Essential Questions: What is an arithmetic sequence? What is an explicit formula? How do we use explicit formulas to find the terms in a sequence?

## Do Now:

Arrange the following numbers in order from least to greatest: $17,29,21,13,25$
Do you notice a pattern?

## What is a sequence?

A sequence is a set of numbers that follow a particular pattern. The individual elements in a sequence are called terms.

List the sequence from the Do Now: $\qquad$

- What is the pattern? $\qquad$ - Which number is the fourth term? $\qquad$

| Term Number <br> (position) | 1 | 2 | 3 | 4 | 5 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Term |  |  |  |  |  |

## Sequences are functions

$>$ whose domain is the set of natural numbers ( $1,2,3,4, \ldots$ ).
$>$ whose range consists of the terms of the sequence.
$>$ that can be expressed in subscript or function notation.

## What is an Arithmetic Sequence?

| Term <br> Number | Term | Subscript <br> Notation | unnction <br> Notation |
| :---: | :---: | :---: | :---: |
| 1 | $\mathbf{1}$ | $a_{1}$ | $f(1)$ |
| 2 | $\mathbf{5}$ | $a_{2}$ | $f(2)$ |
| 3 | $\mathbf{9}$ | $a_{3}$ | $f(3)$ |
| 4 | $\mathbf{1 3}$ | $a_{4}$ | $f(4)$ |
| 5 | $\mathbf{1 7}$ | $a_{5}$ | $f(5)$ |
| 6 | $\mathbf{2 1}$ | $a_{6}$ | $f(6)$ |
| $n$ | $\mathbf{!}$ | $a_{n}$ | $f(n)$ |

An arithmetic sequence is an ordered list of numbers in which the difference between each pair of consecutive terms is the same. This difference is called the common difference (d) and it is a constant value.


To find the common difference: Take any term and subtract the previous term.
$>$ The common difference in this example is $\qquad$ .

To find the next term: Add the common difference to the previous term.
$\Rightarrow$ The next term in this example is $\qquad$ .

Let's take a look at some sequences...is there a common difference?
(2) $-2,-5,-8,-11, \ldots$
(3) $16,12,9,8,4,2, \ldots$
(4) $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1, \frac{5}{4}, \ldots$

## Writing Arithmetic Sequences as Functions

You can use the first term and the common difference to write a function rule that describes an arithmetic sequence.

Let's take another look at the sequence from the Do Now. How can we find the $75^{\text {th }}$ term of the sequence?

$$
13,17,21,25,29
$$

$\mathbf{a}_{1}=$ $\qquad$ $d=$ $\qquad$

| Term \# <br> $n$ | Term <br> $a_{n}$ | Written in terms of <br> $a_{1}$ and $d$ | Term |
| :---: | :---: | :---: | :---: |
| 1 | $a_{1}$ | $a_{1}$ | 13 |
| 2 | $a_{2}$ | $a_{1}+d$ | $13+4=17$ |
| 3 | $a_{3}$ | $a_{1}+d+d--a_{1}+2 d$ | $13+2(4)=21$ |
| 4 | $a_{4}$ | $a_{1}+d+d+d-->a_{1}+3 d$ | $13+3(4)=25$ |
| $n$ | $a_{n}$ |  |  |

The Explicit Formula to find the $n$th term of an arithmetic sequence: Subscript Notation $\quad a_{n}=$

Function Notation $a(n)=$

Use the explicit formula (function rule) from the Do Now to determine the 75th term of the sequence.
(5) Given the following arithmetic sequence: $2,6,10,14, \ldots$
a) Define the sequence explicitly.
b) Find the 15 th term. $n=$ $\qquad$
$a_{1}=$ $\qquad$ $d=$ $\qquad$
(6) Given the following arithmetic sequence: $160,140,120,100, \ldots$
a) Write an equation for the $n$th term.
b) Find the 10th term. $n=$ $\qquad$

$$
a_{1}=
$$

$\qquad$
$\qquad$

## ${ }^{\text {rro }}$ AWAY

$>$ The increase or decrease in an arithmetic sequence is called the

The explicit formula for an arithmetic sequence allows you to find the $n$th term of the sequence by substituting the values of $\qquad$ (first term) and $\qquad$ (common difference) in the equation $a_{n}=$ $\qquad$ .

For \#'s 1 and 2, write the next three terms of the arithmetic sequence.

1) First term: 3

Common difference: 11
2) First term: 15

Common difference: -6

For \#'s 3-5, find the common difference of the arithmetic sequence.
3) $-15,-10,-5,0, \ldots$
4) $240,210,180,150, \ldots$
5) $2,2 \frac{1}{4}, 2 \frac{1}{2}, 2 \frac{3}{4}, \ldots$

For \#'s 6 and 7:
(a) Write an equation for the $n$th term of the arithmetic sequence.
(b) Using your equation, find $a_{10}$.
6) $-3,-1,1,3, \ldots$
7) $2,-3,-8,-13, \ldots$

