

IV. "A Third Memoir on Quantics." By ARTHUR CAYLEY, Esq., F.R.S. Received March 13, 1856.

The object of the author in the present memoir is chiefly to collect together and put upon record various results useful in the theories of the particular quantics to which they relate. The tables at the commencement relate to binary quantics, and are a direct sequel to the tables in the author's second memoir upon Quantics, Phil. Trans. vol. cxlvi. (1856). The definitions and explanations in the next part of the present memoir are given here for the sake of convenience, the further development of the subjects to which they relate being reserved for another occasion. The remainder of the memoir consists of tables and explanations relating to ternary quadrics and cubics.

V. "Elementary Considerations on the subject of Rotatory Motion." By W. GRAVATT, Esq., F.R.S. Communicated by the Rev. J. B. READE, F.R.S. Received March 12, 1856.

(Abstract.)

The author explains the subject of rotatory motion in a series of propositions by the use of prime and ultimate ratios. He commences with a simple problem, determining the law of the forces by which a particle of matter is deflected into any given course, and pursues the inquiry by a consideration of the effect of these forces as referred to a sphere, going on to the investigation of the character of the motion of any body enclosed within an imaginary sphere, such sphere itself being supposed to revolve upon two axes inclined at any angle to each other. Hence the author determines the position of some point of the circumscribing sphere momentarily at rest, or in other words, of the *resultant axis*, from which he insists that all centrifugal forces must really be calculated.

His first application of the law thus enunciated is to the motion of the peg-top; and upon the principles he has already laid down, he shows that there is in the first instance rotation round a momentary horizontal axis, calling up rotation round a momentary vertical axis;

and that the ratio of the velocities of these two rotations, together with the length of the peg, determines the angular inclination of the top, contrary to the received explanation as given by Euler and other mathematicians.

The law is further applied to the effect produced upon a falling body by the axial rotation of the earth, in the discussion of which, La Place, in the opinion of the author, has committed two important errors one in denying any deviation towards the equator, the other ; in his calculation of the amount of the deviation towards the east.

This is followed by an investigation of the motion or direction of flight of a cannon-ball or shell fired in a northerly or southerly direction, from which it appears that a large shell will be subject to a deviation from the true line of projection, in consequence of the earth's rotation, amounting to no less than 22 feet.

The author then refers to the well-known experiment of M. Foucault for proving sensibly the rotation of the earth, and shows from calculation that the errors which would be sufficient to vitiate the results in this experiment are so extremely minute and so difficult of avoidance by any perfection of manipulation which can be employed, that its performance cannot perhaps be safely adduced as proving such rotation.

The author illustrated his views by the exhibition to the meeting of a model apparatus, in which the vertical and horizontal motions may be variously combined, but which could not be intelligibly described without a series of complicated drawings unfitted for the compass of a mere abstract.