 Series and series applications

Resources

[AMSI website](http://www.amsi.org.au/ESA_Senior_Years/SeniorTopic1/1_md/SeniorTopic1d.html) – Supporting Australian Mathematics Project (A guide for teachers year 11 and 12) has a good comprehensive overview of sequences and series [Maths is Fun website](http://www.mathsisfun.com/algebra/sequences-series.html). This link has a very comprehensive set of definitions and although the syllabus does not specifically use the word sequence, it is used to differentiate between a list of numbers with a rule (sequence) and a sum of these numbers (series) [Sigma notation is explored in this section](http://www.mathsisfun.com/algebra/sigma-notation.htm)

And [series on the Maths is Fun website](http://www.mathsisfun.com/algebra/partial-sums.html)

Scope and sequence note

Many teachers (and Textbooks) treat “Applications of geometric series: compound interest, simplified hire purchase and repayment problems. (Part of 7.5 in syllabus)” as a topic separate from the rest of Series and Applications. It is often also delivered later in the course when students are more confident with working with more cumbersome algebra – after Differentiation and Integration

Other parts of this topic can be delivered far earlier in the course.

Before starting Arithmetic or Geometric Series a general discussion of definitions is needed.

Definitions of term, nth term, sum, series sequence need to be clarified.

| Content | Teaching Strategies and Activities | Resources |
| --- | --- | --- |
| Arithmetic series: formula for the nth term and sum of n terms. | Real world examples of arithmetic sequences should be discussed. Time should be spent on guiding students to the nth term and sum formulas themselves.Use (the possibly apocryphal) story of Gauss adding the numbers 1 through 100 as a stimulus[YouTube video on Gauss’s addition](https://youtu.be/arf8wDP_MJE) or [YouTube video on one to one million by numberphile](https://youtu.be/Dd81F6-Ar_0) | [Cool Math page on arithmetic sequences](http://www.coolmath.com/algebra/19-sequences-series/05-arithmetic-sequences-01)[Cool Math page on Gauss’s problem and arithmetic series](http://www.coolmath.com/algebra/19-sequences-series/06-gauss-problem-arithmetic-series-01) |
| Geometric series: formula for the nth term and the sum of n terms. | The following proof of the geometric series partial sum formula uses only sigma notation and simultaneous equations (many use the difference of two powers which is not studied in Mathematics (2U))[Website on derivation of sum of finite and infinite geometric progression](http://www.mathalino.com/reviewer/derivation-of-formulas/sum-of-finite-and-infinite-geometric-progression). | [Cool Math page on geometric sequences](http://www.coolmath.com/algebra/19-sequences-series/07-geometic-sequences-01)[Cool Math page on geometric series](http://www.coolmath.com/algebra/19-sequences-series/08-geometic-series-01) |
| Limiting sum of geometric series when  | The limiting sum formula should be derived from the partial geometric sum formula and the knowledge of limits approaching zero.The case ofshould be discussed using the word convergent – to show it converges on a single number.The specific case of changing recurring decimals to fractions should be explored here, however students should decide whether using the limiting sum formula method or the simultaneous method is the best for them.The 2 other cases ofand should be discussed with the word divergent being used for that type of series. | [Maths is Fun page on infinite series](http://www.mathsisfun.com/algebra/infinite-series.html) |
| Applications to annuities and repayments. | The use of spreadsheets designed to show how the balance decreases depending on the interest, repayment amount or repayment time will give students confidence in estimation of time frames. Bank simulations can be found at [CommBank’s home loan repayment calculator](https://apps.commbank.com.au/propertyhub/calculator/home-loan-repayments) or [NAB home loan repayment calculator](http://www.nab.com.au/personal/loans/home-loans/home-loan-calculators/loan-repayments-calculator) | There are only a few variants of this type of question that have been asked in previous HSC and the questions are often of a high mark value. Recent examples of these questions are:[HSC 2014](http://www.boardofstudies.nsw.edu.au/hsc_exams/2014/pdf_doc/2014-hsc-maths.pdf) Q16b[HSC 2013](http://www.boardofstudies.nsw.edu.au/hsc_exams/2013/pdf_doc/2013-hsc-maths.pdf) Q13d[HSC 2012](http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2012exams/pdf_doc/2012-hsc-exam-maths.pdf) Q15cCommon problems from the Marker’s notes include: incorrect number of instalments e.g. 2 (years) instead of 24 (months), rounding too soon, and using incorrect starting balance. |