Patterns and Rules

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. A rule like "term n = 3n + 2" gives the 10th term as:
(a) 35 **(b)** 23 **(c)** 30 **(d)** 32

2. What comes next? 9, 13, 26, 30, 60, ?
(a) 64 **(b)** 90 **(c)** 65 **(d)** 63

3. One number in this sequence is wrong. Which one? 9, 11, 12, 15, 17, 19, 21
(a) 12 **(b)** 11 **(c)** 19 **(d)** 21

4. What letter comes next? C, G, K, O, S, ?
(a) W **(b)** Y **(c)** X **(d)** V

5. A pattern repeats: A, C, A, C, C, D, A, C, A, C, C, D, A, C, … What is the 112th item?
(a) D **(b)** A **(c)** C **(d)** B

6. The sequence 15, 22, 29, 36, … follows a rule. What is term 69?
(a) 483 **(b)** 498 **(c)** 484 **(d)** 491

7. Which rule gives term n of the sequence 9, 11, 13, 15, 17, …?
(a) 2n + 7 **(b)** 2n + 8 **(c)** 3n + 6 **(d)** 7n + 2

8. In a code, STAR is written as XYFW. How is LAMP written in the same code?
(a) RGSV **(b)** QFRU **(c)** PEQT **(d)** URFQ

Section B — Short answer — 8 × 2 = 16 marks

9. Find the rule for term n of 7, 12, 17, 22, … and use it to find term 30.

10. What comes next? 3, 4, 8, 9, 18, ?

11. One term of this sequence is wrong: 24, 34, 44, 54, 64, 73, 84. (a) Which number is wrong? (b) What should it be?

12. The sequence 12, 16, 20, 24, … follows a rule. What is term 44?

13. The sequence 14, 17, 20, 23, … follows a rule. Which term is 221?

14. A pattern uses 10, 15, 20, 25 sticks for terms 1, 2, 3, 4. How many sticks does term 24 use?

15. If A = 1, B = 2, C = 3 and so on, TREE = 48 (the sum of its letters). What is BOOK?

16. In a code, NEST is written as SJXY. How is JAM written in the same code?

Section C — Word problems — 4 × 4 = 16 marks

17. A pattern of triangles made of sticks uses 3, 5, 7, 9 sticks. (a) Find a rule for n triangles. (b) How many sticks for 25 triangles? (c) How many triangles can be made with 61 sticks?

18. The sequence 22, 31, 40, 49, … follows a rule. (a) What is term 71? (b) Which term is 364? (c) Is 283 a term of the sequence?

19. (a) A pattern uses 3, 5, 7, 9 sticks for terms 1, 2, 3, 4. How many sticks does term 17 use?
(b) A pattern uses 10, 16, 22, 28 sticks for terms 1, 2, 3, 4. Which is the first term to use more than 297 sticks?

20. (a) What letter comes next? E, H, J, M, O, ?
(b) A pattern repeats: D, D, D, A, C, D, D, D, A, C, D, D, … What is the 202nd item?

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Answer key

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Q	Answer	Working
1	**(d) 32**	—
2	**(a) 64**	add 4, then double, in turn
3	**(a) 12**	add 2 each time; it should be 13
4	**(a) W**	jump 4 letters forward each time
5	**(c) C**	the block of 6 repeats; 112 = 6 × 18 + 4, so it is item 4 of the block
6	**(d) 491**	term n = 7n + 8; 7 × 69 + 8 = 491
7	**(a) 2n + 7**	n = 1 gives 2 + 7 = 9, and each term is 2 more
8	**(b) QFRU**	each letter moves 5 places forward in the alphabet (Z goes round to A)
9	**Term n = 5n + 2; term 30 = 152.**	—
10	**19**	add 1, then double, in turn
11	**(a) 73; (b) 74**	add 10 each time
12	**184**	term n = 4n + 8; 4 × 44 + 8 = 184
13	**70**	term n = 3n + 11; (221 − 11) ÷ 3 = 70
14	**125**	term n uses 5 × n + 5 sticks: 5 × 24 + 5 = 125
15	**43**	2 + 15 + 15 + 11
16	**OFR**	each letter moves 5 places forward in the alphabet (Z goes round to A)
17	**(a) 2n + 1. (b) 51. (c) 2n + 1 = 61 gives n = 30.**	—
18	**(a) 652; (b) 39; (c) Yes**	term n = 9n + 13; (364 − 13) ÷ 9 = 39; (283 − 13) ÷ 9 is a whole number
19	**(a) 35; (b) 49**	(a) term n uses 2 × n + 1 sticks: 2 × 17 + 1 = 35; (b) term n uses 6 × n + 4 sticks; term 48 uses 292, term 49 uses 298
20	**(a) R; (b) D**	(a) jump 3, then 2 letters, in turn; (b) the block of 5 repeats; 202 = 5 × 40 + 2, so it is item 2 of the block

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