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## Geometric Sequences

A geometric sequence is a sequence that forms a pattern by the same number by multiplying.

A geometric sequence forms an exponential function because the change from one number to the next forms a multiplication pattern, or common ratio.

$$a_n = a_1 (r)^{n-1}$$

Diagram illustrating the components of the geometric sequence formula:

- $a_n$ : the  $n$ th term in the sequence
- $a_1$ : 1st term of sequence
- $r$ : common ratio  
 $r = \frac{\text{2nd \#}}{\text{1st \#}}$
- $n-1$ : term we are finding

We use the RNA to help us remember what to find.

Is the sequence geometric?

EX1) 1, 6, 36, 216, ...    Yes,  $R=6$

$\downarrow \quad \downarrow \quad \downarrow$   
         $\times 6 \quad \times 6 \quad \times 6$

EX2) 2, 4, 6, 8 ...    No, +2 so arithmetic

$\downarrow \quad \downarrow \quad \downarrow$   
         $+2 \quad +2 \quad +2$

Write the formula for each geometric sequence.

Ex 3)  $a_1 = 7, r = \frac{1}{3}$       $a_n = 7\left(\frac{1}{3}\right)^{n-1}$

Ex 4)  $a_1 = 10, r = -6$       $a_n = 10(-6)^{n-1}$

Find the following term of the geometric sequences.

Ex 5) The 19<sup>th</sup> term; 11, 33, 99, 297, ...

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ \times 3 & \times 3 & \times 3 \end{array}$$

$$\begin{array}{l} R = 3 \\ N = 19 \\ a_1 = 11 \end{array}$$

$$a_{19} = 11(3)^{19-1}$$

$$a_{19} = 4,261,625,379$$

Ex 6) The 10<sup>th</sup> term; 1, -6, 36, -216, ...

$$\begin{array}{ccc} \downarrow & \downarrow & \downarrow \\ \times -6 & \times -6 & \times -6 \end{array}$$

$$\begin{array}{l} R = -6 \\ N = 10 \\ a_1 = 1 \end{array}$$

$$a_{10} = 1(-6)^{10-1}$$

$$a_{10} = -100,776,96$$

Ex 7) The 10<sup>th</sup> term; -27, -9, -3, -1, ...

$$\begin{array}{l} R = \frac{1}{3} \\ N = 10 \\ a_1 = -27 \end{array}$$

$$a_{10} = -27\left(\frac{1}{3}\right)^{10-1}$$

$$a_{10} = \frac{-1}{729} \text{ or } -0.00137...$$

$$\frac{-9}{-27} = \frac{1}{3}$$