see that $d = 0$. Thus $(c_{14} + c_{24})I_1 = 0$. Apply $x_2 = x_2' + x_1'$, whence

$$c_{13}' = c_{13} + c_{23}, \quad c_{14}' = c_{14} + c_{24}, \quad b_1' = b_1 + b_2 + c_{12}.$$

Then $c_{14}I_1 = 0$. Hence every $c_{ij}I_1 = 0$, $I_1 = lA_4$. But I_1 is free of A_4. Hence $I_1 = 0$, $I = 0$, $S = 0$.

THEOREM. *Every linear covariant of* q_4 *is a linear function of* L, A_4L, KL.

Next, let $\omega > 1$. After subtracting from C a constant multiple of $q_4L^{\omega-2}$, whose leader is b_4u, we have $d = 0$ in S. Express S_1 as a polynomial in c_{12}, c_{13}, b_1, and call p the coefficient of their product. The coefficient of $c_{12}c_{13}$ in $S_1' - S_1 = S$, found from (1), is $p(b_4 + c_{14})$, and hence vanishes if $b_4 = c_{14}$; while S itself vanishes if also $c_{24} = c_{34} = 0$. Applying these two conditions to $S = I + b_4I_1$, we find that

$$S = (b_4 + 1)k(n + mK), \qquad n, m \text{ constants}.$$

Several tests failed to exclude this leader. Whether or not there are covariants with such a leader S is not discussed here.

In this connection, note the covariant

$$\Sigma c_{ij}(x_i x_j^{2^r} + x_i^{2^r} x_j) \quad (i, j = 1, \cdots, 4;\ i < j),$$

obtained by replacing the variables in the polar of (x) with respect to q_4 by $x_k^{2^r}$ $(k = 1, \cdots, 4)$.

6. By means of the corollary in § 4, and transformation (1), we readily obtain the

THEOREM. *Every quadratic covariant of* q_4 *is a linear function of* L^2, KL^2, Iq_4, *where* I *is an invariant.*

UNIVERSITY OF CHICAGO,
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THE CONVERSE OF THE HEINE-BOREL THEOREM IN A RIESZ DOMAIN.

BY DR. E. W. CHITTENDEN.

(Read before the American Mathematical Society, April 11, 1914.)

IN various generalized forms of the Heine-Borel theorem*

* Cf. M. Fréchet, "Sur quelques points du calcul fonctionnel," *Rendiconti del Circolo Matematico di Palermo*, vol. 22 (1906), p. 26; and T. H. Hildebrandt, "A contribution to the foundations of Fréchet's calcul fonctionnel," *Amer. Jour. of Mathematics*, vol. 34 (1912), p. 282.