

Write your name here

Surname

Other Names

AS/A Level Mathematics

Geometric Sequences and Series

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled..
- Answer the questions in the spaces provided
– there may be more space than you need.
- You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

1 A geometric series is $a + ar + ar^2 + \dots$

Prove that the sum of the first n terms of the series is

$$S_n = \frac{a(1-r^n)}{1-r}$$

(Total for question 1 is 4 marks)

2 The fifth term of a geometric series is 12 and the eighth term of the series is 96.

- (a) Find the common ratio. (2)
(b) Find the first term of the series. (2)
(c) The sum of the first 20 terms, giving your answer to the nearest whole number. (2)

(Total for question 2 is 6 marks)

3 The third term of a geometric series is 135 and the sixth term of the series is 40.

- (a) Find the common ratio. (2)
(b) Find the first term of the series. (2)
(c) The sum of the first 10 terms of the series. (2)
(d) The sum to infinity of the series. (2)

(Total for question 3 is 8 marks)

4 The second term of a geometric series is 3.75 and the sum to infinity is 20.

- (a) Find the two possible values of r . (2)
(b) Find the corresponding two possible values of a . (2)
Given that r takes the larger of the two possible values,
(c) Find the smallest value of n for which $S_n > 19$ (2)

(Total for question 4 is 6 marks)

5 The first three terms of a geometric series are $(2k - 2)$, $(k + 3)$, and k respectively, where k is a positive constant.

- (a) Show that $k^2 - 8k - 9 = 0$. (4)
(b) Hence show that $k = 9$. (2)
(c) Find the common ratio. (2)
(d) The sum to infinity of the series. (2)

(Total for question 5 is 10 marks)

6 Sophie will be paid a salary of £35000 in 2018. Each year Sophie will get a 3% pay rise, the first increase being in 2019, so that her salaries form a geometric sequence

- (a) Find, to the nearest £100, Sophie's salary in 2020. (2)
Sophie will receive a salary each year until she retires at the end of 2037.
(b) Find, to the nearest £100, the total amount Sophie will have earned from 2018 until she retires in 2037. (4)

(Total for question 6 is 6 marks)
