an examination. Mark the working, not only the final answer: the paper is designed so a teacher can read the result diagnostically, strand by strand, against the Level 8 achievement standard (the extracts are quoted verbatim at the head of each strand section of the paper).

Allocation by question

Q	Part	Strand	Content description (subtopic)	Marks
1	1	Number	VC2M8N04 (1A)	1
2	1	Number	VC2M8N02 (1B)	1
3	1	Number	VC2M8N03 (1C)	1
4	1	Number	VC2M8N01 (1D)	1
5	1	Number	VC2M8N05 (1E, without digital tools)	2
6	1	Algebra	VC2M8A01 (2A)	2
7	1	Algebra	VC2M8A03 (2C)	1
8	1	Algebra	VC2M8A04 (2E)	2
9	1	Measurement	VC2M8M02 (3C)	1
10	1	Measurement	VC2M8M03 (3B)	1
11	1	Measurement	VC2M8M06 (3D)	2
12	1	Measurement	VC2M8M04 (4A)	1
13	1	Measurement	VC2M8M05 (4B)	1
14	1	Measurement	VC2M8M07 (4C)	1
15	1	Space	VC2M8SP01 (5A)	1
16	1	Space	VC2M8SP02 (5B)	1
17	1	Space	VC2M8SP04 (5C)	1
18	1	Statistics	VC2M8ST01 (6A) and VC2M8ST02 (6B)	1
19	1	Statistics	VC2M8ST03	1

Q	Part	Strand	Content description (subtopic)	Marks
			(6C)	
20	1	Statistics	`VC2M8ST04` (6D)	1
21	1	Probability	`VC2M8P01` (7A)	1
22	1	Probability	`VC2M8P02` (7B)	2
23	2	Number	`VC2M8N05` (1E, with digital tools)	4
24	2	Number	`VC2M8N06` (1F)	9
25	2	Algebra	`VC2M8A02` (2B)	8
26	2	Algebra	`VC2M8A05` (2D, graphing software required)	6
27	2	Measurement	`VC2M8M01` (3A)	8
28	2	Space	`VC2M8SP03` (5D, digital tool required)	8
29	2	Probability	`VC2M8P03` (7C, digital tool required)	10
			Total	**80**

Strand totals

Strand	Part 1	Part 2	Total
Number	6	13	19
Algebra	5	14	19
Measurement	7	8	15
Space	3	8	11
Statistics	3	0	3
Probability	3	10	13
Total	**27**	**53**	**80**

Marking notes

1. **Reasoning is part of the mark.** Where a question asks for a reason, explanation, description or review (Q3, Q7, Q8b, Q11b, Q12, Q16, Q17, Q19, Q20, Q24c, Q24e, Q26, Q27d, Q27g, Q28c, Q29d, Q29e), a correct number with no stated reason does not score the mark. Award the reasoning mark for a correct statement in the student's own words; the wording in the solutions is a guide, not a script.
2. **Follow-through.** Where a later part uses a result from an earlier part, award full marks for the later part if the method is correct for the student's carried value, unless the carried value makes the question trivial or impossible.

3. **Units.** Where a question asks for a measurement, the answer needs the correct unit to score the mark (cm, cm^2, cm^3, mL, m, m^2, km, km/h, g, \$, or the stated time format).
4. **Rounding.** Round only where the question says so; otherwise accept exact values. Accept equivalent forms (2.5 or $\frac{5}{2}$; $\frac{7}{30}$ left as a fraction).
5. **Part 1 is calculator-free.** If working in Part 1 shows a calculator-only method (for example a decimal long division with no written strategy), award the answer mark but note it for teaching: `VC2M8N04` and `VC2M8N05` ask for efficient mental and written strategies as well.
6. **Part 2 tool status.** Q26, Q28 and Q29 require the named digital tool (`VC2M8A05`, `VC2M8SP03`, `VC2M8P03` name one without qualification); a hand-drawn substitute does not deliver the CD and should not be credited in full. On Q23, Q24, Q25 and Q27 the tool is permitted, not required — by-hand methods score fully.
7. **Answers will vary** on Q26a, Q26b, Q29c and Q29d. Mark against the structure shown in the solutions (a stated equation and observation; a trial count and a relative frequency computed as count ÷ trials), not against the sample values.
8. **Year 9 readiness.** R8 is the Year 8 exit check and the readiness check for Level 9. The Number, Algebra and Statistics sections are the ones a Year 9 teacher should read first: Level 9's `VC2M9A01`, `VC2M9A02`/`VC2M9A03`/`VC2M9A04` and `VC2M9ST01`/`VC2M9ST02` assume the most and re-teach the least.

