XIII. Reflections on the resolution of algebraic equations of the fifth degree

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XIII. *Reflections on the Resolution of Algebraic Equations of the Fifth Degree.* By G. B. JERRARD.

[Continued from vol. xxvi. p. 574.]

47. **T**HE remarks in No. 44, related to a difficulty which must arise if we can, as seems to have been proved, succeed in tracing the equation for W to a class of equations of the sixth degree, the solution of which can be effected. I have lately reconsidered the subject of that number, and the exact nature of the difficulty in question will, I think, appear from what follows.

Since every symmetric function of the quantities V_1, V_K, V_L will be such as to remain unchanged whilst one of the roots, x_1 , continues fixed, and x_2, x_3, x_4, x_5 are permuted in every possible way among themselves, it might easily be shown that the equation for V ,

$$V^{15} + C_1 V^{14} + \dots + C_{15} = 0,$$

will admit of being resolved into five factors of the form

$$V^3 + \frac{1}{5} C_1 V^2 + r_2(x_\alpha) V + r_3(x_\alpha) = 0,$$

obtained by writing 1, 2, 3, 4, 5 successively for α : r_2 and r_3 being expressive of rational functions, and such that $r_n(x_\alpha)$ shall essentially involve x_α . In this equation, therefore, we cannot generally write $r_n(0)$ instead of $r_n(x_\alpha)$.

But the equation for V will evidently lead to twenty-five expressions for the five roots $x_1, x_2, \dots, x_5$, obtainable from a system of functions of x_α ;

$$\Psi_1(x_\alpha), \Psi_2(x_\alpha), \dots, \Psi_5(x_\alpha)^*.$$

The question therefore suggests itself: Is it permitted, since the number of distinct values of x cannot exceed 5, to suppose that

$$\Psi_m(x_\alpha) = \Psi_n(0),$$

or that the five roots, $x_1, x_2, \dots, x_5$, without considering in what order they will arise, may be expressed by

$$\Psi_1(0), \Psi_2(0), \dots, \Psi_5(0);$$

and thus to avoid the conclusion that the equation of the third degree, at which we shall arrive, will, in the ordinary meaning of the term, be simultaneous with $V^{15} + C_1 V^{14} + \dots + C_{15} = 0$?

In fine, if we can effect the resolution of algebraic equations of the fifth degree, it must be possible to withdraw the terms involving x_α from $\Psi(x_\alpha)$ considered throughout its extent, although we retain those which involve x_α in $r(x_\alpha)$.

London, December 13, 1845.

* See (31.).