sary and sufficient criterion for the existence of a definite integral was supplied by Cantor and Dedekind.

Thus the great body of analysis had been built up long before the fundamental notion of a limit was completely established.

A somewhat similar course might be traced in the development of modern ideas as to the basis of mechanics.

In Prof. Perry's method, especially in teaching the calculus, it is recognised that this is the natural way to approach the subject, not only for the science as a whole, but in the mind of the individual student, and its foundations are soundly laid on direct geometrical intuition and the notion of a rate of increase, full analytical treatment being left to a much later stage.

This enables the calculus to be introduced at a much earlier stage than usual, and I may here quote the graphic advice of Prof. Burkhardt, all the more striking as it comes from a mathematician distinguished in pure mathematics:—"Dem angehenden Jünger der Mathematik würde ich raten, sogleich mit beiden Füssen in die Differential- und Integralrechnung zu springen." F. M. SAXELBY.

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### Rearrangement of Euclid's Propositions.

I FEEL that Prof. Lodge's proposal to change the order of Euclid Book I., 1–32, is the real solution of the present problem of the teaching of elementary geometry. The budding engineer has his practical mathematics, the embryo wrangler will absorb geometrical truths served up in almost any manner; but the ninety per cent. to whom mathematics is a mere mental training must have their work put before them in an interesting, practical and yet logical manner. I should, however, like to put forward the following three points:—

(*a*) That Prof. Lodge's idea should be carried further, and Euclid, Books I.–VI., divided into four new books, as:—

| | |
|---|---|
| The straight line | — Euclid I. 1–32 in some good order. |
| The circle | — Euclid III. 1–34, IV. 1–5 and escribed circles. |
| Areas | — Euclid I. 35–48, II., III. 35, 36, 37, IV. 6 to end. |
| Proportion | — Euclid V. and VI. |

For Book I., I would suggest an order commencing with I. 32, cor. 2, which is the most general proposition for all rectilinear figures; and also that certain well-accepted riders should be added, many of which form more powerful instruments for solving geometrical problems than the majority of Euclid's propositions; that, in the circle, tangents should be treated as limiting chords; that, in areas, the "alternative" proofs of Euclid Book II. should be *the* proofs; finally, that proportion be done semi-algebraically, using fractional notation $\frac{AB}{CD}$.

(*b*) That it is not necessary—I may say, not advisable—to teach a beginner the words of a strict definition; but he should be given the idea alone, built up from practical use of a set of instruments, the verbal definition following when he is able to appreciate it. I would advocate that the following definitions be substituted for Euclid's unsatisfactory ones.

A straight line is one such that if any part be taken up and applied to any other part *in any manner*, so that its extremities fall on that part, it will coincide altogether.

The angle—the trigonometrical definition.

Parallel straight lines—the converse of axiom XII.

These would lead, for the student, to the ideas that a straight line can be drawn with a *ruler*, an angle drawn or measured with a *protractor*, and parallel straight lines drawn with two *set-squares*, one fixed and the other movable.

If these were accepted, I. 13, 14, 15, 27, 28, 29 follow almost axiomatically, and we are enabled to prove I. 32, cor. 2, by a supposititious construction, obviating such practical proofs as "walking round the sides" or Prof. Minchin's better idea of placing a pin along a side and moving it round, substituting a purely geometrical proof.

(*c*) That it is unreasonable to bar supposititious proof-constructions—*e.g.* in the bisector proof of I. 5. For no exception is taken to the particular enunciations of I. 4 or I. 8, although at that stage we are unable to *draw* one triangle with its parts equal to those of the other. J. M. CHILD.

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### The Sweet Briar as a Goat Exterminator.

THE introduction of the sweet briar into Australia, in many parts of which it is naturalised, affords a striking illustration of the mode in which the balance of nature may be disturbed in a wholly unforeseen way.

The fruit of the sweetbriar consists of a fleshy receptacle lined with silky hairs which contains the seed-like carpels.

I extract from the *Agricultural Gazette of New South Wales*, vol. xiii., No. 3, March, 1902, p. 313, the following note by Mr. E. A. Weston, a well-known veterinary surgeon of Launceston, Tasmania:—

"With reference to *Rosa rubiginosa*, I thought it might interest you to know that the hairy linings of the fruit caused the death of a number of goats here by forming hairy calculi, which mechanically occluded the lumen of the bowels. These goats were put on the land with the idea that they would eat down the briars and ultimately eradicate them, but the briars came out best and eradicated the goats. The cattle running on the land are also very fond of the briar berries, and from time to time one will die, and on *post-mortem* no pathological changes can be found in any of the organs, nor do the hairy calculi appear in them, although their various stomachs are one mass of the briar seeds."

Kew. W. T. THISELTON-DYER.

### Stopping down the Lens of the Human Eye.

IN photography, if the lens is affected with spherical aberration or other defects, or if the aperture is too large for good definition, the operator usually gets over the difficulty by using a smaller aperture or stop. This improves the definition and makes the picture sharp even to the corners of the plate. This process is technically called "stopping down the lens." In amateur landscape work I generally use an aperture or stop with a diameter of one-fiftieth of the focal length of the lens, or *f*/50.

But the human eye has defects, especially as we get old. For instance, the curvature of the crystalline lens becomes too flat, &c., and we have to use spectacles to enable us to read. Reasoning by analogy, diminishing the aperture of the eye by "stopping down the lens" ought to improve defective definition and make the vision sharper, and experiment proves that such is actually the fact. I find that the best effect is obtained by holding a thin metal plate close to the eye, with an aperture in it one-fiftieth of an inch in diameter. This arrangement resembles the old single landscape lens used in photography. The small stop is in front, the lens in the middle and the sensitive plate or retina at the back. I use convex spectacles myself for reading, but with a stop of that size I can easily read small print within 4 inches of the eye (or even less) in a good light without spectacles. I have tried the experiment with several of my elderly friends, and in every case with success. Anyone can try the experiment by means of a pinhole in a card.

I do not know exactly what is the focal length of the lens of the human eye, but supposing it to be half an inch, then with a stop of one-fiftieth of an inch the technical expression for the size of the stop would be *f*/25, or double the diameter of the one I use in landscape photography. I enclose a metal disc with such an aperture. By looking through it I can read the smallest type in NATURE at 4 inches from the eye. WM. ANDREWS.

Steeple Croft, Coventry, April 25.

### Prisms and Plates for Showing Dichromatism.

DICHROMATISM, or the change of colour of an absorbing medium with increasing thickness, is usually shown with plates of coloured glass. It is not always easy to obtain the right kind of glass, and only a few of the aniline dyes are suitable for the purpose. The medium should transmit two distinct regions of the spectrum, the absorption coefficient for one being greater than for the other. I have found that it is better to give the medium the form of a prism, for then the transmitted colours are separated, and the more rapid fading of one as the eye is moved from the refracting edge to the base can be followed. A number of years ago I found a small amount of an unlabeled dye which transmitted a red band and a green band, that is, it had a strong absorption band in the yellow and the blue. Thin layers of this dye were bright green, thick layers were blood red. I have never been able to find the dye again, though I have examined a large number of dyes, but I have found that a mixture of commercial "brilliant green" with a little naphthol yellow has