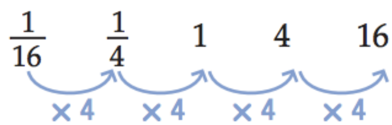
<u>NEW OUTCOME:</u> Analyze and make predictions about arithmetic and geometric sequences and series.

A ***geometric sequence*** is a sequence whose successive terms are determined by multiplying a nonzero constant to the previous term. This constant value is called the ***common ratio***. Consider the sequence below, this is geometric because each term is 4 times as much as the previous term.



PART I: Determining a Rule for Geometric Sequences.

Using subscript notation, the general rule for a geometric sequence is $a_n = a_1 r^{n-1}$, where a_1 is the first term, r is the common ratio, and a_n is the nth term.

APPLICATION/PRACTICE:

1. Determine whether each sequence is Arithmetic, Geometric, or Neither.

(a) 16, 24, 36, 54, … (b) 1, 4, 9, 16, … (c) 23, 17, 11, 5, …

2. Which of the following is the next term in the geometric sequence $8, 6, \frac{9}{2}, \frac{27}{8}, \ldots$

(1) $\frac{11}{8}$ (2) $\frac{27}{16}$ (3) $\frac{9}{4}$ (4) $\frac{81}{32}$

3. Consider the sequence 32, 8, 2, …

(a) Find the next three terms in the sequence.

(b) Create an equation for the nth term in the sequence.

(c) What is the domain and range for the six terms of the sequence?

4. Tammy's car is expected to depreciate at a rate of 15% per year. Her car is currently valued at $24,000. Create a geometric formula for this situation and solve for, to the nearest dollar, how much it will be worth in 6 years.

5. Shira receives a joke in an e-mail that asks her friend to forward it to four of her friends. She forwards it, then each of her friends forwards it to four of their friends, and so on. If the pattern continues, how many people will receive the e-mail on the ninth round of forwarding? Create a geometric rule to calculate the answer.

PART II: Working with a Geometric Series

A ***geometric series*** is the sum of the terms of a geometric sequence. The sum of the first *n* terms of a series is denoted by $S_n = \frac{a_1 - a_1 r^n}{1 - r}$. We can use the information given in sigma notation to enter into the formula for S_n and solve, take a look at the example below.

Find $\sum_{k=3}^{10} 4(2)^{k-1}$.

Find a_1, r, and n. In the first term, $k = 3$ and $a_1 = 4 \cdot 2^{3-1}$ or 16. The base of the exponential function is r, so $r = 2$. There are $10 - 3 + 1$ or 8 terms, so $n = 8$.

$$S_n = \frac{a_1 - a_1 r^n}{1 - r} \quad \text{Sum formula}$$

$$= \frac{16 - 16(2)^8}{1 - 2} \quad a_1 = 16, r = 2, \text{and } n = 8$$

$$= 4080 \quad \text{Use a calculator.}$$

APPLICATION/PRACTICE:

1. Find the sum of each geometric series below.

(a)

$$\sum_{k=1}^{6} 3(4)^{k-1}$$

(b)

$$\sum_{k=1}^{8} 4\left(\frac{1}{2}\right)^{k-1}$$

2. Mira arranges rows of dominoes so that after she knocks over the first one, each domino knocks over two more dominoes when it falls. If there are ten rows, how many dominoes does Mira use? [*Hint: Make a series to see how many dominoes are used for the first few rows to help make sense*]