

Geometric Sequence

Each term after the first is found by multiplying the previous term by a common ratio. = r

Find the common ratio r in each of the following:

ex 1 - $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$
 $\frac{1}{8} \div \frac{1}{4} = \frac{1}{8} \cdot \frac{4}{1} = \frac{4}{8} = \frac{1}{2}$

$$r = \frac{1}{2}$$

ex 2 - $2, -4, 8, -16, \dots$ $r = -2$

ex 3 - $45 + .0045 + .000045 + \dots$ $r = .01$

ex 4 - $-\frac{2}{3}, \frac{1}{2}, -\frac{3}{8}, \dots$ $r = -\frac{3}{4}$

$r \rightarrow$ take any term and divide by the one before it

$$\boxed{a_n = a_1 r^{n-1}} \quad (\text{where } r \text{ is the common ratio}) \quad \frac{1}{2} \div -\frac{2}{3} = \frac{1}{2} \cdot \frac{-3}{2} = -\frac{3}{4}$$

ex 1 - Find the ninth term of the geometric sequence for which $a_1 = -3$ and $r = -2$.

$$a_n = a_1 \cdot r^{n-1}$$

$$n=9 \quad a_9 = a_1 \cdot r^8$$

$$a_9 = (-3)(-2)^8 = -768$$

ex 2 - Find the n th term of the geometric sequence for which $a_1 = -125$, $r = -\frac{2}{5}$, and $n = 5$.

$$a_5 = a_1 \cdot r^4$$

$$a_5 = -3.2$$

ex 3 - Insert three geometric means between 3.4 and 2125.

$$\begin{array}{cccccc} r=5 & 3.4 & \underline{17} & \underline{85} & \underline{425} & 2125 \\ & a_1 & & & & a_5 \\ r=-5 & 3.4 & \underline{-17} & \underline{85} & \underline{-425} & 2125 \end{array}$$

$$a_5 = a_1 \cdot r^4$$

$$2125 = 3.4 \cdot r^4$$

$$\frac{2125}{3.4} = r^4 \quad r^4 = 625$$

$$\text{if index is EVEN, use } \pm \quad r = \pm \sqrt[4]{625} \\ r = \pm 5$$

ex 4 - Find a_6 for 540, 90, 15, \dots

$$r = \frac{90}{540} = \frac{1}{6}$$

$$a_6 = a_1 \cdot r^5$$

$$a_6 = 540 \cdot \left(\frac{1}{6}\right)^5 = \frac{5}{72}$$

Geometric Sequences

1. Find the common ratio r in each of the following:

(a) $.5 + .05 + .005 + .0005 + \dots$ $r = \underline{\hspace{2cm}}$ (b) $-\frac{3}{16}, -\frac{1}{8}, -\frac{1}{12}, \dots$ $r = \underline{\hspace{2cm}}$

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

Use a formula on every problem. Show work carefully.

2. Find the eighth term of the geometric sequence for which $a_1 = 14$ and $r = -1.2$.
3. Find the n th term of the geometric sequence for which $a_1 = 324$, $r = -\frac{3}{2}$, and $n = 6$.
4. Insert three geometric means between 9 and 144.
5. Find a_8 for $4, -12, 36, \dots$