Algebra 1 7.7

Identify and generate geometric sequences

Relate geometric sequences to exponential functions

sequence

* arithmetic sequence (3.5) + rule
* geometric sequence × rule
common ratio = r
whiteboards

Quiz 7.5-7.6

2, 13, 24, 35 . . .

$a_1 = 2$ $d = 11$

2, 4, 8, 16, 32 . . .

$a_1 = 2$ $r = 2$

Example 1 Identify Geometric Sequences

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

+ × other

a. 256, 128, 64, 32, …

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

$\div 2$

b. 4, 9, 12, 18, … neither

$+5$ $+3$ $+6$

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

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1A. 1, 3, 9, 27, …

g r = 3

1B. −20, −15, −10, −5, …

a d = 5

1C. 2, 8, 14, 22, …

+6 +6 +8

neither

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

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

Must be a multiplication rule...

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2A. −3, 15, −75, 375, …

g r = −5

2B. 24, 36, 54, 81, …

g x 1.5

r = 1.5

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

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, ...

$\times -4$

256, −1024, 4096

$a_1 = 1$

$r = -4$

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

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

$a_1 = 1$ $r = 9$

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

1 9 81 729 6561 59049

531441 4,782,969

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?

$r = 4$

1	2	a_1
2	8	$a_1 \cdot 4$
3	32	$(a_1 \cdot 4) \cdot 4$
4	128	$(a_1 \cdot 4 \cdot 4) \cdot 4$
5	⋮	$a_1 \cdot 4 \cdot 4 \cdot 4 \cdot 4$

Is there a better way?

$a_1 (\quad)^{13}$

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

Look for patterns...

p. 441
15-31 odd

KeyConcept *n*th term of a Geometric Sequence

The nth 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

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

-6(?)=12

find a_1
find r
answer the question

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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.

find a_1
find r
answer the question

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