Name: ______________________________ Date: ______________

Sequences: Lesson 4 – Recursive Sequence Formulas Algebra 1 CC

Warm Up: Given the explicit formula $a_n = 2n + 10 \; for \; n \geq 1$ and that $a_1 = 12$:

(a) Find the next five terms.

12	14	16	18	20	22
a_1	a_2	a_3	a_4	a_5	a_6

(b) If we know that $a_1 = 12$, how did we go from a_1 to a_2? How did we get from a_2 to a_3? Justify.

added 2, added 2.
Because 2 is the common difference.

Learning Target *"I can write and use recursive arithmetic and geometric formulas."*

A Recursive **formula** is a rule that allows any term of a sequence, *except the first,* to be computed using a previous term. You must always state a_1 then a_n when writing a recursive formula.

(Two Lines)

Investigation 1: Given the following 5 terms in a sequence-

$$a_1 = 5, \;\; a_2 = 8, \;\; a_3 = 11, \;\; a_4 = 14, \;\; a_5 = 17$$

(a) How can we find the fifth term, in terms of the fourth term?

(b) How can we find the sixth term in terms of the fifth term?

(c) How can we find the $(n + 1)$ term in terms of the nth term?

Investigation 2: Given the following sequence 5376, 1344, 336, …, find the fifth term in the sequence.

There is a recursive formula for each type of sequence, as follows:

Recursive Arithmetic	***Recursive Geometric***
$\boldsymbol{a_n = \boxed{a_{n-1}} + d}$ where d = the common difference previous term	$\boldsymbol{a_n = \boxed{a_{n-1}}(r)}$ where r = the common ratio PT

Exercise 1- Write a recursive formula for the sequence **23**, **29**, **35**, **41**, ... 47 53 59

+6 +6

5 6 7

Step 1: Determine if the sequence is arithmetic or geometric. Find *d* ($\boldsymbol{d} = \boldsymbol{a_2} - \boldsymbol{a_1}$) or *r* $\left(\boldsymbol{r} = \frac{\boldsymbol{a_2}}{\boldsymbol{a_1}}\right)$.

Arithmetic $d = 6$

Step 2: Use the recursive formula for an arithmetic sequence: $a_n = a_{n-1} + d$, to substitute *d.*

* TWO Lines

$a_1 = 23$

$a_n = \boxed{a_{n-1}} + 6$

Exercise 2- Write a recursive formula for the sequence **6**, **24**, **96**, ...

×4 ×4

Step 1: Determine if the sequence is arithmetic or geometric. Find *d* or *r*.

Geometric $r = 4$

Step 2: Use the recursive formula for a geometric sequence: $a_n = a_{n-1}(r)$, to substitute *r.*

$a_1 = 6$

$a_n = \boxed{a_{n-1}}(4)$

Problem Set:

(1) Given the following sequence **12**, **9**, **6**, **3** ...

-3 -3 -3

a) Write a recursive formula for the sequence (A)

$a_1 = 12$

$a_n = \boxed{a_{n-1}} - 3$

b) What is the 8th term of the sequence? 12 9 6 3 0 -3 -6 -9

-3 -3

5 6 7 8

$a_8 = -9$

(2) Consider a sequence given by the formula $\boldsymbol{a_n} = \boxed{\boldsymbol{a_{n-1}}} - \mathbf{5}$, where $\boldsymbol{a_1} = \mathbf{12}$.

PT -5

a) List the first five terms of the sequence

(A) $d = -5$

12, 7, 2, -3, -8

-5 -5 -5 -5

b) Write an explicit formula

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

$a_n = 12 - 5(n-1)$

$12 - 5n + 5 = -5n + 17$

(3) A sunflower is 3 inches tall at week 0 and grows 2 inches each week. Which function(s) shown below can be used to determine the height, *f(n),* of the sunflower in *n* weeks?

I. $f(n) = 2n + 3$
II. $f(n) = 2n + 3(n - 1)$
III. $f(n) = f(n - 1) + 2$ where $f(0) = 3$

(1) I and II
(2) II, only
(3) III, only
(4) I and III

(4) If $a_1 = 6$ and $a_n = 3 + 2(a_{n-1})^2$, then a_2 equals..

(1) 75
(2) 147
(3) 180
(4) 900

(5) Given the recursive formula:

$$a_1 = 3$$
$$a_n = 2(\boxed{a_{n-1}} + 1)$$

$2(\underline{PT} + 1)$

State the values of $\underline{a_2}$, $\underline{a_3}$, and $\underline{a_4}$ for the given recursive formula.

$a_2 = 2(\underline{3} + 1) = 8$
$a_3 = 2(\underline{8} + 1) = 18$
$a_4 = 2(\underline{18} + 1) = 38$

(6) Write the first 4 terms of the recursive sequence given that $a_1 = 3$ and $a_n = a_{n-1} + 4$

(7) Consider a sequence given by the formula $a_n = a_{n-1}(-2)$, where $a_1 = 7$.

a) List the first four terms of the sequence using the recursive formula given.

b) Write an explicit formula.