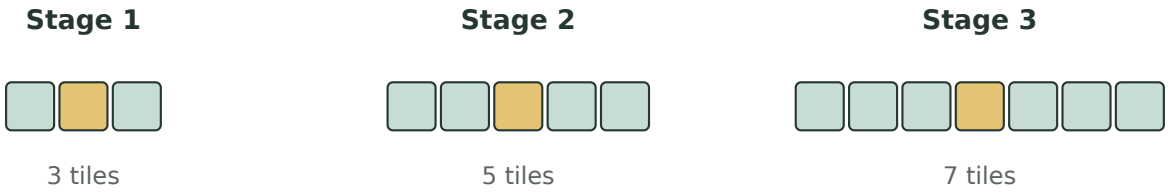
Growing patterns, tables and Cartesian graphs

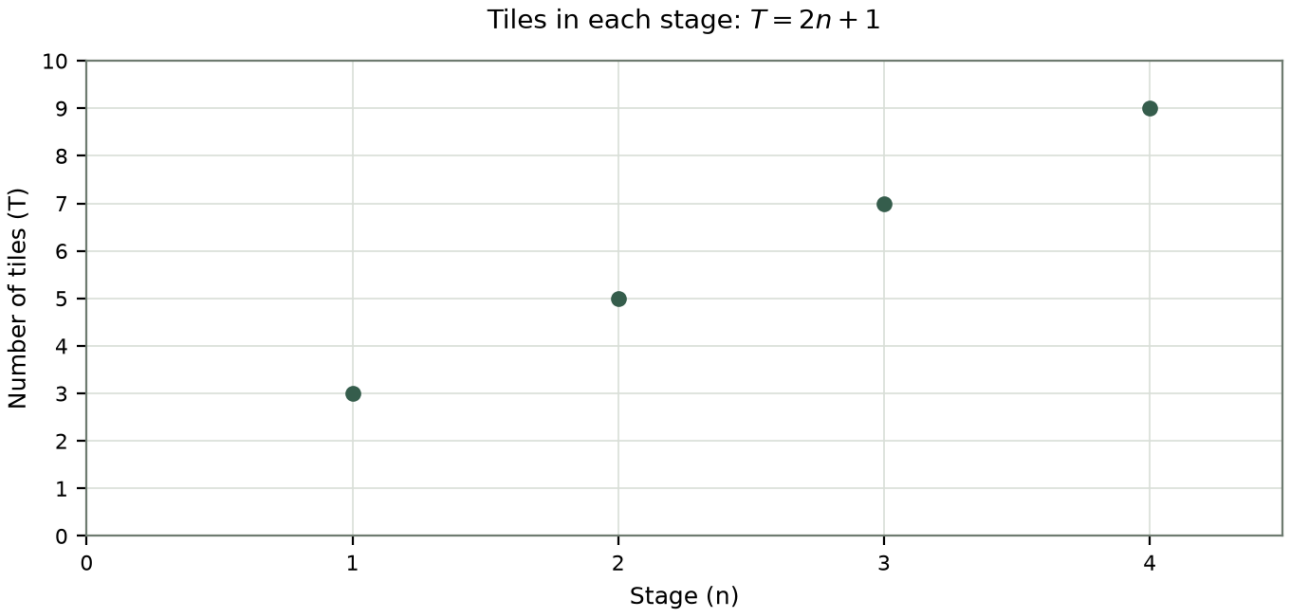
8 questions | 24 marks

Equivalent correct methods and notation earn corresponding marks. Include units and directions where asked. Each worked step identifies the mark allocation.

The growing tile pattern



Gold: one centre tile. Green: the two arms, each with n tiles.



Constructed tile pattern; positive whole-number stages only

1. The pictured pattern has a centre tile and two arms. Stage 1 has 3 tiles, stage 2 has 5, and stage 3 has 7. Describe what is added at each step and find the number of tiles in stage 4. [2 marks]

Each arm grows by one tile, so the total increases by 2. (1 mark)

Stage 4 has $7 + 2 = 9$ tiles. (1 mark)

Answer: One tile is added to each arm, making 2 extra tiles. Stage 4 has 9 tiles.

