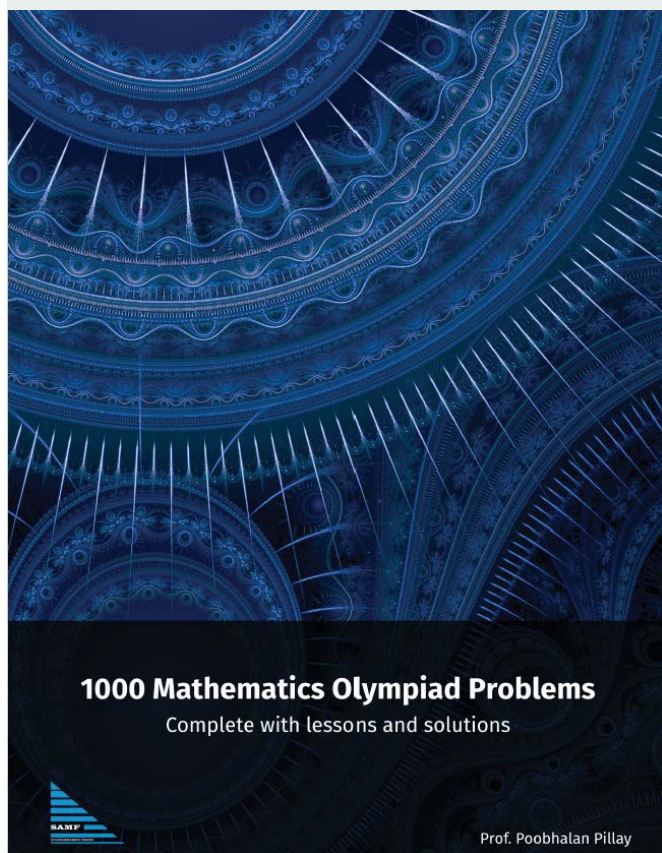


New e-book for maths enrichment



The South African Mathematics Foundation (SAMF) has launched a new e-book to help learners from Grades 7 to 12 improve their mathematics skills. The e-book, *1 000 Mathematics Olympiad Problems*, was compiled by Prof. Poobhalan Pillay, an Emeritus Professor in the School of Mathematics, Computer Science and Statistics at the University of KwaZulu-Natal. Prof. Pillay was on the South African Mathematics Olympiad (SAMO) Round 3 panel, and acted as national moderator of National Senior Certificate (NSC) Mathematics for 20 years. He is currently the academic coordinator for the Siyanqoba Regional Olympiad Training Programme, which manages 10 training centres across the country.

“The programme, organised by the SAMF and sponsored by the Department of Science and Innovation (DSI), concentrates on developing problem-solving skills,” he explains. “Unlike the regular school curricula that focus more on solving routine-type questions, the emphasis of the Siyanqoba programme is on the understanding of mathematical concepts rather than pure memorisation of formulae.”

Each problem in the e-book is assigned a difficulty level ranging from Level 2 to Level 10, the higher-level problems being suitable for learners who qualified for the various Olympiad programmes offered by the SAMF.

According to a review by Prof. Michael de Villiers, who chairs SAMO’s Senior Problem-Solving Committee R1-R2,

most of the problems have their origins in SAMO, the SAMF’s Team Competitions or the SAMF’s Talent searches, but other resources on problem-solving were also used. Learners are encouraged to first attempt to solve the problems, and if possible to do so, solve them in more than one way. Fully worked solutions to all the problems are provided at the back of the e-book.

He explains that the book also includes 11 lessons and seven appendices. Examples of topics covered include:

- Numbers: from natural numbers to complex numbers
- Sequences and series: arithmetic and geometric sequences and series, triangular numbers, Fibonacci sequences, Farey sequences, sums of the first n squares and cubes, proof by mathematical induction
- Rational and irrational numbers: irrationality proofs, recurring decimals, Farey sequences
- Factorisation: factorisation of sums and difference of integral powers
- Geometry: general polygons, concurrency theorems, Euler’s formula and Platonic solids
- Areas: Heron’s formula, areas of regular polygons, Pick’s Theorem
- Trigonometry: trigonometric ratios of multiples of 18° , sum of sines
- Counting and probability: binomial coefficients, binomial theorem, counting with repetitions.

Topics in elementary number theory include congruence arithmetic, the Euclidean algorithm, the Chinese Remainder Theorem, solutions of Diophantine Equations, Fermat’s little theorem, perfect numbers, and Mersenne and Fermat primes.

Advanced topics in geometry include the Euler line, the nine-point circle, the power of a point, Ceva’s Theorem, Ptolemy’s Theorem, Pick’s Theorem, and a detailed treatment of the regular pentagon. New results on Cevian ratios, constructing Pythagorean triples, and constructing 60° triangles with integral sides are presented. Diameters of the inscribed, circumscribed and nine-point circles in terms of the sides of a triangle are determined.

The Cauchy-Schwartz and rearrangement inequalities, as well as the inter-relationships amongst the difference means are discussed. The lesson on polynomials provides an in-depth treatment of quadratic polynomials, while moving onto a general discussion of roots of arbitrary polynomials over complex numbers, and consequences of the Fundamental Theorem of Algebra. The Viète formula, De Moivre’s Theorem and roots of unity are also discussed in passing.

The e-book can be purchased for R520 (VAT inclusive) at: <https://www.samf.ac.za/en/mathematics-olympiad-problems>.

Learners on the Siyanqoba programme will receive the e-book on a flash drive free of charge.

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