6-3 Finite Geometric Series

Objectives:

1. I can write a series with sigma notation.

2. I can derive the formula for the sum of a geometric series (when the common ratio is not 1)

3. I can use the formula of a geometric series to solve problems.

Warm - up

1. Write a <u>recursive rule</u> and an explicit rule for the sequence:

3, 9, 27, 81, 243

$f(0) = 3$
$f(n) = 3 \cdot f(n-1)$

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

$b = 3$
$a = 3$

2. Find the stated term of the geometric sequence:

-3, -6, -12, -24, … ; 9th term

0	1	2	3	4	5	6	7	8	9
$-\frac{3}{2}$	-3	-6	-12	-24					

$b = 2$
$a = -\frac{3}{2}$

$-\frac{3}{2}(2)^{n} \leftarrow 9$

$= \boxed{-768}$

You have 2 biological parents, 4 biological grandparents, and 8 biological great-grandparents. How many great-great-great-great grandparents (6th generation) do you have?

generation

0th	1	2	3	4	5	6
1	2	4	8	16	32	64

add

How many total ancestors do you have if you trace your ancestry back 6 generations?

126 ancestors

Series

definition: the sum of a sequence

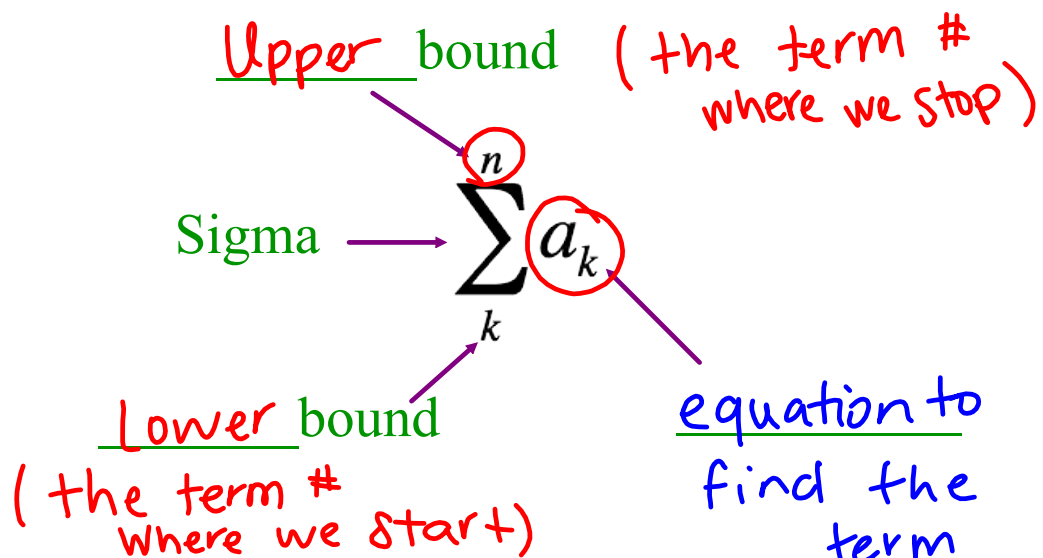sum: usually a total of a finite number of items added together

Summation

$$a_1 + a_2 + a_3 + ... + a_n$$

(how do we write the sum of long lists of numbers?)

$\sum$ sigma   means summation

↳ sum of the #'s

Summation notation: $\sum_{k=1}^{n} a_k = a_1 + a_2 + a_3 + ... + a_n$

↑ equation

Vocabulary

Upper bound (the term # where we stop)

Sigma ⟶ $\sum_{k}^{n} a_k$

Lower bound (the term # where we start)

equation to find the term

Read as:

The sum of a_k from k to n

Find the following sums:

a. $\displaystyle\sum_{k=1}^{5} 3k = 3(1) + 3(2) + 3(3) + 3(4) + 3(5)$

$3 + 6 + 9 + 12 + 15 = \boxed{45}$

b. $\displaystyle\sum_{k=5}^{8} k^2$ $(5)^2 + (6)^2 + (7)^2 + (8)^2$

$25 + 36 + 49 + 64 = \boxed{174}$

c. $\displaystyle\sum_{k=3}^{7} 4x+1 = (4(3)+1) + (4(4)+1)$

13 → 17 →

$(4(5)+1) + (4(6)+1) + (4(7)+1)$

21 + 25 + 29

$= \boxed{105}$

Find the following sums:

2+5+8+11+...+23

pattern continues

1	2	3	4	5	6	7	8
2	5	8	11	14	17	20	23	=

-4+0+4+8,...+20

+4

Find the sum of the series:

4, 8, 16, ..., <u>128</u>

4, 8, 16, 32,

$1-2+4-8+16-32$

$$\frac{1}{2} - \frac{1}{4} + \frac{1}{8} - \ldots - \frac{1}{64}$$

Write the following in sigma notation and then find the sum

1st term

A geometric series that begins with <u>3, a common</u> factor of 2, with 6 terms

0	1	2
?	3	6

$3/2$ $\times 2$

$$\sum_{\textcircled{k=1}}^{6} \frac{3/2\,(2)^{\textcircled{k}}}{}$$

explicit

The Wimbledon Ladies' Singles Championship begins with 128 players. Each match, two players play and only one moves to the next round. The players compete until there is one winner. How many rounds must the winner play?

A Particular type of bacteria divides into two new bacteria every 20 minutes. A scientist growing the bacteria in a laboratory begins with 200 bacteria. How many bacteria are present after 4 hours?