2.28-2 Algebra, Sequences and Patterns Depth Set 2: 30-minute Pack

GL ASSESSMENT EP.M39 · Calculators not allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

Algebra, Sequences and Patterns Depth Set 2

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A second 11+ early-algebra and sequences paper for scholarship-level preparation, complementing EP.M13 (Sequences and Patterns), EP.M14 (Early Algebra) and EP.M28 (Algebra, Sequences and Patterns Depth). It covers function machines, forming and simplifying expressions, one-step and two-step equations, term-to-term and position-to-term sequences, linear nth-term rules and pattern sequences, with an entirely fresh set of numbers and contexts. Questions are ramped from straightforward warm-up items to demanding multi-step and reverse-reasoning problems designed to stretch the strongest candidates.

1 Solve 5y - 6 = 19. Show your working.

(2)

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2 The nth term of a sequence is 5n + 3.

(a) Write down the first three terms of the sequence. **(1)**

.....

(b) Find the 20th term of the sequence. **(2)**

.....

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3 A sequence begins 7, 13, 19, 25, ... Find an expression for the nth term of the sequence. Show your working.

(2)

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4 A function machine has two operations: first multiply the input by a number, then add another number, using the same rule each time. Input 3 gives output 13. Input 6 gives output 25. Input 9 gives output 37.

(a) Find the two operations of the function machine. **(2)**

.....

(b) Use your rule to find the output when the input is 15. **(1)**

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5 Chidinma thinks of a number. She adds 9 to it, then multiplies the result by 2. Her answer is 38. Form an equation and solve it to find Chidinma's number. Show your working.

(2)

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6 Solve $6(x - 4) = 18$. Show your working.

(2)

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7 Which rule describes the sequence 10, 17, 24, 31, ...?

- ☐ A) nth term = 7n + 3
- ☐ B) nth term = 7n - 3
- ☐ C) nth term = 7n + 10
- ☐ D) nth term = 3n + 7
- ☐ E) nth term = 10n - 7

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8 Solve: x + 11 = 19

- ☐ A) 8
- ☐ B) 30
- ☐ C) 9
- ☐ D) -8
- ☐ E) 7

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9 Solve: 7y = 56

(1)

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10 Simplify fully: 6p + 4q - 3p + 2q

(2)

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11 A function machine works like this: input, then multiply by 6, then subtract 7, to give the output. The output is 29. Work out the input, showing your working.

(2)

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12 A function machine works like this: input, then subtract 3, then multiply by 5, to give the output. Find the output when the input is 8.

(1)

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13 Leah has t trading cards. Her friend Yusuf has 9 more trading cards than Leah. Write an expression, in terms of t, for the number of trading cards Yusuf has.

(1)

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14 A garden centre lays an L-shaped path from square slabs. Pattern 1 uses 8 slabs, pattern 2 uses 11 slabs, pattern 3 uses 14 slabs and pattern 4 uses 17 slabs.

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

(b) Find an expression for the nth term of the sequence. **(2)**

(c) A pattern in this sequence uses 47 slabs. Work out which pattern number this is. Show your working. **(2)**

15 Sequence P has nth term 4n + 7. Sequence Q has nth term 6n - 5.

(a) Find the 8th term of Sequence P. **(1)**

(b) Find the 8th term of Sequence Q. **(1)**

(c) Show that there is a value of n for which Sequence P and Sequence Q give the same term, and find that term. **(3)**

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Mark scheme · 2.28-2 Algebra, Sequences and Patterns Depth Set 2: 30-minute Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

5y = 25 seen **M1**

y = 5 cao **A1**

Answer: y = 5

Question 2

(a) 8, 13, 18 all correct cao **B1**

(a) Answer: 8, 13, 18

(b) substitutes n = 20 into 5n + 3 **M1**

(b) 103 cao **A1**

(b) Answer: 103

Question 3

common difference of 6 identified, giving 6n seen **M1**

6n + 1 oe cao **A1**

Answer: 6n + 1

Question 4

(a) correct multiplier found from the differences, e.g. (25 - 13) / (6 - 3) = 4 **M1**

(a) multiply by 4, then add 1 (both correct) cao **A1**

(a) Answer: Multiply the input by 4, then add 1.

(b) 61 cao (ft their rule from part a) **B1**

(b) Answer: 61

Question 5

correct equation formed: 2(x + 9) = 38 oe, or correct reverse method (halve then subtract 9) **M1**

x = 10 cao **A1**

Answer: 10

Question 6

x - 4 = 3 seen, or correct expansion 6x - 24 = 18 seen **M1**

x = 7 cao **A1**

Answer: x = 7

Question 7

A (nth term = 7n + 3) cao **B1**

Answer: A) nth term = 7n + 3

Question 8

A (8) cao **B1**

Answer: A) 8

Question 9

y = 8 cao **B1**

Answer: y = 8

Question 10

p terms or q terms collected correctly (3p or 6q seen) **M1**

3p + 6q oe cao **A1**

Answer: 3p + 6q

Question 11

correct reverse method: add 7 then divide by 6 oe **M1**

6 cao **A1**

Answer: 6

Question 12

25 cao **B1**

Answer: 25

Question 13

t + 9 oe **B1**

Answer: t + 9

Question 14

(a) add 3 to the previous term each time oe **B1**

(a) Answer: Add 3 to the previous term each time (starting at 8).

(b) common difference of 3 identified, giving 3n seen **M1**

(b) 3n + 5 oe cao **A1**

(b) Answer: 3n + 5

(c) 3n + 5 = 47 set up (ft their nth term from part b), or equivalent correct method **M1**

(c) pattern 14 cao **A1**

(c) Answer: Pattern 14

Question 15

(a) 39 cao **B1**

(a) Answer: 39

(b) 43 cao **B1**

(b) Answer: 43

(c) correct equation formed: 4n + 7 = 6n - 5; accept an equivalent route to the same value without algebra, such as trial and improvement **M1**

(c) correctly rearranges to 2n = 12 oe **M1**

(c) n = 6 and term = 31 both stated cso **A1**

(c) Answer: n = 6, giving the term 31

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