

Notes #2 GEOMETRIC SEQUENCES

geometric sequence

- a sequence of values that follow a pattern of multiplying each term by a fixed amount to arrive at the next term.

Common ratio

- the fixed amount each term is multiplied by.
To find the common ratio, divide the second term by the first term.

$$r = \frac{a_2}{a_1}$$

Example 1: Is the given sequence geometric? If so, identify the common ratio.

A. a_1, a_2

A. 5, 15, 45, 135, ... $r = \frac{15}{5} = 3$

$\times 3$

yes $r = 3$

B. 15, 30, 45, 60, ...

$r = \frac{30}{15} = 2$

$\times 2$
 $30 \times 2 \neq 45$

no

Example 2: Find the common ratio of each sequence. Then find the next term.

A. a_1, a_2

A. 12, 18, 27, 40.5, ... $r = 1.5$

B. 98, 14, 2, ...

$r = \frac{14}{98} = \frac{1}{7}$

$$r = \frac{a_2}{a_1} = \frac{18}{12} = \frac{3}{2}$$

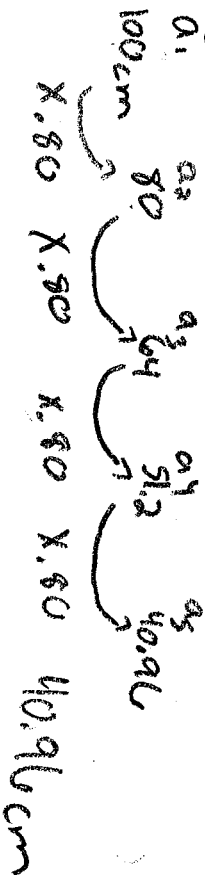
$$r = \frac{14}{98} = \frac{1}{7}$$

$r = \frac{3}{2}$ or 1.5

$$80/100 = .80$$

$$80/100 = .80 \quad a_1$$

Example 3: Suppose you drop a ball from a height of 100 cm. It bounces back to 80% of its previous height. How high will it go after its fifth bounce?



Example 4: Find the 4th term in each geometric sequence

a. $a_1 = 4, r = -\frac{1}{2}$

b. $a_2 = -9, r = \frac{1}{3}$

Geometric Sequence Formulas

Recursive Formula

$$a_1 = \text{a given value}$$

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

Explicit Formula

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

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

Next = Now \cdot Common Ratio

You can think of each term in the sequence as:
 $a_1, a_2, a_3, a_4, \dots, a_{n-1}, a_n, \dots$

In these formulas,

a_n is the n th term

a_1 is the first term

n is the number of the term

r is the common ratio

Example 5:

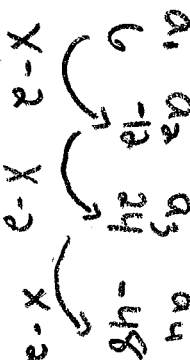
a. Write the recursive and explicit formulas for the geometric sequence with $a_1 = 6$ and $r = 2$.

$$R \quad a_1 = 6$$

$$E \quad a_n = 6 \cdot (-2)^{n-1}$$

$$a_n = a_{n-1} \cdot 2$$

b. Write the 1st 5 terms of this geometric sequence.



c. Find the 50th term of the sequence.

$$a_{50} = 6 \cdot (-2)^{50-1}$$

$$a_{50} = 6 \cdot (-2)^{49}$$

$$-33776997205271872$$

Example 6: Use the sequences to find the recursive formula and explicit formula.

$$a_1, a_2$$

A. 66, 33, 16.5, 8.25, ...

$$r = \frac{33}{66} = \frac{1}{2}$$

B. 33, 11, $\frac{11}{3}, \frac{11}{9}, \dots$

a) Recursive

$$a_1 = 66$$

b) Explicit

$$a_n = 66 \cdot \left(\frac{1}{2}\right)^{n-1}$$

a) Recursive

b) Explicit

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