Name: *Date:* *Per:*

Notes 12.1-12.2 – Arithmetic Sequences & Series – Algebra 2

Learning Target

- **I can identify a sequence as Arithmetic or not.**
- **I can write a rule for the *n*th term of an Arithmetic sequence.**
- **I can write a rule given a term and the common difference.**

A **sequence** is a list of numbers. We can call a list of numbers an **ARITHMETIC sequence** if you can add or subtract the SAME number each time to get from one to the next. For example, 2,4,6,8... is an ARITHMETIC sequence because I am adding 2 each time.

- Each term in an arithmetic sequence is notated by: a_1 is the first term, a_2 is the second term, and so on.

Example 1:
Find the pattern in the sequence:

20, 23, 26, 29, ...
+3 +3 +3 +3

Adding 3 each time

- Find the 10th term in the list: a_{10} = 47

- Find the 100th term in the list: a_{100} = 317

If you have an arithmetic sequence, you can use this formula to find numbers in the list: $\boldsymbol{a_n = a_1 + (n-1)d}$

d is the common difference
a_1 is the first term in the list
n is the place of the term in the list

Example 2: **Write a rule for the nth term of the sequence. You need to know the first term and the common difference.**

a. 2, 9, 16, 23, . . .
+7 +7 +7

$a_n = 2 + 7(n-1)$

Use your rule to find the 19th term (a_{19})

$a_{19} = 2 + 7(19-1)$

$a_{19} = 128$

b. 57, 45, 33, 21, . . .
-12 -12 -12

$a_n = 57 - 12(n-1)$

Use your rule to find the 50th term (a_{50})

$a_{50} = 57 - 12(50-1)$

$a_{50} = -531$

Arithmetic Sequence: $a_n = a_1 + (n-1)d$

Example 3: **The eleventh term of an arithmetic sequence is $a_{11} = 41$. The common difference is $d = 5$. Write a rule to find any term in the list.**

$41 = a_1 + 5(11-1)$

$41 = a_1 + 50$

$-9 = a_1$

$a_n = -9 + 5(n-1)$

What is the 100th number in the list? $a_{100} = -9 + 5(100-1)$

$= 486$

Example 4: **Two terms of the arithmetic sequence are $a_6 = 7$ and $a_{22} = 87$. Find a rule for the *n*th term.** $a_n = a_1 + d(n-1)$

$7 = a_1 + d(5)$ & $87 = a_1 + d(21)$

$7 - 5d = a_1$ & $87 - 21d = a_1$

$7 = a_1 + (5)(5)$

$7 = a_1 + 25$

$a_1 = -18$

$7 - 5d = 87 - 21d$

$16d = 80$

$d = 5$

$a_n = -18 + 5(n-1)$

What is the 100th number in the list? $a_{100} = -18 + 5(99)$

$a_{100} = 477$

ARITHMETIC SERIES means to **ADD** up all the numbers in the arithmetic sequence.

$\sum$ (this is the SIGMA sign. It means to **ADD** up all the terms in the list!)

Example 5: **Add up the numbers in the sequence:** S_n

12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54 $= 495$

$\sum_{i=\#}^{n} (a + di)$ — n: how many terms you're adding; $(a+di)$: expression you use to evaluate a_1 & a_2; $i=\#$: the first number in the list

SHORTCUT: Use the formula for arithmetic s $S_n = \frac{n}{2}(a_1 + a_n)$

n = how many terms you're adding up

a_1 = the first number in the list

a_n = the last number in the list

1. $\sum_{i=1}^{18}(77-4i)$

$a_1 = (77 - 4(1)) = 73$

$a_{18} = (77 - 4(18)) = 5$

$S_{18} = \frac{18}{2}[73 + 5]$

$S_{18} = 702$

2. $\sum_{i=1}^{15}(9+3i)$.

$a_1 = (9 + 3(1)) = 12$

$a_{15} = (9 + 3(15)) = 54$

$S_{15} = \left(\frac{15}{2}\right)(12 + 54)$

$S_{15} = 495$