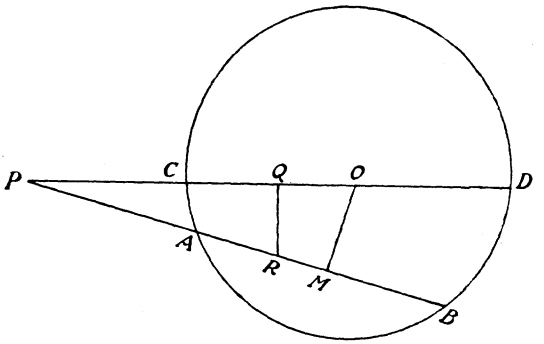
If we take the figure, in which CD is a diameter passing through P, of a circle whose centre is O and AB a chord passing through P, whose mid point is M, and QR is the polar of P cutting CD in Q and AB in R, then $\hat{OQM} = \hat{OMA} = 90°$ and $OQ \cdot OP = OC^2$.



If we substitute P, Q, C, D, O for P, R, A, B, M in the formulae (1), (2), (3), (4), then $OQ \cdot OP = OC^2$ corresponds to (2), and formulae corresponding to (1), (3), (4) an equivalent to it. If we start from any one of these, and deduce from it any of the 4 original formulae, then we have obtained a proof of the theorem for which five proofs have already been given. Our first proof is of this type.

As another example, let us deduce (4) from the corresponding formula

$$PQ^2 = PO^2 + OQ^2 - 2OC^2.$$

We have

$$\begin{aligned} PR^2 &= PQ^2 + QR^2 \\ &= PO^2 + OQ^2 - 2OC^2 + QR^2 \\ &= PM^2 + MO^2 - 2OC^2 + OQ^2 + QR^2 \\ &= PM^2 + MO^2 - 2OC^2 + OR^2 \\ &= PM^2 + MO^2 - 2OC^2 + OM^2 + MR^2 \\ &= PM^2 + MR^2 - 2(OA^2 - OM^2) \\ &= PM^2 + MR^2 - 2AM^2. \end{aligned}$$

Q.E.D.

R. F. MUIRHEAD.

REVIEWS.

Geometry for Beginners. By C. GODFREY, M.A., and A. W. SIDDONS, M.A. Pp. x+80. Price 1s. (Cambridge Press.)

The preface states that "this book has been largely inspired by the Board of Education's Circular on the Teaching of Geometry (and Graphical Algebra) in Secondary Schools," and, further, that it consists of:

"First Stage. Introductory practical work concerned with the fundamental concepts, and not primarily designed to give facility in using instruments.

"Second Stage. Experimental work leading up to the discovery of the fundamental facts of geometry; including angles at a point, parallels, angles of a triangle and polygon, congruent triangles."

As a consequence of these aims, the book is to all intents and purposes a collection of nearly 500 questions, with a few definitions and statements of the facts which have been learned from the answers to the questions. Many of the questions are exceedingly simple verbal questions. The authors have succeeded very well in what they have set out to do. The only place in which they are liable to criticism is in their treatment of the difficult question of parallel straight

lines. The word 'parallel' first occurs on p. 12, and next in Ex. 158, which asks for instances of parallel straight lines; but the term appears to require a little more explanation in lieu of a formal definition. No doubt the intention is that the teacher should fill in such gaps as this.

The pupil who has worked through this book is in a position to take up the authors' Elementary Geometry at the section on Constructions. A special edition of the latter book is now issued without the part which this little book supersedes.

Experimental Mechanics for Schools. By F. CHARLES, B.A., and W. H. HEWITT, B.A., B.Sc. Pp. 288. Price 3s. 6d. (George Bell & Co.)

Here we have a book of experiments and examples interspersed with a number of theoretical proofs of certain theorems of both Statics and Dynamics. The general plan appears to be to establish experimental results when possible, and sometimes to add a theoretical proof as well. The scope of the book is wide, extending to graphical work on frames and moments of inertia.

The book gives one the impression that too much has been attempted, so that there is a lack of completeness; thus, while 'resultants' and 'equilibrants' are explained, 'moments' and 'centres of gravity' are not. A property of couples is used before the word 'couple' is defined! Unfortunately, the authors have allowed a number of serious errors to pass in the proof. For instance, the experiment in § 24 is not satisfactorily explained, and might easily, as it appears, give rise to an erroneous conclusion. The enunciation of § 52 is not quite what was intended. In § 55 four forces in equilibrium are acting on a body; it is not true that "evidently the rigid body could have been replaced by any system of rods, provided only that their extremities lay on the lines of action of the forces."

On page 33 is a list of C.G.'s, but those of a circular arc, a circular sector, and a spherical sector are wrong.

A more serious error is, however, to be found in the chapter on motion in a circle, from which it would appear that $\frac{mv^2}{r}$ is a force acting *on* the body *away* from the centre of the circle. No attempt is made to explain it as a *fictitious outward* force for the purpose of reducing the dynamical equations to statical ones. It is impossible to be too careful in dealing with the so-called centrifugal force.

The definitions arising in connection with the Laws of Motion are exceedingly vague in § 98, and in several other places the book wants most careful revision. The authors, in fact, seem sometimes to be giving a logical sequence of results of mechanics, and sometimes to be merely providing an experimental companion to such a course.

The experiments described are mostly familiar ones—Atwood's machine appears amongst them. The most attractive feature of the book is its fine collection of examples. The miscellaneous examples cover 86 pages. The last 41 examples are practical ones taken from Civil Service and L.C.C. papers.

Elementary Algebra. By A. E. LAYNG, M.A. Pp. 464, with Answers. Price 4s. 6d. (Blackie.)

Mr. Layng's book takes the pupil from the very beginning of the subject as far as the Experimental and Logarithmic Series, and almost the last piece of work is the method of calculating Napierian Logarithms. The book rightly follows what ought to be the universal practice of introducing simple equations at a very early stage. Factorisation is taken immediately after Multiplication, and simple identities are proved by the Remainder Theorem immediately after Division. Graphical methods of solving equations are given, and the opportunity is taken of doing some coordinate geometry of the straight line and circle. Other interesting features are the early introduction of Inequalities, Ratio, Proportion, and Variation, and the very sensible plan of giving a short chapter on Convergence, before dealing with the Binomial Theorem for any index.

The explanations are lucid throughout, as in this author's other books, and there are large numbers of examples, chiefly of the formal type; but we believe that this and most other algebras would be much improved by a larger number of more 'practical' examples in the interests of those pupils whose studies are not likely to go beyond such a book as this. In particular, such examples as the