Essential Questions: What is a recursive rule? How do we use recursive formulas to find the terms in a sequence?

Do Now: Create a sequence of numbers using the following information below.

Write the sequence here: $\qquad$

1) The first number of the sequence is 2 .
2) To find the second number of the sequence, take the first number, multiply it by 5 then subtract 3 .
3) To find the third number of the sequence, take the second number, multiply it by 5 then subtract 3 .
4) To find the fourth number of the sequence, take the third number, multiply it by 5 then subtract 3 .


Let's take a closer look at the sequence from the Do Now.

1) Is the sequence arithmetic?
2) Is the sequence geometric?
3) Does the sequence follow a pattern?

The sequence from the Do Now can be defined $\qquad$ .

## Using a Recursive Rule to Generate a Sequence

A recursive rule for a sequence defines the nth term by relating it to one or more previous terms.

A recursive formula will help you find the next term in a sequence. Each term is found by doing something $(+,-, x, \dot{-})$ to the previous term(s).

A recursive formula is written with two parts:

- a statement of the starting term
- a statement of the formula used to arrive at the next term

Let's define the sequence from the Do Now recursively.
The first term is 2.
The nth term equals 5 times the previous term minus 3 .

$$
\varlimsup_{-}=2 \quad \varlimsup^{-}=5 \quad-3
$$

Find the first four terms of each sequence given the recursive rule.

1) $a_{1}=6 ; a_{n}=2 a_{n-1}+1$
2) $a_{1}=-12 ; a_{n}=\frac{1}{2} a_{n-1}-4$

| $n$ |  | $a_{n}$ |
| :--- | :--- | :--- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
|  |  |  |


| $n$ |  | $a_{n}$ |
| :---: | :--- | :--- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
|  |  |  |
|  |  |  |

3) $f(1)=\frac{1}{2} ; f(n)=-4 f(n-1)+6$

| $n$ |  | $f(n)$ |
| :--- | :--- | :--- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
|  |  |  |



- Sequences defined recursively use the previous term to find the next term of the sequence.
- The symbols $a_{n-1}$ and $f(n-1)$ represent the previous term in the sequence.


## More Recursive Rules

4) If a sequence is defined recursively by $f(1)=10$ and $f(n)=-f(n-1)+3$ then find $f(5)$.
5) A sequence is defined recursively by adding 4 to twice the value of the previous term. Write a recursive rule for this sequence if the first term is 15.

## The ${ }^{\text {The }}$ AWEAY

When creating a sequence using a recursive rule, it is important to understand that each term of the sequence is found using the $\qquad$ term. If the $n$th term of the sequence is denoted by $a_{n}$ then the previous term is $\qquad$ .

PIPS CORNER
One of the most famous sequences in mathematics is The Fibonacci Sequence. It is defined recursively as follows: $a_{n}=a_{n-1}+a_{n-2} ; a_{0}=1$ and $a_{1}=1$. Using this rule, find the first five terms of the sequence.