2. For stages $n = 1, 2, 3, 4, 6$, complete the totals $T = 3, 5, \square, \square, \square$. Use $T = 2n + 1$ and show each missing calculation. [3 marks]

At $n = 3$, $T = 2(3) + 1 = 7$. (1 mark)

At $n = 4$, $T = 2(4) + 1 = 9$. (1 mark)

At $n = 6$, $T = 2(6) + 1 = 13$. The last column skips stage 5, so do not just add 2 to the previous displayed total. (1 mark)

Answer: The missing totals are $7, 9, 13$.

3. Find the total tiles in stage 15 of $T = 2n + 1$. Explain what the $2n$ and the $+1$ represent in the picture. [3 marks]

$T = 2(15) + 1 = 31$ tiles. (1 mark)

$2n$ counts two arms with n tiles in each. (1 mark)

$+1$ counts the single centre tile. (1 mark)

Answer: 31 tiles; $2n$ counts the two arms and $+1$ counts the centre tile.

4. A student proposes $T = n + 2$ for the pattern $3, 5, 7, 9, \ldots$ because the total goes up by 2. Test the rule at stages 1 and 2, then explain why the constant difference is not a complete stage rule. [3 marks]

At $n = 1$, $n + 2 = 3$, so the proposed rule matches the first stage. (1 mark)

At $n = 2$, $n + 2 = 4$, which does not match the actual total 5. (1 mark)

A difference tells how consecutive totals change. A stage rule must connect each stage number to its total; here $T = 2n + 1$. (1 mark)

Answer: It gives 3 at stage 1 but 4 at stage 2, so it fails. The difference describes the change between stages; $T = 2n + 1$ gives the total directly from the stage number.

5. Draw a Cartesian graph for stages 1 to 4 of $T = 2n + 1$. Label the horizontal axis 'Stage n' and the vertical axis 'Tiles T'. Use a scale of 1 per interval on both axes, plot the four points and explain why they should remain separate points. [4 marks]

Label the horizontal axis Stage n and the vertical axis Tiles T, with 1 per interval. (1 mark)

Correctly plot $(1, 3)$ and $(2, 5)$. (1 mark)

Correctly plot $(3, 7)$ and $(4, 9)$. (1 mark)

Use separate points: fractional stage numbers do not represent stages of this tile pattern. (1 mark)

Answer: Plot $(1, 3)$, $(2, 5)$, $(3, 7)$ and $(4, 9)$ on labelled axes with the stated scales. Keep the points separate because only positive whole-number stages exist.

6. Which stage of $T = 2n + 1$ has 25 tiles? Show your calculation and check your answer by substitution. [3 marks]

$2n + 1 = 25$, so subtract 1 from both sides to get $2n = 24$. (1 mark)

Divide both sides by 2: $n = 12$. (1 mark)

Check: $2(12) + 1 = 25$. The stage number is a positive whole number. (1 mark)

Answer: Stage 12.

7. The horizontal axis is stage number and the vertical axis is number of tiles. Which point represents stage 7 of $T = 2n + 1$: $(7, 15)$ or $(15, 7)$? Explain the coordinate order. [2 marks]

$T = 2(7) + 1 = 15$, so choose $(7, 15)$. (1 mark)

The first coordinate is horizontal, $n = 7$; the second is vertical, $T = 15$. (1 mark)

Answer: $(7, 15)$; stage number comes first and total tiles second.

8. For $B = 3n + 1$, make a table for stages 1 to 4. List the four coordinates (n, B) and state how the total changes when the stage increases by 1. [4 marks]

For stages 1 and 2, $B = 3(1) + 1 = 4$ and $B = 3(2) + 1 = 7$. (1 mark)

For stages 3 and 4, $B = 3(3) + 1 = 10$ and $B = 3(4) + 1 = 13$. (1 mark)

Pair each stage with its total: $(1, 4)$, $(2, 7)$, $(3, 10)$ and $(4, 13)$. (1 mark)

The successive differences are $7 - 4 = 3$, $10 - 7 = 3$ and $13 - 10 = 3$, so the total increases by 3 for each extra stage. (1 mark)

Answer: The totals are $4, 7, 10, 13$. The points are $(1, 4)$, $(2, 7)$, $(3, 10)$ and $(4, 13)$. The total increases by 3 per stage.

Curriculum alignment

Australian Curriculum, presented by QCAA | 9.0 | AC9M7A05

Generate values from a visual pattern or function rule, describe the relationship and represent it with Cartesian coordinates.

Official curriculum source | Checked 2026-11-02