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MATHEMATICAL NOTES.

598. [A. 1.] *A Simple and Elementary Method of Multiplication.*

The following example is self-explanatory:

9	9	7	2	4		
		8	3	4		
72	72	56	16	32		
	27	27	21	06	12	
		36	36	28	08	16
83	1	6	9	8	1	6

Is this original?

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599. [R. 4. c. d.; V. a. μ.] What is the orthodox way of solving the following problem?

"A framework of light rods is in the form of an isosceles triangle ABC, the middle point D of the base BC being connected by light rods to E and F, the middle points of the equal sides AB, AC. The framework is maintained in a vertical plane by supports at B, C, BC being horizontal. Equal weights are hung from A, D, E, F. Draw a diagram showing the stresses in the various rods." [Sci. Schol. Ox.:—University, Balliol, Oriel, etc. Dec. 1920.]

600. [V. 2. 10.] The same paper also contains the following question:

"A body moves under an accelerating force g and against a frictional resistance. Investigate its motion when the frictional resistance varies

(1) directly as the velocity v,

(2) as $av+bv^2$."

The second part of this question seems a very long piece of work for a paper of this sort to require.

Is it too much to ask for a definite pronouncement as to the amount of mathematical equipment expected from candidates for Science Scholarships at Oxford, Cambridge and elsewhere?

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Mr. W. J. Dobbs replies as follows to the first of the above queries: (1) It is, I believe, an accepted principle, that, in designing a light jointed framework, the bars should be made so strong that there is no need to call upon any joint for a constraining couple. Rigidity in a joint becomes then an added source of strength. Hence, in drawing the stress diagram of a light jointed framework, all joints are reckoned as free, and bars connecting different joints are reckoned as separate bars.

(2) Again, "if a framework has n joints, it requires $2n-3$ bars to make it rigid." "In a strictly indeformable figure $s=2v-3$," s being the number of sides and v the number of vertices.

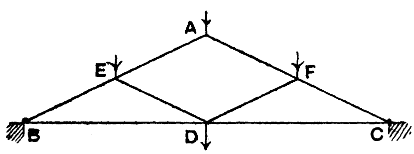

Fig. 1.

In agreement with (1) the given framework has 6 joints but only 8 bars. It is therefore, by (2), not strictly indeformable, having one bar short. But it may be contended that if the joints B and C are both fixed, there is added in effect a ninth bar BC. Yes; but $BDCB$ does not form a triangle; also the supporting forces at B and C cannot be vertical. Without appreciably increasing the lengths of BD and DC, the joint D may sink appreciably. The space and stress diagrams are then as shown below. When BD and DC each $\rightarrow$ horizontal lines, RL and TQ each $\rightarrow \infty$, *i.e.* the tension in each tie-bar $\rightarrow \infty$.

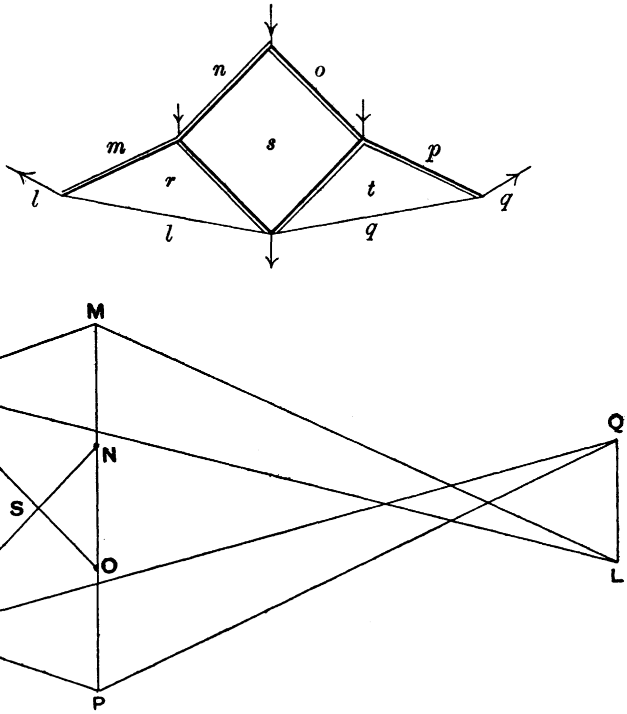

FIG. 2.

W. J. DOBBS.

601. [K¹. 1. 6.] *On the Bisectors of the Angles between two Straight Lines.*

Let the lines $x \sin \alpha - y \cos \alpha = p$ and $x \sin \beta - y \cos \beta = q$ meet the axes of X in A and B.

Then one of the bisectors is

$$(x \sin \alpha - y \cos \alpha - p) + (x \sin \beta - y \cos \beta - q) = 0,$$

$$i.e.\ 2x \sin \frac{\alpha+\beta}{2} \cos \frac{\alpha-\beta}{2} - 2y \cos \frac{\alpha+\beta}{2} \cos \frac{\alpha-\beta}{2} = p + q,$$

$$i.e.\ x \sin \frac{\alpha+\beta}{2} - y \cos \frac{\alpha+\beta}{2} = \frac{p+q}{2 \cos \frac{\alpha-\beta}{2}}, \quad \text{..................(I.)}$$

and since this makes an angle $\frac{\alpha+\beta}{2}$ with OX, it cuts the axis between A and B.