Algebra 2 Name: ___________________________ Date: _________

Chapter 9.2 – Arithmetic Sequences– Notes

In our last class we were introduced to sequences. We learned two types of formulas for sequences: **recursive** and **explicit**.

In this section, we will learn about a particular type of sequence called an **arithmetic sequence**. (Note: when we use the word **arithmetic** to describe a sequence, it is pronounced differently than when we say it to mean the math of operating on numbers; the third syllable is emphasized: "**a-rith-MET-ic"**.)

<u>Exploration</u>

In what way are these sequences like each other?

a) $1, 5, 9, 13, 17, \ldots$

b) $0, -3, -6, -9, -12, \ldots$

c) $100, 200, 300, 400, 500, \ldots$

d) $\frac{1}{2}, 1, \frac{3}{2}, 2, \frac{5}{2}, \ldots$

Describe the characteristics that all of the above sequences share:

Now determine which of the following sequences share this same characteristic:

e) $4, -4, -12, -20, -28, \ldots$

f) $1, 2, 4, 8, 16, \ldots$

g) $0, 1, 3, 6, 10, \ldots$

h) $10, 9, 8, 7, 6, \ldots$

i) $5, 25, 45, 65, 85, \ldots$

If you chose correctly, then you know how to identify an **arithmetic sequence**!

An **arithmetic sequence** is a sequence in which the difference between each pair of consecutive terms is constant. We call this the **common difference**, denoted as $\boldsymbol{d}$. We find d by subtracting:

$$d = a_2 - a_1$$

Actually we can subtract any term from the term that follows to find d:

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

Notice that we **add the common difference** to each term to get the next term. When the terms decrease, the common difference is negative.

Like other sequences, arithmetic sequences can be expressed by a recursive formula or by an explicit formula.

Recursive Formula for an Arithmetic Sequence:

$$a_1 = a$$
$$a_n = a_{n-1} + d$$

Where a is the first term, d is the common difference, and $n > 1$.

Although we can use a recursive formula, the explicit formula is more versatile and the one we will usually use for these sequences.

Explicit Formula for an Arithmetic Sequence:

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

Where a_1 is the first term, d is the common difference, and $n \geq 1$.

Another form of the explicit formula is very useful if you happen to know two terms of the sequence, but not the first term.

Alternate Explicit Formula for an Arithmetic Sequence:

$$a_n = a_k + (n-k)(d)$$

Where a_k is a known k^{th} term, d is the common difference, and $n \geq 1$.

✍Follow the examples we do in class to see how these formulas are used.

✏Now try the odd-numbered problems in the 9-2 Practice worksheet.