

(3)  $\Psi$  is defined by the equation  $\Psi = Z - \frac{dP}{dt}$ , in which (after the explicit differentiation of  $P$  with respect to  $t$ ),  $x_1$ , &c.,  $y_1$ , &c. are to be expressed in terms of the new variables.  $y_1$ , &c. are thus expressible by the help of the  $m$  equations  $\frac{dP}{d\xi_i} = \eta_i$  and the  $n-m$  equations  $\frac{dL}{dt} + \sum_i \left( \frac{dL}{dx_i} \frac{dZ}{dy_i} \right) = 0$ .

If  $(x_1)$ , &c., do not contain  $t$  explicitly, then  $\frac{dP}{dt} = 0$ , and  $\Psi$  is obtained merely by expressing  $Z$  in terms of the new variables.

It may be observed that the whole of the above reasoning would apply to the case in which the new variables  $\xi_1, \dots, \xi_m$  are more in number than the independent variables of the problem (or  $m > n-r$ ), *with this exception*; that the  $m$  equations  $\frac{dP}{d\xi_i} = \eta_i$ , together with the  $r$  equations obtained by differentiating the equations of condition totally with respect to  $t$ , would be *more than sufficient* to express  $y_1, \dots, y_n$  in terms of the new variables; consequently  $y_1$ , &c. might be so expressed in *different ways*, and therefore, although the *value* of  $\Psi$  obtained by the above rule would certainly be the same as that obtained by recurring to the original formula (D.), the *form* of  $\Psi$  might be different, and therefore the resulting formula erroneous.

There must doubtless exist some rule for choosing  $n-m$  combinations of the equations of condition in such a way as to lead to the correct *forms* of  $y_1, \dots, y_n$  as functions of the new variables; but I have not at present attempted to investigate it, and perhaps it would be hardly worth while. The theorem in the case in which the new coordinates are independent, may, I believe, be practically useful.

#### ERRATA IN PART I.

Art. 1. equation (4.), for  $dx$  read  $dx_i$ .

Art. 10. In paragraph preceding equation (26.) *omit* the words "not containing  $t$  explicitly."

Art. 18. equation ( $\beta$ ), for  $y_i$  read  $y'_i$ .

Art. 19. equation (29.), for  $h_i$  read  $b_i$ .

Art. 24. second line after equation (L.), for "such as  $h, k$ " read "such as  $f, g$ ."

Art. 30. The expressions equated to  $h, k, c$ , and the three terms in the left-hand column of the table of elements, should each be multiplied by  $m$ .

Art. 42. near the end, for "according as  $\Theta$  is between  $\circ$  and  $\pi$ , or not" read "according as  $\Theta$  is between  $\pi$  and  $2\pi$ , or between  $\circ$  and  $\pi$ ."