

## Geometric sequence

The  $n^{\text{th}}$  term of a  
geometric sequence

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

The sum of  $n$  terms of a  
finite geometric sequence

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

The sum of an infinite  
geometric sequence

$$S_\infty = \frac{u_1}{1 - r}, \quad |r| < 1$$

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  $n^{\text{th}}$  term

$r$  is the common ratio

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

$S_n$  is sum of  $n$  terms

**Show geometric sequence:**

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



## List the terms

1. Consider the sequence defined by  $u_n = 3(2)^{n-1}$

List the first four terms of the sequence.

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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.

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

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## Sum of geometric sequence





### 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 11<sup>th</sup> term of the geometric sequence.

(c) Find the sum of the first 20 terms of the arithmetic sequence.

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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  $n^{\text{th}}$  strike of the hammer, is  $d_n$ .

The distances  $d_1, d_2, d_3, \dots, d_n$  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.

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