through E' Hence the axes, vertices and foci of sections through l lie on the polar plane of E', which passes through l', and the V locus is the section by this plane. The tangent cones from Q, Q' have for their curve of intersection QQ' twice and a conic, the locus of the focus F, in the polar plane of E'. This conic has four-point contact with the V locus at R. In cases (i) and (ii) l' does not lie in the plane o, and we can express the V and F loci in the forms $xy=c$, $xy+ay^2=c$, where VF is given, for varying planes through l, by intercepts parallel to the x-axis. It follows immediately that of parallel parabolic sections two are equal but " pointing in opposite directions " In cases (iii) and (iv) the tangency of l is replaced by its passage through the point of intersection of the lines of S, and l' lies in o, with the trivial special case when l and l' coincide with one of the lines. Excepting this special case the V and F loci are parabolas which can be expressed in the forms $y^2=ax$, $y^2=ax-b$; it follows immediately that VF is constant in magnitude and sign for a given l and all the derived sections are therefore equal and " pointing the same way ".

H. G. G.

CORRESPONDENCE.

KARL PEARSON'S SELECTION FORMULAE.

To the Editor of the *Mathematical Gazette*.

SIR,—In " An Inquiry into the Prediction of Secondary School Success " (University of London Press, 1942) Mr. W. G. Emmett used Karl Pearson's selection formulae to calculate what the correlations between entrance tests and subsequent success would have been had the whole age-group of children gone on into secondary schools. The necessary data for this calculation were accessible in the experiment, though usually they are lacking.

Mr. Frank Sandon, reviewing Emmett's book in the *Mathematical Gazette* (December, 1942), has questioned his use of Karl Pearson's formulae on the ground that they are only applicable when all the distributions are normal, both in the population and sample, whereas in secondary school selection the sample is the upper tail of a distribution, sharply cut off (though not so sharply as Mr. Sandon imagines in any one test, when the sum of three scores is used for selection). I wish to support the view that these selection formulae *are* applicable here, and to quote some experimental and theoretical evidence. In view of the editor's need for brevity I shall give few details.

In the first place Mr. Emmett had previously made a large number of calculations on data from Northumberland, where the actual correlations in a certain population were known, and found a substantial amount of agreement when estimates from truncated samples were made using Pearson's formulae. Mr. Emmett is absent on war service but I have his calculations before me.

Recently I have had data from Leicester through my hands which permit of the same calculation and check. Of 1390 boys, 245 went into secondary, 214 into intermediate, and 931 into senior schools. A certain correlation coefficient was known to have the value ·926 in the whole population of 1390. The actual values in the above three samples were ·841, ·671 and ·881 respectively. Estimated by Karl Pearson's formulae the population values found were ·912, ·916 and ·932 respectively. The case of the intermediate school sample is the most relevant here, for the selection was solely on a test and the cutting off quite sharp. In the secondary school sample this is not so definitely the case as fee-paying pupils with lower scores were present. Similar results were found for the 1189 girls.

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It can be shown theoretically that Pearson's formulae apply to a wider range of distributions than the normal. Mr. D. N. Lawley has recently set out the necessary and sufficient conditions to be fulfilled (*Proceedings of the Royal Society of Edinburgh*, July, 1943). They are (1) that regressions must be linear and (2) that for any set of values of the variables to be selected directly, the partial standard deviations and correlations of the other variables must be the same as for any other set of selected values.

If the original distributions are linear in their regressions and sufficiently normal, and the selections are made by cutting off upper tails, these two conditions will be met. Yours, etc., GODFREY THOMSON.

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Edinburgh.

DEAR SIR,—I have to thank Prof. Thomson for bringing to my notice the recently published paper by Mr. Lawley, and the Leicester figures. Prof. C. Burt has recently been working on the same problem, and in the *British Journal of Psychology* (1943, Sept., XXXIV, 1, pp. 7-17) considers Pearson's formula and applies his results to some L.C.C. figures. He reaches much the same conclusions as Thomson, viz. that if certain conditions, not too remote from actual practice, are fulfilled, the formula is appropriate in selection-by-examination practice and will give reasonable approximations. Both these papers have, of course, been published since my review (*M.G.*, December, 1942). Yours sincerely, FRANK SANDON.

GLEANINGS FAR AND NEAR.

1438. The discovery that mathematics is good for the child's character, which was made at a recent educational conference, ought to be hushed up. The average boy approaches trigonometry with sufficient reluctance as it is : the belief that it will strengthen his character may well plant an ineradicable phobia in his mind. In any event, we flatly refuse to endorse the theory that to prove that the square on the hypotenuse equals the sum of the squares on the other two sides has anything to do with character at all. The world is full of delinquents who can perform that kind of sleight of mind in their sleep.—*The Scotsman*, April 22, 1943.

1439. Pyramids, Arches, Obelisks, were but the irregularities of vain-glory, and wilde enormities of ancient magnanimity. But the most magnanimous resolution rests in the Christian Religion, which trampleth upon pride, and sets on the neck of ambition, humbly pursuing that infallible perpetuity, unto which all others must diminish their diameters and be poorly seen in Angles of contengency (*d*).—Sir Thomas Browne, *Hydriotaphia, Urne-Buriall* (1658), p. 29.

The author's marginal note is : (*d*) *Angulus contingentiæ*, the least of Angles. This is the angle between a circular arc and the tangential halfline at one end of it. Although the measure of the angle is zero, whatever the radius of the circle, to commonsense it is clear that the angle increases as the radius diminishes ; herein are the makings of the prettiest of scholastic quarrels. Doubtless Browne owed, if not his knowledge of the subject, at least the readiness with which it came to his mind in 1658, to the publication in 1656 of Wallis' *De Angulo Contactus et Semicirculi Disquisitio Geometrica*, which is to be found in the second volume of Wallis' *Opera Mathematica*, where it is followed by a *Defensio* published in 1685.—[Per Prof. E. H. Neville.]