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SYNOPSIS

65 The Academy Corner: No. 9 *Bruce Shawyer*

Featuring a University Undergraduate Mathematics Competition.

66 The Olympiad Corner: No. 180 *R.E. Woodrow*

Featuring the 3rd Mathematical Olympliad of the Republic of China (Taiwan); the solutions to last month's Five Klamkin Quickies, and Another Five Klamkin Quickies; reader's solutions to the 16th Austrian Polish Mathematics Competition; the solution to problem 2 from the VII Nordic Mathematical Contest; and the solutions to two problems from the 32nd Ukranian Mathematical Olympiad.

78 Book Review *Andy Liu*

This month's book is:

Leningrad Mathematical Olympiads 1987–1991, by Dmitry Fomin and Alexey Kirichenko, published by MathPro Press, Westford, MA, USA, 1994. (Contests in Mathematics Series, vol. 1.), paperbound, 202 + xxii pages, ISBN 0–9626401–4–X, US$24.

Reviewed by ***József Pelikán,*** Eötvös Loránd University, Budapest, Hungary.

81 Folding the Regular Heptagon

by *Robert Geretschläger, Bundesrealgymnasium, Graz, Austria*.

Ever since Greek antiquity, mathematicians have been considering constructions that can be done with straight-edge and compass only, the so-called Euclidean constructions. A number of famous problems, such as squaring the circle, trisecting angles and doubling the cube, were unsolvable for the Greeks, and later shown to be theoretically unsolvable by Euclidean methods. The reason for this is that only such problems that can be reduced algebraically to combinations of linear and quadratic equations are solvable in this sense. We now know that these three problems, as well as many others, cannot be represented by combinations of such equations.

One specific problem the Greeks attempted to solve in this way was the construction of regular n–gons for small n. They were sucessful in finding constructions for $n = 3, 4, 5, 6, 8, 10$ and 12, but not for

$n = 7$, 9 or 11. Since 7 is the smallest n for which no construction could be found, it was of special interest why this particular problem should prove so stubborn.

Robert Geretschläger, with his knowledge of origami, shows how to use paper folding techniques to make a regular heptagon. This interesting article is accompanied by detailed instructions and diagrams showing where and how to fold.

89 The Skoliad Corner: No. 20 *R.E. Woodrow*

Featuring the Mathematical Association National Mathematics Contest 1994 (UK) and the solutions to the 1994 Nat West UK Junior Mathematical Challenge.

94 Mathematical Mayhem

94 Matrix Exponentials: An Introduction
Donny Cheung

What is meant by e^M, where M is a matrix? It is shown how to give meaning to this idea, some fundamental properties, and some interesting results are left to the reader to explore.

100 Mayhem Problems
101 High School Solutions
102 Advanced Solutions
106 Challenge Board Solutions

109 Problems: 2214–2225

This month's "free sample" is

2223. *Proposed by Joaquín Gómez Rey, IES Luis Buñuel, Alcorcón, Madrid, Spain.*

We are given a bag with n identical bolts and n identical nuts, which are to be used to secure the n holes of a gadget.

The $2n$ pieces are drawn from the bag at random one by one. Throughout the draw, bolts and nuts are screwed together in the holes, but if the number of bolts exceeds the number of available nuts, the bolt is put into a hole until one obtains a nut, whereas if the number of nuts exceed the number of bolts, the nuts are piled up, one on top of the other, until one obtains a bolt.

Let L denote the discrete random variable which measures the height of the pile of nuts.

Find $E[L] + E[L]^2$.

112 Solutions to problems 2113–2123