

Editorial

Dear Readers,

welcome to *Parabola*! It is just a day away from the New Year and, for me, 2018 was a productive and happy year; I hope that it was a happy year for you too!

In this reflexive frame of mind, it has been nice to look back at the recent flourishing of *Parabola*, from longstanding and much beloved maths journal for Australian high school students to now, since 2014, an international journal that is enjoyed by a fast-growing international audience. It is also nice to see that good-quality articles and other content are now being submitted from all around the world, and in increasing quantity: the contributors to this issue of *Parabola* hail from Australia, Denmark, Poland, Singapore, UK, and USA; and this issue features four articles, one more than the usual three. I look forward to see *Parabola* attract a yet bigger and wider community of readers and contributors, so please feel free, dear Reader, to contribute too!

The articles of this issue all directly concern numbers in one way or another. In the first article, my good colleague Liangyi (Lee) Zhao has written a beautiful article on how to estimate the number $\pi(x)$ of primes numbers less than or equal to any number x . The Prime Number Theorem famously states that $\pi(x)$ is approximated by $\frac{x}{\ln x}$ and that this approximation gets increasingly better as x grows. Better approximations have been given and, in this paper, Lee shows good lower and upper bounds on $\pi(x)$ using simple and elegant combinatorial proofs.

The second paper, by Michael Kielstra, is about games on integers. If you are given the numbers $1, 2, \dots, n$ and are allowed to use certain arithmetic operations, are you then able to use these numbers and these operations to form given target numbers? This paper answers this question through an analysis of a number of game variations in which certain sets of arithmetic operations are given. I invite you, dear Reader, to challenge yourself to try out these games yourself!

In the third article, by Marian Maciocha, we see Chebyshev appear once more. Here, we can read about a special case of his Inequality, one which relates arithmetic means to root mean squares. It is simple to prove, has nice visual proofs in the two-variable case, and has equally nice applications, as this paper demonstrates.

The final paper, by Benny Lim, returns to the topic of primes and of counting them. Based on empirical data, the papers shows that there appear to be unusually many primes of the form $H_n \pm 1$ where H_n are *highly composite numbers*. The paper also offers food for thought and imagination via informal discussion and conjectures.

As usual, you will also find more of David Angell's beautifully set problems, and Robert Schneider provides a new variation of his maths puns, and a taste of a new comic series, in *Square Root of Negative Pun*.

Please enjoy, and have a happy New Year!,

Thomas Britz
Editor