64.11 Cook-book calculus

The mistake in the following 'solution' cannot be original, but I thought it might make an interesting Note. The 'method' works for any ratio of edges of the base.

PROBLEM. *A closed rectangular box has base edges in the ratio* 2 : 1 *and the volume is* 243 cm^3. *Find the height if the surface area is a minimum.*

'SOLUTION'. Call the base edges $2x$ and x. Let the height be h. Then

$$h = \frac{243}{2x^2}$$

and the surface area

$$A = 4x^2 + 6xh.$$

So

$$\frac{dA}{dx} = 8x + 6h \ (sic).$$

This is zero when $x = -\frac{3}{4}h$, so that

$$h = \frac{243}{2(\frac{3}{4}h)^2},$$

$$h = 6 \text{ cm}.$$

[The 'explanation' is that, by partial differentiation,

$$0 = (8x + 6h)\delta x + 6x\,\delta h \quad \text{and} \quad 0 = 2xh\,\delta x + x^2\,\delta h,$$

which gives $8x = 6h$; but I was not prepared to accept the above!]

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Correspondence

No longer in our prime

DEAR MR QUADLING,

I wonder how many readers have noticed that whereas 1979 was prime, 1980 is rich in divisors, having 36 including 1 and 1980 itself. We have to go back to 1800 to find an earlier year with as many, and a lot of people (myself included) are unlikely to see the next which occurs 36 years hence in 2016. (In the absence of a handy table of factors I have depended on my own unchecked calculations but believe the results mentioned to be correct.)

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If there is a prize for the most useless piece of information submitted to you, this letter ought to win it!

Yours sincerely.

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Editorial note. The information in Mr Bizley's letter may be "useless", but it set me off on a fascinating line of investigation. Why, I wondered, did 36 occur three times but with no number of comparable size intervening? The answer lies in the fact that 36 can be written as a product in so many different ways—as $4 \times 3 \times 3$, as $3 \times 3 \times 2 \times 2$, as $6 \times 3 \times 2$, and several more. Now the number of divisors of $a^{\alpha-1} b^{\beta-1} c^{\gamma-1} \ldots$ (where $a, b, c \ldots$ are prime) is $\alpha\beta\gamma \ldots$, so we shall get a total of 36 divisors from numbers of the form $a^3b^2c^2$, a^2b^2cd, a^5b^2c, etc. Of Mr Bizley's three years, 1800 $(=2^3 \times 3^2 \times 5^2)$ comes from the first form, 1980 $(= 2^2 \times 3^2 \times 5 \times 11)$ from the second and 2016 $(= 2^5 \times 3^2 \times 7)$ from the third.

When will 36 next be exceeded? Why shall not get 38 until the year 786432 $(= 2^{18} \times 3)$, or 39 until 36864 $(=2^{12} \times 3^2)$. On the other hand, 40 occurred already during Newton's lifetime, in 1680 $(= 2^4 \times 3 \times 5 \times 7)$. I think this is the record so far ... but perhaps this is the point at which to leave further exploration to the reader!

And if, like Mr Bizley, you have no table of factors to hand, you might care to try writing a program to show all the prime factors of a given number on your programmable calculator.
D.A.Q.

Reviews

Statistical education and training for 16–19-year-olds, by a working party set up by the Centre for Statistical Education. Pp. i, 191. £1·95 (including postage). 1979 (Centre for Statistical Education, University of Sheffield)

If you start with the premise "most problems of importance are statistical" you will readily accept the central and all-pervading role of statistics in education claimed, both implicitly and explicitly, by the authors of this report. But difficulties arise from the premise itself (is it true; can you test its truth statistically?) and the working out of the consequences of even a partial acceptance of it. The authors are certainly well aware of these difficulties and, commendably, they make no attempt at facile solutions to problems such as

how do we introduce statistics into the curriculum for all children?
how do we reconcile the claims of statistics and mechanics in A level mathematics?
how do you avoid the 'cookbook' approach when teaching 'users'?
how do you teach statistics as it should be taught?
how shall we train teachers—teachers in all subjects—appropriately?

These, and other, matters that need very careful consideration are thoroughly examined in the report and it would be inappropriate for a review to attempt to survey what is, in effect, a series of surveys in three sections: *Present position*; *Needs at 19+, employment and higher education*; *Future prospects*. However, it may be helpful to point out that it covers statistics in FE (BEC and TEC courses) as well as school courses and includes a useful list of texts with some commentary.

There are a few misprints and some errors, the most striking of the latter being the omission of the MEI syllabuses from Appendix 1 and Table 2.1 (in which the SMP is listed as an examining board!) and an incorrect statement about the SUJB paper AM2. The report will be of interest to all those concerned with syllabus and curriculum development, and a