Arithmetic Sequences

An **Arithmetic Sequence** is a numerical pattern that increases or decreases at a constant rate.

← Slope

The constant rate is called the **common difference**

Determine whether each sequence is an arithmetic sequence. If the answer is yes, find the next term in the sequence.

1. 17, 14, 10, 7, 3,...

-3 -4

No

2. -1, -2, -4, -8,...

-1 -2 -4

No

3. 0, 1, 4, 9, 16,...

1 3 5 7

No

4. −5.25, 1, 7.25, 13.5,...

6.25 6.25 6.25

Yes

5. Becca volunteers at an animal shelter after school. One of her jobs is feeding the adult cats. The table and graph show the amount of cat food she has before feeding each of the cats at the shelter.

Cat	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Cups of Food	12	11.25	10.5	9.75	9	8.25	7.5	6.75	6	5.25	4.5	3.75	3	2.25	1.5	0.75

-.75

a. How much food does each cat receive?

0.75 or 3/4 of a cup

b. With the amount of food that Becca has, how many cats can she feed?

12.75

17 cats

c. Do you think the points from the table model a linear function?

Yes

Each term of an arithmetic sequence can be expressed in terms of the first term a_1 and the common difference d.

For example: Using the sequence: 22, 17, 12, 7, 2, ...

Let's create a general rule one step at a time

Terms	**Symbol**	**In terms of a_1 and d**	**Number**
First term	a_1	a_1	22
Second term	a_2	$a_1 + d$	$22 + 1(-5) = 17$
Third term	a_3	$a_1 + 2d$	$22 + 2(-5) = 12$
Fourth term	a_4	$a_1 + 3d$	$22 + 3(-5) = 7$
nth term	a_n	$a_1 + (n - 1)d$	$22 + (n - 1)(-5)$

$22 + -5n + 5$

$a_n = -5n + 27$

The n refers to the term's place in the sequence. So, when we say a_6, we are referring to the 6th term in the sequence. When we say a_n, we are creating a rule (equation) that can be used to find any term in the sequence.

6. Use the arithmetic sequence -4, -1, 2, 5,... to complete the following.

$a_n = a_1 + (n-1) \cdot d$ $\quad d = 3$ $\quad a_1 = -4$

a. Write an equation

$a_n = -4 + (n-1) \cdot 3 \rightarrow a_n = -4 + 3(n-1)$

$-4 + 3n - 3$

$a_n = 3n - 7$

b. Use the equation to find the 16th term in the sequence.

$a_{16} = 3(16) - 7$

$a_{16} = 41$

7. Use the arithmetic sequence 13, 8, 3, –2, ... to complete the following.

$a_1 : 13$

$d : -5$

a. Write an equation for the nth term of the arithmetic sequence.

$a_n = a_1 + d(n-1)$

$a_n = 13 - 5(n-1)$

$a_n = 13 - 5n + 5$

$* a_n = -5n + 18 *$

b. Find the 20th term in the sequence.

$a_{20} = -5(20) + 18$

$a_{20} = -82$