

WA6MNA PR1

Patterns and relationships

Core + Challenge

Growing Patterns and Rules — Marking Key

I can continue growing and shrinking patterns and write a rule that links each term to its position.

For tutors and parents. Award method marks for correct working even if the final answer is wrong.

Marks summary

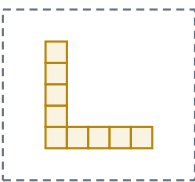
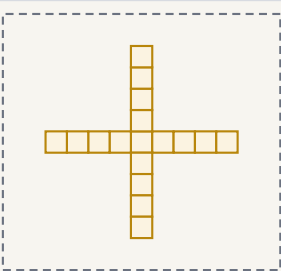
A Warm up: 16 B Practise: 22 C Think it through: 10 D Challenge: 9 **Total: 57**

Gold shading in this key shows what the child should have shaded or drawn. Accept any correct arrangement unless the question fixes it.

A

Warm up answers

/ 16 marks

Q	Answer	Model answer / notes	Marks
1	13 sticks	 Term 4 Terms 1 to 3 have 4, 7, 10 sticks, going up by 3 each time. Term 4: $10 + 3 = 13$.	1
2	9 sticks	 Term 4 Terms 1 to 3 have 3, 5, 7 sticks, going up by 2 each time. Term 4: $7 + 2 = 9$.	1
3	9 tiles	 Term 4 Terms 1 to 3 have 3, 5, 7 tiles, going up by 2 each time. Term 4: $7 + 2 = 9$.	1
4	17 tiles	 Term 4 Terms 1 to 3 have 5, 9, 13 tiles, going up by 4 each time. Term 4: $13 + 4 = 17$.	1

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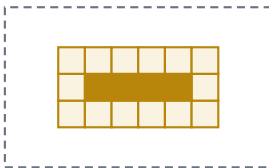
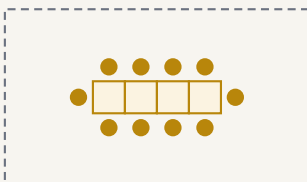
Q	Answer	Model answer / notes	Marks
5	17, 21	 The pattern goes up by 4 each time: 5, 9, 13, 17, 21.	1
6	32, 26	The pattern goes down by 6 each time: 50, 44, 38, 32, 26.	1
7	34, 43	The pattern goes up by 9 each time: 7, 16, 25, 34, 43.	1
8	64, 52	The pattern goes down by 12 each time: 100, 88, 76, 64, 52.	1
9	8, 23	The pattern goes up by 5 each time: 3, 8, 13, 18, 23.	1
10	68, 40	 The pattern goes down by 7 each time: 68, 61, 54, 47, 40.	1
11	30	Rule: value = position $\times$ 3. At position 10: $10 \times 3 = 30$.	1
12	23	Rule: value = position $\times$ 2 + 3. At position 10: $10 \times 2 + 3 = 23$.	1
13	40	Rule: value = position $\times$ 4. At position 10: $10 \times 4 = 40$.	1
14	51	Rule: value = position $\times$ 5 + 1. At position 10: $10 \times 5 + 1 = 51$.	1
15	38	Rule: value = position $\times$ 4 - 2. At position 10: $10 \times 4 - 2 = 38$.	1
16	12	Rule: value = $32 - \text{position} \times 2$. At position 10: $32 - 10 \times 2 = 12$.	1

B Practise *answers and working*

/ 22 marks

Q	Answer	Working / sample response	Marks												
1	21, 26; rule: houses $\times$ 5 + 1; 101	<table border="1"><thead><tr><th>Houses</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr></thead><tbody><tr><td>Sticks</td><td>6</td><td>11</td><td>16</td><td>21</td><td>26</td></tr></tbody></table> Each new house adds 5 sticks (it shares a wall), so $16 + 5 = 21$ and $21 + 5 = 26$. Rule: number of houses $\times$ 5 + 1 (the 1 is the first wall). 20 houses: $20 \times 5 + 1 = 101$ matchsticks. <i>1 mark: 21 and 26.</i> <i>1 mark: the rule (in words or as position $\times$ 5 + 1).</i> <i>1 mark: 101.</i>	Houses	1	2	3	4	5	Sticks	6	11	16	21	26	3
Houses	1	2	3	4	5										
Sticks	6	11	16	21	26										

