Textbooks and sea sickness: Belfast's first professor of mathematics.

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If asked the, admittedly unlikely, pub quiz question of 'Who was the first professor of mathematics in Belfast?', you could be forgiven for presuming that the answer was whoever happened to be the first professor of mathematics at the Queen's College Belfast (which later became Queen's University). That person, by the way, was William Parkinson Wilson, the 1847 Cambridge Senior Wrangler who was at Queen's from 1849 to 1854. But if you answered with Wilson's name you would be quite wrong. Belfast's first professor of mathematics was in fact one James Thomson, who today is chiefly remembered for being William Thomson's (Lord Kelvin's) father, but in his own lifetime was well known as an author of textbooks.

James Thomson was born on the 13th of November 1786 at the family farm outside the market town of Ballynahinch in County Down. As a child he appears to have been mathematically precocious. It is said that he taught himself arithmetic from a textbook and was able to construct sundials and night dials. It was even claimed that he would absent mindedly trace out geometrical problems on the floor of the barn when he was supposed to be cleaning it. At school he passed quickly through the ranks from pupil to schoolmaster's assistant, and in the autumn of 1810, aged 24, he entered Glasgow University. At Glasgow, Thomson was hard working and successful, taking prizes in mathematics, Latin translation and natural philosophy. He graduated M.A. in 1812 and then continued his studies at Glasgow with the intention of becoming a Presbyterian minister. At the same time however he was also applying for a job in the soon to be opened Belfast Academical Institution. The aim of this institution was to be both a school and college combined, with the college section providing a university level education that would reduce the need for local boys to travel across the Irish Sea to be educated in the Scottish universities. The foundation stone for the Belfast Academical Institution had been laid in the summer of 1810 before Thomson had left for Glasgow, but building was slow and it wasn't until 1814 that it opened its doors. James was appointed to the post of teacher of mathematics and arithmetic in the school department in January 1814 and by the end of 1815 he was also professor of mathematics in the college department. He was a man with two jobs, two salaries, a prodigious work ethic and considerable ambition.

Thomson moved efficiently from gaining two careers to building two houses opposite the Belfast Academical Institution; one to live in and one to rent out. In 1817 he married the cousin of one of his work colleagues, having initially managed, it must be said improbably, to woo her with what she described as a 'feeling discussion on sea sickness and the best mode of preventing it' followed by 'a very instructive and amusing lecture upon astronomy.'[1]

By the accounts of his children he was a loving and devoted father and husband, while also maintaining a strong commitment to his college and school work. He would rise at 4:00 am with coffee, cream and a lamp to work on writing textbooks, before heading across the road to take 8 am and 11 am classes in the college department, followed by afternoon classes in the school department. Of the books he wrote, the volumes which went through most editions, and went on to be published outside the author's own lifetime, were all targeted at school or introductory level: *A treatise on arithmetic* (1819), *An introduction to modern geography* (1828), *The first six and eleventh and twelfth books of Euclid* (1834), and *An elementary treatise on algebra* (1844). But he also wrote books aimed at his college students: *Elements of plain and spherical trigonometry* (1825) and *An introduction to the differential and integral calculus* (1831).

Arithmetic

In producing a book on arithmetic Thomson was entering a crowded market and like any arithmetic text, his book was replete with drill questions on multiplication (evaluate 12345x686), division (what is 571824753344 ÷ 839?), fractions (find $4\frac{1}{24} - 3\frac{1}{16}$), proportions (If 96 men reap 40 acres of grain in a week, how many would reap 65 acres in the same time?) and conversions between the multiple units of weights and measures which plagued the early 19th Century (Reduce 53 miles , 3 furlongs, 12 perches, 4 yards to yards) . For this last question, I can doubtless assume that readers of *Mathematics Today* are familiar with the fact that there are 8 furlongs in a mile, 40 perches in a furlong, and 5.5 yards in a perch.

Like any teacher who wants to answer the perennial student question '*When will we ever need to know this*?', Thomson's book is well supplied with applications. Where Thomson's applications were different from other textbooks was that he included examples with real data, stating in the introduction 'As the information contained in these questions has been all derived from authentic sources, its correctness may be depended upon: and it is hoped, that what is thus presented, may excite in the young reader a desire to enrich his mind by the acquisition of further information.'[2]

A couple of examples give a feel for his use of 'authentic sources' from the worlds of commerce and industry, careers where his pupils were likely to find themselves in a rapidly expanding Georgian Belfast:

The quantity of linen exported from Ireland to the United States, in 1806, was 2,675,619 yards. How many miles in length was the whole?

Or

In the salmon fishery on the Bann, near Coleraine, 320 tons of salmon were taken in 1760. How many stones of 14 pounds are in this quantity?

