

Math 3206

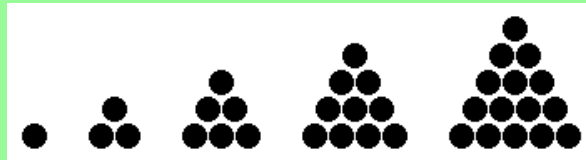
Unit 1: Patterns

Section 1.1: Patterns in Sequences

Sequence: an ordered group of numbers, symbols, or pictures that have a pattern.

ex. 5, 10, 15, 20, 25, . . .

ex.



Each item in the list is called a **term**. Terms are labelled accordingly:

t_1 - first term

t_2 - second term

t_3 - third term

t_n - the nth term ("n" can change)

Each term is determined through some rule or formula.

A sequence is written as a list of numbers in the form

$\{t_1, t_2, t_3, t_4, \dots\}$

Sequences can be **finite** (they end)

ex $\{1, 3, 5, 7, 9\}$ or $\{2, 4, 8, 16, 32, 64\}$

OR

Sequences can be **infinite** (they don't end)

ex $\{5, 10, 15, 20, \dots\}$ or $\{3, 6, 10, 15, 21, \dots\}$

Example: Describe the pattern and use the pattern (rule) to list the next three terms in the sequence.

A) $\{20, 17, 14, 11, 8, \dots\}$

Pattern: Subtract 3 from previous term
5, 2, -1

B) $\{\text{Alice, Bob, Curtis, David, } \dots\}$

Pattern: 1st letter increases by one letter

C) $\{1/2, 2/3, 3/4, 4/5, \dots\}$

Pattern: Numerator + denominator increases by 1.
 $\{5/6, 6/7, 7/8\}$

D) $\{1, 4, 9, 16, 25, \dots\}$

Pattern: Perfect Squares
 $\{36, 49, 64, \dots\}$

E) 

Pattern: Add 1 block to previous diagram.



Example: Describe the pattern in each sequence and find t_7 .

A) $\{4, 9, 14, 19, \dots\}$ $24, 29, \boxed{34} = t_7$
 Add 5 to previous term

B) $\{14, 5, -4, -13, \dots\}$ $-22, -31, \boxed{-40} = t_7$
 Subtract 9 from previous term

C) $\{5, 10, 20, 40, 80, 160\}$

Multiply previous term by 2
 there is no 7th term.

this sequence is a finite sequence;
 it does not continue indefinitely.

Example: Give an example of an infinite sequence where the first term is 3 and each term increases by 5. List 5 terms of this sequence. What is t_8 ?

$$\{3, 8, 13, 18, 23, \dots\}$$

$$28, 33, 38 \quad t_8 = 38$$

Example: Give an example of an finite sequence that has 6 terms. The first term is -17 and each term decreases by 3. List all members of this sequence.

$$\{-17, -20, -23, -26, -29, -32\}$$

Each sequence has an associated table of values.

Example: Given the sequence $\{3, 8, 13, 18, 23, \dots\}$

- A) How many terms does it have? *infinite*
- B) Complete the associated table of values for this sequence.

Term Number (n)	Sequence Value (tn)
1	3
2	8
3	13
4	18
5	23

D,

$8 - 3 = 5$

$13 - 8 = 5$

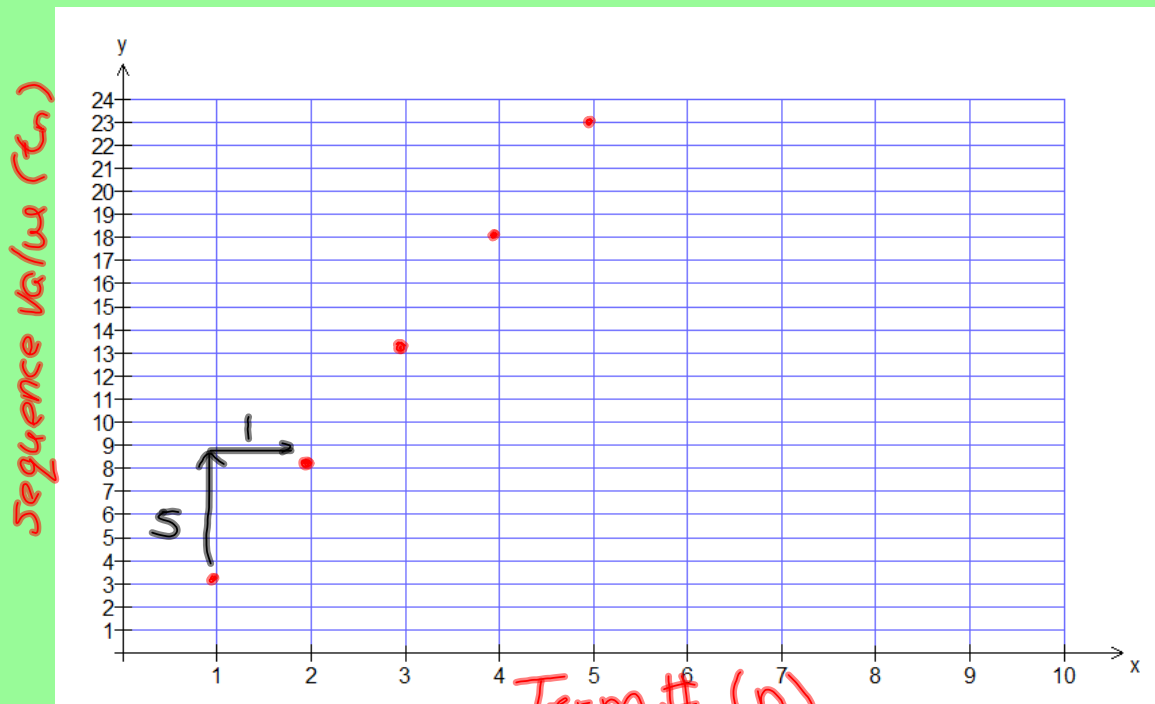
$18 - 13 = 5$

$23 - 18 = 5$

Domain: $\{1, 2, 3, 4, \dots\}$

Range: $\{3, 8, 13, 18, \dots\}$

- C) Graph the data.



* do not join points because the data is discrete.

D) What is the slope?

$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{5}{1} = 5$$

E) What do you notice about the **difference of the y-values (D1)** and the slope of the graph?

$D_1 = 5$, so they are the same.

F) The sequence $\{3, 8, 13, 18, 23, \dots\}$ can also be represented by the equation $t_n = 5n - 2$. What does this mean?

$n = \text{term \# (ie, 1st term, 2nd term, \dots)}$
 $t_n = \text{term value}$
 This formula will generate the terms of the sequence.

When $n = 1$:

$$t_n = 5n - 2$$

$$t_1 = 5(1) - 2$$

$$t_1 = 5 - 2$$

$$t_1 = 3$$

When $n = 2$:

$$t_n = 5n - 2$$

$$t_2 = 5(2) - 2$$

$$t_2 = 10 - 2$$

$$t_2 = 8$$

As you have seen, a sequence can be represented as a:

- list
- table of values
- graph
- equation
- pictures