BO1 History of Mathematics
HT 2020 reading course: The gradual acceptance of complex numbers

Essay 1: John Wallis and the interpretation of 'impossible quantities'

This is the topic for the classes in weeks 2 and 3 (and hence for reading in weeks 1 and 2). For Monday of week 2 please do enough research that you can discuss the topic in class and begin to focus the approach you propose to take for your written work. For week 3, please submit a 2,000-word essay to the appropriate box in the hand-in area by 5pm on Thursday of week 2.

Here are some suggestions as to what points you might choose to focus on in your research and your essay. Every essay needs some background to set the context. Beyond that, you should NOT expect to cover everything. There is much too much here. Choose one or two points to focus on.

- What was Wallis's motivation?
- How does this text fit into the rest of his corpus?
- Which writers did Wallis read and refer to?
- Summarise the material studied.
- What else (briefly) does the text contain?
- When and how were his ideas taken up?

Main text for weeks 1 and 2

John Wallis, *A treatise of algebra, both historical and practical*, London, 1685.

The core suggested reading is listed below, but do please browse more widely and follow up references — in particular, browse through the sections in which Wallis discusses the solutions of quadratic, cubic, and quartic equations, in order to see what he says there about complex numbers. Elsewhere, you may also need to refer to Euclid in order to figure out what Wallis is saying!

- preface;
- Chapters LXVI–LXIX and LXXI (pp. 264–273 and 278).

Other sources that might be useful

- Paul J. Nahin, *An imaginary tale: the story of* $\sqrt{-1}$, Princeton University Press, 1998 [or any other edition].
- Leo Corry, *A brief history of numbers*, Oxford University Press, 2015.

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Essay 2: Jean-Robert Argand and imaginary quantities in the plane

This is the topic for the classes in weeks 4 and 5 (and hence for reading in weeks 3 and 4). For Monday of week 4 please do enough research that you can discuss the topic in class and begin to focus the approach you propose to take for your written work. For week 5, please submit a 2,000-word essay to the appropriate box in the hand-in area by 5pm on Thursday of week 4.

Here are some suggestions as to what points you might choose to focus on in your research and your essay. Every essay needs some background to set the context. Beyond that, you should NOT expect to cover everything. There is much too much here. Choose one or two points to focus on.

- What was Argand's motivation?
- How does this text fit into the rest of his corpus?
- Which writers did Argand read and refer to?
- Summarise the material studied.
- What else (briefly) does the text contain?
- When and how were his ideas taken up?

Main text for weeks 3 and 4

Jean-Robert Argand, *Essai sur une manière de représenter les quantités imaginaires dans les constructions géométriques*, Paris, 1806; reprinted with additional material by Gauthier-Villars, Paris, 1874; English translation by A. S. Hardy: *Imaginary quantities: their geometrical interpretation*, van Nostrand, New York, 1881.

Since Argand's text is not long, I recommend that you read the whole thing: it appears on pp. 17–82 (with very few words to a page) of the Hardy translation listed above. Hardy's text also contains useful secondary sources: a translation of a preface by a previous editor (J. Houel, pp. iii–xvi), and some notes by Hardy himself (pp. 87–135). You should also see what other secondary sources you are able to track down.

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Essay 3: William Rowan Hamilton and 'algebraic couples'

This is the topic for the classes in weeks 6 and 7 (and hence for reading in weeks 5 and 6). For Monday of week 6 please do enough research that you can discuss the topic in class and begin to focus the approach you propose to take for your written work. For week 7, please submit a 2,000-word essay to the appropriate box in the hand-in area by 5pm on Thursday of week 6.

Here are some suggestions as to what points you might choose to focus on in your research and your essay. Every essay needs some background to set the context. Beyond that, you should NOT expect to cover everything. There is much too much here. Choose one or two points to focus on.

- What was Hamilton's motivation?
- How does this text fit into the rest of his corpus?
- Which writers did Hamilton read and refer to?
- Summarise the material studied.
- What else (briefly) does the text contain?
- When and how were his ideas taken up?

Main text for weeks 5 and 6

William Rowan Hamilton, Theory of conjugate functions, or algebraic couples; with a preliminary and elementary essay on algebra as the science of pure time, *Transactions of the Royal Irish Academy* **17** (1831) 293–423.

Suggested reading (but do please browse more widely and follow up references):

- 'General Introductory Remarks' (pp. 293–297);
- 'Theory of Conjugate Functions, or Algebraic Couples' (pp. 393–422).

Note that, although I have not included it in the recommended reading, Hamilton does use some ideas and notation from his 'Preliminary and Elementary Essay on Algebra as the Science of Pure Time' (pp. 298–392) in his discussion of 'algebraic couples' — you should work around these as best you can, but it shouldn't be too difficult to do so.

Other sources that might be useful

- Adrian Rice, Inexplicable? The status of complex numbers in Britain, 1750–1850, in *Around Caspar Wessel and the Geometric Representation of Complex Numbers: Proceedings of the Wessel Symposium at The Royal Danish Academy of Sciences and Letters, Copenhagen, August 11–15 1998*, The Royal Danish Academy of Sciences and Letters, Copenhagen, 2001, pp. 147–180.