As a first for my present tenure as book reviewer for *Crux*, I present multiple books in this column. The two books are radically different, one appealing to the brain and the other the heart. What links them is that I see both as possible gifts.

*Trigonometry: A clever study guide* by James Tanton
Published by MAA Press: Problem book series, 2015

James Tanton is an education consultant, who used to teach in high school and university. He worked on several outreach programs for the MAA and serves as an ambassador for the MAA in Washington D.C. This is his third book for the MAA.

Trigonometry problems in the book are split in 20 categories, each occupying its own chapter, each following the same pattern: a list of Common Core State Standards covered in the chapter, a brief synopsis of the chapter with, where possible, some historical notes, a simple calculation example, a worked out example with comments and, in most cases, a series of problems to solve. All the proposed problems come from either the American Mathematics Competitions (AMC) or American High School Mathematics Examination (AHSME) contests ranging from 1952 to 2013, but most coming from the 1980–2010 period. The 20 chapters take up about three quarters of the book and cover mostly classical sections of a standard trigonometry course from Chapter 1 “The Pythagorean Theorem” to Chapter 17 “Heron’s formula”.

The last three chapters stand out for several reasons: their originality and the fact they do not come with practice problems. This seems to be at odds with the aim of the book, which is to train the reader for math competitions, but they do round out the knowledge a true mathlete should have about the subject. The first of these is “Fitting trigonometric functions to periodic data”. In my opinion, the name of the chapter is misleading as you might think that this is a chapter on statistics, namely trigonometric regression, and you would be wrong. The following non-trivial and fun problem illustrates the chapter well:

For each integer $n > 1$, let $F(n)$ be the number of solutions of the equation $\sin x = \sin nx$ on the interval $[0, \pi]$. What is $\sum_{n=2}^{2007} F(n)$? (#24, AMC 12A, 2007)

Not an easy cookie to crack, but far from the only interesting math morsel in the book! Sadly, there are no practice problems of the same kind to hone one’s skills. The last two chapters, “Polar Coordinates” and “Polar Graphs”, are even sparser,
but they are clearly labelled as extra chapters. After all, they do not correspond to any Common Core State Standards, but maybe, that is the mistake.

The book is a small paperback and can easily be carried everywhere, even to that coffeeshop around the corner where you can dabble in math problems while sipping a latte. The book is abundantly illustrated and the problems are definitely worthy of the attention of _Crux_ readers. Here are two more:

All three vertices of an equilateral triangle lie on a parabola $y = x^2$, and one of its sides has a slope of 2. The $x$-coordinates of the three vertices have a sum of $m/n$, where $m$ and $n$ are relatively prime positive integers. What is the value of $m + n$? (#24, AMC 12B, 2005)

Inscribed in a circle is a quadrilateral having sides of lengths 25, 39, 52 and 60 taken consecutively. What is the diameter of this circle? (#25, AHSME, 1972)

The book is clearly not a standalone resource on the subject and has no real introductory level exercises. The reader must have a basic comprehension of basic trigonometry and can use this book as a further study guide. An interesting feature is the presence of links to webpages, although I must admit I did not explore them. The last 50 pages of the book are filled with complete solutions to the problems, which are labelled from 1 to 100 in the order they appear and independent of the chapter they are in. This provides for an easy way to find the solutions. A little warning: the solutions proposed in the book are bareboned. But if you are working on a solution, it should be enough to see if you are right or help you find your mistake if you took the same approach. At the end, the author also presents a 10-step strategy to conquer math contest problems, though I do not really see its use since the book itself is aimed at problem solvers who should already have developed and practiced these strategies.

This book has a well defined readership, namely all prospective mathletes and various honours students who need extra stimulation to keep them interested. _Crux_ readers and problem solvers of all ages and strengths will also find this book interesting. I hear a lot of people reminisce about the good old days when they had time to play around with math, especially trigonometry. Maybe this book might make a good gift for that nostalgic engineer friend of yours? In any case, good reading!

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*Patterns of the universe : a coloring adventure in math and beauty* by Alex Bellos and Edmund Harriss
ISBN 978-1-61519-323-3, 144 pages
Published by The experiment publishing, 2015

Alex Bellos wears many hats: he is math and puzzles blogger for *The Guardian*, he is a science presenter on the BBC and he has written a few mathematics general interest books. Edmund Harriss is a mathematics professor at the University of

_Crux Mathematicorum_, Vol. 41(9), November 2015
Arkansas who actively participated in many math outreach programs. Together, they created the most mathematical colouring I’ve ever seen.

This book is made to stimulate artistic beauty and creativity while subtly enticing mathematical curiosity. Each drawing is accompanied by a small description of the mathematical object to be drawn. The book is separated into 2 sections, which are further divided into subcategories: coloring (Voronoi diagrams, transformations, fractals, periodic tiling, non-periodic tiling, knots, mechanical curves, polyhedra, proportions, space-filling curves, ...) and creating (randomness, latin squares, cellular automata, ...).

Naturally, any artistically inclined mathematician would be interested in such a book. It would make a good gift for artists who say they were “never good at math”. Maybe, they would be surprised how much of mathematics has been discovered by artists or how much good artistic representations helped advance mathematics. Good reading!

Colour the above Voronoi diagram (image is from Patterns of the universe: a coloring adventure in math and beauty courtesy of Amazon).