

Geometric sequence

The n^{th} term of a geometric sequence

The sum of n terms of a finite geometric sequence

The sum of an infinite geometric sequence

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

$$S_n = \frac{u_1(r^n - 1)}{r - 1} = \frac{u_1(1 - r^n)}{1 - r}, \ r \neq 1$$

$$\left| S_{\infty} = \frac{n_1}{1-r}, |r| < 1 \right|$$

 u_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 nth 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:

 $\frac{\mathbf{u}_2}{\mathbf{u}_1} = \frac{\mathbf{u}_3}{\mathbf{u}_2}$



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.



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.



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.

Sum of geometric sequence

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$$S_n = \frac{u_1(r^n - 1)}{r - 1} OR \frac{u_1(1 - r^n)}{1 - r}$$

1. Find the sum of 4 + 8 + 16 + 32 + ... to the 22^{nd} terms.

2. Find the sum of 3 - 6 + 12 - 24 + ... to the 14^{th} terms.



3. Consider a geometric sequence 5, -10, 20,

(a) Find the common ratio.

(b) Find the expression S_n .

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Exercise

1. The table shows the first five terms of three sequences: u_n , v_n and

 w_n .

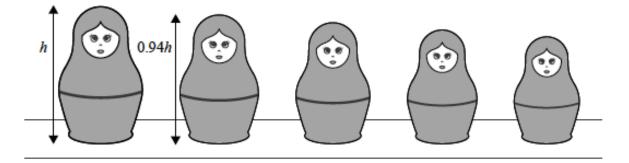
	n				
	1	2	3	4	5
u _n	10	20	40	80	160
v _n	10	20	30	60	100
w _n	10	20	30	40	50

- (a) State which sequence is
- (i) arithmetic
- (ii) geometric
- (b) Find the exact value of the 11th term of the geometric sequence.
- (c) Find the sum of the first 20 terms of the arithmetic sequence.



2. Matryoshka dolls, or Russian dolls, are similarly designed dolls which open up and fit inside each other.

The largest set of these type of dolls is a 51 piece set which was completed in 2003. The height of the largest piece in this set is 54 cm. The heights of successive smaller dolls are 94 % of the preceding larger doll, as shown.



(a) Find the height of the smallest doll in this set.

(b) Find the **total** height if all 51 dolls were placed one on top of another.





3. A hydraulic hammer drives a metal post vertically into the ground by striking the top of the post. The distance that the post is driven into the ground, by the nth strike of the hammer, is d_n .

The distances d_1 , d_2 , d_3 , ..., d_n form a geometric sequence.

The distance that the post is driven into the ground by the first strike of the hammer, d_1 , is 64 cm.

The distance that the post is driven into the ground by the second strike of the hammer, d_2 , is 48 cm.

(a) Find the value of the common ratio for this sequence.

(b) Find the distance that the post is driven into the ground by the eighth strike of the hammer.

(c) Find the **total depth** that the post has been driven into the ground after 10 strikes of the hammer.