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SYNOPSIS

1 Editorial

2 Mot de la Rédaction

3 Skoliad: No. 67 *Shawn Godin*

12 Mathematical Mayhem

- 12 Mayhem Editorial
- 14 Mayhem Problems M.76–M.81
- 16 Mayhem Solutions M.26–M.30
- 19 Pólya's Paragon *Paul Ottaway*

22 The Olympiad Corner: No. 227 *R.E. Woodrow*

Featuring the 2000 Korean Mathematical Olympiad, 2000 Bulgarian Mathematical Olympiad, and the 2000 Vietnamese Mathematical Olympiad; an alternate solution to problem #1 of the XXIII All Russian Olympiad; readers' solutions to some of the problems of the 20^{th} Austrian-Polish Mathematical Competition; readers' solutions to Selected Problems from Israel Mathematical Olympiads; and readers' solutions to problems from the Estonian Mathematical Olympiads 1996–1997, Final Round of the National Olympiad.

37 Book Review *John Grant McLoughlin*

The Golden Section
by Hans Wasler

39 Brahmagupta Quadrilaterals: A Description

K.R.S. Sastry

Heron of Alexandria (Egypt) gave the formula $\sqrt{s(s-a)(s-b)(s-c)}$ for the area of a triangle in terms of its sides a, b, c, and its semi-perimeter, $s = (a+b+c)/2$. Right-angled triangles having sides and area that are integers were determined long before Heron. But to his credit he found such a triangle that is **not** a right-angled one: 13, 14, 15; 84. Because of this we honour Heron by naming triangles with integer sides and area *Heron triangles*.

The Indian mathematician Brahmagupta determined Heron triangles by adjoining two right-angled triangles along a common side. He took his principle further and gave us a construction to obtain a cyclic (inscribable in a circle) quadrilateral with integer sides, diagonals, and area. Later mathematicians were intrigued by the Brahmagupta process.
But it took Kummer to demystify it. We call an inscribable quadrilateral a *Brahmagupta quadrilateral* if it has integer sides, diagonals, and area. Our present aim is to provide a description of Brahmagupta quadrilaterals via *Heron angles*.

Read on!

This month's "free sample" is:

2802. *Proposed by Christopher J. Bradley, Clifton College, Bristol, UK.*

Four positive integers, a, b, c, d, are said to have property $\mathcal{PS}$ if all of $bc + cd + db$, $ac + cd + da$, $ab + bd + da$, and $ab + bc + ca$ are $\mathcal{P}$erfect $\mathcal{S}$quares.

Suppose that the positive integers m, p, q, and r satisfy $p \le q \le r$ and $pq + qr + rp = m^2$. Let $s = p + q + r + 2m$.

Prove that p, q, r, and s have property $\mathcal{PS}$.

. . . .

On dit que quatre entiers positifs, a, b, c, d, possèdent la propriété $\mathcal{CP}$ si tous les nombres $bc + cd + db$, $ac + cd + da$, $ab + bd + da$, et $ab + bc + ca$ sont des $\mathcal{C}$arrés $\mathcal{P}$arfaits.

Supposons que les entiers positifs m, p, q, et r satisfont $p \le q \le r$ et $pq + qr + rp = m^2$. Soit $s = p + q + r + 2m$.

Montrer que p, q, r, et s possèdent la propriété $\mathcal{CP}$.