Ramsey numbers. This arose as an offshoot to the paper's main business. For it, we have to imagine n randomly placed points in the plane where each is joined to each by either a blue edge or a red edge. If $n \geqslant 6$ Ramsey's theorem states that there is always exists either a red triangle or a blue triangle. This is expressed as the Ramsey number $R(3) = 6$. So, out of randomness there is some structure present, and Ramsey's theorem is encapsulated by stating that 'complete disorder is impossible'.

With this theory there are some difficult combinatorial problems ahead. Moving onto quadrilaterals, pentagons, …, it is known that $R(4) = 18$, but only that $43 \leqslant R(5) \leqslant 49$, it being conjectured that $R(5) = 43$. The exact values are unknown for higher values of n, and the gaps between possible values widen, for example $102 \leqslant R(6) \leqslant 165$ and $205 \leqslant R(7) \leqslant 540$.

The various theories that received the 'Ramsey touch' tend to be recondite, and rather than letting the modern accounts interrupt the book's story, there are 'boxed' capsule summaries by various experts at the appropriate places. For example, economist Joseph Stiglitz judged that Ramsey's paper on taxation published in the Economic Journal (edited by Keynes) provided a landmark in the economics of public finance. Above all Ramsey was a philosopher, of a rare kind, who could look at a topic with a mathematician's eye (for which he was criticized by Wittgenstein for not focusing purely on Philosophy).

For people interested in British cultural life of the 1920s, this book will be a valuable source, and also for those wanting new light on the careers of such figures as Wittgenstein, Sigmund Freud, Lytton Strachey, G. E. Moore, Richard Braithwaite, C. D. Broad, Bertrand Russell, Lionel Penrose, John Maynard Keynes, Clive and Vanessa Bell, and the educationalist A. S. Neill (whom he met in Austria). Ramsey was closely linked with the Bloomsbury Set and the Vienna Circle. Also in the cast list are mathematicians G. H. Hardy, Max Newman, J. E. Littlewood, L. E. J. Brouwer, and the algebraist Issai Schur. Finally, we are left with a tantalizing 'What if': shortly after Ramsey's death Alan Turing went up to King's College as a freshman, and what a combination that would have been.

This is everything a biography should be. It does not overwhelm us with technicalities but keeps a steady focus on a person grappling with the struggles of growing up, and the relationships with family and academic personalities, all told against a backcloth of the scientific advances he was able to make (though an error in the family tree diagram escaped the proofreader's eye).

The scholarship is superb, and the specialist will be able to check the author's claims through the Notes in conjunction with a comprehensive Bibliography. It is accessible to the non-specialist too. I can't wait to reread it.

10.1017/mag.2022.94 TONY CRILLY

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The secret formula by Fabio Toscano, pp. 161, £22 (hard), ISBN 978-0-69118-367-1, Princeton University Press (2020)

Most readers of this review will know something about the priority dispute between Tartaglia and Cardano over the solution of the cubic equation, but perhaps like me were rather vague about the details. This account is a welcome clarification. It uses an impressive collection of the actual correspondence between the two of them, and also between Tartaglia and others who became embroiled at various stages. The original challenges were 'private' in that they were communicated by letter, not in a live face-to-face conflict. Some of the letters are far from polite! Tartaglia discovered how to solve various forms of cubic equations but always feared anyone stealing his ideas. He refused to reveal them, but Cardano managed to persuade Tartaglia to send him the method. Cardano swore not to reveal it, but then learnt that it had previously been found, independently, by Scipione dal Ferro. Cardano and his pupil Ludovico Ferrari expanded the method to quartics, and, on the basis that the material was very important and that using Scipione's method would not break his oath to Tartaglia, published the whole body of theory in his *Ars magna* (1545), with due acknowledgement to Tartaglia—who was furious.

Even with much original source material to quote, the story is not a long one. Toscano gives eighteen pages to Tartaglia's early life (he was lucky to survive severe head wounds as a twelve-year-old at the Siege of Brescia) and another twenty-three pages to Sumerian and Egyptian methods of solving linear and quadratic equations. The last thirty-one pages are notes, bibliography and index. The original verbal form of the equations, such as "cube and thing equals number", is used throughout, alongside the modern equivalent (in this case $x^3 + ax = c$). On the other hand there is no real sense of how the Italian Renaissance mind-set might have affected the mathematical developments.

The book is plainly aimed at a general readership. Mathematically knowledgeable readers may be frustrated by the lack of detail in such tantalising comments as '[before Tartaglia and Scipione] certain very particular cases of the [cubic] equation could be solved by approximation methods'. Regarding the problem that arises when the method requires the square root of a negative number (called here the 'irreducible' case), all that Toscano says is that Cardano would be able to find all three solutions to such equations 'using some peculiar methods as an alternative to the formula'. What might these have been? Bombelli would solve the problem in 1572 by means of 'a new and rather abstract category of numbers, known today as "complex numbers" '.

The translation from the Italian is correct enough but rather awkward in places ('The Frenchman … was appointed by Otto II, abbot at Bobbio'—it was the Frenchman who was appointed abbot). I imagine that the style would have been more lively in the original. The contexts tend to be Italian-centred (Tartaglia's triangle, not Pascal's); the rhyme known in England as 'As I was going to St Ives' appears here as 'On the road to Camogli'—and worded so as to avoid the trick answer of 1. The diagram on page 40 shows what should be a parabola as having vertical tangents.

The correspondence is a little slow-moving at times, but for a historically-sourced narration of what actually happened this book is well worth reading.

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The flying mathematicians of World War I by Tony Royle, pp. 269, £22.50 (paper), ISBN 978-0-2280-0373-1, McGill-Queen's University Press (2020)

The book opens with the author on the tarmac. He is a younger version of his present self, sitting in the cockpit of a Jet Provost trainer about to take off on his first solo. The date (6 October 1983) is ingrained, a date every flyer remembers. His instructor took the decision to send him off, gave the order 'not to crash' and it was now all down to him. The excitement is palpable and it clouded his mind (as it did for me) but the important procedures had become instinctive as the jet roared down the runway. From this ten-minute flight, one circuit and a bump, the author went on to a career in the Royal Air Force followed by years of commercial flying.