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Q	Answer	Working / sample response	Marks												
		 Term 4													
2	14; rule: position $\times$ 2 + 6	Term 4 has 4 flower tiles with a border of 14 white tiles. White tiles: 8, 10, 12, 14 (up 2 each time). Rule: position $\times$ 2 + 6 (2 white tiles above and below each flower tile, plus 3 at each end). 1 mark: term 4 drawn correctly. 1 mark: 14 in the table. 1 mark: a correct rule, e.g. position $\times$ 2 + 6.	3												
3	38, 34; 10 trips	<table><tr><th>Trips</th><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><th>Balance</th><td>\$50</td><td>\$46</td><td>\$42</td><td>\$38</td><td>\$34</td></tr></table> The balance goes down by \$4 each trip: 50, 46, 42, 38, 34. Rule: 50 – trips $\times$ 4. To get to \$10 he uses \$40, and 40 $\div$ 4 = 10 trips. 1 mark: \$38 and \$34. 1 mark: 10 trips.	Trips	0	1	2	3	4	Balance	\$50	\$46	\$42	\$38	\$34	2
Trips	0	1	2	3	4										
Balance	\$50	\$46	\$42	\$38	\$34										
4	4, 10, 16, 58; position 17	<table><tr><th>Position</th><td>1</td><td>2</td><td>3</td><td>10</td><td></td></tr><tr><th>Value</th><td>4</td><td>10</td><td>16</td><td>58</td><td>100</td></tr></table> 1 $\times$ 6 – 2 = 4, 2 $\times$ 6 – 2 = 10, 3 $\times$ 6 – 2 = 16, 10 $\times$ 6 – 2 = 58. Work backwards from 100: 100 + 2 = 102, and 102 $\div$ 6 = 17. 1 mark: 4, 10, 16 and 58. 1 mark: position 17.	Position	1	2	3	10		Value	4	10	16	58	100	2
Position	1	2	3	10											
Value	4	10	16	58	100										
5	a) 42 b) 49 tables	 Term 4 Chairs: 4, 6, 8, 10 ... Rule: tables $\times$ 2 + 2 (one above and one below each table, plus one at each end). a) 20 $\times$ 2 + 2 = 42 chairs. b) 100 – 2 = 98 and 98 $\div$ 2 = 49 tables. 1 mark: 4 tables with 10 chairs drawn. 1 mark: 42. 1 mark: 49.	3												

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Q	Answer	Working / sample response	Marks										
6	See lines	4, 8, 12, 16 3, 7, 11, 15 5, 6, 7, 8 6, 8, 10, 12 position + 4 position × 4 − 1 position × 2 + 4 position × 4 4, 8, 12, 16: position × 4. 3, 7, 11, 15: position × 4 − 1. 5, 6, 7, 8: position + 4. 6, 8, 10, 12: position × 2 + 4. 2 marks: all four correct. 1 mark: two or three correct.	2										
7	Term 4: 12 tiles; term 6	Term 4 Each term loses one column of 4 tiles: 24, 20, 16, 12. Keep going: term 5 has 8 and term 6 has 4 tiles. (Rule: $28 - \text{position} \times 4$.) 1 mark: term 4 drawn as 12 tiles (4 rows of 3). 1 mark: term 6.	2										
8	\$129; week 16	<table><tr><th>Week</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Savings</td><td>\$15</td><td>\$21</td><td>\$27</td><td>\$33</td></tr></table> Weeks 1 to 4: \$15, \$21, \$27, \$33. Rule: $\text{week} \times 6 + 9$. Week 20: $20 \times 6 + 9 = \\$129$. Week 15: $15 \times 6 + 9 = \\$99$ (not yet). Week 16: $16 \times 6 + 9 = \\$105$, so week 16. 1 mark: \$27 and \$33. 1 mark: \$129. 1 mark: week 16.	Week	1	2	3	4	Savings	\$15	\$21	\$27	\$33	3
Week	1	2	3	4									
Savings	\$15	\$21	\$27	\$33									
9	5, 8, 11 dots; term 10: 32	Term 1: $1 \times 3 + 2 = 5$, term 2: 8, term 3: 11 dots. Term 10: $10 \times 3 + 2 = 32$ dots. For example: 2 dots, then a column of 3 dots for each position. 1 mark: three terms drawn with 5, 8 and 11 dots (any arrangement). 1 mark: 32.	2										

