

39: No 2      February / Février 2013

Published by:

Canadian Mathematical Society  
Société mathématique du Canada  
209 - 1725 St. Laurent Blvd.  
Ottawa, ON K1G 3V4, Canada  
Fax/Télé. : 613 733 8994

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**SYNOPSIS**

- 55 Mathematical Mayhem      *Shawn Godin*  
Cruz problem 3724 originally (erroneously) reproduced Mayhem problem M504. Quite a few solutions were received before a replacement problem was published. A new generalization is published in this issue. Also, some further work on problem M506 is reported. Finally, the solutions to the last of the Mayhem problems, M513–M518, are presented.
- 64 The Contest Corner: No. 12      *Shawn Godin*
- 64    The Contest Corner Problems: CC56–CC60
- 66    The Contest Corner Solutions: CC6–CC10
- 70 The Olympiad Corner: No. 310      *Nicolae Strungaru*
- 70    The Olympiad Corner Problems: OC116–OC120
- 71    The Olympiad Corner Solutions: OC56–OC60
- 79 Book Reviews      *Amar Sodhi*
- 79    *Jim Totten's Problem of the Week*  
edited by John Grant McLoughlin, Joseph Khoury and Bruce Shawyer
- 81 Problem Solver's Toolkit: No. 4      *J. Chris Fisher*

This is the first of a four part series by *Cruz* editor J. Chris Fisher. The goal of the series is to study Harmonic sets. This first instalment lays some of the foundations of projective geometry, and introduces the Desargues Theorem.

84 Six Ways to Count the Number of Integer Compositions

*Amitabha Tripathi*

In this article, for positive integers  $n$  and  $k$ , the author defines a composition of  $n$  into  $k$  (positive) parts as

*an ordered  $k$ -tuple  $(x_1, \dots, x_k)$  with each  $x_i \in \mathbb{N}$  and  $x_1 + \dots + x_k = n$ . The  $x_i$ 's are the **parts** of the composition. Thus  $(1, 2, 2, 3)$  is a composition of 8 into 4 parts. If we denote by  $p_k^*(n)$  the number of compositions of  $n$  into  $k$  parts, it is a standard result in combinatorics that*

$$p_k^*(n) = \left| \left\{ (x_1, \dots, x_k) : x_1 + \dots + x_k = n, x_i \geq 1 \right\} \right| = \binom{n-1}{k-1}.$$

The author then goes on to prove the given result in six different ways.

89 Problems: 3793, 3811–3820

This month's "free sample" is:

**3811.** *Proposé par Jung In Lee, Seoul Science High School, Seoul, Republic of Korea.*

Déterminer toutes les fonctions  $f : \mathbb{N} \rightarrow \mathbb{N}$  telles que, pour tous les entiers positifs  $a$  et  $b$ ,  $af(a+b) + bf(a) + b^2$  soit un carré parfait.

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**3811.** *Proposed by Jung In Lee, Seoul Science High School, Seoul, Republic of Korea.*

Determine all functions  $f : \mathbb{N} \rightarrow \mathbb{N}$  such that for all positive integers  $a$  and  $b$ ,  $af(a+b) + bf(a) + b^2$  is a perfect square.

93 Solutions: 3676, 3711–3720