Solutions

Fully-worked solutions

Q1. Work inside the brackets first, then multiply, then subtract the negative.

$$(-8+2)\times\frac{3}{4}-(-7)=-6\times\frac{3}{4}-(-7)=-\frac{18}{4}+7=-4.5+7=2.5.$$

∴ the value is 2.5.

Q2. Apply the laws one at a time: $(3^2)^3=3^{2\times 3}=3^6$; then $3^6\div 3^4=3^{6-4}=3^2$; and $5^0=1$ (the zero exponent).

∴ $3^2\times 1=9$.

Q3. $8=2^3$: the denominator's only prime factor is 2, so $\frac{7}{8}$ terminates. 11 is prime and is neither 2 nor 5, so $\frac{5}{11}$ recurs.

∴ a fraction in lowest terms terminates exactly when its denominator's prime factors are only 2s and 5s; any other prime factor gives a recurring decimal.

Q4. $\sqrt{16}=4$, a rational number; $0.\overline{7}=\frac{7}{9}$, a recurring decimal, so it is rational. $\sqrt{12}$ is not a perfect square, and π is not a fraction of integers.

∴ the irrational numbers are $\sqrt{12}$ and π.

Q5.

a. 10% of 90 = 9, so 20% of 90 = 18. Sale price: $90-18=72$.
b. A price with GST is 11 equal parts (10 parts price, 1 part GST), so divide by 11: $99\div 11=9$.

∴ (a) $72; (b) $9 of GST.

Q6.

a. $3(2x-4)+5x=6x-12+5x=11x-12$.
b. The highest common factor of 12 and 8 is 4: $12x+8=4(3x+2)$.

∴ (a) $11x-12$; (b) $4(3x+2)$.

Q7. At $t=80$, $V=400-5\times 80=0$: the tank is empty. For $t>80$ the formula gives negative volumes, and a volume of water cannot be negative — an empty tank stays empty.

∴ the model is only appropriate for $t\le 80$.

Q8.

a. Step 1: $4+8+9=21$. Step 2: $21\div 2=10.5$. The procedure gives 10.5.
b. The error is Step 2: the total must be divided by the number of values, which is 3, not 2. Corrected: $21\div 3=7$.

∴ (a) 10.5; (b) divide by 3, giving a mean of 7.

Q9. Volume of a right prism = base area × height: $50\times 12=600$ cm³. Since 1 mL = 1 cm³, the capacity is 600 mL.

∴ 600 cm³; 600 mL.

Q10.

a. $C=2\pi r=2\times 3.14\times 10=62.8$ cm.
b. $A=\pi r^2=3.14\times 10^2=3.14\times 100=314$ cm².

∴ (a) 62.8 cm; (b) 314 cm².

Q11.

a. Pythagoras' theorem: $c^2 = 6^2 + 8^2 = 36 + 64 = 100$, so $c = \sqrt{100} = 10$ cm.
b. Compare $a^2 + b^2$ with c^2, where $c = 9$ is the longest side: $5^2 + 7^2 = 25 + 49 = 74$, and $9^2 = 81$. Since $74 < 81$, the triangle is obtuse.

∴ (a) 10 cm; (b) obtuse, because $a^2 + b^2 < c^2$.

Q12. 21 July sits between the first Sunday in April and the first Sunday in October, so Victoria is outside daylight saving: Melbourne is on AEST (UTC+10). Perth keeps AWST (UTC+8) all year, 2 hours behind Melbourne: $09:15 - 2$ hours $= 07:15$.

