Recursive Sequences

Any arithmetic sequence is also considered a RECURSIVE SEQUENCE!

You have already learned how to use the formula for finding the nth term to write an equation of an arithmetic sequence.

We can also write an arithmetic sequence with a RECURSIVE formula!!

A **recursive sequence** is defined as a sequence in which each term is found by manipulating the term before.

Since we are working with arithmetic sequences, our recursive sequences will involve addition and subtraction.

Keep this in mind:

a_1 is the first term in the sequence

a_2 is the second term in the sequence

a_3 is the third term in the sequence

and so on...

When we work with recursive formulas, we use this:

a_n is the nth term in the sequence

a_{n-1} is the term before the nth term

Take a look at these equations:

Ex. 1 $a_1 = 15$

$$a_n = a_{n-1} + 6$$

In Ex. 1, the first equation tells us that the first term in the sequence is 15. The second equation tells us that to find the next term, we take the term before it and add 6.

$a_2 = a_1 + 6$ (the 2nd term is the 1st term plus 6)

$a_3 = a_2 + 6$ (the 3rd term is the 2nd term plus 6)

$a_4 = a_3 + 6$ (the 4th term is the 3rd term plus 6)

Therefore, the sequence looks like this: 15, 21, 27, 33, 39, ...

Ex. 2 $a_1 = -7$

$$a_n = a_{n-1} - 2$$

In Ex. 2, the first equation tells us that the first term in the sequence is -7. The second equation tell us that to find the next term, we take the term before it and subtract 2.

$$a_2 = a_1 - 2$$

$$a_3 = a_2 - 2$$

$$a_4 = a_3 - 2$$

Therefore, the sequence looks like this: -7, -9, -11, -13, -15, ...

In Summary, every arithmetic sequence can be written as a linear equation and as a recursive equation!!

Once you have reviewed the information on recursive formulas, try these!

Given the first term, use the recursive formula to find the next four terms in the arithmetic sequence.

1. $a_1 = 2$

   $a_n = a_{n-1} - 6$

2. $a_1 = -8$

   $a_n = a_{n-1} + 3$

3. $a_1 = 1$

   $a_n = a_{n-1} + 8$

4. $a_1 = 4$

   $a_n = a_{n-1} - 3$

Match the recursive formula to the arithmetic sequence that it describes. (You may use a letter more than once!!)

A. $a_n = a_{n-1} + 3$

B. $a_n = a_{n-1} + 11$

C. $a_n = a_{n-1} - 6$

D. $a_n = a_{n-1} - 4$

E. $a_n = a_{n-1} + 9$

F. $a_n = a_{n-1} - 7$

5. 17, 11, 5, −1, ...

6. −12, −9, −6, −3, ...

7. 98, 91, 84, 77, ...

8. −8, −12, −16, ...

9. 3, 14, 25, 36, ...

10. −4, 5, 14, 23, ...

11. 6, 2, −2, −6, −10, ...

12. −7, 4, 15, 26, ...

13. 31, 34, 37, 40, ...

Why do you think you were able to use the same recursive formula for different arithmetic sequences?