KEY

DAY 1 NOTES - 10/10

Vocabulary – Recursive Pattern

Concept/Vocabulary Word	Definition
explicit equation	AN EQUATION THAT CALCULATES OUTPUT USING INPUT
input	X-VALUES → VALUES THAT YOU PUT INTO THE EQUATION
iteration	WHEN YOU TAKE THE OUTPUT AND USE IT AS THE INPUT (REPEATING A PROCESS)
mapping diagram	MAPS INPUT TO OUTPUT EX: 
output	Y-VALUES
recursive equation	"NEXT-NOW" EQUATIONS THE VALUE OF AN EQUATION DEPENDS ON THE PREVIOUS
sequence	A LIST OF NUMBERS (USUALLY IS A PATTERN)

Write the rule in NOW-NEXT form, written as follows:

*Starting at ____, NEXT = NOW (+, –, *, /) _____.

This is representing the pattern that you see in the sequence, if I have a number (NOW) how do I get to the NEXT number?

Examples:

5, 10, 15, 20, . . .   START = 5, NEXT = NOW +5

2, 4, 8, 16, 32, . . .   START = 2, NEXT = NOW *2

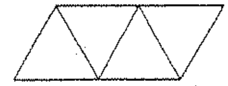
"Guess My Rule"

Term	1	2	3	4	5
Value	-3	6	-12	24	-48

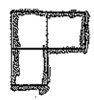
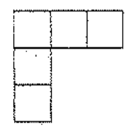
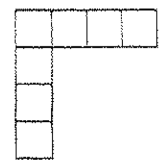
START = -3, NEXT = NOW *-2

Term	1	2	3	4	5
Value	52	46	40	34	28

START = 52, NEXT = NOW -6

				
n = number of triangles P = Perimeter	n = 1 P = 3	n = 2 P = 4	n = 3 P = 5	n = 4 P = 6

START = 3, NEXT = NOW + 1

				
n = number of squares P = Perimeter	n = 1 P = 4	n = 3 P = 8	n = 5 P = 12	n = 7 P = 16
* n = number of squares A = Area	n = 1 A = 1	n = 3 A =	n = 5 A =	n = 7 A =

START = 4, NEXT = NOW + 4

Iterating Functions on the Graphing Calculator

Calculators can quickly iterate functions. Start by entering your initial value, then take advantage of the ANS (2^{nd} (–)) key to create a function to iterate simply by pressing ENTER repeatedly.

For example, to iterate NEXT = 5·NOW + 10, starting at an initial value of 1:

Hit 1, ENTER. Enter 5Ans+10 and then hit ENTER repeatedly.

```
1
                1
5Ans+10
               15
               85
              435
             2185
```

Interpret the calculator: initial value is 1; the next is 15, and so on. 2185 is the fourth iteration.

Investigation • Recursive Toothpick Patterns

Name ______________________ Period __________ Date ____________

You will need: a box of toothpicks

In this investigation you will learn to create and apply recursive sequences by modeling them with puzzle pieces made from toothpicks.

Consider this pattern of triangles.

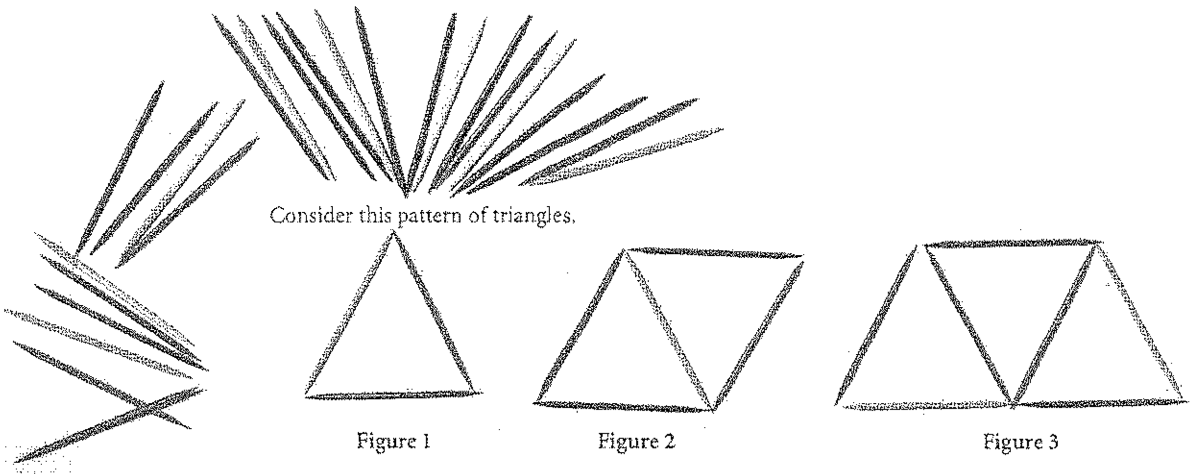
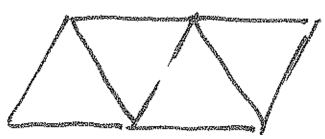


Figure 1 Figure 2 Figure 3

Step 1 Make Figures 1–3 of the pattern using as few toothpicks as possible. How many toothpicks does it take to reproduce each figure? How many toothpicks lie on the perimeter of each figure?



Step 2 Make Figures 4–6 from toothpicks by adding triangles in a row. Record the results in the table.

	Number of toothpicks	Perimeter
Figure 1	3	3
Figure 2	5	4
Figure 3	7	5
Figure 4	9	6
Figure 5	11	7
Figure 6	13	8
Figure 10	21	12
Figure 25	51	27

Investigation • Recursive Toothpick Patterns (continued)

Step 3 What is the rule for finding the number of toothpicks in each figure? What is the rule for finding the perimeter? Use your calculator to create recursive routines for these rules. Check that these routines generate the numbers in your table.

* • START = 3 NEXT = NOW + 2
• START = 3 NEXT = NOW + 1

Step 4 Now make Figure 10 from toothpicks. Count the number of toothpicks and find the perimeter. Does your calculator routine give the same answers? Find the number of toothpicks and the perimeter for Figure 25. Add those results to the table.

Next you'll see what sequences you can generate with a new pattern.

Step 5 Design a pattern using a row of squares, instead of triangles, with your toothpicks. Repeat Steps 1–4 and answer all the questions with the new design. Record the results in the table.

	Number of toothpicks	Perimeter
Figure 1	4	4
Figure 2	7	6
Figure 3	10	8
Figure 4	13	10
Figure 5	16	12
Figure 6	19	14
Figure 10	31	22
Figure 25	76	52