∴ 7:15 am, and Melbourne is on AEST because 21 July is on the winter side of the changeover.

Q13. Speed = distance ÷ time: $45 \div 1.5 = 30$.

∴ 30 km/h.

Q14. Actual distance $= 8 \times 25{,}000 = 200{,}000$ cm. Convert: 200,000 cm $= 2{,}000$ m $= 2$ km.

∴ 2 km.

Q15. All three pairs of corresponding sides are equal (4 cm, 6 cm, 7 cm), so the triangles are congruent by SSS — three matching sides are sufficient.

∴ yes, congruent; the condition is SSS.

Q16. The angle facts come first, then the congruence, then the conclusion read off from matching sides.

∴ the valid order is (iii), then (ii), then (i): alternate angles give the two equal angle pairs; with the equal included side $AB = CD$, ASA gives congruent triangles; matching sides then give $AO = CO$ and $BO = DO$, so the diagonals bisect each other.

Q17. The ratios of corresponding sides are $6 \div 3 = 2$, $8 \div 4 = 2$ and $10 \div 5 = 2$: a constant ratio of 2. The flow chart checks whether the constant ratio is 1. It is not — it is 2.

∴ the flow chart reports *similar, not congruent*: the ratios of corresponding sides are constant (similar), and the ratio is not 1 (so not congruent).

Q18.

a. Every member of the population is asked, so this is a **census**.
b. Selecting every 10th name from a complete list is **systematic sampling**.

∴ (a) census; (b) systematic sampling.

Q19. The larger samples vary less. A sample of 50 reflects the population more steadily than a sample of 10, so the means of samples of size 50 cluster closer together, while single unusual values move a sample of 10 much more.

∴ the student using samples of size 50.

Q20. Any wording that marks the figure as an estimate from a sample scores the mark, for example: "Based on our sample of 30 households, we estimate that the mean quarterly electricity bill in our town is about $182."

∴ the conclusion must say *about* (or *estimated from the sample*), not state the value as a fact about the whole town.

Q21. Complementary events have a combined probability of 1: $Pr(\text{not win}) = 1 - Pr(\text{win}) = 1 - 0.04 = 0.96$.

∴ 0.96.

Q22.

a. Walks, no pet: $12-7=5$. No pet total: $30-19=11$. Does not walk, no pet: $11-5=6$. Does not walk, pet: $19-7=12$. Does not walk total: $12+6=18$. Check: $18+12=30$. ✓

	Has a pet	No pet	Total
Walks to school	7	5	12
Does not walk to school	12	6	18
Total	19	11	30

b. Favourable outcomes: walks and has a pet = 7; total = 30.

∴ (a) the completed table above; (b) $\frac{7}{30}$.

Q23.

a. $7,121,900-7,004,600=117,300$ people.

b. $\frac{117,300}{7,004,600}\times 100\,\%\approx 1.6746\,\%$, which rounds to 1.7%.

c. Error $=|7,150,000-7,121,900|=28,100$. Compare it with the actual value: $\frac{28,100}{7,121,900}\times 100\,\%\approx 0.3946\,\%$, which rounds to 0.4%.

∴ (a) 117,300 people; (b) 1.7%; (c) 0.4%. Check: 1% of the population is about 70,000, so 117,300 is a little more than 1%, and 28,100 is well under 1% — the right sizes.

Source: Australian Bureau of Statistics, "National, state and territory population", December 2025, released 18 June 2026; retrieved 20 August 2026.

Q24.

a. The first \$18,200 pays Nil. The next \$26,800 (from \$18,200 to \$45,000) pays 15c per dollar: $26,800\times 0.15=4,020$. The remaining \$7,000 (from \$45,000 to \$52,000) pays 30c per dollar: $7,000\times 0.30=2,100$. Tax payable: $4,020+2,100=6,120$.

b. $\frac{6,120}{52,000}\times 100\,\%\approx 11.769\,\%$, which rounds to 11.8%.

c. The claim is **not correct**. The 30% is the *marginal* rate — it applies only to each dollar earned above \$45,000, not to the whole income. The overall share of the income that goes to tax is 11.8%, not 30%.

