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

↳ always multiplying so if #'s get smaller ratio is a fraction

## Geometric Sequence

- Find the first five terms of the geometric sequence with $a_1 = -3$ and common ratio (r) of 5.
- -3, -15, -75, -375, -1875 (·5 ·5 ·5 ·5)

$r = \frac{-15}{-3} = 5$

## Practice Problems

- Find the first five terms of the geometric sequence desribed.

ex. 1: $a_1 = 2$, $r = -3$

2, -6, 18, -54, 162

ex. 2: $a_1 = 243$, $r = 1/3$

243, 81, 27, 9, 3

*to find r: divide 2nd term by 1st term

## Examples

- Find the next two terms in the sequence -64, -16, -4 ...
- -64, -16, -4, ___, ___
- -16/-64 = 1/4
- So we multiply by 1/4 to find the next two terms.
- -64, -16, -4, -1, -1/4

## Practice

- **Find the next two terms in each geometric sequence:**
- **ex. 3: 405, 135, 45, ...** $\frac{135}{405} = 1/3$ $r = 1/3$ 15, 5
- **ex. 4: 81, 108, 144, ...** $r = 4/3$ 192, 256

## Geometric Sequence

- Find the common ratio of the sequence 2, -4, 8, -16, 32, ...
- To find the common ratio, divide any term by the previous term.
- 8 ÷ -4 = -2; -16 ÷ 8 = -2; 32 ÷ -16 = -2, etc.
- r = -2

## Examples

- Find the 10th term of the geometric sequence with $a_1 = 2000$ and a common ratio of $1/2$.
- $a_{10} = 2000 \cdot (1/2)^9 =$
- $2000 \cdot 1/512 =$
- $2000/512 = 125/32$

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

**Find the indicated term of each geometric sequence:**

**ex. 5:** $a_1 = 1/3, r = 3, n = 8$ ($n-1$)

$a_8 = \frac{1}{3}(3)^7 = 729$

**ex. 6:** $a_1 = 16,807, r = 3/7, n = 6$

$a_6 = 16,807\,(3/7)^{6-1}$

$= 243$

## Write an equation for the nth term

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

**To write a general equation for finding any term of a geometric sequence, you will have "n" as part of your equation, plug in values for the other parts.**

**Example: Write an equation for the nth term of the sequence: 3, 12, 48, 192, ...**

$a_n = 3 \cdot 4^{n-1}$

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

- **Write an equation for the nth term of each geometric sequence:**
- **ex. 7: 36, 12, 4, ...**

$a_n = 36(1/3)^{n-1}$

- **ex. 8: -2, 10, -50, ...**

$a_n = -2(-5)^{n-1}$

## Geometric Means

- -5, ___, ___, 625
- 625 is $a_4$, -5 is $a_1$.
- $625 = -5 \cdot r^{4-1}$ divide by -5
- $-125 = r^3$ take the cube root of both sides
- $-5 = r$

## Geometric Means

- -5, ___, ___, 625
- Now we just need to multiply by -5 to find the means.
- -5 • -5 = 25
- -5, 25, ___, 625
- 25 • -5 = -125
- -5, 25, -125, 625

## Examples

- **Find the geometric means in each sequence:**

**Ex. 9:** 9, 18, 36, 72, 144

$\frac{144}{9} = \frac{9(r)^{5-1}}{9}$

$16 = r^4$

$\sqrt[4]{16} = r$

$r = 2$

**Ex. 10:** 32, 16, 8, 4, 2, 1

$\frac{1}{32} = \frac{32(r)^{6-1}}{32}$

$\frac{1}{32} = r^5$

$\sqrt[5]{1/32} = r$

$r = 1/2$