## THE MATHEMATICAL ASSOCIATION

The fundamental aim of the Mathematical Association is to promote good methods of mathematical teaching. A member receives each issue of one or more of The Mathematical Gazette, Mathematics in School, Primary Mathematics (according to the class of membership chosen), together with Newsletters. Reports are published from time to time and these are normally available to members at a reduced rate. Those interested in becoming members should contact MA Headquarters for information and application forms. The address of the Association Headquarters is $\mathbf{2 5 9}$ London Road, Leicester LE2 3BE, UK (telephone 0116221 0013). The Association should be notified of any change of address. If copies of the Association periodicals fail to reach a member through lack of such notification, duplicate copies can only be supplied at the published price. If change of address is due to a change of appointment, the Association will be glad to be informed. Subscriptions should be submitted to the Treasurer via Headquarters. Correspondence relating to Teaching Committee should be addressed to Dr Jim Simons. The Association's Library is housed in the University Library, Leicester.
Views expressed in the Mathematical Gazette by authors or advertisers are not necessarily those of the Association.

## THE MATHEMATICAL GAZETTE

Editor:
Dr Gerry Leversha, 15 Maunder Road, Hanwell, London W7 3PN g.leversha@btinternet.com

Production Editor:
Mr Bill Richardson, Kintail, Longmorn, Elgin IV30 8RJ
wpr3145@gmail.com

Problem Corner:
Mr Nick Lord, Tonbridge School, Tonbridge, Kent TN9 1JP njl@tonbridge-school.org

Reviews Editor:
Mr Owen Toller, 4 Caldwell House, 48 Trinity Church Road, London SW13 8EJ owen.toller@btinternet.com

Potential advertisers should send an e-mail to: advertisingcontroller@m-a.org.uk Material for publication should be sent to the Editor. Books for review should be sent to the Reviews Editor.

Advice to authors of notes and articles.
Study the format of articles in the Gazette. Please note the format for references, which should be listed in their order of appearance in an article. MSS may be submitted electronically, preferably in pdf format, or, if sent by post, should be typed and two copies included. (Mathematical expressions may be hand written.) Please send by e-mail not on floppy discs. This edition of the Gazette was produced on an Acorn machine using TechWriter and Draw.
10.1017/mag. 2019.136

## CONTENTS

## Articles

Margaret E Rayner Irene Ault ..... 385
Alice's adventures in inverse tan land Paul Glaister ..... 388

- mathematical argument, language and proof
New proofs of certain characterisations of Sadi Abu-Saymeh ..... 401 cyclic circumscriptible quadrilaterals and Mowaffaq Hajja
Coincidence of the barycentre and the Ulrich Abel ..... 409
geometric centre of weighted points
Characterisations of the parabola Steven J. Kilner and ..... 416
David L. Farnsworth
The Chinese Ring puzzle, the Crazy Elephant Curtis Cooper ..... 431
Dance puzzle, the $b$-Spinout puzzle, and Gray codes
The morphology of $\mathbb{Z}[\sqrt{10}]$ Andrew J. Simoson ..... 442
A diagram for inequalities of Stan Dolan ..... 461 symmetric functions
Eight formulae for the area of triangle OIH Martin Josefsson ..... 470
Iterating circum-medial triangles Hans Humenberger ..... 480
and Franz Embacher
An Appreciation Gerry Leversha ..... 488
Notes 103.28 to 103.46
On a link between Triangular and K. B. Subramaniam ..... 489 Fibonacci numbers
Heronian triangles and squares Stan Dolan ..... 490
in arithmetic progression
Tests for divisibility by prime numbers Mehdi Hassani ..... 494
Factorising numbers with oracles Peter Shiu ..... 495
More on the gaps between sums of two squares G.J.O.Jameson ..... 499
Conditions for the terms of an arithmetic sequence Purwanto ..... 504 to form a multiplicative modular group
Indefinite integration by parts as a Carlo Del Noce ..... 508
translation of functionsHölder's inequality revisitedK. Razminia512
Three footnotes to Cartwright's proof that $\pi$ Nick Lord ..... 514 is irrational
A sudoku puzzle with a big rectangular hole Tamsin and Tony Forbes ..... 517
Four hundred years of the fractal coastline Eoghan Bradley and ..... 518
Mark McCartney
A lemma to solve Langley's problem Yongcheng Chen ..... 521
Identifying golden and equilateral triangles Aldo Scimone ..... 525
that arise from the golden Arbelos
A spatial characterisation of Pascal limaçons Francisco Javier González ..... 531
Vieli and Marion Maillard
The Feuerbach hyperbola revisited J. A. Scott ..... 536
An inequality arising from the inarc centres Martin Lukarevski ..... 538 of a triangle
The denominators of the Bernoulli numbers G. J. O. Jameson ..... 541
Improving elementary numerical integration Robin Murphy ..... 548 using numerical differentiation
A four-hundred year calendar P. Stanley ..... 556
Problem Corner Nick Lord ..... 559
Student Problems Stan Dolan ..... 567
Reviews ..... 570

The cover picture is published with the permission of
Heritage Image Partnership Ltd
© The Mathematical Association 2019
Typeset by Bill Richardson

# CAMBRIDGE UNIVERSITY PRESS 



Printed in the UK by Bell \& Bain Ltd.

## CAMBRIDGE

## MATHEMATICAL TEXTBOOKS



For more information and to request exam copies of any of these titles, visit cambridge.org/maths_textbooks

