Algebra 1 7.7

Identify and generate geometric sequences

Relate geometric sequences to exponential functions

sequence

arithmetic sequence (3.5)

geometric sequence

common ratio = r

whiteboards

Quiz 7.5-7.6 Tues

3, 6, 12, 24, 48 . . .

r = common ratio

5, 8, 11, 14, 17 . . .

d = difference

Example 1 Identify Geometric Sequences

Determine whether each sequence is *arithmetic*, *geometric*, or *neither*. Explain.

a. 256, 128, 64, 32, …

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

$\div 2$ $\times \frac{1}{2}$

b. 4, 9, 12, 18, …

neither ✓

Adding rule, multiplying rule, or other (combination?)

A G N

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1A. 1, 3, 9, 27, …

1B. −20, −15, −10, −5, …

1C. 2, 8, 14, 22, …

G
$r = 3$

A
$d = +5$

A
$d = +6$

b. $9, 3, 1, \frac{1}{3} \ldots$

G

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

Must be a multiplication rule...

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2A. −3, 15, −75, 375, …

G

r = −5

2B. 24, 36, 54, 81, …

+12

$\frac{36}{24}$ $\frac{54}{36}$ $\frac{81}{54}$

G

r = 1.5

What is the first term? What is common ratio?

Example 2 Find Terms of Geometric Sequences

Find the next three terms in each geometric sequence.

a. 1, −4, 16, −64, ... 256, −1024, 4096

$\frac{-4}{1}$ $\frac{16}{-4}$ $\frac{-64}{16}$

$r = -4$

1(?) = - 4
- 4(?) = 16
16(?) = - 64

$1 \cdot 9^7$ $\quad a_i \cdot r^{n-1}$

26. The first term of a geometric series is 1 and the common ratio is 9. What is the 8th term of the sequence?

$3 \cdot 7^7$

1	1
2	9
3	81
4	729
5	6561
6	59049
7	531441
8	4782969

$a_8 = 4,782,969$

1	3
2	$3 \cdot 7 = 21$
3	$21 \cdot 7 = 147$
4	$147 \cdot 7 = 1029$
5	$1029 \cdot 7 = 7203$
6	$7203 \cdot 7 = 50421$
7	$7 \quad 352947$
8	$3 \cdot 7^7 = 7\,2470625$

Is there an better way?

27. The first term of a geometric series is 2 and the common ratio is 4. What is the 14th term of the sequence?

$2(4)^{13} = 134,217,728$

Is there a better way?

Look for patterns...

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

KeyConcept *n*th term of a Geometric Sequence

The ***n***th term a_n of a geometric sequence with first term a_1 and common ratio r is given by the following formula, where n is any positive integer and $a_1, r \neq 0$.

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

Example 3 Find the *n*th Term of a Geometric Sequence

PT

a. Write an equation for the *n*th term of the sequence $-6, 12, -24, 48, \ldots$.

-6(?)=12

$= a_1 r^{n-1}$

$r = -2$

$48 \div -24$

find a_1

find r

answer the question

$y = (-6)(-2)^{n-1}$

$y = (-6)(-2)^4$

-96

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3. Write an equation for the nth term of the geometric sequence 96, 48, 24, 12, … . Then find the tenth term of the sequence.

a) $y = (96)\left(\frac{1}{2}\right)^{n-1}$ $r = \frac{1}{2}$

$r = 0.5$

find a_1

find r

answer the question

b) $= (96)\left(\frac{1}{2}\right)^{9}$

$= 0.1875$

28. What is the 15th term of the geometric sequence $-9, 27, -81, \ldots$?

find a_1
find r
write an equation
answer the question

$(-9)(-3)^{14}$

$-43{,}046{,}721$

$$-3^2 \qquad (-3)^2$$

$$-1 \cdot 3^2 \qquad \downarrow$$

$$-1 \cdot 3 \cdot 3 \qquad -3 \cdot -3$$

$$-9 \qquad 9$$

7.7

15-31 all

47-67o