Geometric sequence

The n^{th} term of a geometric sequence	$u_n = u_1 r^{n-1}$
The sum of n terms of a finite geometric sequence	$S_n = \frac{u_1(r^n - 1)}{r-1} = \frac{u_1(1-r^n)}{1-r}$, $r \neq 1$
The sum of an infinite geometric sequence	$S_\infty = \frac{u_1}{1-r}$, $\lvert r \rvert < 1$

Examples of geometric sequence

2, 10, 50, 250

1, 3, 9, 27, 81

$5, -1, \frac{1}{5}, -\frac{1}{25}$

u_n is the n^{th} term

r is the common ratio

$r = \frac{u_2}{u_1}$ or $\frac{u_{n+1}}{u_n}$

S_n is sum of n terms

Show geometric sequence:

$$\frac{u_2}{u_1} = \frac{u_3}{u_2}$$

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Show Geometric sequence

1. Show that 12, –6, 3, $-\frac{3}{2}$, … is geometric and find the common ratio.

2. Show that 8, $4\sqrt{2}$, 4, $2\sqrt{2}$, … is geometric and find the common ratio.

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List the terms

1. Consider the sequence defined by $u_n = 3(2)^{n-1}$
List the first four terms of the sequence.

2. Consider the sequence defined by $u_n = 4(-3)^{n-1}$
List the first four terms of the sequence.

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Find the general term

$$u_n = u_1 r^{n-1}$$

1. A geometric sequence has $u_2 = -2$ and $u_7 = 64$. Find the expression of general term.

2. A geometric sequence has $u_3 = 8$ and $u_6 = -1$. Find the expression of general term.

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Paper 1 exercise

1. Three consecutive terms of a geometric sequence are $x - 3$, 6 and $x + 2$.

Find the possible values of x.

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2. The first three terms of a infinite geometric sequence are $m - 1$, 6, $m + 4$, where $m \in \mathbb{Z}$.

(a) (i) Write down an expression for the common ratio, r.

(ii) Hence, show that m satisfies the equation $m^2 + 3m - 40 = 0$.

(b) (i) Find two possible values of m.

(ii) Find the possible value of r.

(c) The sequence has a finite sum.

(i) State which value of leads to this sum and justify your answer.

(ii) Calculate the sum of the sequence.

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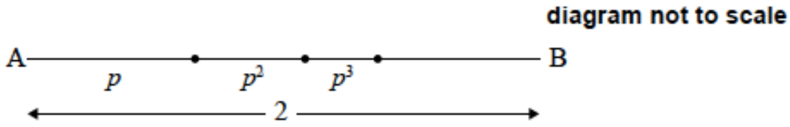
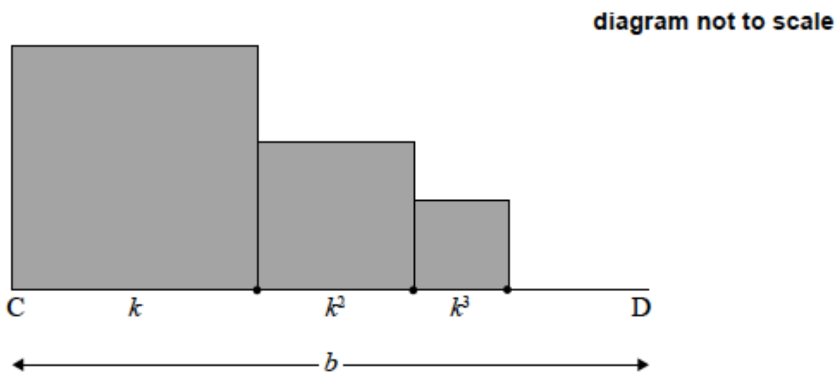
3. The following diagram shows [AB], with length 2 cm.
The line is divided into an infinite number of line segments. The diagram shows the first three segments.



The length of the line segments are p cm, p^2 cm, p^3 cm, … , where 0 < p < 1.
Show that p = $\frac{2}{3}$.

(b)The following diagram shows [CD], with length b cm, where b > 1. Squares with side lengths k cm, k^2 cm, k^3 cm, … , where 0 < k < 1, are drawn along [CD]. This process is carried on indefinitely. The diagram shows the first three squares.



The total sum of the areas of all the squares is $\frac{9}{16}$. Find the value of b.

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Paper 2 exercise

1. Consider a geometric sequence where the first term is 768 and the second term is 576. Find the least value of n such that the n^{th} term of the sequence is less than 7.

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2. (a) Consider an infinite geometric sequence with u_1 = 40 and r = $\frac{1}{2}$.

(i) Find u_{14}

(ii) Find the sum of the infinite sequence.

Consider an arithmetic sequence with n terms, with first term (–36) and eighth term (–8).

(b) (i) Find the common difference.

(ii) Show that S_n = $2n^2$ – 38n.

(c) The sum of the infinite geometric sequence is equal to twice the sum of the arithmetic sequence. Find n.

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3. The diagrams below show the first four squares in a sequence of squares which are subdivided in half. The area of the shaded square a is $\frac{1}{4}$.

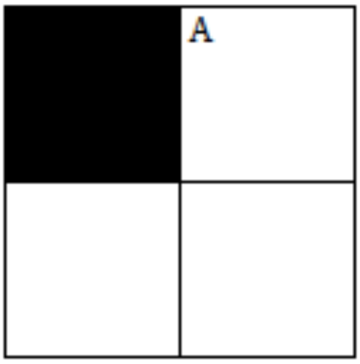

Diagram 1

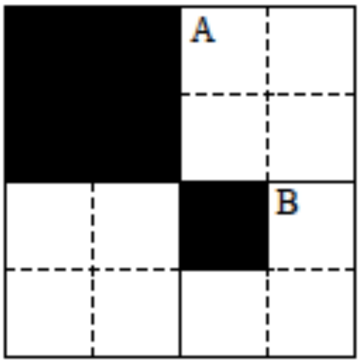

Diagram 2

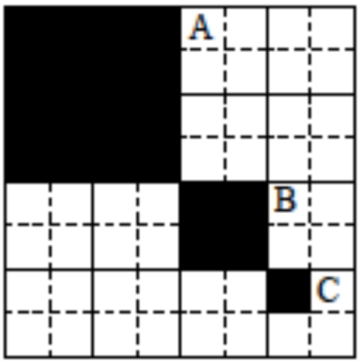

Diagram 3

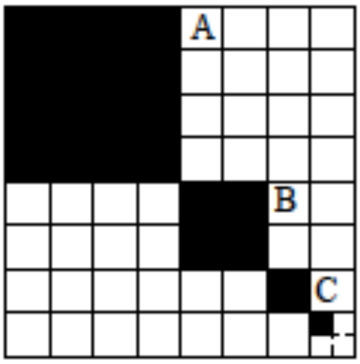

Diagram 4

(a) (i) Find the area of square B and of square C.

(ii) Show that the areas of squares A, B and C are in geometric progression.

(iii) Write down the common ratio of the progression.

(b) (i) Find the total area shaded in diagram 2.

(ii) Find the total area shaded in the 8^{th} diagram of this sequence. Give your answer correct to six significant figures.

(c) The dividing and shading process illustrated is continued indefinitely. Find the total area shaded.

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