

Geometric Sequences

Difficulty: Medium

Question Paper 1

Level	A Level only
Subject	Maths - Pure
Exam Board	Edexcel
Topic	Sequences & Series
Sub-Topic	Geometric Sequences
Difficulty	Medium
Booklet	Question Paper 1

Time allowed: 70 minutes

Score: /58

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>76%	61%	52%	42%	33%	23%	<23%

Question 1

A company predicts a yearly profit of £120 000 in the year 2013. The company predicts that the yearly profit will rise each year by 5%. The predicted yearly profit forms a geometric sequence with common ratio 1.05

(a) Show that the predicted profit in the year 2016 is £138 915 (1)

(b) Find the first year in which the yearly predicted profit exceeds £200 000 (5)

(c) Find the total predicted profit for the years 2013 to 2023 inclusive, giving your answer to the nearest pound. (3)

(Total 9 marks)

Question 2

The second and fourth terms of a geometric series are 7.2 and 5.832 respectively.

The common ratio of the series is positive.

For this series, find

(a) the common ratio, (2)

(b) the first term, (2)

(c) the sum of the first 50 terms, giving your answer to 3 decimal places, (2)

(d) the difference between the sum to infinity and the sum of the first 50 terms, giving your answer to 3 decimal places. (2)

(Total 8 marks)

Question 3

- (a) A geometric series has first term a and common ratio r . Prove that the sum of the first n terms of the series is

$$\frac{a(1-r^n)}{1-r} \quad (4)$$

Mr. King will be paid a salary of £35 000 in the year 2005. Mr. King's contract promises a 4% increase in salary every year, the first increase being given in 2006, so that his annual salaries form a geometric sequence.

- (b) Find, to the nearest £100, Mr. King's salary in the year 2008. (2)

Mr. King will receive a salary each year from 2005 until he retires at the end of 2024.

- (c) Find, to the nearest £1000, the total amount of salary he will receive in the period from 2005 until he retires at the end of 2024. (4)

(Total 10 marks)

Question 4

The first term of a geometric series is 120. The sum to infinity of the series is 480.

(a) Show that the common ratio, r , is $\frac{3}{4}$. (3)

(b) Find, to 2 decimal places, the difference between the 5th and 6th terms. (2)

(c) Calculate the sum of the first 7 terms. (2)

The sum of the first n terms of the series is greater than 300.

(d) Calculate the smallest possible value of n . (4)

(Total 11 marks)

Question 5

A geometric series has first term a and common ratio r .
The second term of the series is 4 and the sum to infinity of the series is 25.

(a) Show that $25r^2 - 25r + 4 = 0$. (4)

(b) Find the two possible values of r . (2)

(c) Find the corresponding two possible values of a . (2)

(d) Show that the sum, S_n , of the first n terms of the series is given by

$$S_n = 25(1 - r^n). \quad (1)$$

Given that r takes the larger of its two possible values,

(e) find the smallest value of n for which S_n exceeds 24. (2)

(Total 11 marks)

Question 6

A trading company made a profit of £50 000 in 2006 (Year 1).

A model for future trading predicts that profits will increase year by year in a geometric sequence with common ratio r , $r > 1$.

The model therefore predicts that in 2007 (Year 2) a profit of £50 000 r will be made.

(a) Write down an expression for the predicted profit in Year n . (1)

The model predicts that in Year n , the profit made will exceed £200 000.

(b) Show that $n > \frac{\log 4}{\log r} + 1$. (3)

Using the model with $r = 1.09$,

(c) find the year in which the profit made will first exceed £200 000, (2)

(d) find the total of the profits that will be made by the company over the 10 years from 2006 to 2015 inclusive, giving your answer to the nearest £10 000. (3)

(Total 9 marks)