Lesson 12 – Arithmetic Sequences

Goal: • Can identify arithmetic sequences as a linear relationship. • Can build an equation for an arithmetic sequence and use it to find specific terms of the sequence.
New Terminology: • Arithmetic Sequence • Term • Common Difference

Discuss: Consider the pattern:

$$14, 19, 24, 29, \ldots$$

What comes next? What would the 32nd number in the pattern be? What position would 274 be in?

We call patterns like these **ARITHMETIC SEQUENCES** for two reasons:

1. Arithmetic because

2. Sequence because

Examples of arithmetic sequences:

a. $\{5, 5, 5, \quad\}$

b. $\{7, 3, 1, \quad\}$

c. $\{3.2, 4.4, 5.6, \quad\}$

The **COMMON DIFFERENCE** of the sequence is:

Discuss: What is the minimal information we need to define an arithmetic sequence?

Example: The common difference is -12 and the 3rd term is 8. Find the first 5 terms of the arithmetic sequence.

Practice: The common difference is 7 and the 4^{th} term is 12. Find the first 5 terms of the arithmetic sequence.

Discuss: If the common difference of an arithmetic sequence is 2.7 and the first term is 3. What is the 117^{th} term? This should be possible!

We want to generalize the sequence to solve this problem. So, let's use a let statement on two characteristic we know we need.

Let a_1 be

Let d be

Zeroth Term	First Term	Second Term	Third Term	...	n^{th} Term

Example: The common difference of an arithmetic sequence is $-\frac{12}{5}$ and the first term is 99. What term will be -109.8?

Practice: The 77th term is 26 and the common difference of an arithmetic sequence is 3.7. What is the first term?

Practice: The 46th term is -823 and the first term of an arithmetic sequence is 42. What is the common difference?

Discuss: The 10^{th} term of an arithmetic sequence is 64 and the 15^{th} term is 99. What is the first term?

Example: The 23^{rd} term of an arithmetic sequence is 92 and the 43^{rd} term is 68. What is the first term?

Practice: The 57th term of an arithmetic sequence is 57 and the 83rd term is 291. What is the first term?

KEY IDEAS:

- Sequences are ordered sets where there is a first, second, third and so on.
- Arithmetic sequences are built by adding the same number again and again (the **common difference**)
- You need two pieces of information for an arithmetic sequence:
    a. Any two terms and their position
    b. Any term and its position AND the common difference
- Arithmetic sequences are built from the formula

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

OR

$$a_n = a_0 + n \cdot d$$

Where a_1 is the first term, d is the common difference and a_n is the n^{th} term. [Here a_0 is the term that would have come before the first term]

- This formula can be used to find any of the four variables: a_1, a_n, d, and n

Assigned Problems: Arithmetic Sequences Worksheet