

## CORRESPONDENCE.

## "A WEIGHTY MATTER."

To the Editor of the *Mathematical Gazette*.

DEAR SIR,—Mr. Grattan-Guinness has been so polite to me personally and has included so many shrewd observations in the superstructure of his article in the October *Gazette*, that it is with regret that I attempt to make him see the fallacy which underlies his argument.

By finding that two identical bodies balance, we may infer that the balance works truly, but *no inference extending our knowledge of the (ex hypothesi) identical bodies can be drawn*. Except therefore as a test of the balance, it seems undesirable that in our teaching we should either place identical bodies in the pans of a balance or suppose them to be so placed.

Mr. Grattan-Guinness says that the balance *compares* weights (equal weights, of course, but a lever would compare unequal weights) but must *measure* something, so it measures masses. It is as if one said "a ruler measures lengths, therefore it calculates the areas of rectangles" For this, the correct version is, "a ruler measures lengths, therefore it enables us to calculate the areas of rectangles, *because we know* the way in which these areas depend on lengths." In the same way, the balance enables us to measure masses, *because we know* or assume that bodies which have at the same place equal weights have also equal masses. But to know this, we must have *beforehand* some idea of the meaning of mass. How is this idea got?

It is *not* got by saying "mass is the property in which identical bodies agree when you have ceased to consider all the properties such as volume, colour, shape, smell, which you can detect by methods other than the use of the balance" No one knows how many different properties a given body possesses, and in any case this explanation is too negative to give any positive idea of mass. A boy does not get the idea of a straight line from the statement that not more than one of them passes through two points, but from something he can see, such as a line drawn in pencil, on which he can base a mental concept. Similarly he gets the idea of mass from one of two ways in which mass appeals to the senses.

The first is as "quantity of matter" The boy buys milk by the pint or butter by the pound and knowing that he does not drink volume or eat weight, he forms the idea of quantity of matter. The difficulties underlying this phrase are well known. Quantity of matter is the product of volume and density, while to explain density is to get round again to mass. Still the idea is a positive one and *one which the boy has got*. One can hear the teacher saying, "If there was only one kind of matter mass would be measured by volume but in some kinds of matter the atoms, particles, protons or what you will, are packed together more tightly than in other kinds of matter. If you could count these protons, etc., you could get a real direct measure of mass. As it is, you have to fall back on the assumption that equal masses have (at the same place) equal weights, and determine masses by weighing."

The second way in which the boy gets the idea of mass is from the difficulty of starting into motion bodies which are at rest and still more from the difficulty of stopping bodies which are in motion. This leads to the dynamical explanation of mass or inertia and does not, as far as I am aware, lead to arguments in a circle such as are involved in "Volume times density" Hence the statement that the inertia idea is the *only scientific* way of explaining mass as opposed to the vague and popular idea of quantity of matter, and hence also the suggestion that the word mass if used scientifically may be replaced by

inertia and that if it cannot be so replaced it is not being used scientifically but in one of its popular senses.

To turn to the later part of Mr. Grattan-Guinness' article. His suggestions of "lig" and "tug" are most attractive but unfortunately most unpractical, for it is extraordinarily difficult to get people to adopt these pet names. Teachers love the pet names which they invent themselves, but regard as undignified and unscientific those which other people invent. I was brought up on "velo" and "celo" and still think they have advantages over "ft./sec." and "ft./sec.<sup>2</sup>" but I fear that "velo" and "celo" are dead. "Slug" survives in use by aircraft designers and that it does so speaks volumes for the forceful personality of its inventor or backer, Professor Perry, but the mere name "slug" has prevented generations of teachers from using the British engineer's unit of mass at all. If Mr. Grattan-Guinness or anyone else other than a dictator can introduce "lig" and "tug", good luck to him. He might begin by trying to get strong resolutions in favour of the idea from the various boards controlling the larger certificate examinations.

Yours truly,

C. O. TUCKEY.

#### THE NEED FOR REFORM IN THE TEACHING OF MATHEMATICS.

To the Editor of the *Mathematical Gazette*.

DEAR SIR,—I hope I may be afforded a little space for some remarks on Mr. Dockeray's article in the October *Gazette*. He gave admirable expression to my own misgivings about the status of mathematics in the schools. Quite apart from any future change in our economic system, envisaged by Mr. Dockeray, the present standing of the subject cannot be regarded as satisfactory.

In the first place, it is a fact that in the Sixth Forms of a large number of schools, mathematics, as a cultural subject, has little chance of existence because the only boys taking it are members of the Science Sixth, who all do physics or chemistry as well. No facilities exist for the mathematical specialist and in these circumstances, mathematics is mainly regarded as a necessary adjunct to the science subjects. As quite a few promising mathematicians are not at all attracted by the chemistry laboratory, they inevitably turn to arts subjects.

Also I cannot help feeling that, in the early stages, some of the modern methods of teaching geometry (for example, construction of models), unless very carefully employed by expert teachers of mathematics, tend to give the subject a materialistic bias from the outset. In trying to widen the appeal of the subject, are we not in danger of diminishing its aesthetic value?

Yours truly,

E. JOHNSON.

#### REFERENCE FOR SIMILAR TRIANGLES.

To the Editor of the *Mathematical Gazette*.

SIR,—The notation for references for similar triangles which Mr. Tuckey suggests on p. 486 of the December *Gazette* seems to me very artificial and entirely unnecessary. A.A.A., S.A.S., S.S.S. are quite enough without bracketing an S. (If he brackets one S, why does he not bracket every S?) There is no danger of confusing congruence and similarity. S.A.S. means only that we have used two sides and the included angle; whether it is for congruence or for similarity is clearly stated in the line at the end of which the S.A.S. is written.