# Infinite Geometric Series

**Practice:**

For each Geometric series, find the partial sums for the first 3 terms, first 4 terms, and first 6 terms.

$S_n = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \cdots$ $R_n = \frac{1}{32} + \frac{1}{16} + \frac{1}{8} + \frac{1}{4} + \frac{1}{2} + \cdots$

When $|r| < 1$, the partial sum approaches a fixed number and the series is said to **converge**.

When $|r| \geq 1$, the partial sum does not approach a fixed number and the series is said to **diverge**.

Example #1:

**Determine whether each geometric series converges or diverges.**

**A.** 10 + 1 + 0.1 + 0.01 + ...

**B.** 4 + 12 + 36 + 108 + ...

**C.**

$$\sum_{k=1}^{\infty} 25\left(\frac{1}{5}\right)^{k-1}$$

If an infinite series converges, we can find the sum.

**Sum of an Infinite Geometric Series**

The sum of an infinite geometric series $S$ with common ratio $r$ and $|r| < 1$ is

$$S = \frac{a_1}{1 - r},$$

where $a_1$ is the first term.

Example #2:

**Find the sum, if it exists: 1 – 0.2 + 0.04 – 0.008 + ...**

You try: **Find the sum, if it exists.**

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

$$\sum_{k=1}^{\infty} \frac{3}{4}(7)^{k-1}$$

$$\sum_{k=1}^{\infty} 3\left(\frac{2}{5}\right)^{k-1}$$