2.28 Algebra, Sequences and Patterns Depth: 30-minute Pack

Total Marks

GL ASSESSMENT EP.M28 · Calculators not allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Algebra, Sequences and Patterns Depth

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An 11+ early-algebra and sequences paper for scholarship-level preparation, complementing EP.M13 (Sequences and Patterns) and EP.M14 (Early Algebra). It covers function machines, missing-number problems, simple equations, term-to-term and position-to-term sequences, pattern continuation and formulae expressed in words. Questions are ramped from straightforward warm-up items to demanding multi-step and reverse-reasoning problems designed to stretch the strongest candidates.

1 Solve: 2x = 18

- ☐ A) 7
- ☐ B) 8
- ☐ C) 9
- ☐ D) 16
- ☐ E) 36

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2 Continue the pattern: 20, 17, 14, ___

- ☐ A) 10
- ☐ B) 11
- ☐ C) 12
- ☐ D) 13
- ☐ E) 17

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3 A function machine works like this: input, then add 4, then multiply by 2, then subtract 3, to give the output.

(a) Find the output when the input is 5. **(1)**

.....

(b) Find the output when the input is 10. **(1)**

.....

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4 Find the missing number: 6, 12, 18, ___, 30

- ☐ A) 20
- ☐ B) 22
- ☐ C) 24
- ☐ D) 26
- ☐ E) 28

---

5 Priya is p years old. Her brother Arjun is 5 years younger than Priya. Their auntie Fatima is 3 times as old as Arjun.

(a) Write an expression, in terms of p, for Arjun's age. **(1)**

.....

(b) Write an expression, in terms of p, for their auntie's age. **(1)**

.....

(c) Priya is 13. How old is their auntie? **(1)**

.....

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6 A sequence begins 4, 9, 14, 19, ...

(a) Describe, in words, the term-to-term rule for the sequence. **(1)**

.....

(b) Find the 10th term of the sequence. **(2)**

.....

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7 A sequence begins 3, 7, 11, 15, ...

(a) Write down the next two terms of the sequence. **(2)**

.....

(b) Describe, in words, the term-to-term rule for the sequence. **(1)**

.....

8 Solve: $x + 6 = 13$

- ☐ A) 6
- ☐ B) 7
- ☐ C) 8
- ☐ D) 13
- ☐ E) 19

9 A function machine works like this: input, then multiply by 3, then subtract 4, to give the output. The output is 20. Work out the input, showing your working.

(2)

10 Priya makes a pattern from matchsticks. Pattern 1 uses 4 matchsticks, pattern 2 uses 7 matchsticks and pattern 3 uses 10 matchsticks. Each new pattern uses 3 more matchsticks than the last.

(a) How many matchsticks are needed for pattern 4? **(1)**

.....

(b) How many matchsticks are needed for pattern 6? **(1)**

.....

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11 A shop hires out bikes. To find the total cost, in pounds, of hiring a bike, multiply the number of hours by 3, then add 2.

(a) Find the cost of hiring a bike for 4 hours. **(1)**

.....

(b) Find the cost of hiring a bike for 7 hours. **(1)**

.....

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12 A function machine adds 6 to the input number. If the input is 9, what is the output?

- ☐ A) 3
- ☐ B) 6
- ☐ C) 15
- ☐ D) 45
- ☐ E) 54

---

13 Find the missing number: 9 + ___ = 17

- ☐ A) 6
- ☐ B) 7
- ☐ C) 8
- ☐ D) 9
- ☐ E) 26

---

14 A function machine multiplies the input by 2, then adds 5. Complete the table below.

(a) Input = 3. Find the output. **(1)**

(b) Input = 8. Find the output. **(1)**

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15 Continue the pattern: 2, 4, 6, 8, ___

- ☐ A) 9
- ☐ B) 10
- ☐ C) 11
- ☐ D) 12
- ☐ E) 16

---

16 The nth term of a sequence is 6n - 4. Find the first term in the sequence that is greater than 50. Show your working.

(2)

---

17 Which rule describes the sequence 7, 12, 17, 22, ...?

- ☐ A) nth term = 7n + 5
- ☐ B) nth term = 2n + 5
- ☐ C) nth term = 5n + 7
- ☐ D) nth term = 5n + 2
- ☐ E) nth term = 5n - 2

---

18 Two sequences are given. Sequence A: 3, 8, 13, 18, ... (nth term = 5n - 2). Sequence B: 6, 11, 16, 21, ... (nth term = 5n + 1).

(a) Find the 20th term of Sequence A. **(1)**

(b) Find the 20th term of Sequence B. **(1)**

(c) What is the difference between the 20th term of Sequence B and the 20th term of Sequence A? Explain why this difference is the same for every matching pair of terms in the two sequences. **(1)**

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Mark scheme · 2.28 Algebra, Sequences and Patterns Depth: 30-minute Pack

Question 1

C (9) cao **B1**

Answer: C) 9

Question 2

B (11) cao **B1**

Answer: B) 11

Question 3

(a) 15 cao **B1**

(a) Answer: 15

(b) 25 cao **B1**

(b) Answer: 25

Question 4

C (24) cao **B1**

Answer: C) 24

Question 5

(a) p - 5 oe **B1**

(a) Answer: p - 5

(b) 3(p - 5) oe (accept 3p - 15) **B1**

(b) Answer: 3(p - 5), which is the same as 3p - 15

(c) 24 cao (ft their expression from part b) **B1**

(c) Answer: 24

Question 6

(a) add 5 to the previous term each time oe **B1**

(a) Answer: Add 5 to the previous term each time (starting at 4).

(b) valid method, e.g. nth term = 5n - 1, or systematic continuation to the 10th term **M1**

(b) 49 cao **A1**

(b) Answer: 49

Question 7

(a) 19 oe **B1**

(a) 23 oe **B1**

(a) Answer: 19, 23

(b) add 4 to the previous term each time oe **B1**

(b) Answer: Add 4 to the previous term each time (starting at 3).

Question 8

B (7) cao **B1**

Answer: B) 7

Question 9

correct reverse method: add 4 then divide by 3 oe **M1**

8 cao **A1**

Answer: 8

Question 10

(a) 13 cao **B1**

(a) Answer: 13

(b) 19 cao **B1**

(b) Answer: 19

Question 11

(a) 14 cao (accept £14) **B1**

(a) Answer: £14

(b) 23 cao (accept £23) **B1**

(b) Answer: £23

Question 12

C (15) cao **B1**

Answer: C) 15

Question 13

C (8) cao **B1**

Answer: C) 8

Question 14

(a) 11 cao **B1**

(a) Answer: 11

(b) 21 cao **B1**

(b) Answer: 21

Question 15

B (10) cao **B1**

Answer: B) 10

Question 16

correct method, e.g. 6n - 4 > 50 set up, or systematic trial of terms near 50 **M1**

56 cao (with n = 10 identified) **A1**

Answer: 56 (the 10th term)

Question 17

D (nth term = 5n + 2) cao **B1**

Answer: D) nth term = 5n + 2

Question 18

(a) 98 cao **B1**

(a) Answer: 98

(b) 101 cao **B1**

(b) Answer: 101

(c) 3 stated, with a correct explanation that both sequences share the same common difference (5), so the gap between matching terms stays constant oe (ft their terms from parts a and b) **B1**

(c) Answer: 3. Both sequences increase by 5 each time (the same common difference), and their starting terms differ by 3 (6 - 3 = 3), so every matching pair of terms will always differ by 3.

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