The Elements of Quaternions *(First Paper).*

By Dr WILLIAM PEDDIE.

In this paper the laws of addition and subtraction of vectors were considered, and examples of their extreme usefulness in geometrical applications were given.

Adams's Hexagons and Circles.

By J. S. MACKAY, M.A., LL.D.

FIGURE 24.

In triangle ABC, AD, BE, CF are concurrent at O; through O parallels are drawn to EF, FD, DE, meeting the sides of ABC in L, M, P, Q, S, T, and the sides of DEF in L′, M′, P′, Q′, S′, T′. The two hexagons LMPQST, L′M′P′Q′S′T′ thus formed have the following properties:

(1) The sides L′M′, P′Q′, S′T′ of the latter are parallel to the sides of ABC.

The complete quadrilateral AFOEBC has its diagonal AO cut harmonically by EF and BC;

therefore A, U, O, D is a harmonic range,

and E·A U O D is a harmonic pencil.

Now OP′EQ′ is a parallelogram;

therefore P′Q′ is bisected by EO;

therefore P′Q′ is parallel to that ray of the harmonic pencil which is conjugate to EO, namely EA.

In like manner S′T′ is parallel to AB, and L′M′ to BC.

(2) The sides QS, TL, MP of the former are parallel to the sides of DEF.

Since PEQ′P′ and QEP′Q′ are parallelograms,

therefore PE = QE.

Similarly TF = SF;

therefore PE : QE = TF : SF.

Now PT is parallel to EF;

therefore QS is parallel to EF.

In like manner TL is parallel to FD, and MP to DE.

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