

WA7MNALP1

Linear and non-linear patterns and relationships

Core + Challenge

Growing Patterns and Rules

I can describe growing patterns with tables and rules, find unknown terms and tell linear from non-linear.

Name: _____ Date: _____ Score: _____ / 56

Key idea

Linear pattern: goes up (or down) by the same amount each time. 4, 7, 10, 13 → +3 each time → rule $3n + 1$

Finding the rule: the constant difference is the number in front of n ; then adjust: term 1 = $3 \times 1 + 1$.

Non-linear patterns don't have a constant difference: square numbers 1, 4, 9, 16 → n^2 ; doubling 2, 4, 8, 16 → 2^n

Use the rule to find any term: 20 squares in a row use $3 \times 20 + 1 = 61$ matchsticks.

A

Fluency *practise the skill*

/ 16 marks

Q1–8: write the next term. Q9–14: write a rule for the n th term. Q15–16: as asked.

- | | |
|---------------------------------------|--|
| 1. Next term: 3, 7, 11, 15, ... _____ | 9. Rule for the n th term: 4, 8, 12, 16 _____ |
| 2. Next term: 50, 44, 38, ... _____ | 10. Rule for the n th term: 5, 7, 9, 11 _____ |
| 3. Next term: 2, 4, 8, 16, ... _____ | 11. Rule for the n th term: 3, 8, 13, 18 _____ |
| 4. Next term: 1, 4, 9, 16, ... _____ | 12. Rule for the n th term: 10, 20, 30, 40 _____ |
| 5. Next term: 1.5, 2, 2.5, ... _____ | 13. Rule for the n th term: 1, 4, 7, 10 _____ |
| 6. Next term: 100, 50, 25, ... _____ | 14. Rule for the n th term: 6, 11, 16, 21 _____ |
| 7. Next term: 1, 3, 6, 10, ... _____ | 15. Table x : 1, 2, 3 → y : 7, 9, 11.
Rule? _____ |
| 8. Next term: 2, 5, 10, 17, ... _____ | 16. 100th term of $2n + 3$ _____ |

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B**Core** *apply the skill to problems*

/ 22 marks

- 1** A row of squares is made from matchsticks: 1 square uses 4, 2 squares use 7, 3 squares use 10. [3 marks]

- (a) How many matchsticks for 5 squares?
(b) Write a rule for n squares.
(c) How many for 20 squares?

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Answer: _____

- 2** Chairs are placed around square tables pushed together in a row: 1 table seats 4, 2 tables seat 6, 3 tables seat 8. Write a rule, then find the seats for 10 tables. [2 marks]

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Answer: _____

- 3** A casual worker's pay: 1 hour \$25, 2 hours \$50, 3 hours \$75. Write a rule for pay p after h hours, and find the pay for 7.5 hours. [2 marks]

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Answer: _____

- 4** A dot pattern grows 1, 4, 9, 16, ... [2 marks]
(a) Is the pattern linear? Explain.
(b) How many dots are in the 10th pattern?

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Answer: _____

- 5** A seedling is 12 cm tall and grows 3 cm each week. [3 marks]
(a) Write a rule for its height h after w weeks.
(b) After how many weeks will it be 36 cm tall?

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Answer: _____

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- 6 Complete a table of values for $5n - 2$ for $n = 1$ to 5. Describe what the points would look like if plotted. [2 marks]

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Answer:

- 7 Pattern A: 2, 4, 6, 8, ... Pattern B: 2, 4, 8, 16, ... Find the 10th term of each. Which grows faster? [2 marks]

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Answer:

- 8 Taxi fares: 0 km \$4, 1 km \$6.50, 2 km \$9, 3 km \$11.50. Write a rule for the fare for k km. [2 marks]

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Answer:

- 9 In a linear pattern, the 5th term is 23 and each term is 4 more than the one before. Find the 1st term and a rule for the n th term. [2 marks]

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Answer:

- 10 Triangular numbers are 1, 3, 6, 10, 15, ... Find the 8th triangular number and describe how the pattern grows. [2 marks]

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Answer:

C

Reasoning *explain, justify and check*

/ 9 marks

- 1 Explain how you can tell from a table of values whether a pattern is linear. [2 marks]

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- 2 Ava says the rule for 5, 8, 11, 14 is $n + 3$. Explain her mistake and give the correct rule. [2 marks]

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- 3 Is 100 a term in the pattern $3n + 1$? Is 150? Explain. [3 marks]

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- 4 In the matchstick rule $3n + 1$, explain what the 3 and the 1 represent in the pictures. [2 marks]

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D

Challenge *multi-step and problem-solving*

/ 9 marks

- 1 For the pattern 7, 12, 17, 22, ..., which is the first term greater than 200? Which term number is it? [2 marks]

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Answer: _____

- 2 In the pattern 1, 1, 2, 3, 5, 8, ..., each term is the sum of the two before it. Find the 10th term. [2 marks]

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Answer: _____

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- 3 L-shapes are made from squares: 3, 5, 7, 9, ... squares. Write a rule and find which shape uses 99 squares. [3 marks]

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Answer: _____

- 4 Pattern A has rule $4n + 1$ and pattern B has rule $6n - 9$. For which term number are they equal, and what is that term? [2 marks]

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Answer: _____

How did I go?

Fluency ____ / 16 Core ____ / 22 Reasoning ____ / 9 Challenge ____ / 9 **Total ____ / 56**

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