

4. On the Real Nature of Symbolical Algebra. By D. F. Gregory, B. A.

The object of this paper is to determine in what consists the difference between general Symbolical Algebra and the sciences subordinate to it, particularly Arithmetical Algebra. The view which the author takes is, that Symbolical Algebra takes cognizance only of the laws by which the symbols are combined, without considering the nature of the operations represented. The greater part of the paper is occupied in applying this definition, by shewing what are the laws to which are subject the various symbols of operations we are in the habit of using ; and one or two examples are given of the advantages derivable from this way of considering the subject—particularly with respect to the connection between the arithmetical and geometrical meanings of $+$ and $-$. The chief application of the theory may be said to be the elucidation of the causes of analogies between operations by no means similar in their nature.

2. On a New Method in the Conic Sections. By J. Scott Russell, Esq.

In this paper the author institutes an examination of the various methods of conceiving and constructing the conic sections, the different standards of comparison to which they have been referred, and the means by which their properties have been developed and expressed in the ancient and modern schools of mathematics. He finds that the constitution of the curves *in plano* by means of their remarkable properties, and the demonstration of their other properties from the constitution so obtained ; have been noticed by Eutocius in the 6th century, and by him referred to Apollonius, although the formal adoption of the plane method is generally referred to a recent date.

The author agrees with modern writers in considering the plane method in the conic sections as more philosophical, as well as more useful, than the solid method ; but he differs from them in the methods of constituting these curves, without reference to what he considers their proper origin and standards of reference. Apollonius employed the straight line and circle to constitute his cone ; or, in other words, he derived the conic sections from the straight line and the circle, using the cone as the *mechanism of derivation*. Mr Russell has succeeded in deriving the conic sections from the straight line

and circle directly, without the intervention of the cone. He thus removes the conic sections altogether from the geometry of solids into the geometry of planes, according to the modern method, without separating them from the family of the circle to which they properly belong.

The definition from which he sets out is this : If between a given circle and its tangent straight line there be traced a curve whose distance from the circle shall bear a constant proportion to its distance from the straight line, that curve is a conic section, and according as the given ratio is one of equality, deficiency, or excess, the cone becomes a parabola, ellipse, or hyperbola.

The author shews with how much facility the other properties of the curve follow from this constitution : he gives examples of some of these; shews a new and remarkable property of the tangents of the conic sections, and proves that they may be readily identified with the sections of the cone from the constructive property alone, without the intervention of any derived property.

[The Meetings were adjourned till the first Monday in November.]