following is particularly simple. Consider the vectors $\mathbf{OA} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and

$\mathbf{OB} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$ and their sum $\mathbf{OC} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$.

Now $\angle BOX = \tan^{-1} \frac{1}{2}$ and $\angle XOC = \tan^{-1} \frac{1}{3}$, but $OBCA$ is a square, so $\angle BOX + \angle XOC = 45°$.

D. M. HALLOWES

Heath School, Halifax

62.9 Fibonacci on the road

Drivers who find that arithmetic impairs their concentration but who carry in their heads the first few numbers of the Fibonacci sequence $\{f_n\}$ may find the following set of equivalences useful:

8 km $\approx$ 5 miles, 13 km $\approx$ 8 miles, 21 km $\approx$ 13 miles

and in general,

f_{n+1} km $\approx f_n$ miles

'Calculator cats' may be amused to find the first value of n for which this rule fails to give the conversion correct to the nearest whole number.

DOUGLAS QUADLING

Cambridge Institute of Education, Shaftesbury Road, Cambridge CB2 2BX

Correspondence

Modelling in examination questions

DEAR EDITOR,

The editorial introduction to the series of articles on modelling contained in the June 1977 *Gazette* (Vol. 61, No. 416) may have given the impression that very little attempt has been made to incorporate such ideas into school examinations. The Mathematics in Education and Industry (MEI) Project has, for over ten years, been striving for just such a reform, not altogether without success. Admittedly it is rare that "the whole modelling process" is examined—it is hardly practicable to do so—but a considerable departure has been made from the stereotyped pattern of "applied maths. questions" of twenty years ago.

The Schools and Industry Committee, mentioned in the editorial, has been closely associated with MEI since its inception and has given active encouragement to the Project's attempts to forge closer links between school mathematics and industrial

applications of the subject. In view of the current "great debate" the work of MEI is perhaps of greater relevance than ever before.

Yours sincerely,
STUART PARSONSON

57 High Street, Harrow on the Hill, Middlesex HA1 3HT

[Could a member of the MEI team be persuaded to expand the first paragraph of this letter in an article, with some actual examples and an account of the candidates' response? D.A.Q.]

The use of vectors in mechanics

DEAR EDITOR,

In his note 61.12 in the June 1977 *Gazette* Dr Collinson points out that it is for the inverse square law alone that his equation (3) is integrable. This is the same as equation (4) on p. 236 of E. A. Milne's *Vectorial mechanics* (Methuen 1948). Put in Milne's form

$$\frac{d}{dt}(\mathbf{h} \wedge m\dot{\mathbf{r}}) = mr^2 F(r)\frac{d}{dt}\left(\frac{\mathbf{r}}{r}\right),$$

the result is immediate. Milne attributes this to Hamilton, and the reference is given by Dr Collinson in a previous article in the *I.M.A. Bulletin* 9, 377–8 (1973) as well as references to Runge and Lenz, but not to Milne and Chapman or indeed Weatherburn. Milne had clearly translated Hamilton's version in quaternions as given in *Proc. R. Ir. Acad.* 3, xxxix (1846).

As I remember, and as Milne states in the preface to his book, he and Chapman were strongly advocating the use of vectors and tensors in *Mechanics* in the 1920s. It was unfortunate that, owing to other work, the publication of the book was delayed. It was to have been a joint work with Chapman who (the story went) once said that it must be written even if Milne had to write it all; this was in fact what happened, but long before this Hartree, who succeeded Milne at Manchester in 1929, showed these methods to me and we used them in our lectures. In particular, Milne laid emphasis on the power of the vector product (it gets rid of any vector you don't want) and on the interpretation of the first integral of the motion.

I should like to draw attention to two references in the *Gazette:*
   (1) D. R. Hartree, S. Chapman, E. A. Milne, 20, 272 (1936). (A letter on vector notation. I regret that their recommendation of $\wedge$ instead of $\times$ has not been more generally adopted.)
   (2) Volume 23, which abounds in proofs of the formula for the triple vector product. Here I cannot help feeling that the suffix notation has the edge on vectors.

I believe that Milne's book is, regrettably, out of print. There is a well used copy in the library of this College.

Yours faithfully,
BERTHA JEFFREYS

Girton College, Cambridge

Matters of degree

"Leonardo of Pisa was also associated with the Rabitt Breading problem." (Our correspondent adds that this is thought by scholars to be an early form of the Ham Sandwich Theorem.)

"The text of the Chou-Pei clearly infers that geometry arises from menstruation." Extracts gleaned from a B.Sc. finals History of Mathematics script (per Geoffrey Howson).