

Worksheet: Basics of Series

This worksheet will help you understand the basics of series, such as sigma notation, finite and infinite series, and working out arithmetic and geometric series. You can read the study guide: [Basics of Series](#) before trying these questions.

Basics of Series
study guide



Model answers to
this sheet



- Write the following series using sigma notation.
 - The series of the first five cube numbers $1 + 8 + 27 + 34 + 125$.
 - The series of the first twenty triangle numbers $1 + 3 + 6 + \dots + 210$.
The k^{th} triangle number is equal to $\frac{1}{2}k(k+1)$.
 - The series of the first n powers of 3 given by $1 + 3 + 9 + \dots + 3^{n-1}$.
 - The infinite series $1 + \sqrt{2} + \sqrt{3} + 2 + \sqrt{5} + \dots$
- The formula to work out the sum S_n of the first n terms of an arithmetic series with starting number a and common difference d , is:

$$S_n = na + \frac{1}{2}n(n-1)d$$

For each of the series below, use this formula to work out S_n when n is 11, 21 and 41.

- $2 + 8 + 14 + 20 + 26 + \dots$
- $100 + 210 + 320 + 430 + 540 + \dots$
- $300 + 285 + 270 + 255 + 240 + \dots$
- $1 + \frac{3}{2} + 2 + \frac{5}{2} + 3 + \dots$

3. The formula to work out the sum S_n of the first n terms of a geometric series with starting number a and common ratio r is:

$$S_n = \frac{a(1-r^n)}{(1-r)}$$

For each of the series below, use this formula to work out S_n when n is 5, 11 and 21.

a) $1 + \frac{3}{2} + \frac{9}{4} + \frac{27}{8} + \frac{81}{16} + \dots$

b) $\sum_{k=1}^{\infty} \left(\frac{5}{6}\right)^{k-1}$

c) $1 + 4 + 16 + 64 + 256 + \dots$

d) $243 - 81 + 27 - 9 + 3 - \dots$

e) $\sum_{k=1}^{\infty} 9\left(\frac{1}{10}\right)^k$

Explain clearly which of these series converge and which of these series diverge.

4. The formula for the sum S_n of a convergent geometric series as n approaches infinity with starting number a and common ratio r is:

$$S_n = \frac{a}{1-r}$$

For any convergent series in question 3, use this formula to work out S_n as n approaches infinity.



This worksheet is one of a series on mathematics produced by the Learning Enhancement Team with funding from the UEA Alumni Fund. Scan the QR-code with a smartphone app for [more resources](#).



UEA

University of East Anglia

**STUDENT SUPPORT
SERVICE**