Unit 2 5.4 Sequences (Guided Notes) Name: Key

Objective: The student will be able to recognize a sequence, distinguish between arithmetic and geometric sequences, and understand/calculate the parts of each equation.

Sequence – A set of numbers in a specific order. It is discrete, not continuous.

Example1 - 8, 11, 14, 17, … Example2 - 6, 12, 24, 48 …

Discrete – Data that can only take certain values.

For example: the number of students in a class (you can't have half a student).

Term – Each number in the sequence.

In Example 1 above – the 2nd term is 11, the 4th term is 17.

Types of Sequences

Formulas:

$$a_n = a_0 + d \cdot n$$

Arithmetic Sequence – A sequence made by adding the same value each time.

$a_n =$ value of term you want

$a_0 =$ zero term (y-intercept)

$d =$ common difference

$n =$ # of term you want to find

Does this sequence and it's formula remind you of an equation we've worked with earlier this year?

$y = mx + b$ $d = m$ $a_0 = b$

Example: Write an equation for the following arithmetic sequences.

a. 1, 5, 9, 13, 17, …

$a_1 = 1$ $a_2 = 5$ $a_3 = 9$ $a_4 = 13$ $a_5 = 17$

$d = 4$ $a_0 = -3$ $\boxed{a_n = -3 + 4n}$

b. −3, −6, −9, −12, …

$d = -3$ $a_0 = 0$ $\boxed{a_n = 0 - 3n}$

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Geometric Sequence – A sequence made by multiplying the same value each time.

Formulas:

$\boldsymbol{a_n = a_0 \cdot r^n}$

$a_n =$ value of the term you want

$a_0 =$ zero term $= \frac{a_1}{r}$

r ~~d~~ $=$ Common ratio $= \frac{a_2}{a_1}$

$n =$ # of the term you want to find

Example: Write an equation for the following geometric sequences.

a. $1, 4, 16, 64, 256, \ldots$

$a_0 = \frac{1}{4}$ $\quad r = 4$ $\quad \boxed{a_n = \frac{1}{4}(4)^n}$

b. $-32, 16, -8, 4, \ldots$

$a_0 = 64$ $\quad r = -\frac{1}{2}$ $\quad \boxed{a_n = 64(-1/2)^n}$

What if you can't easily find the '0' term?

Example: Write an equation for the following arithmetic sequences without using a_0.

a. $10, 14, 18, 22, \ldots$ (*use* a_1)

$a_n = 10 + 4(n-1)$

b. $-10, -5, 0, 5, 10, \ldots$ (*use* a_4)

$a_n = 5 + 5(n-4)$

Example: Write an equation for the following geometric sequences without using a_0.

a. $1, 3, 9, 27, 81, \ldots$ (*use* a_5)

$a_n = 81(3)^{n-5}$

b. $512, 256, 128, 64, \ldots$ (*use* a_3)

$a_n = 128(1/2)^{n-3}$

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What if you're given a term and have to find the 'n'?

Example: Given: $a_n = -30 + 6n$; If $a_n = 48$, what is n?

$48 = -30 + 6n$

$78 = 6n$

$\boxed{n = 13}$

Example: Given: $a_n = 90 \cdot (\frac{1}{3})^n$; If $a_n = \frac{10}{27}$, what is n?

$\frac{10}{27} = 90(1/3)^n$ $\frac{1}{243} = \left(\frac{1}{3}\right)^n$ $\boxed{n = 5}$

Practice:

I. For each sequence, state if it is arithmetic, geometric, or neither. Then, if it's arithmetic or geometric, write a formula for it.

a. $8, 6, 4, 2, 0, -2, \ldots$ A

$a_n = 8 - 2(n-1)$

b. $-4, 12, -36, 108, -324$ G

$a_n = -4(-3)^{n-1}$

c. $64, 48, 36, \ldots$ G

$a_n = 85\,1/3\,(.75)^n$

d. $0, 3, 8, 15, 24$ N

e. $-24, -26, -18, -10, -2$ N

f. $5, 1, \frac{1}{5}, \frac{1}{25}, \frac{1}{125}$ G

$a_n = 25\,(1/5)^n$

II. Write the first 3 terms of the following sequences.

a. $a_n = -43 + 4n$

$a_1 =$ -39 $a_2 =$ -35 $a_3 =$ -31

b. $a_n = 2 \cdot (-3)^n$

$a_1 =$ -6 $a_2 =$ 18 $a_3 =$ -54

b. $a_n = 3 \cdot (2)^{n-1}$

$a_1 =$ 3 $a_2 =$ 6 $a_3 =$ 12

d. $a_n = -163 + 200(n-1)$

$a_1 =$ -163 $a_2 =$ 37 $a_3 =$ 237

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Practice.

1. $a_n = 16 + 5n$
   a. Find the 80th term.
   b. If $a_n = 71$, what is n?

a) $a_{80} = 16 + 5(80) = \boxed{416}$

b) $71 = 16 + 5n$

$\boxed{n = 11}$

2. $a_n = -8 + 2n$
   a. Find the 50th term.
   b. If $a_n = 44$, what is n?

a) $a_{50} = -8 + 2(50) = \boxed{92}$

b) $44 = -8 + 2n$

$52 = 2n$

$\boxed{n = 26}$

3. $a_n = 1080 - 36n$
   a. Find the 16th term.
   b. If $a_n = 900$, what is n?

a) $a_{16} = 1080 - 36(16) = \boxed{504}$

b) $900 = 1080 - 36n$

$\boxed{n = 5}$

4. $a_n = -600 + 5n$
   a. Find the 900th term.
   b. If $a_n = -225$, what is n?

a) $a_{900} = -600 + 5(95) = \boxed{-125}$

b) $-225 = -600 + 5n$

$375 = 5n$ $\boxed{n = 75}$

5. $a_n = 3 \cdot 2^n$
   a. Find the 10th term.
   b. If $a_n = 192$, what is n?

a) $a_{10} = 3 \cdot 2^{10} = \boxed{3072}$

b) $192 = 3 \cdot 2^n$

$64 = 2^n$ $\boxed{n = 6}$

6. $a_n = 700(0.8)^n$
   a. Find the 20th term.
   b. If $a_n = 358.4$, what is n?

a) $a_{20} = 700(.8)^{20} = \boxed{8.07}$

b) $358.4 = 700(.8)^n$

$.512 = .8^n$

$\boxed{n = 3}$

7. $a_n = 60(\frac{1}{2})^n$
   a. Find the 10th term.
   b. If $a_n = \frac{15}{8}$, what is n?

a) $a_{10} = 60(1/2)^{10} = \boxed{.06}$

b) $\frac{15}{8} = 60(1/2)^n$

$.03125 = (1/2)^n$

$\boxed{n = 5}$

8. $a_n = 1000(0.95)^n$
   a. Find the 16th term.
   b. If $a_n = 902.5$, what is n?

a) $a_{16} = 1000(.95)^{16} = \boxed{440.13}$

b) $902.5 = 1000(.95)^n$

$.9025 = .95^n$

$\boxed{n = 2}$