

BO1 History of Mathematics  
HT 2021 reading course: The meaning of the word 'analysis'

Christmas Vacation Reading

The subject of this year's reading course is a topic that we touched upon during the lecture course: the changing meaning(s) of the word 'analysis', up to around 1750. We have seen that it appeared in mathematics at the end of the 16th century as a word attached to a supposed ancient Greek method for solving problems: by first assuming that the answer was known, and then working from there towards a known truth. During the early application of analytic geometry, the labelling of line segments by symbols and the setting up of equations involving these was seen as being akin to this process of 'analysis', and so the word was applied to methods for solving equations — a sense much closer to our use of the word 'algebra'. Later in the 17th century, within the study of infinite series, certain authors had no qualms about extending techniques for handling finite equations to the infinite case, and so the word 'analysis' became increasingly attached to the study of infinite processes. By the time Cauchy wrote his *Cours d'analyse* in 1821, the word had more or less assumed its current definition.

In this reading course, we will consider extracts from the writings of William Oughtred (1574–1660), Isaac Newton (1642–1727), and Leonhard Euler (1708–1783). In particular, we will examine the contents of their writings with a view to determining what they each meant by 'analysis'. Broadly speaking, Oughtred used it for equation-solving (in his *Clavis mathematicae* of 1631), Newton began the extension to the infinite case (in a manuscript 'De analysi' and a letter 'Epistola prior', written in 1699 and 1676, respectively), and Euler continued this latter process (in volume I of his *Introductio ad analysin infinitorum* of 1748) — but our aim will be to provide a more nuanced picture than this. Your reading for the course will start from, but will not be limited to, the texts mentioned here: as during the lecture course, the emphasis will be on the use of *original sources* (in translation where necessary). It should be noted that the recommended reading that will appear on the O1 course page will represent the bare minimum of reading needed: you will be expected to uncover further material for yourselves, which will then be the subject of discussion during our classes.

As preparation for the reading course, please read biographical material on the various figures mentioned above. A good starting point for this is the MacTutor History of Mathematics Archive <<http://www-history.mcs.st-and.ac.uk/>>, which features short biographies of mathematicians. If you scroll down to the bottom of each biography, you will find a link to further published biographies and other relevant secondary sources, many of which are available electronically through SOLO. Other useful biographical resources that are available online are the *Oxford Dictionary of National Biography* and the *Dictionary of Scientific Biography*, as mentioned at the beginning of the lecture course. You should go beyond the basic MacTutor biographies and explore the available material, particularly if certain parts of it grab your interest. You should be alert to the accuracy (or otherwise) of the materials that you read. We will discuss and compare the sources you have found in the first class of Hilary Term.

As further preparation, you should refresh your memory about the development of analysis, as described in the lecture course, starting from the early calculus, and running through to the 19th-century analysis of Cauchy and others. Beyond Oughtred, Newton, and Euler, are there any other mathematicians (writing prior to 1750) whom you feel should receive attention during the reading course? If so, please come to the first class of Hilary Term with suggestions that you are prepared to defend!

Finally, as practice in locating online resources, in finding out what is available in your college library, and as practical preparation for the reading ahead, you should try to track down the main primary sources that we will be using throughout the reading course, namely:

- William Oughtred, *Arithmeticae in numeris et speciebus institutio quæ tum logisticæ, tum analyticæ, atque adeo totius mathematicæ, quasi clavis est*, London, 1631, commonly known as *Clavis mathematicæ*; translated into English by Robert Wood as *The key to the mathematicks new forged and filed*, London, 1647;
- Isaac Newton, 'De analysi', 1699, published in 1711 as *Analysis per quantitatum series, fluxiones, ac differentias*; translated into English by D. T. Whiteside in *The mathematical papers of Isaac Newton*, vol. II, Cambridge University Press, 1968, 206–247;
- Isaac Newton to Gottfried Wilhelm Leibniz via Henry Oldenburg, 'Epistola prior', June 1676, partially published by John Wallis in his *Treatise of algebra* (1685) and volume III of his *Opera mathematica* (1699); translated into English by H. W. Turnbull, *The correspondence of Isaac Newton*, vol. II, Cambridge University Press, 1960, 20–47;
- Leonhard Euler, *Introductio ad analysin infinitorum*, vol. I, 1748; translated into English by John Blanton as *An introduction to analysis of the infinite*, vol. I, Springer, 1988.

Some of these are available online, via SOLO or otherwise — please see what you can find.