d. The extra \$8,000 sits entirely inside the \$45,001–\$135,000 bracket, so it is taxed at the marginal rate of 30c per dollar: $8,000\times 0.30=2,400$. The share of the extra income is $\frac{2,400}{8,000}=30\,\%$.

e. Any one well-explained reason scores full marks, for example: the table models income tax on *taxable* income, but money is deducted before tax is worked out, so Jordan's actual pay is higher than the taxable income; or the model counts income tax only — it says nothing about other taxes Jordan pays, such as the GST built into prices, so the amount kept after all taxes is smaller than the model shows. The reason must say *how* it changes the prediction, not merely name it.

∴ (a) \$6,120; (b) 11.8%; (c) no — 30% is the marginal rate on dollars above \$45,000, the overall share is 11.8%; (d) \$2,400, which is 30% of the extra income; (e) as explained.

Source: Australian Taxation Office, "Tax rates for Australian residents", last updated 13 August 2026; retrieved 20 August 2026.

Q25.

a. Substitute each x into $y=3x-2$: for $x=-1$, $y=-5$; for $x=2$, $y=4$; for $x=3$, $y=7$.

x	-1	0	1	2	3
y	-5	-2	1	4	7

b. The five points lie on a straight line; join them and extend the line.
c. On the graph, $y=10$ where $x=4$. Verify by substitution: $3\times4-2=12-2=10$. ✓ The solution is $x=4$.
d. On the graph, the line is below $y=7$ wherever x is less than 3; the two are equal at $x=3$. So $3x-2<7$ when $x<3$.
e. Substitute $x=8$: $3\times8-2=22$, not 21. The point $(8,21)$ does not lie on the line.

∴ (a) −5, 4, 7; (b) straight line through the five points; (c) $x=4$, verified; (d) $x<3$; (e) no, because $3\times8-2=22\neq21$.

Q26. Answers will vary; a sample run follows.

a. Two confirming tests: enter $y=-x+5$ — the line falls from left to right; enter $y=-4x-1$ — this line also falls, and more steeply. Both agree with the conjecture.
b. Confirming test: $y=2x+1$ rises from left to right, as claimed. Edge case: with coefficient 0, the line is $y=3$, a horizontal line — it neither rises nor falls. Since 0 is not positive, this does not break the claim; it marks its edge. The second student's claim survives.
c. For a line $y=ax+b$: if $a>0$, the line rises from left to right; if $a<0$, it falls from left to right; if $a=0$, the line is horizontal. The constant term b moves the line up or down without changing whether it rises or falls.

Mark the structure: two tests with equations and observations in (a); one confirming line plus the $a=0$ edge case with a correct reading in (b); a generalisation in (c) that covers positive, negative and zero coefficients.

Q27.

a. Rectangle: $4\times3=12$ m².
b. Triangle: $\frac{1}{2}\times4\times1.5=3$ m².
c. Total area: $12+3=15$ m².
d. The outer boundary is made of the two 3 m sides of the rectangle, the 4 m side opposite the triangle, and the two 2.5 m sides of the triangle: $3+2.5+2.5+3+4=15$ m. The 4 m side the triangle sits on is **not** included — it is inside the shape, not on the boundary.
e. $15\times250=3,750$ g of fertiliser.
f. $12+\frac{1}{2}\times10=12+5=17$ m².
g. With a finer grid, the partial squares are smaller, so the amount of the shape that is only partly counted is smaller too; the estimate is squeezed closer to the true area.

∴ (a) 12 m²; (b) 3 m²; (c) 15 m²; (d) 15 m — the shared 4 m side is excluded; (e) 3,750 g; (f) about 17 m²; (g) as explained.

