HIGHER

2.4 Arithmetic and Geometric Sequences and Series: Test Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 65 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 An arithmetic sequence used to model temperatures has nth term $a_n = 12 - 4n$. Find the first three terms of this sequence, giving each term explicitly.

(Total for Question 1 is 1 mark)

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2 In a savings plan the monthly deposit follows an arithmetic sequence with first term a = 7 and common difference d = 5. Find the nth term of this arithmetic sequence, written in terms of n.

(Total for Question 2 is 1 mark)

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3 The 7th term of an arithmetic sequence is 51 and the 8th term is 57.
(a) Find the first term and the common difference.
(b) Find the sum of the first 20 terms.

(Total for Question 3 is 6 marks)

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4 The 11th term of an arithmetic sequence is 49 and the 12th term is 54.

(a) Find the first term and the common difference.

(b) Find the sum of the first 25 terms.

(Total for Question 4 is 6 marks)

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5 The 6th term of an arithmetic sequence is -16 and the 10th term is -32.

(a) Find the first term and the common difference.

(b) Find the sum of the first 20 terms.

(Total for Question 5 is 6 marks)

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6 The 7th term of an arithmetic sequence is 40 and the 13th term is 76.

(a) Find the first term and the common difference.

(b) Find the sum of the first 20 terms.

(Total for Question 6 is 6 marks)

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7 The first four terms of a geometric sequence are 64, 32, 16, 8, ...
(a) Write down the common ratio.
(b) Find the 8th term.

(Total for Question 7 is 4 marks)

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8 Find the least value of n such that the partial sum of the arithmetic series with first term a = 5 and common difference d = 3 exceeds 500. Use $S_n = n/2(2a + (n - 1)d)$ and show your working.

(Total for Question 8 is 3 marks)

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9 A convergent geometric series models a payment stream with first term a = 5 and common ratio r = 0.6. Find the sum to infinity of this series, using S_infty = a/(1 - r). Give your answer with one decimal place.

(Total for Question 9 is 2 marks)

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10 A population is modelled by a geometric decay where the initial population is 2500 and it decreases by 12% each year. Find the population after 5 years, giving your answer to the nearest whole number and using ar^n, where a is the initial population.

(Total for Question 10 is 2 marks)

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11 A convergent geometric series has sum to infinity 75 and first term 5. Find the common ratio r of this series, giving r as an exact fraction and as a decimal to 4 decimal places.

(Total for Question 11 is 3 marks)

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12 Show that the geometric series with first term a = 2 and common ratio r = -1/3 converges, and find its sum to infinity. Give the exact value and a decimal to two decimal places.

(Total for Question 12 is 4 marks)

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Mark scheme · 2.4 Arithmetic and Geometric Sequences and Series: Test Pack

Question 1

terms: 8, 4, 0 cao **B1**

Answer: 8, 4, 0

Question 2

nth term = 7 + (n - 1)5 = 5n + 2, cao **B1**

Answer: 5n + 2

Question 3

forms a + 6d = 51 and a + 7d = 57 **M1**

subtracts to get d = 6 **M1**

d = 6 **A1**

a = 15 **A1**

uses S = (n/2)(2a + (n - 1)d) with n = 20 **M1**

sum = 1440 **A1**

Answer: a = 15, d = 6; sum of first 20 terms = 1440

Question 4

forms a + 10d = 49 and a + 11d = 54 **M1**

subtracts to get d = 5 **M1**

d = 5 **A1**

a = -1 **A1**

uses S = (n/2)(2a + (n - 1)d) with n = 25 **M1**

sum = 1475 **A1**

Answer: a = -1, d = 5; sum of first 25 terms = 1475

Question 5

forms a + 5d = -16 and a + 9d = -32 **M1**

subtracts to get 4d = -16 **M1**

d = -4 **A1**

a = 4 **A1**

uses S = (n/2)(2a + (n - 1)d) with n = 20 **M1**

sum = -680 **A1**

Answer: a = 4, d = -4; sum of first 20 terms = -680

Question 6

forms a + 6d = 40 and a + 12d = 76 **M1**

subtracts to get 6d = 36 **M1**

d = 6 **A1**

a = 4 **A1**

uses S = (n/2)(2a + (n - 1)d) with n = 20 **M1**

sum = 1220 **A1**

Answer: a = 4, d = 6; sum of first 20 terms = 1220

Question 7

common ratio = second term / first term = 32/64 **M1**

r = 1/2 **A1**

8th term = 64 x $(1/2)^7$ **M1**

1/2 **A1**

Answer: (a) r = 1/2; (b) 1/2

Question 8

writes inequality n/2(2*5 + (n - 1)3) > 500 and expands to a quadratic, e.g. $(3/2)n^2 + (7/2)n - 500 > 0$, oe **M1**

shows testing or solving leads to n = 17 giving $S_{17} = 493 \leq 500$ and n = 18 giving $S_{18} = 549 > 500$ **M1**

least integer n = 18 cao **A1**

Answer: n = 18

Question 9

uses S_infty = 5/(1 - 0.6) **M1**

S_infty = 5/0.4 = 12.5 cao **A1**

Answer: 12.5

Question 10

uses $a_5 = 2500*(0.88)^5$ with r = 0.88 and n = 5 **M1**

population approximately 1319 (to nearest whole number) cao **A1**

Answer: Approximately 1319 people

Question 11

uses formula 75 = 5/(1 - r) and rearranges to 1 - r = 5/75 = 1/15 **M1**

finds r = 1 - 1/15 = 14/15 **M1**

r = 14/15, approximately 0.9333 cao **A1**

Answer: r = 14/15, approximately 0.9333

Question 12

states condition for convergence |r| < 1 and shows |-1/3| = 1/3 < 1 **M1**

uses S_infty = a/(1 - r) with a = 2 and r = -1/3 **M1**

exact sum S_infty = 2/(1 + 1/3) = 2/(4/3) = 3/2 cao **A1**

decimal 1.50 cao **A1**

Answer: S_infty = 3/2 = 1.50

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