

Geometric Sequences

Arithmetic:
adding



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Geometric Sequence

multiply

- Each term, after the 1st, is the product of the preceding term and the common ratio, r .

- The common ratio can be found:

$$r = \frac{a_n}{a_{n-1}}$$

Recursive:

$$a_n = r a_{n-1}$$



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Are the following Arithmetic, Geometric, or neither. If arithmetic, state d . If Geometric, state r .



- 4, 12, 36, ... Geometric $r=3$
 $\frac{12}{4}=3$ $\frac{36}{12}=3$
- 8, 4, 0, -4, ... Arithmetic $d=-4$
- 2, -4, 8, -16, 32, ... Geometric $r=-2$
 $\frac{-4}{2}=-2$ $\frac{32}{-16}=-2$
- 1, 4, 9, 16, 25, ... neither n^2

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Let's figure out the formula for a geometric sequence!



- 1st Term: a_1
- 2nd Term: $a_1 \cdot r$
- 3rd Term: $a_1 \cdot r \cdot r = a_1 \cdot r^2$
- 4th Term: $a_1 \cdot r^2 \cdot r = a_1 \cdot r^3$
- 10th Term: $a_1 \cdot r^9$
- nth Term: $a_n = a_1 \cdot r^{n-1}$ $a_n = a_1 + (n-1)d$

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Find the 10 term if $a_1 = 4$ and $r = -1/2$.

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

$$a_{10} = 4 \cdot \left(-\frac{1}{2}\right)^{10-1}$$

$$a_{10} = 4 \cdot \left(-\frac{1}{2}\right)^9$$

$$a_{10} = \frac{-1}{128}$$



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Find a_{10} if $\frac{1}{2}, 1, 2, 4, \dots$

$$r = \frac{a_n}{a_{n-1}} = \frac{4}{2} = 2$$

$$a_{10} = \frac{1}{2} \cdot (2^{10-1})$$

$$a_{10} = 256$$

$$a_{10} = \frac{1}{2} \cdot (2^9)$$



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Find the 9th term if $a_1 = 3$ and $r = \frac{1}{2}$.

$$a_9 = 3 \cdot \left(\frac{1}{2}\right)^{9-1}$$

$$a_9 = 3 \cdot \left(\frac{1}{2}\right)^8$$

$$a_9 = \frac{3}{256}$$



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Find a_{12} if $a_4 = 108$ and $r = 3$.

$$a_4 = 108$$

$$a_3 = 36$$

$$a_2 = 12$$

$$a_1 = 4$$

$$a_{12} = 4 \cdot 3^8$$

$$a_{12} = 708,588$$

$$a_{12} = 108 \cdot 3^8$$

$$a_{12} = 708,588$$



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Find a_1 if $a_4 = 8.4$ and $r = 4$

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

$$8.4 = a_1 (4^3)$$

$$a_1 = \frac{8.4}{4^3}$$

$$a_1 = \frac{21}{160}$$

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If $a_2 = -18$ and $a_5 = \frac{2}{3}$, find the sixth term.

$$\frac{2}{3} = \frac{-18 \cdot r^3}{-18} \quad a_4 = \frac{1}{3} a_5$$

$$a_6 = \frac{1}{2} \left(\frac{2}{3} \right)$$

$$\sqrt[3]{\frac{-1}{27}} = \sqrt[3]{r^3} \quad a_6 = -\frac{2}{9}$$

$$r = -\frac{1}{3}$$

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Find the 9th term if given 7, 21, 63, ...



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If $a_4 = 125$ and $a_{10} = 125/64$, find the fourteenth term.



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Arithmetic**Geometric**

$$d = a_n - a_{n-1}$$

$$a_n = a_1 r^{n-1} \quad r = \frac{a_n}{a_{n-1}}$$

$$S_n = \frac{n}{2} (a_1 + a_n)$$

$$a_n = a_1 + (n-1)d$$

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Homework

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