$(kn^2 + \alpha, kn^3 + \beta)$, giving $y = x^3 - kz^2 = k(3kn^4\alpha + 3n^2\alpha^2 - 2kn^3\beta) + (\alpha^3 - k\beta^2)$. To satisfy $1 \leqslant y < k$, we require the first bracket to equal zero and $1 \leqslant \alpha^3 - k\beta^2 < k$, so that (α, β) must be another proper solution. Now the maximum relevant value of α is

$$k(n+1)^2 - kn^2 - 1 = 2kn + k - 1,$$

which is less than kn^2 when $kn^2 > 2kn + k - 1$ or $k(n-1)^2 > 2k - 1$, which is satisfied by $n \geqslant 3$. Hence, if (x, z) is a proper solution, with $x > 3^2k = 9k$, then there is another proper solution (α, β) where $\alpha < x$. By repeating this process, if there are indeed any solutions, then there must be at least one solution (x, z) where $x < 9k$. Thus, for a given k, there are only a finite number of values of x to check in order to establish whether there are any solutions. Confining our attention to a finite number of values of k, we note that many of the equations have solutions of the form $(x, 1)$ so that $x^3 = y + k$. For a given $x = n$, to ensure that $1 \leqslant y < k$ the possible values of k lie between $\left[\dfrac{n^3+2}{2}\right]$ and $n^3 - 1$.

$n = 2$ gives $5 \leqslant k \leqslant 7$;

$n = 3$ gives $14 \leqslant k \leqslant 26$;

$n = 4$ gives $33 \leqslant k \leqslant 63$;

$n = 5$ gives $63 \leqslant k \leqslant 124$

and all subsequent values of n give intervals of k which overlap with the previous interval, which can be verified by considering $\left[\dfrac{(n+1)^3+2}{2}\right] \leqslant n^3 - 1$. So the only values of k to check are 2, 3, 4, 8, 9, 10, 11, 12, 13, 27, 28, 29, 30, 31, 32. A simple computer search gives $k = 11$ $(21, 29)$; $k = 13$ $(4, 2)$; $k = 27, 28, 29, 30, 31$ $(5, 2)$; $k = 32$ $(21, 17)$ and no solutions for the other values of k.

If the restriction $1 \leqslant y < k$ is lifted a variety of parametric solutions can be found such as $x = 1 + 4t^2k$, $y = 1 + 3t^2k$, $z = t(3 + 8t^2k)$, given by Stan Dolan which, however, fails to give all solutions.

My thanks to Professor Bryan Birch, J. H. E. Cohn, S. Dolan, M. C. Harrison, G. Howlett, R. F. Tindall and H. B. Talbot for their sterling efforts and helpful comments.

G.T.Q.H.

Correspondence

The history of the magic hexagon

DEAR EDITOR,

I have a surprising addition to make to Frank Tapson's interesting history of the only possible magic hexagon (October 1987 *Gazette*). I have received a letter from Heinrich Hemme, of Osnabrück, West Germany, informing me that the magic hexagon was given as a problem in a German periodical in 1888. This precedes the rediscovery of the hexagon by William Radcliffe. The construction of the hexagon was Problem 795 in the German magazine *Zeitschrift für mathematischen und naturwissenschaftlichen Unterricht* (Vol. 19, page 429, 1888). The proposer was identified only as von Haselberg, of Stralsund. His solution was published in Vol. 20, pages 263–264, 1889.

The structure could easily have been discovered by mathematicians in ancient times, but as of now, this is the earliest known publication.

Yours sincerely,

MARTIN GARDNER

Woods End, Inc., 110 Glenbrook Drive, Hendersonville, North Carolina 28739, U.S.A.

Some special numbers

DEAR EDITOR,

At a recent mathematics conference, a member of the conference came up with a set of numbers I had not heard of and I thought that a wider audience may bring results.

The numbers are called STØPHOMN, although nobody was sure of the spelling. Their properties are:

(i) each digit is prime
(ii) the sum of the digits is prime
(iii) the number itself is prime

No one was sure if the set of these numbers was finite.

One of the member's room number was 223 which has the added property that $2^n + 2^n + 3^n$ is prime for $1 \leqslant n \leqslant 6$. This makes 223 a sixth order STØPHOMN number.

Can anyone help with further information?

Yours sincerely,
PETER WICKS

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Reviews

The I hate mathematics! book, by Marilyn Burns. Pp. 96. £6·95 (hardback), £3·95 (paperback). 1987. ISBN 0-521-33414-4/33659-7 (Cambridge University Press)

She met me with her file on space. She told me about Mars, Haley's Comet, the Horse's Head Nebula, Saturn, Jupiter, Laplace's Nebula and the Spiral Galaxy, and announced that she wanted to go into space when she grew up. My son at the same age (seven) knew all about the birds of Britain and how to bet and win on horses, and my brother in his day knew all about motor bikes and used to make intricate, correct models of them in plasticine.

What, you are no doubt wondering, has all this got to do with *The I hate mathematics! book*? I think that what it has to do with the book is that children, from an early age, are capable of absorbing a prodigious amount of information on matters that interest them, and that it is sad that so few people have had the idea (or at any rate pursued it if they had it) of providing for children material that might make mathematics as exciting as motor bikes, birds and space. I think *The I hate mathematics! book* makes a start on something like this for us.

My hackles rose at the title. How could anyone reinforce the poor image of mathematics by splashing it over our bookshelves? I read a little and found myself becoming disarmed by its use of genuine mathematical vocabulary. But much too hard for young children, I thought before I remembered the space file and the complex space vocabulary included in it.

The book is written and illustrated in a highly readable way, using all the typical ploys of comics and other commercial reading matter for children. Its humour is the humour that appeals to children of all ages. It uses games, puzzles and some well known problems, besides encouraging children to think that pursuing mathematical activities in their fantasies and in their everyday lives is an attractive rather than a dull, mundane occupation. It touches on some decidedly more advanced mathematical ideas, perhaps thereby threatening us as teachers by risking for us the time honoured claim 'We've done that before'.

For me the most significant feature of the book is that it never shrinks from using the appropriate mathematical vocabulary, however light-hearted the setting within which it is introduced. It thus confronts what is to many people the alien nature of mathematical language and in doing so it becomes a book that ordinary children (and people) can read and enjoy.