6-3 Finite Geometric Series
with multiplies

Objectives: end

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.

$$
\Omega 2,4,8,16,32,64 \ldots
$$

$$
16,8,4,2 \ldots
$$

$$
\cdot 1 / 2 \cdot 1 / 2 \cdot 1 / 2+n+e n m
$$

explict: $f(n)=\stackrel{\downarrow}{a} \cdot r^{n}$ what you muttiplyby
Recursive: $f(n)=f(n-1) \cdot r$

$$
f(0)=a
$$

Warm - up

1. Write a recursive rule and an explicit rule for the sequence: $\stackrel{9,27,81,243}{E: f(n)}=3 \cdot 3^{n}$
$R: f(n)=f(n-1) \cdot 3 ; f(0)=3$
2. Find the stated term of the geometric sequence:
$-3,-6,-12,-24, \ldots ; 9^{\text {th }}$ term
$\cdot 2 \cdot 2 \cdot 2 \cdot 2$

$$
\begin{aligned}
& f(n)=-1.5 \cdot 2^{n} \\
& f(9)=-1.5 \cdot 2^{9}=-768
\end{aligned}
$$

You have 2 biological parents, 4 biological grandparents, and 8 biological great-grandparents. How many great-great-great-great grandparents ( $6^{\text {th }}$ generation) do you have?


## Series

definition: SUM of TerMS in a sequence
sum: usually a total of a finite number of items added together

## Summation <br> $$
a_{1}+a_{2}+a_{3}+\ldots+a_{n}
$$

(how do we write the sum of long lists of numbers?)
$\sum$ sigma means summation

Summation notation: $\sum_{k=1}^{n} a_{k}=a_{1}+a_{2}+a_{3}+\ldots+a_{n}$

## Vocabulary



The sum of $\mathrm{a}_{\mathrm{k}}$ from k to n

Find the following sums:
a. $\sum_{k=1}^{5} 3 k=3(1)+3(2)+3(3)+3(4)+3(5)$
b. $\begin{aligned} & \sum_{k=5}^{8} k^{2}=5^{2}+6^{2}+7^{2}+8^{2} \\ & 25+36+49+64=174\end{aligned}$
c. $\sum_{k=3}^{7} 4^{k}+1=[(4 \cdot 3)+1]+[4(4)+1]+[4(5)+1]+$

$$
\begin{gathered}
{[4(6)+1]+[4(7)+1]} \\
13+17+21+25+29=105
\end{gathered}
$$

Find the following sums:

$$
\begin{array}{r}
2+5+8+11+\ldots+23 \\
14,17,20=100
\end{array}
$$

$$
\begin{array}{r}
-4+0+4+8, \ldots+20 \\
+12,16
\end{array}=56
$$

Find the sum of the series:

$$
\begin{gathered}
4 \& 8,46, \ldots ., 128 \\
+32,164+
\end{gathered}
$$

$$
252
$$

$$
\stackrel{.-2}{1-2+4-8+16-32}
$$

$$
\begin{array}{r}
\frac{1}{2}-\frac{1}{4}+\frac{1}{8}-\frac{1}{64} \\
-\frac{1}{16}+\frac{1}{32}-\frac{1}{64}
\end{array}=\frac{21}{64}
$$

Write the following in sigma notation and then find the sum

A geometric series that begins with 3, a common factor of 2, with 6 terms


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?

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | $\frac{1}{\text { START }}$ |
| 12 ness: |  |  |  |  |  |  |  |

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?

