Peter Lynch: That's Maths, Gill, 2016.
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REVIEWED BY COLM MULCAHY

Persi Diaconis once aptly remarked, "Pick up anything Martin Gardner wrote, you'll smile and learn something." Based on the evidence found within the covers of this delightful compendium, it's possible that the same can be said of Peter Lynch. The book is based on his long-running blog and *Irish Times* column of the same name, and one can't help wondering why excerpts from some of 100 gems found here haven't also made it onto radio. RTE's long-running *Sunday Miscellany*, if it were to broaden its horizons, would be a good fit. That show's avowed goal it to present radio essays that "capture our times, passions and curiosities." Surely, in the year mo twogro[1], that should include more maths exposition of this calibre.

The author of this tome is a UCD mathematical science graduate with a PhD in dynamic meteorology from TCD under Ray Bates. Peter joined the meteorological service in 1971, eventually rising to the rank of Deputy Director, having also served as Head of the Research and Training Division there. In 2004, he switched gears, and threw in his lot with UCD's School of Mathematical Sciences, as Met Eireann Professor of Meteorology and Director of the Meteorology & Climate Centre. A decade before the book under review appeared, he published *The Emergence of Numerical Weather Prediction: Richardson's Dream* (Cambridge University Press).

That's Maths, then, is a book by a seasoned applied mathematician. A casual reader might be surprised to learn that, however, based on reading the diverse essays presented in these pages. Peter's writing displays a fine appreciation for both the elegance and beauty that can characterise the best mathematics, and the power of abstraction in the subject. In the Preface, he writes, "The articles are accessible to anyone who has studied mathematics at secondary school. Mathematics can be enormously interesting and inspiring,

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[1]i.e., 1200 in base 12, or 2016 in base 10; see Peter's "Dozenal Digits" chapter.

but its beauty and utility are often hidden." The level of mathematics expected of his readers varies from the purposely equation-free musings of the *Irish Times* articles, to the more sophisticated pieces published only in his blog. A hint of whose writings Peter's can be compared to can be found in a recent interview at mathsireland.ie [1], where he cites E. T. Bell, Martin Gardner, Dave Richeson, Glen van Brummelen and Bill Dunham as writers he has admired or learnt from. Unlike, say Gardner—who was generally less interested in mere application—Peter seems to be equally intrigued by utility, surprise, elegance and beauty.

The self-contained chapters are generally two to three pages long, occasionally four or five. This makes them ideal for quick dips: flip to a random page, and within a few minutes one has learnt something interesting. He crams a lot of information into each page, very effectively and with great style, and often leaves one wanting more. The 2-pager pieces always induced disappointment for this reader when the second page was turned and a new piece began unexpectedly. One rarely sees the end coming, which, upon reflection, is related to the fact that Peter sometimes dispenses with summary concluding paragraphs.

Since he writes for the general public, he covers many classics from down through the ages, ranging from Pythagorean triples and Platonic solids, to Bayes' rule and Cantor's breakthroughs on infinity, right up to RSA cryptography and fractals. Even when gathering and displaying these chestnuts—as so many have done before him—Peter manages to do so in a fresh, engaging way. The same applies to his vignettes on remarkable personalities from the history of mathematics, such as Kovalevskaya and Ramanujan. Since his interests and passions are broad, he throws in mathematical delights such as Bézout's Theorem, Bézier curves, and the Bailey-Borwein-Plouffe formula, as well as applied material like population growth, epidemic spread, CAT scans, musical instrument tuning and the Black-Scholes equation.

As a meteorologist with intimate knowledge of the geometry and physics associated with spheres, Peter has several related articles and insights concerning weather, astronomy, engineering, transatlantic cable laying and GPS. He rescues spherical geometry from the obscurity to which history has unfairly banished it, though oddly, both on pages 14 & 66, the spherical triangles depicted are

"traditional Napier-style but anatomically incorrect" ones. They are shown with one bulging and two pinched corners, whereas actual spherical triangles have three bulging corners. (Their hyperbolic counterparts have three pinched ones. Perhaps it was Peter's spherical propensity that prevented him from pointing out that the Pythagorean theorem cos c = cos a cos b — which he rightly touts for spheres — has a predictable hyperbolic parallel.)

There are numerous local heros found within these pages too, from Wicklow's Robert Halpin, Sligo's George Stokes, Clare's Matthew O'Brien, Dublin's John Graves, TCD's Galbraith & Haughton, and Guinness's William Gosset, to the atmospheric railway that once shuttled back and forth between Dun Laoghaire and Dalkey. By including them, and tying them to their geographical origins, Peter is also continuing some of the good work done by the late Mary Mulvihill in books such as her landmark *Ingenious Ireland* [2].

In "A Hole Through the Earth" (pages 104-106) we learn that under ideal conditions, paying attention only to gravity while ignoring air resistance and molten magma, an object dropped into a straight tunnel, burrowed though the earth, would emerge at the far end of the tunnel after a fixed period of time. That time, which amazingly is independent of the tunnel length (and hence the angle at which the tunnel was drilled), is about 42 minutes and 12 seconds. One is reminded of a mindboggler made famous by Gardner, the solution of which is that the volume remaining when a cylindrical hole six units long is drilled straight through the centre of a solid sphere is 36π cubic units, regardless of the radius of the sphere.

Unlike Gardner, who loved brainteasers and wrote dozens of puzzle books, Peter's focus is on concise, original exposition. However, he does give pride of place to this counter-intuitive watermelon puzzle:

> A farmer brings a load of watermelons to the market. Before he sets out, he measures the total weight and the percentage water content. He finds that the total weight is 100kg and the water content is 99%. The weather is hot, so his load loses some moisture *en route*. He checks the water content when he arrives at the market: it has dropped to 98%.
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> QUESTION: What is the total weight of the load on arrival at market?

In "Kelvin's Wake" (pages 75-77), we are told that if a duck swims in the shallow pond at St Stephen's Green, then the V in the water which bounds the dispersive waves the bird leaves in its wake forms an angle of about 40 degrees. The reason given is that half the angle in question is $\arcsin(1/3)$, which is about 0.3398 radians, or roughly 19.47 degrees. (The duck apex angle is hence a tad under 39 degrees.) Moreover, this angle is allegedly independent of the speed at which the duck moves. We are not told if this result also holds for ducks in Herbert Park or other metropolitan waterways, or indeed for those beyond the Pale. Nor is there any discussion of the converse: if it takes (to water) and wakes (at an angle of approximately 40 degrees) like a duck, then it is a duck.

For several reasons it would be helpful if the chapters were numbered[2]. As it is, it's often challenging to go back to find something which caught one's attention on an earlier perusal. For instance, while there is an index, no wakes or ducks (dead or alive) seem to lurk therein.

These are minor quibbles. *That's Maths* is a superb collection of thought-provoking essays—100 of them!—which every numerate or curious teen or adult in Ireland and elsewhere should devour.

REFERENCES

[1] Mathematics Ireland: *Peter Lynch's That's Maths*, blog and interview, October 2016.
http://www.mathsireland.ie/blog/2016_10_cm
[2] M. Mulvihill: *Ingenious Ireland: A County-by-County Exploration of Irish Mysteries and Marvels*, Town House, Dublin, 2002.

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[2]The week the book appeared, Peter provided chapter numbers at his own blog https://thatsmaths.com/2016/10/27/thats-maths-book-published.