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LEARNING OBJECTIVE: We will define integer sequences and give explicit formulas to define the pattern of a sequence. (Alg1M3L1)

ACTIVATING PRIOR KNOWLEDGE

We can recognize patterns in numbers.

What are the next three numbers in the pattern: 2, 5, 8, 11, _____, _____, _____ Describe the pattern:	What could the next three numbers in the pattern be? 2, 4, 8, _____, _____, _____ Describe the pattern:

CONCEPT DEVELOPMENT

A **sequence** can be thought of as an ordered list of elements.
Each element in the list is a term.
The terms are indexed by a subscript to make sure that they are in order.
Example:
Stephan thought of a pattern that shows powers of 3. Here are the first five numbers of his sequence: 3, 9, 27, 81, 243,…

What expression can we write for the nth number in Stephan's sequence?

Can we make a few different tables of values?

Term Number	Term

Sequence Term	Term

Function notation: Instead of using a_n, we can use $f(n)$ notation, which means the formula for the nth term.
Example: $a_n = n^2 - 1$ becomes $f(n) = n^2 - 1$

FOR NOW, we are always starting when n=1!

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GUIDED PRACTICE

Steps to Writing Explicit Formulas for Sequences

1. Consider the given sequence, and define the pattern.
2. Write a formula that can be used to predict the nth term in the formula.
**Remember, start when $n = 1$.
3. Rewrite your formula as an explicit formula by including $(n - 1)$ in your formula (if necessary).
4. Answer any questions as required by applying the formula.

Sequence: 4, 7, 10, 13, 16,… Formula: (a_n and $f(n)$notation) Formula (when $n = 0$): What is the 13th term in the sequence?	Sequence: 2, 6, 10, 14,… Formula: (a_n and $f(n)$notation) Formula (when $n = 0$): What is the 19th term in the sequence?
Sequence: 30, 25, 20, 15,… Formula: (a_n and $f(n)$notation) Formula (when $n = 0$): What is the 26th term in the sequence?	Sequence: 119, 117, 115, 113,… Formula: (a_n and $f(n)$notation) Formula (when $n = 0$): What is the 17th term in the sequence?

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Sequence: 1, 5, 25, 125, 625 mult. by 5

a_1, a_2, a_3, a_4, a_5

Formula: (a_n and $f(n)$notation)

$f(n) = 5^{n-1}$

$f(1) = 1 = 5^{1-1} = 5^0 = 1$

$a_n = 5^{n-1}$

Formula (when $n = 0$):

$f(n) = 5^n$ Exponential

What is the 9th term in the sequence?

$a_9 = f(9) = 5^8 = 390{,}625$

Sequence: 1, 16, 256, 4096,…

Formula: (a_n and $f(n)$notation)

$a_n = 16^{n-1} = (4^2)^{n-1} = 4^{2n-2} = 2^{4n-4}$

$f(n) = 16^{n-1} = 4^{2n-2} = 2^{4n-4}$

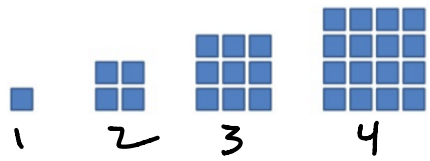
Formula (when $n = 0$):

$f(n) = 16^n$

What is the 8th term in the sequence?

268,435,456

Sequence: Consider the following sequence:



Formula: (a_n and $f(n)$notation)

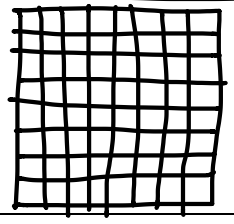
$f(n) = n^2$ Quadratic.

$a_n = n^2$

Formula (when $n = 0$):

$f(n) = (n+1)^2$ 1

What does the 8th term look like?



8x8 square.

Sequence: 1, 8, 27, 64,…

Formula: (a_n and $f(n)$notation)

$f(n) = n^3$

$a_5 = 125$

$a_n = n^3$

Formula (when $n = 0$):

$f(n) = (n+1)^3$

What is the 9th term in the sequence?

$f(9) = 9^3 = 729$

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Sequence: A standard piece of paper has a length and width of 8.5 inches by 11 inches. Find the area of one piece of paper. 93.5 in.^2 If the paper were folded completely in half, what would be the area of the resulting rectangle? 46.75 in.^2 Write a formula for a sequence to determine the area of the paper after *n* folds. $a_n = \frac{93.5}{2^n} = 93.5 \cdot \left(\frac{1}{2}\right)^n$ What is the area after 7 folds? $a_7 = \frac{93.5}{128} = .7304687 \text{ in.}^2$	Sequence: Janet won the lottery—her after tax winnings were $1,000,000,000. Each year she spent exactly half of the money she had. How much money did she spend the first year? 500,000,000 How much money does she have left after the 3rd year? 125,000,000 Write a formula for a sequence to determine the amount of money after *n* years. $f(n) = \frac{1,000,000,000}{2^n}$ $remaining $spent 1B-f(n) How much money does she have left after 10 years? $976,562.50

INDEPENDENT PRACTICE

Complete Problem Set for Module 3, Lesson 1.

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CLOSURE

NOTES

Module 3, Lesson 1. Algebra 1