Algebra II/Trig Name ______________________

Arithmetic Sequences (2.3)

<u>Activity – Linear vs. Exponential Functions</u>

In this activity, you will compare linear and exponential relationships. Examine the following two scenarios and make a prediction about which model will produce the greatest amount of money:

Model 1	A prize will be awarded that begins with \$10 and increases by \$5 each week for 20 weeks
Model 2	A prize will be awarded that begins with \$0.01 and doubles each week for 20 weeks.

1. Make a prediction about which model you believe will generate the greatest amount of money. Explain your reasoning:

Complete the chart below for the first 6 weeks:

Week #	**Model 1**	**Model 2**
	Amount of Prize Money Awarded	**Amount of Prize Money Awarded**
0		
1		
2		
3		
4		
5		

2. After computing the prize money awarded for more and more weeks, Annie begins to believe that the method for awarding the prize described in Model 2 (begins with \$0.01 and doubles each week) will result in a prize of a greater amount of money. How could Annie verify this belief?

Complete the chart below for weeks 6-10:

Week #	Model 1	Model 2
	Amount of Prize Money Awarded	**Amount of Prize Money Awarded**
6		
7		
8		
9		
10		

3. Describe the patterns that are displayed in the "Amount of Prize Money Awarded" by:

Model 1:

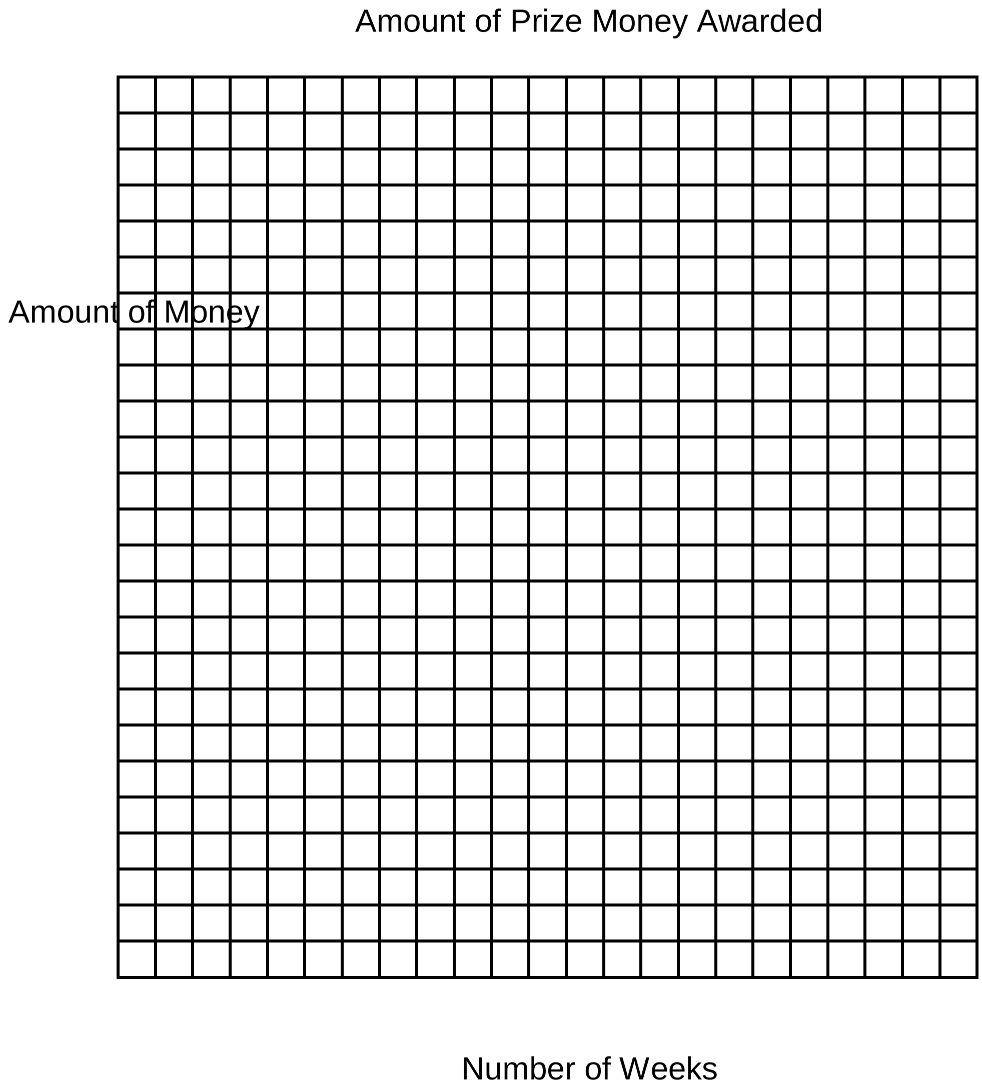
Model 2:

Complete the chart below for the next 10 weeks:

Week #	Model 1	Model 2
	Amount of Prize Money Awarded	**Amount of Prize Money Awarded**
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

4. After how many weeks does Model 2 award more money than Model 1?

5. Graph the two models.



Definition of an Arithmetic Sequence

An arithmetic sequence is a sequence in which each term after the first differs from the preceding term by a constant amount. The difference between consecutive terms is called the common difference of the sequence. Arithmetic sequences are model by linear functions.

Finding the Common Difference

The common difference is found by subtracting any term from the term that directly follows it.

$$d = a_2 - a_1$$

Example 1: Find the common difference for the arithmetic sequence.

a. 142, 146, 150, 154, 158, ...

b. – 5, –2, –1, 4, 7, ...

Example 2: Write the first six terms of each arithmetic sequence.

a. $a_1 = 8$, $d = -6$

b. $a_1 = \frac{3}{4}$, $d = -\frac{1}{4}$

General Term of an Arithmetic Sequence

The nth term (the general term) of an arithmetic sequence with the first term a_1 and common difference d is

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

Example 3: Write a formula for the general term (nth term) of each arithmetic sequence.

a. 2, – 3, – 8, – 13, …..

b. 6, 10, 14, 18, …..

Example 4: Find the indicated term of the arithmetic sequence with first term, a_1, and common difference *d*.

a. Find a_{20} when $a_1 = 35$, $d = -3$

b. Find a_{150} when $a_1 = -60$, $d = 5$

Example 5: Write a formula for the general term (nth term) of each arithmetic sequence.

a. $a_9 = -5$, $a_{14} = -30$

b. $a_6 = -11$, $a_{22} = -75$

The Sum of the First *n* Terms of an Arithmetic Sequence

The sum, S_n, of the first *n* terms of an arithmetic sequence is given by

$$S_n = \frac{n}{2}(a_1 + a_n)$$

in which a_1 is the first term and a_n is the *n*th term.

Example 6:

a. Find the sum of the first 100 terms of the arithmetic sequence: 1, 3, 5, 7,.......

b. Find the sum of the first 15 terms of the arithmetic sequence: 3, 6, 9, 12,.......

c. Find the following sum:

1. $\sum_{i=1}^{35}(5i-9)$

2. $\sum_{i=8}^{30}(6i-11)$

d. Daniel gets a job with a starting salary of $70,000 per year with an annual raise of $3,000.
   1. What will Daniel's salary be in year 10?

   2. Find the total salary for Daniel over his first 10 years?