Q28.

a. In the software's 3D view: A sits 2 along x, 3 across parallel to y, 1 up; B sits 6 along, 3 across, 1 up; C sits 6 along, 7 across, 4 up.
b. From $A(2,3,1)$ to $B(6,3,1)$: move 4 parallel to the x-axis, 0 parallel to the y-axis and 0 parallel to the z-axis — only the first coordinate changes.
c. Same as 2D: perpendicular axes meeting at an origin, and coordinates written in a fixed order. Different from 2D: three axes and three numbers instead of two, with the third number giving height; and space is cut into eight octants where the plane had four quadrants. (Any correct same-and-different pair scores.)
d. Climbing straight up changes only the height: $(6,7,12)$.
e. Further north means a smaller south latitude: Mildura, at 34.24° S, has the smallest, so Mildura Airport is furthest north. The greatest elevation is 1707 m, at Mount Buller.

∴ (a) points plotted; (b) 4 parallel to x, 0 parallel to y, 0 parallel to z; (c) as explained; (d) $(6,7,12)$; (e) Mildura Airport, Mount Buller.

Source: Bureau of Meteorology, climate statistics for Australian locations, station pages 086282, 086077, 076031 and 083024; retrieved 20 August 2026.

Q29.

a. The outcomes with sum 8 are $(2,6)$, $(3,5)$, $(4,4)$, $(5,3)$, $(6,2)$ — 5 outcomes out of 36 equally likely outcomes. Theoretical probability $=\frac{5}{36}$.

b. One trial = one roll of the two dice. Use the digital tool to generate two random whole numbers from 1 to 6 — one for each die — and count the trial as a success when the two numbers add to 8. The chances in the simulation match the chances in the real experiment.

c. Answers will vary; a sample: the event happened 14 times in 100 trials, so the relative frequency is $14 \div 100 = 0.14$. Mark the count and a relative frequency computed as count ÷ trials.

d. The sample's 0.14 is close to $\frac{5}{36} \approx 0.139$. As the number of trials grows to 1,000, the relative frequency settles closer and closer to the theoretical probability.

e. $431 \div 3{,}000 \approx 0.144$ (to three decimal places). This is close to $\frac{5}{36} \approx 0.139$ — the combined long-run relative frequency sits near the theoretical probability, as expected.

∴ (a) 5 outcomes, $\frac{5}{36}$; (b) as designed; (c) answers will vary; (d) close, and settling closer with more trials; (e) 0.144, close to 0.139.

Compact answer key

Q	Answer
1	2.5
2	9
3	$8=2^3$ (only 2s) → terminates; 11 is a prime other than 2 or 5 → recurs
4	$\sqrt{12}$ and π
5	a. \$72 · b. \$9
6	a. $11x-12 \cdot b.4(3x+2)$
7	At $t=80$ the tank is empty; beyond that the formula gives negative volumes
8	a. 10.5 · b. divide by 3, not 2; mean = 7
9	600 cm³; 600 mL
10	a. 62.8 cm · b. 314 cm²
11	a. 10 cm · b. obtuse ($74<81$)
12	7:15 am; 21 July is outside daylight saving (AEST)
13	30 km/h
14	2 km
15	Yes — SSS
16	(iii), (ii), (i)
17	Ratios 2, 2, 2 → similar, not congruent (ratio ≠ 1)

Q	Answer
18	a. census · b. systematic sampling
19	Samples of size 50; larger samples vary less
20	"…we estimate the mean is about \$182" (estimate/uncertainty language)
21	0.96
22	a. 5, 12, 6, 18, 11 · b. $\frac{7}{30}$
23	a. 117,300 · b. 1.7% · c. 0.4%
24	a. \$6,120 · b. 11.8% · c. no — 30% is the marginal rate, overall is 11.8% · d. \$2,400, 30% · e. model covers income tax on taxable income only
25	a. −5, 4, 7 · c. $x=4$ · d. $x<3$ · e. no ($3\times8-2=22$)
26	Answers vary: tests support both claims; $a>0$ rises, $a<0$ falls, $a=0$ horizontal
27	a. 12 m² · b. 3 m² · c. 15 m² · d. 15 m · e. 3,750 g · f. 17 m² · g. finer grid, smaller partial squares
28	b. 4 parallel to x · c. same: axes/order; different: three numbers, height · d. $(6, 7, 12)$ · e. Mildura Airport; Mount Buller
29	a. $\frac{5}{36}$ · e. 0.144 ≈ close to 0.139