

(A) Lesson Objectives:

- a. Introduce geometric series through an investigation.
- b. Introduce the formulas associated with geometric series.
- c. Apply geometric series to real world scenarios.

(B) Definitions:

- a. A **SERIES** simply refers to the sum of the terms of a sequence
- b. Mathematically, $S_n = u_1 + u_2 + u_3 + \dots + u_{n-1} + u_n$

(C) Exploring Patterns and Series

- a. Let's work with PARTIAL SUMS to find some patterns and strategies for finding sums (NO CALCULATORS ALLOWED)
 - i. The sum of the first 4 term of the series $1 + 3 + 9 + 27$:
 - ii. The sum of the first 7 term of the series $1 + 3 + 9 + 27 + 81 + 243 + 729$:
 - iii. The sum of the first 10 term of the series $1 + 3 + 9 + 27 + 81 + 243 + 729 + \dots$:
 - iv. So the sum of the first 30 term of the series $1 + 3 + 9 + 27 + 81 + 243 + 729 + \dots$ is:

(D) Key Ideas – Formula for Arithmetic Series

- a. The formula(s) for the sum of an geometric series is/are:

(E) Examples:

- a. Find S_8 given: (a) $2 + 6 + 18 + 54 + \dots$ (b) $200 + 100 + 50 + 25 + \dots$

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- b. Find the sum of the first 12 terms of the series $-2 + 10 - 50 + \dots$
- c. Find the sum $1/16 + 1/4 + 1 + 4 + \dots + 65536$
- d. Find the sum of $1 + 2 + 4 + 8 + \dots + 32768$
- e. Find the sum of the first eight terms defined by the series $u_n = 2 \times 3^{n-1}$
- f. In this question, we will work with the series $1 + 2 + 4 + 8 + \dots$
- Find the sum of the first 4 terms of the series
 - Determine S_5, S_6, S_7, S_8 (these are called partial sums)
 - What do you notice about the successive partial sums?
 - Are the partial sums getting larger?
 - If the partial sums are getting larger, is this by smaller or larger amounts?
- g. In this question, we will work with the series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$
- Find the sum of the first 4 terms of the series
 - Determine S_5, S_6, S_7, S_8 (these are called partial sums)
 - What do you notice about the successive partial sums?
 - Are the partial sums getting larger?
 - If the partial sums are getting larger, is this by smaller or larger amounts?
 - What number do the partial sums seem to be approaching?
- h. Find the total amount you make if you were paid a peso on the first day of the month, but the amount was doubled every day for a month

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- i. I deposit \$12000 at the beginning of every year (say I started investing on Jan 1, 2006) into a retirement savings plan earning 5%/pa compounded annually. Answer the following questions regarding the value of this investment.
- What is the value of my investment at the END of 2006.
 - What is the value of my investment at the BEGINNING of 2007 (after my second deposit).
 - What is the value of my investment at the BEGINNING of 2008 (after my third deposit).
 - What is the value of my investment at the BEGINNING of 2009 (after my fourth deposit).
 - What is the value of my investment at the BEGINNING of 2010 (after my fifth deposit).
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- Write the first five terms of this investment as a series.
 - Find the TOTAL VALUE of this investment at the beginning of 2010.
 - Calculate the TOTAL VALUE of this investment after my 25th deposit.

(F) **Homework/Resources**

- **HW: from HH Textbook** → HH Textbook, Exercise 12G.3, p415, Q1abc, 2bd,3,4
- Video Help: <http://www.brightstorm.com/math/algebra-2/sequences-and-series/geometric-series/> , as well as <http://www.brightstorm.com/math/algebra-2/sequences-and-series/geometric-series-problem-1/> (there are 2 further videos with examples)