

INTRODUCTION TO SEQUENCES N-GEN MATH[®] ALGEBRA I



A **sequence** is a very special type of function. When students first encounter sequences, they often think of them as just a list of numbers in some particular order (and then they have to find the pattern). We will start with the technical definition of a sequence in terms of a function.

SEQUENCE DEFINITION

A **sequence** is a function whose set of inputs, the **domain**, is a subset of the natural numbers, $\{1, 2, 3, 4, 5, \dots\}$. A sequence is often shown as an ordered list of numbers, called the **terms** or **elements** of the sequence. Sequence function notation can be tricky.

Exercise #1: Consider the sequence below. If we represent this sequence with the letter a , then do the following.

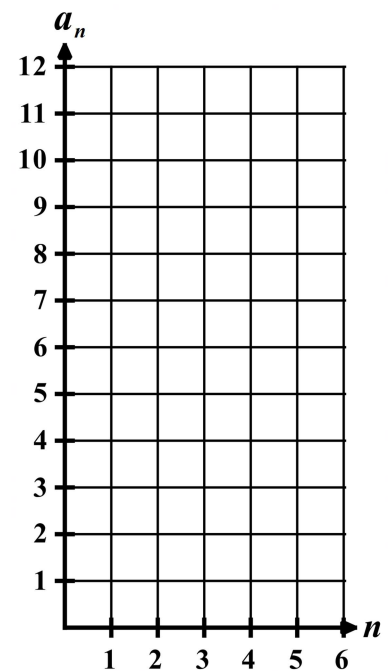
4, 8, 16, 32, 64, 128, 256

- (a) What is the value of a_3 ? (b) What is the value of a_6 ? (c) Find the value of $a_7 - a_1$

Sequences are functions. The **input** is simply the **number's place in the list** and the output is the actual **number in the list**. The input is given using a **subscript**.

Exercise #2: Consider the sequence defined by the formula $a_n = 2n + 1$.

- (a) Write out the first 5 elements or terms of this sequence.
- (b) Graph the sequence on the grid shown for $1 \leq n \leq 5$.
- (c) Why shouldn't we connect the points plotted with a **continuous** straight line?
- (d) What is the 21st term of this sequence? Show how you arrived at your answer.



Sequences, at least in this course, will be **defined** using what is known as an **explicit formula** that tells you how to calculate the term's value if you know where the term sits in the list.

Exercise #3: For each of the following explicitly defined sequence rules, find the value of the stated element.

(a) for $a_n = \frac{1}{2}n + 7$

find the value of a_{20}

(b) for $b_n = 5(2)^{n-1}$

find the value of b_4

(c) for $c_n = \frac{n^2 - 1}{n - 1}$

find the value of c_8

Exercise #4: A sequence is defined using the rule $a_n = 4|n - 3|$. If the domain of the sequence is the set $\{1, 2, 3, 4, 5\}$, then write a set that gives the range of the sequence.

Very often, the input variable used in sequence rules is n instead of x . It certainly does not have to be, especially if the input variable has some real-world meaning.

Exercise #5: Obi is on an exercise plan where the number of pushups he does each day depends on the day of the plan. The sequence is given by the rule:

$$p_d = 15 + 5(d - 1)$$

(a) According to this rule, how many pushups should Obi do on the first day?

(b) Find the value of p_7 . Give an interpretation of what this means in the context of this problem.

(c) Find the value of $p_{14} - p_7$. Give an interpretation of what this means in the context of this problem.



INTRODUCTION TO SEQUENCES
N-GEN MATH[®] ALGEBRA I HOMEWORK

FLUENCY

1. Consider the sequence below. If we represent this sequence with the letter a , then do the following.

1, 7, 13, 19, 25, 31, 37, 43

(a) Find a_5

(b) Find $a_2 + a_6$

(c) Find $a_4 + 2a_3$

(d) Find $\sqrt{a_5}$

(e) Find $a_7 - a_6$

(f) Find $\frac{a_5 - a_3}{2}$

2. Consider the sequence defined in the table below.

n	1	2	3	4	5
b_n	2	12	22	32	42

Which of the following is the value of $b_5 - b_2$?

(1) 12

(3) 22

(2) 18

(4) 30

3. A sequence is given by the rule $c_n = 28 - 4(n - 1)$. Which of the following is the value of its fifth term?

(1) 12

(3) 18

(2) 15

(4) 21

4. The terms of a sequence are generated by the formula $a_n = \frac{60}{14 - n}$. Which of the following represents the difference between the 11th term and the fourth term of the sequence?

(1) 6

(3) 14

(2) 9

(4) 24



APPLICATIONS

5. The visits, v , that a website has received per month for each month that it has operated is modeled using the sequence:

$$v_m = 150 + 30(m-1)$$

- (a) How many visits did the website receive in the first month it operated?
- (b) Find the value of v_{12} . What does this value represent?
- (c) Find the value of $v_8 - v_4$. What does this value tell you in the context of this problem?

REASONING

6. The first four rows of a shape pattern are shown below. Answer the following questions:

- (a) If the pattern continued, how many shapes would be in the sixth row? Explain.



$n = 1$



$n = 2$



$n = 3$



$n = 4$

- (b) Sam believes that the correct formula for the number of shapes in a given row is:

$$s_n = 2n + 3$$

How can you tell that Sam's formula is not correct?

- (c) Can you think of a way to find how many shapes will be in the 20th row? If so, how many are there? How did you find the answer?

