Answer on Question #51588 – Math – Calculus

Find the geometric series whose sum is 1 and first term is 0.4

Given

a_1=0.4 - the first term of geometric series

S=1 - the sum of geometric series

Find common ratio *r* and geometric series $a_1, a_2, a_3, a_4, \ldots$.

Solution

The **sum of a certain number of terms** of a **geometric sequence:**

$$S_n = \sum_{i=1}^{n} a_i = \frac{a_1(1-r^n)}{1-r}$$

where S_n is the sum of *n* terms (***n*th partial sum**), a_1 is the first term, *r* is the common ratio.

The ***n*th term** of a **geometric sequence:**

$$a_n = a_1 r^{n-1}$$

where a_1 is the first term of the sequence, *r* is the common ratio, *n* is the number of the term.

If -1<r<1, the sum S_n converges to the geometric series, where the sum is given by

$$\mathbf{S = \frac{a_1}{1-r}} \qquad \mathbf{(1)}$$

Solve equation (1) for *r*:

$$1= \frac{0.4}{1-r},$$

$$1-r = 0.4,$$

$$r=1-0.4,$$

$$r = 0.6$$

Then compute

$$a_2 = a_1 r^1 = 0.4 \cdot 0.6 = 0.24,\ a_3 = a_1 r^2 = 0.4 \cdot 0.6^2,\ a_4 = a_1 r^3 = 0.4 \cdot 0.6^3, \ldots,$$

$$a_n = a_1 r^{n-1} = 0.4 \cdot 0.6^{n-1}$$

In this case the geometric series is 0.4+0.24+0.144+0.0864+…..

If r>1 or r<-1 the sum S_n diverges, solution is valid only when a partial sum and value of *n* are known.