Math 3206

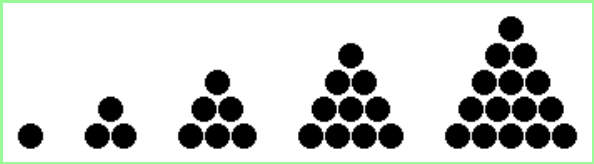
Unit 1: Patterns

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

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, . . .} or { 3, 6, 10, 15, 21, . . . }

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

A) {20, 17, 14, 11, 8, . . .}

Pattern: Subtract 3 from previous term

5, 2, -1

B) {Alice, Bob, Curtis, David, . . . }

Pattern: 1st letter increases by one letter

C) { 1/2, 2/3, 3/4, 4/5, . . . }

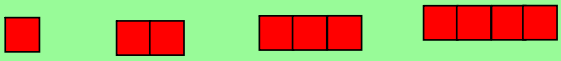
Pattern: Numerator & denominator increases by 1.

{5/6, 6/7, 7/8}

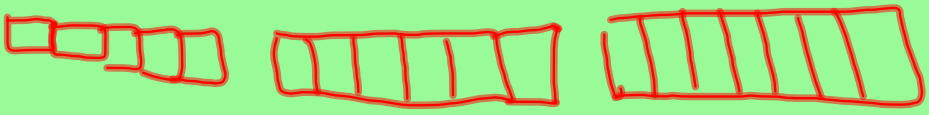
D) {1, 4, 9, 16, 25, . . . }

Pattern: Perfect Squares

{36, 49, 64 . . .

E) 

Pattern: Add 1 block to previous diagram.



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

A) {4, 9, 14, 19, . . . } 24, 29, 34 $= t_7$

Add 5 to previous term

B) {14, 5, - 4, -13, . . . } -22, -31, -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 . . .}

28, 33, 38 $t_8 = 38$

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, . . .}

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

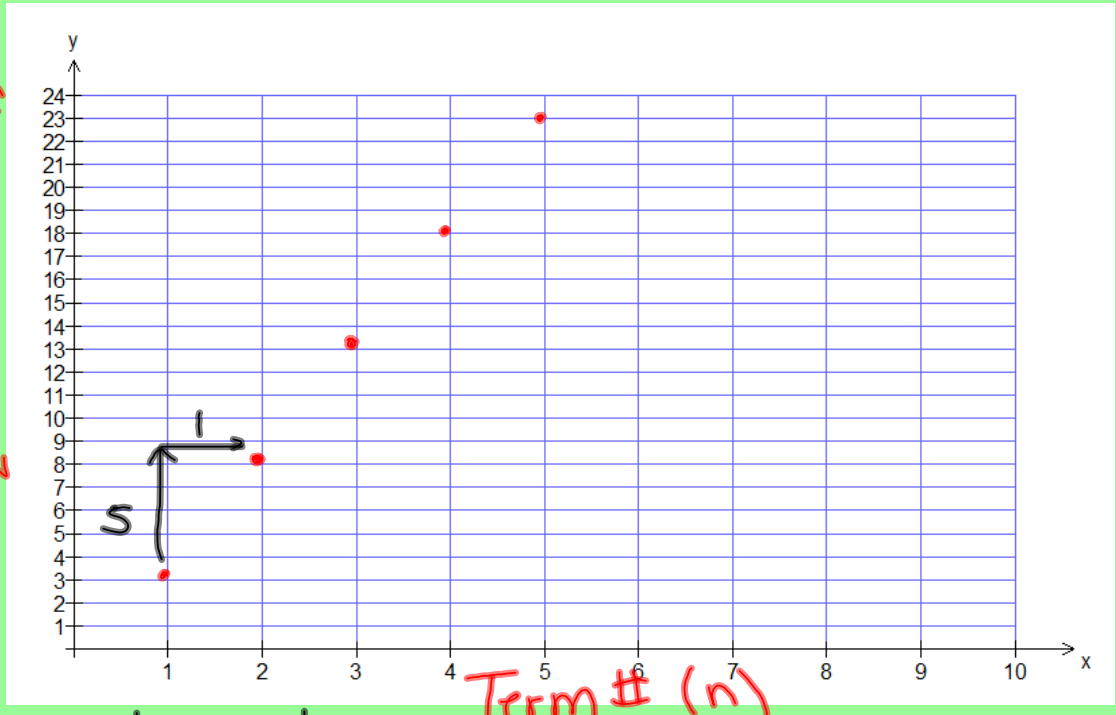
18-13 = 5

23-18 = 5

Domain: {1,2,3,4. . . .}

Range: {3,8,13,18. . . .}

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, . . .} can also be represented by the equation $t_n = 5n - 2$. What does this mean?

n = term # (ie. 1st term, 2nd term, . . .}

t_n = 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