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[Letter from W. F. B.]

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VAP , pmP and the fact that PN , AB are parallel, it is easy to show that

$$x = \frac{a\xi - c\eta}{\eta + a}, \quad y = \frac{b\eta}{\eta + a}.$$

It is of course obvious that this relation provides short proofs of a number of projection-theorems and may be used to establish rigorously the validity of imaginary projection. It is easy to find for instance a simple transformation of this kind which turns the general equation of the second degree into that of a circle, or one which will project any two given points into ω , ω' ; for example, the relation $\xi = \frac{gx}{y-g}$, $\eta = \frac{ify}{y-g}$ projects the points (f, g) , $(-f, g)$ into ω , ω' .

In the final stage, after defining the conic as the projection of a circle and giving the usual projective definitions of the centre, asymptotes, parabola, etc., it may then be shown that every conic is represented by an equation of the second degree and that every conic through ω , ω' is a circle and that $C\omega$, $C\omega'$ are the asymptotes of any circle, centre C . The foci are then defined as the meets of the tangents from ω , ω' to the conic and their properties and also those of confocal conics follow easily from the harmonic properties of the circumscribing quadrilateral.

Although no doubt a considerable amount of rider-work will be essential, this course now leaves the student in the position of being able to use to the fullest degree every form and variation of general projection. And by its aid, many of the more complicated theorems which still lie before him may be reduced to simpler terms and attacked with success. But it should be noted that the extent of previous reading which is required is really of quite a limited character. If, at every opportunity that presents itself, the student is encouraged to compare geometrical and analytical processes, his appreciation of the significance of the properties he is investigating will be deepened and his resources will be strengthened. Each line of attack is adapted to a special range of circumstance and each has its peculiar needs which may be supplied by the other.

C. V. DURELL.

CORRESPONDENCE.

TO THE EDITOR OF THE *Mathematical Gazette*.

SIR,—We have now had approximately ten years' experience of the modern—as opposed to Euclidean—methods of teaching geometry. After such a lapse of time it is only business-like to review the situation.

It is not here my purpose to question the general success of the reform, about which there can be no doubt, but rather to plead for the discussion of a small but vital portion of the subject.

My contention is, reactionary as it may appear, that the absolute elements of geometry should be taught according to *one recognised order*. This, it will be said, would destroy at a stroke the liberty and elasticity of the present methods; but in the preliminary work there can be no such freedom for the individual master; in an average school the mathematical authorities fix the sequence to be followed, and master and boy must conform to it. There is within my knowledge one school where the contrary practice obtained; the beginners in the lower classes encountered no less than three different orders, but the results were not such as to commend the experiment. Apart from this instance, have we not all suffered from and pitied the boy, who, after learning according to one order at a preparatory school, is condemned to follow another later on?

Surely this so-called elasticity, when practised on the beginner, can end in nothing but a truly British muddle, bad alike for the pupil, for his teachers,

and for his examiners. The different methods of approaching the subject have now had a fair trial, and, if geometry is any longer to educate the reasoning faculties, it remains for the Mathematical Association to choose the best method, and to recommend it until a better appears.

Yours faithfully, W. F. B.

ARITHMETIC IN ELEMENTARY SCHOOLS.

DEAR SIR,—Many members of the M.A. must be working in schools in which there are scholars from the elementary schools. The experience of the writer has led him to the conclusion that little or no attempt is made in elementary schools to teach Arithmetic on modern lines. Thus a considerable amount of time has to be taken up in training these boys in methods which should have been placed before them quite at the beginning.

The attention of the teachers in elementary schools should be drawn to the fact that multiplication should be begun with the highest digit and not with the digit of least importance. It is astonishing that the old method is not dead: it is very much alive, especially amongst the female teachers. Pupil teachers who attend secondary schools for a portion of their time where modern methods are in use are sent to be trained to teach Arithmetic in the elementary school to which they are attached. Here the master or mistress persists in the old ways, and when the pupil teachers are called upon to give a lesson in Arithmetic they must not run counter to their instructors, and so the blunders are perpetuated. Enquiry has been made of former pupils, who are at this moment in Training Colleges in London and elsewhere, as to the methods in favour at the schools they attend during their training. "Oh, we are still in the dark up there, we stick to our unit digit." A teacher, who was being helped to prepare for the Certificate Examination, had his attention drawn to the same fact. "Yes," said he, "I have seen it done like that, and I suppose it has its advantages, but when I am giving a lesson I drop into the old method." In cases of this kind what seems to be wanted is a little energetic action on the part of His Majesty's Inspectors. If these gentlemen will administer the necessary amount of shocks things may improve, and if they will steadily set their faces against the use of some abominable text-books much may be done.

Decimals are taken in hand as though the pupils were being initiated into processes absolutely new, and the place values of digits are not properly enforced. As a result, the child who is being stuffed with multiplication sees "one of those d—d dots," as a former Chancellor of the Exchequer is said to have described them, suddenly appear in the product, its position having been fixed by the usual jargon.

In what sort of condition is a boy, who has been so treated, to tackle a simple bit of contracted work? Elaborate directions in carrying out contracted work are not necessary when place values of digits are properly grasped. There is a great saving of time, and logarithms come on the scene without much delay.

"Shop" subtraction is not taught in the place of the ancient method, and Italian Division is ignored, because the teacher has not been accustomed to the method and will not practise it. It is doubtful if any one ever goes back to the cumbrous old method who has once broken away from it. It is sometimes stated that it is more difficult to detect a mistake in division done in the Italian fashion, but familiarity with the method cures this weakness.

The elementary scholar now and again does some wonderful things in division.

It must be remembered that the boys who come from elementary schools to secondary are sometimes the pick of the schools from which they come,