while those on the other cut both in and out. This particular property is not shown by the model as constructed, with the present choice of co-ordinates. If, however, we had measured entropy horizontally in the diagram, then the isentropics, being vertical, might be tangent to cut through the steam-line. This choice of co-ordinates has, however, seemed impossible for the reasons previously given.

We may if we wish discuss the question by a different method. The lines drawn in Figs. 1 and 2 are all lines through the critical point. In Fig. 1 the lines of constant pressure and

FIG. 2.

temperature are tangent to the broken line; Fig. 2 shows the same property. In Fig. 1 the line of constant entropy cuts the broken line twice, but no other pair of lines has more than one intersection. Fig. 2 does not, as drawn, show the same property. In Fig. 1, passing from the water-line around the critical point in the homogeneous region to the steam-line, one cuts the lines in the following order: water-line, pressure, temperature, entropy, volume, pressure, temperature, entropy, steam-line. Fig. 2 gives the same order, with the choice of co-ordinates, which we have adopted, if we let the temperature lines always

FIG. 3.

slope downward, as do the pressure lines. With this change the two diagrams seem to agree, but otherwise their disagreement seems hopeless.

I shall be very glad to receive from any one any suggestion which will help to remove the apparent disagreement between the two diagrams, or so modify the model that it may more completely represent the possible properties of actual bodies than it now seems to do.

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The University of California,
Berkeley, Cal., U.S.A., February 1.

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To Calculate a Simple Table of Logarithms.

A YEAR ago Prof. Perry drew attention to a method by which a schoolboy knowing how to extract square roots could, with the help of squared paper, construct a table of logarithms (NATURE, February 23, 1899).

It does not appear to be known that it is possible for a boy to make a simple table of logarithms in a few minutes without even knowing square root in arithmetic.

Up to a few years ago the teaching of logarithms in schools was generally deferred until they were required in trigonometry for the solution of triangles, but the general introduction of practical physics into secondary schools has resulted in the teaching of logarithms to younger boys.

The following method which I have introduced into several Schools of Science in my district has been carefully tested in classes of boys of about thirteen years of age with excellent results.

On a sheet of squared paper ruled in inches and tenths, plot logarithms to base 2: $\log 2 = 1$: $\log 4 = 2$: $\log 8 = 3$: $\log 16 = 4$, and draw a curve.

It will be found convenient to arrange numbers from 1 to 16 on a horizontal axis, taking 1" as unit, and the logarithms on the vertical axis, taking 3" as unit.

From the curve read off the value of $\log_2 10$, which will be found to be approximately $3\frac{1}{3}$. Let us assume that $\log_2 10$ is exactly $3\frac{1}{3}$.

On any system of logarithms $\log 4 = 2$: $\log 2 = 1$: $\log 8 = 3$: $\log 16 = 4$, &c. Hence the curve obtained may be used to represent

The left-hand vertical column of figures in the diagram represent scale logs. to base 2, and the right-hand column scale logs to base 10.

logarithms to any base if the ordinates are measured on a suitable scale.

The scale used for measuring logs. to base 2 is a plain scale. To construct a scale for measuring logs. to the base 10, write $\log 10 = 1$ instead of $3\frac{1}{3}$; and as this falls on the 10th line, the distance from 0 to 1 can be at once divided into 10 parts, and numbered 0.1: 0.2, &c., the finer lines (not shown in the diagram) giving the second decimal place.

Having assumed that $\log_2 10 = 3\frac{1}{3}$, $\log_{10} 2$ becomes .300 instead of .301, so that the values from the curve are in error to the extent of $1/300$; but this is not greater than small errors due to the freehand drawing of the curve and irregularities in the ruling of the squared paper.

ARTHUR DUFTON.

Sheffield, February 13.

THE publication of Mr. Dufton's method will, I think, serve a useful purpose. It is a common exercise in schools to plot on squared paper, numbers and their logarithms to the base 2 (see Blaine's "Methods of Calculating," Spon), to give a general notion of how the logarithm varies as the number varies; but I have never known it to be made a method of calculation. Indeed, I do not think it right to give a boy the idea that he may find $\log 10$ by interpolation between $\log 8$ and $\log 16$. There is a specious appearance of accuracy due to the fact that $\log_2 10$ is so nearly $3\frac{1}{3}$; and Mr. Dufton heightens it by using