Trigonometry and calculus

Thomson's trigonometry text covers what we might expect from an introduction: standard sum, difference and multiple angle formulae, spherical trigonometry and practical problems. However, more interesting from a teaching point of view is that in the introduction to the second edition of the book Thomson states 'The first edition of this work was intended chiefly as a Text-Book for the use of students in the BELFAST INSTITUTION and it was therefore written not as a regular and complete treatise on Trigonometry but as an outline to be filled up and illustrated orally in the Lectures'[3]. The phrase 'filled up' means just that. Of the five physical copies of the textbook which I have seen (two first and three second editions) four are bound with alternate blank and printed leaves, with some of the blanks containing student notes (see Figure 1).

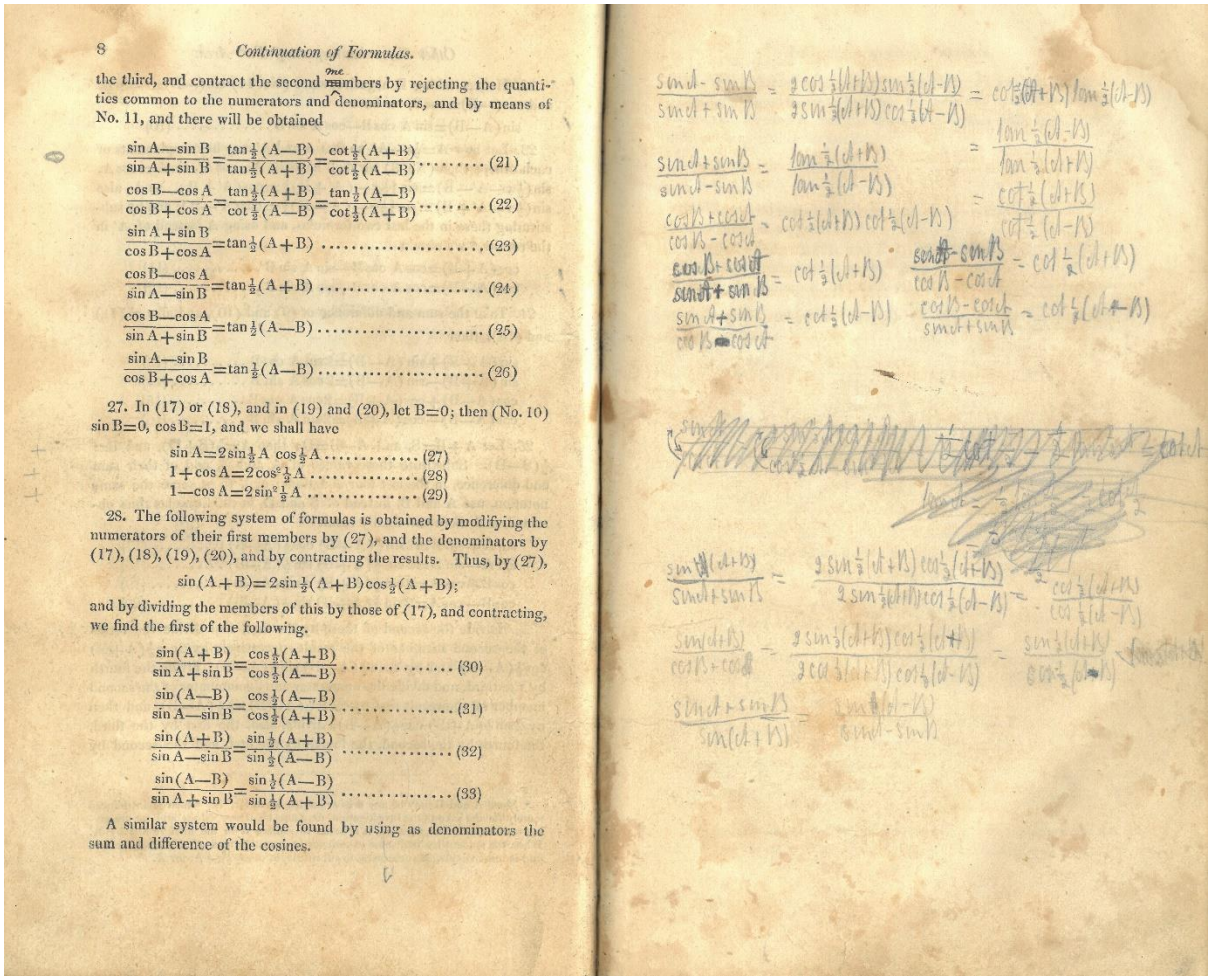
Published in 1831 the *Introduction to the differential and integral calculus* came at the very end of Thomson's time at Belfast and the evidence suggests that the material contained within it went well beyond what he taught his college students. Indeed, it was more extensive that Baden Powell's 1829 *Short treatise on the principles of the differential calculus* which was targeted at students at the University of Oxford. It was, in part, advertising Thomson's scholarly credentials to the electors of the vacant chair of mathematics at Glasgow, a post which he was very eager to obtain. It was part of a strategy that worked, and by the end of 1831 he had been appointed.

