

Finding the Sum to Infinity

The total of all the terms in a series is called the sum to infinity. This occurs if $r < 1$ (which makes it a convergent geometric series and $r > -1$).

Formula for the sum to infinity:-

$$S_{\infty} = \frac{a}{1-r} \quad \text{when } -1 < r < 1$$

Example 1. Find the sum to infinity of the sequence 49, 14, 4

$$a = 49 \quad r = \frac{2}{7}$$

$$\begin{aligned} \therefore S_{\infty} &= \frac{a}{1-r} \\ &= \frac{49}{1-0.2857} \\ &= 68.6 \end{aligned}$$

Example 2. Find the first 4 terms of the geometric series if the first term is 12 and the sum to infinity is 24.

$$a = 12 \quad S_{\infty} = 24 \quad \text{we need to find } r$$

$$S_{\infty} = \frac{a}{1-r}$$

$$24 = \frac{12}{1-r}$$

$$24(1-r) = 12$$

$$24 - 24r = 12$$

$$12 = 24r$$

$$0.5 = r$$

Because $r = 0.5$

$$12 \times 0.5 = 6$$

$$6 \times 0.5 = 3$$

$$3 \times 0.5 = 1.5$$

\therefore first 4 terms are 12, 6, 3, 1.5