C

Think it through *sample answers and criteria*

/ 10 marks

Q	Answer	Working / sample response	Marks
1	No, term 20 is 61	The rule is $\text{position} \times 3 + 1$. Term 20 = $20 \times 3 + 1 = 61$. Doubling 31 doubles the extra 1 as well, so Noah gets 62. The extra 1 is only added once. <i>1 mark: No, 61.</i> <i>1 mark: explains that the + 1 should not be doubled (or uses the rule).</i>	2
2	False	The pattern goes up by 3 and the rule is $\text{position} \times 3 + 2$. Term 32 is 98 and term 33 is 101, so it skips 100. ($100 - 2 = 98$, and 98 is not a multiple of 3.) <i>1 mark: False.</i> <i>1 mark: shows 98 and 101 are neighbouring terms, or that 98 is not a multiple of 3.</i>	2
3	Sometimes	Always Sometimes Never 4, 8, 12, 16 goes up by 4 and its rule is $\text{position} \times 4$. 5, 9, 13, 17 also goes up by 4, but its rule is $\text{position} \times 4 + 1$. So it is only sometimes true. <i>1 mark: Sometimes.</i> <i>1 mark: one example that fits and one that does not.</i>	2
4	C	A, B and D all go up by 4. C goes up by 5. (C is also the only one whose rule is just $\text{position} \times \text{a number}$: $\text{position} \times 5$.) <i>1 mark: C.</i> <i>1 mark: C goes up by 5 while the others go up by 4. Accept another choice only with a correct, clear reason.</i>	2
5	Bea's; 151	Ali's rule only tells you the next term, so you would need to count on 49 times. Bea's rule links the value to the position, so term 50 = $50 \times 3 + 1 = 151$ straight away. <i>1 mark: Bea's, with a reason (it uses the position / no need to find every term).</i> <i>1 mark: 151.</i>	2

D

Challenge *solutions and criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	19 hexagons, 4 left over	Sticks: 6, 11, 16 ... Each new hexagon adds 5, so the rule is $\text{hexagons} \times 5 + 1$. 19 hexagons: $19 \times 5 + 1 = 96$ sticks. 20 hexagons would need 101, which is too many. $100 - 96 = 4$ left over. <i>1 mark: the rule or the pattern 6, 11, 16 ...</i> <i>1 mark: 19 hexagons.</i> <i>1 mark: 4 left over.</i>	3

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Q	Answer	Working / sample response	Marks
2	Position 10, value 41; A is bigger after	A goes up by 4: rule $\text{position} \times 4 + 1$. B goes down by 3: rule $71 - \text{position} \times 3$. Each step the gap closes by 7. The gap at position 1 is $68 - 5 = 63$, and $63 \div 7 = 9$ more steps, so position 10. A: $10 \times 4 + 1 = 41$. B: $71 - 30 = 41$. After that A is bigger (position 11: A = 45, B = 38). <i>1 mark: position 10.</i> <i>1 mark: 41.</i> <i>1 mark: working shown (table or gap reasoning) and A is bigger after.</i>	3
3	Term 1 = 9; rule $\text{position} \times 4 + 5$; term 20 = 85	From term 3 to term 7 is 4 steps and $33 - 17 = 16$, so each step is $16 \div 4 = 4$. Term 1 = $17 - 4 - 4 = 9$. Rule: $\text{position} \times 4 + 5$ (check: $3 \times 4 + 5 = 17$). Term 20 = $20 \times 4 + 5 = 85$. <i>1 mark: term 1 = 9 (step of 4 found).</i> <i>1 mark: a correct rule.</i> <i>1 mark: 85.</i>	3