# Praxis – Sequences

| | | |
|---|---|---|
| **Example 1** | 2, 4, 6, 8, … | → adding 2 |
| **Example 2** | 10, 20, 30, 40, … | → adding 10 |
| **Example 3** | 5, 10, 15, 20, … | → adding 5 |

are all very recognizable patterns.

In grade school, you skip counted by fives by using five as the first term. Another way of saying that is when you skip counted in early grades the first number you used was the number you added to find subsequent numbers.

These next examples represent a slight variation to the first three examples.

| | | |
|---|---|---|
| **Example 4** | **2, 12, 22, 32, …** | → **adding 10** |
| **Example 5** | 10, 13, 16, 19, … | → **adding 3** |

This skip counting is a slight variation because the number I am adding to find subsequent terms is not necessarily the first number – not necessarily a multiple.

All of these examples fit the definition of an Arithmetic Sequence.

A**rithmetic sequence** is a sequence in which every term after the first term is found by adding a constant – called the common difference (d).

**Example 6** Find the $6^{th}$ term of the sequence.

2, 12, 22, 32, 42, ____

+10 +10 +10 +10 +10

**Example 7** Find the $10^{th}$ term of the sequence

3, 8, 13, 18, 23, …

Writing that out we have:

3, 8, 13, 18, 23, 28, 33, 38, 43, ____

How'd we get from one term to the next in example 7? You added 5. Write that down.

3, 8, 13, 18, 23, 28, 33, 38, 43, ____

+5 +5 +5 + 5 +5 +5 +5 +5 +5

**Example 8** Find the $4^{th}$ term of the following arithmetic sequence

7, 15, 23, ____

7, 15, 23, ____

+ 8 + 8 + 8

Let's put this together:
In example 6, to find the $6^{th}$ term, how many times did I add 10? – 5 times
In example 7, to find the $10^{th}$ term, how many times did I add 5? – 9 times
In example 8, to find the $4^{th}$ term, how many times did I add 8? – 3 times

In Example 6 to find the $6^{th}$ term of the sequence, we found we added 10 five times to the first term – which is 2. So, we added 5 tens or 50 to the first term. The answer was 52.

Generalizing, what would be the $101^{st}$ term?

$$\mathbf{a_n = a_1 + (n - 1)d}$$

**$a_n$ represents the $n^{th}$ term of the sequence**
**$a_1$ represents the $1^{st}$ term of the sequence**
**d represents the common difference (what we are adding)**
**n–1 represents we are multiplying by one less than the $n^{th}$ term**

**Example 9** Find the 21st term of the sequence 3, 7, 11, 15, …

Since I am looking for the 21st term, n = 21
The common difference is 4
The first term, $a_1$, is 3

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

$a_{21} = 3 + (21-1)4$
$a_{21} = 3 + (20)\ 4$
$a_{21} = 83$

**Example 10** Find the 51st term of the sequence 12, 7, 2, –3, –8,…

In this case, n = 51, $a_1 = 12$, and d = –5

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

$a_{51} = 12 + (51-1)(-5)$
$a_{51} = 12 + (50)(-5)$
$a_{51} = -238$

In example 10, you can see the numbers in the sequence were getting smaller so we were adding a (–5).

Keys to success in these problems, identify the terms as first, second, third, etc, then substitute those into our formula for arithmetic sequences – if it is an arithmetic sequence.

$$\mathbf{a_n = a_1 + (n - 1)d}$$