Algebra RH

Essential Questions: What is a recursive sequence? How do we write their formulas? How do we use recursive formulas to find the terms in a sequence?

Do Now:

Each square in this pattern has side length 1 unit. Imagine that the pattern continues.

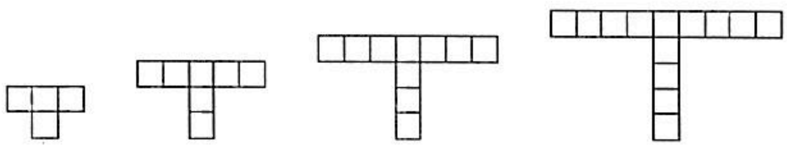


Figure 1 Figure 2 Figure 3 Figure 4

Record the information for the given figures in the table below and then continue the pattern.

Figure	1	2	3	4	5	6
Perimeter	10	16	22	28	34	40

Sequence

3, 5, 7, 9, …

1st term 2nd term 3rd term 4th term

three dots means goes on forever (infinite)

A **sequence** is a set of numbers called **terms**, in a specific order.

What is a recursive sequence?

A **recursive sequence** is the process in which each step of a pattern is dependent on the step or steps before it.

A famous recursive sequence is the Fibonacci sequence shown below. What is the pattern?

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, …

Writing a **recursive formula** will help you find the **next term** in a sequence. Each term is found by doing something (+, -, x, ÷) to the **previous term(s)**.

A **recursive formula** is written with **two parts**:

- a statement of the **starting term**, and
- a statement of the **formula** used to arrive at the next term

Given Term	Next Term
a_1	a_2
a_4	a_5
a_{n+1}	a_{n+2}
a_n	a_{n+1}
$a(6)$	$a(7)$
$a(n)$	$a(n+1)$
$a(n+1)$	$a(n+2)$

From the first rung, a_1,

you move to the second rung, a_2

From the second rung, a_2,
you move to the third rung, a_3

Previous Term	Given Term
a_0	a_1
a_3	a_4
a_n	a_{n+1}
a_{n-1}	a_n
$a(5)$	$a(6)$
$a(n-1)$	$a(n)$
$a(n)$	$a(n+1)$

(1) Consider the perimeter example from the Do Now:

(a) Find the pattern. add 6

(b) Write a recursive formula for the sequence. $a_n = a_{n-1} + 6, \quad a_1 = 10$

$$a_n = a_{n-1} \boxed{+/-/\cdot/\div} \text{ pattern}$$

the term in the sequence

the previous term in the sequence

(c) Use the formula to find the 7th term in the sequence.

$a_6 = 40$

$a_7 = a_6 + 6$
$= 40 + 6 = 46$

(2) Consider the sequence: 1, 3, 9, 27 ...

(a) Find the pattern. $\times 3$

(b) Write a recursive formula for the sequence.

$$a_n = 3(a_{n-1}), \quad a_1 = 1$$

Write a recursive formula for the following sequences.

(3) 100, 96, 92, ...

-4

$a_n = a_{n-1} - 4, \quad a_1 = 100$

term

previous term

(4) 200, 40, 8, ...

$\div 5$

$a_n = \dfrac{a_{n-1}}{5}, \quad a_1 = 200$

Sequences with a combination of operations

Find the first 4 terms in each of the following sequences.

(5) $a_n = a_{n-1} - 4$ where $a_1 = 15$

$a_1 = 15$

$a_2 = a_1 - 4$

$= 15 - 4$

$a_2 = 11$

$a_3 = a_2 - 4$

$= 11 - 4$

$a_3 = 7$

$a_4 = a_3 - 4$

$= 7 - 4$

$= 3$

(6) $a(n+1) = 5a(n)$ and $a(1) = 3$

$a(1) = 3$

$a(2) = 5 \cdot a(1) \rightarrow 5(3) \rightarrow 15$

$a(3) = 5 \cdot a(2) \rightarrow 5(15) \rightarrow 75$

$a(4) = 5 \cdot a(3) \rightarrow 5(75) \rightarrow 375$

(7) $a(n) = \frac{1}{4}a(n-1)$ where $a(1) = 8$

$a(1) = 8$

$a(2) = \frac{1}{4}a(1) \rightarrow \frac{1}{4}(8) \rightarrow 2$

$a(3) = \frac{1}{4}a(2) \rightarrow \frac{1}{4}(2) \Rightarrow \frac{1}{2}$

$a(4) = \frac{1}{4}a(3) \rightarrow \frac{1}{4}\left(\frac{1}{2}\right) \rightarrow \frac{1}{8}$

$8, 2, \frac{1}{2}, \frac{1}{8}$

(8) $a_{n+1} = 3a_n + 4$ where $a_1 = 5$

$a_1 = 5$

$a_2 = 3a_1 + 4 \rightarrow 3(5) + 4 \rightarrow 19$

$a_3 = 3a_2 + 4 \rightarrow 3(19) + 4 \rightarrow 61$

$a_4 = 3a_3 + 4 \rightarrow 3(61) + 4 \rightarrow 187$

(9) The diagrams below represents the first three terms of a sequence.

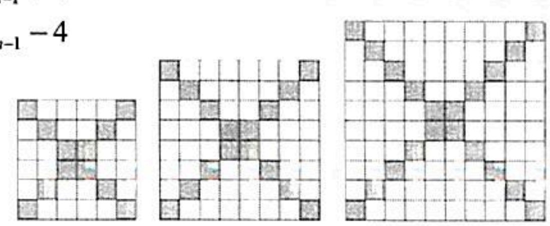
Assuming the pattern continues, which formula determines the a_n, the number of shaded squares in the n^{th} term?

(a) $a_n = a_{n+1} + 4$

(b) $a_n = a_{n+1} - 4$

(c) $a_n = a_{n-1} + 4$

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



Term 1 Term 2 Term 3