



STEM SMART Double Maths 25 - Sequences, Series & Summation

Sequences and Series 1i

Subject & topics: Maths **Stage & difficulty:** A Level P2

A sequence of terms u_1, u_2, u_3, \dots is defined by

$$u_1 = 2 \text{ and } u_{n+1} = 1 - u_n$$

$$\text{for } n \geq 1$$

Part A Values

Give the values of u_2 , u_3 and u_4 .

 $u_2 =$ $u_3 =$ $u_4 =$

Part B Behaviour

Describe the behaviour of the sequence.

- ☐ The sequence is periodic, with a period of four. The first two values that repeat are 2 and -1 .
- ☐ It is a geometric sequence, with first term 2 and constant ratio $-\frac{1}{2}$.
- ☐ The sequence is periodic, with a period of three. It cycles through values of 2, -1 and 1.
- ☐ The sequence is periodic, with a period of two. It alternates between values of 2 and -1 .

Part C
Sum

Find $\sum_{n=1}^{100} u_n$.

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Arithmetic Series 1ii

Subject & topics: Maths**Stage & difficulty:** A Level P2**Part A****Value of x**

The first three terms of an arithmetic progression are $2x$, $x + 4$, and $2x - 7$ respectively. Find the value of x .

 $x =$ **Part B****Common difference**

The 20th term of a second arithmetic progression is 10 and the 50th term is 70.

Find the common difference of the second arithmetic progression.

Part C**First term**

Find the first term of the second arithmetic progression.

Part D

Sum to 29 terms

Calculate the sum of the first 29 terms of the second arithmetic progression.

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Arithmetic Series 1i

Subject & topics: Maths **Stage & difficulty:** A Level P2

In an arithmetic progression the first term is 5 and the common difference is 3. The n^{th} term of the progression is denoted by u_n .

Part A
Value of u_{20}

Find the value of u_{20} .

The following symbols may be useful: u_20

Part B
Sum

Find the value of $\sum_{n=10}^{20} u_n$.

Part C

Value of N

Find the value of N such that $\sum_{n=N}^{2N} u_n = 2750$.

The following symbols may be useful: \mathbb{N}

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Geometric Series 1ii

Subject & topics: Maths **Stage & difficulty:** A Level P2

Records are kept of the number of copies of a certain book that are sold each week. In the first week after publication, 3000 copies were sold, and in the second week 2400 copies were sold. The publisher forecasts future sales by assuming that the number of copies sold each week will form a geometric progression with first two terms 3000 and 2400. Calculate (to the nearest number of whole books) the publisher's forecasts for:

Part A

20th Week

The number of copies that will be sold in the 20th week after publication.

Part B

Total copies sold in 20 weeks

The total number of copies sold during the first 20 weeks after publication.

Part C

Total sold copies

The total number of copies that will ever be sold.

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Geometric Series 2ii

Subject & topics: Maths Stage & difficulty: A Level P2

Part A

Geometric progression 1 - r

In a geometric progression, the sum to infinity is four times the first term.

Find the common ratio.

Part B

Geometric progression 1 - a

Given that the third term is 9, find the first term.

Part C

Geometric progression 1 - sum

Find the sum of the first twenty terms. Give your answer to 3 sf.

Part D

Geometric progression 2

In another geometric progression, the first term is 6 and the sum to infinity is 10.

Find the common ratio.

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Geometric Series 4ii

Subject & topics: Maths **Stage & difficulty:** A Level P2

In a geometric progression, the first term is 5 and the second term is 4.8.

Part A

Sum to Infinity

Find the sum to infinity.

Part B

Value of n

The sum of the first n terms is greater than 124. By showing that

$$0.96^n < 0.008$$

and using logarithms, calculate the smallest possible value of n .

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Series: Summation - Standard Results 2ii

Subject & topics: Maths **Stage & difficulty:** Further A P1

Find

$$\sum_{r=1}^n (4r^3 + 6r^2 + 2r),$$

expressing your answer in a fully factorised form.

The following symbols may be useful: n

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Series: Summation - Standard Results 1i

Subject & topics: Maths Stage & difficulty: Further A P1

Part A

$\sum_{r=n}^{2n} r^3$

Express $\sum_{r=n}^{2n} r^3$ in terms of n , giving your answer in fully factorised form.

The following symbols may be useful: n

Part B

$\sum_{r=n}^{2n} r \left(r^2 - 2 \right)$

Hence find $\sum_{r=n}^{2n} r \left(r^2 - 2 \right)$, giving your answer in a fully factorised form.

The following symbols may be useful: n

Adapted with permission from UCLES, A Level, June 2014 , Paper 4725, Question 8.