Thomson spent the rest of his career in Glasgow, producing new editions of some of his books and publishing an edition of Euclid and a book on algebra. He remained a successful teacher, and while he published a small amount of research, none of it was of any great significance. He died of cholera on the 12th of January 1849. At the very end of his life he returned, in his mind, to Ireland: delirious and

incoherent, calling out arithmetical problems and imagining he was teaching a class in Belfast from 30 years ago.

And the college department of the Belfast Academical Institution? It was superseded by the opening of the Queen's College Belfast. But the Royal Belfast Academical Institution (or 'Inst.' as it is universally known in Belfast) remains as a popular grammar school, with at least one of its pupils (my younger son) being incredulous that previous generations of Inst. pupils would have been expected to evaluate 571824753344 ÷ 839 without a pocket calculator.

Figure 1: An example of student notes on the interleaved blank and printed pages in a second edition of Thomson's *Elements of plain and spherical trigonometry*. (Source: author's copy.)



8 *Continuation of Formulas.*

the third, and contract the second members by rejecting the quantities common to the numerators and denominators, and by means of No. 11, and there will be obtained

$$\frac{\sin A-\sin B}{\sin A+\sin B}=\frac{\tan\frac{1}{2}(A-B)}{\tan\frac{1}{2}(A+B)}=\frac{\cot\frac{1}{2}(A+B)}{\cot\frac{1}{2}(A-B)} \quad \ldots\ldots (21)$$

$$\frac{\cos B-\cos A}{\cos B+\cos A}=\frac{\tan\frac{1}{2}(A+B)}{\cot\frac{1}{2}(A-B)}=\frac{\tan\frac{1}{2}(A-B)}{\cot\frac{1}{2}(A+B)} \quad \ldots\ldots (22)$$

$$\frac{\sin A+\sin B}{\cos B+\cos A}=\tan\tfrac{1}{2}(A+B) \quad \ldots\ldots (23)$$

$$\frac{\cos B-\cos A}{\sin A-\sin B}=\tan\tfrac{1}{2}(A+B) \quad \ldots\ldots (24)$$

$$\frac{\cos B-\cos A}{\sin A+\sin B}=\tan\tfrac{1}{2}(A-B) \quad \ldots\ldots (25)$$

$$\frac{\sin A-\sin B}{\cos B+\cos A}=\tan\tfrac{1}{2}(A-B) \quad \ldots\ldots (26)$$

27. In (17) or (18), and in (19) and (20), let $B=0$; then (No. 10) $\sin B=0$, $\cos B=1$, and we shall have

$$\sin A=2\sin\tfrac{1}{2}A\cos\tfrac{1}{2}A \quad \ldots\ldots (27)$$
$$1+\cos A=2\cos^2\tfrac{1}{2}A \quad \ldots\ldots (28)$$
$$1-\cos A=2\sin^2\tfrac{1}{2}A \quad \ldots\ldots (29)$$

28. The following system of formulas is obtained by modifying the numerators of their first members by (27), and the denominators by (17), (18), (19), (20), and by contracting the results. Thus, by (27),

$$\sin(A+B)=2\sin\tfrac{1}{2}(A+B)\cos\tfrac{1}{2}(A+B);$$

and by dividing the members of this by those of (17), and contracting, we find the first of the following.

$$\frac{\sin(A+B)}{\sin A+\sin B}=\frac{\cos\frac{1}{2}(A+B)}{\cos\frac{1}{2}(A-B)} \quad \ldots\ldots (30)$$

$$\frac{\sin(A-B)}{\sin A-\sin B}=\frac{\cos\frac{1}{2}(A-B)}{\cos\frac{1}{2}(A+B)} \quad \ldots\ldots (31)$$

$$\frac{\sin(A+B)}{\sin A-\sin B}=\frac{\sin\frac{1}{2}(A+B)}{\sin\frac{1}{2}(A-B)} \quad \ldots\ldots (32)$$

$$\frac{\sin(A-B)}{\sin A+\sin B}=\frac{\sin\frac{1}{2}(A-B)}{\sin\frac{1}{2}(A+B)} \quad \ldots\ldots (33)$$

A similar system would be found by using as denominators the sum and difference of the cosines.

Further Reading

M. McCartney. James Thomson Senior and mathematics at the Belfast Academical Institution 1814-1832 in *Beyond the Learned Academy: The Practice of Mathematics,1600-1850*, Ed. P Beeley and C Hollings, Oxford University Press, 2022 (projected).

References

[1] Joseph Larmor and James Thomson, *Collected Papers in Physics and Engineering by James Thomson*, Cambridge: Cambridge University Press, 1912, p. xvi

[2] James Thomson, *A Treatise on Arithmetic in Theory and Practice* (2/e) , Belfast: Simms & McIntyre, 1825, p iii-iv

[3] James Thomson, *Elements of Plane and Spherical Trigonometry* (2/e), Belfast: Simms & McIntyre, 1830, p i