Philosophical Magazine Series 3

ISSN: 1941-5966 (Print) 1941-5974 (Online) Journal homepage: http://www.tandfonline.com/loi/tphm14

XLV. Supplementary remarks on elimination, and on the theory of equations

James Cockle M.A.

To cite this article: James Cockle M.A. (1845) XLV. Supplementary remarks on elimination, and on the theory of equations , Philosophical Magazine Series 3, 27:180, 292-294, DOI: 10.1080/14786444508645280

To link to this article: http://dx.doi.org/10.1080/14786444508645280

Published online: 30 Apr 2009.

it in shallow vessels to the rays of the sun, or to a current of dry or hot air. When dry it forms a friable mass, which, when slightly rubbed, crumbles into a very fine powder. The quantity of lime required to precipitate the phosphoric acid from urine is by no means great, and the only difficulty experienced in the whole process is in the filtration, which proceeds much more slowly than could be wished, though I have no doubt that a little practice would suggest the means of greatly diminishing, if not of wholly obviating this impediment.

Glasgow, August 26, 1845.

P.S. Since the above was written, I have ascertained that the difficulty in filtering and drying the precipitate, to which reference has more than once been made, may be greatly obviated by intimately mixing a small quantity of finely-powdered wood-charcoal with the precipitate, after the great bulk of the water has been drawn off by means of a siphon or otherwise. The quantity of charcoal which is necessary for this purpose, is by no means considerable; it has the effect of rendering the precipitate tolerably porous, and thus greatly facilitating its being filtered and dried. If the charcoal-powder, before being mixed with the precipitate, has had a considerable quantity of putrid urine filtered through it, it becomes strongly charged with ammonia, and is thus rendered much more valuable as a manure. The urine which has been used to impregnate the charcoal can, of course, be run into the tank, and the phosphoric acid it contains be precipitated with lime in the way already described. J. S.

XLV. *Supplementary Remarks on Elimination, and on the Theory of Equations. By* JAMES COCKLE, *M.A., of Trinity College, Cambridge; Special Pleader**.

5. IN the development of f^3 (10.)†, let the coefficient of $z_p z_q z_r$ be denoted by $(p\,q\,r)$, with the exception of that of z^3, which we shall represent by a_1, and let

$$\tau_{p,q} = a_1 (1\,p\,q) - \frac{2}{3}(1^2 p)(1^2 q), \quad . \quad . \quad . \quad . \quad (11.)$$

$$\tau_{p,q,r} = a_1^2 (p\,q\,r) - \frac{2}{9}(1^2 p)(1^2 q)(1^2 r), \quad . \quad . \quad (12.)$$

subject to the condition that, when m of the quantities p, q, r become equal, the last terms of (11.) and (12.) are to be divided by $m(m-1)\,..\,2\,.\,1$, then, if

* Communicated by T. S. Davies, Esq., F.R.S., F.S.A., &c.

† See my paper in this (August) Number of the Phil. Mag. p. 126, line 3.

$$a_1^2 f^3(10.) = h_1^3 + a_1 z_1 f^2(9.) + f^3(9.), \quad . \quad . \quad (13.)$$

we have

$$f^2(9.) = \Sigma(\tau_{p,q}\, z_p\, z_q), \quad . \quad . \quad . \quad . \quad . \quad (14.)$$

and

$$f^3(9.) = \Sigma(\tau_{p,q,r}\, z_p\, z_q\, z_r). \quad . \quad . \quad . \quad . \quad (15.)$$

6. Next, suppose J_r to be free from $z_1, z_2, .. z_{r-1}$, then it is allowable at line 9 of p. 126 of my last paper, to change the suffixes of J from 9, 8, 7, 6, into 2, 4, 6, 8, respectively, for we may group as we please the squares into which $f^2(9.)$ is decomposed. This gives us after reduction $J_2^{(2)} =$

$$0 = \gamma_2 z_2 + \gamma_3 z_3 + \ldots + \gamma_9 z_9 + \gamma_0, \quad . \quad . \quad . \quad (16.)$$

where

$$\gamma_2 = \pm \sqrt{\tau_{2^2}}, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (17.)$$

and

$$\gamma_3 = \frac{1}{2}\cdot\frac{\tau_{2,3}}{\gamma_2} \pm \sqrt{\tau_{3^2} - \frac{1}{4}\cdot\frac{\tau_{2,3}^{\;2}}{\gamma_2^{\;2}}}; \quad . \quad . \quad (18.)$$

and if δ, ε, ζ, η be the coefficients, taken in the usual order, of the terms which (after substituting for z_3 in $f^3(9.)$ its value derived from (16.)) contain z_2^3, then, a_2 being the coefficient of z_2^3 in the result,

$$a_2 = \delta - \varepsilon\frac{\gamma_2}{\gamma_3} + \zeta\left(\frac{\gamma_2}{\gamma_3}\right)^2 - \eta\left(\frac{\gamma_2}{\gamma_3}\right)^3 \quad . \quad . \quad . \quad (19.)$$

The above is general, whatever be the value or form of $f^3(10.)$, and is applicable to the annihilation of the 2nd, 4th and 6th terms of the equation of the 6th degree; but, in case the order in which the squares into which $f^2(9.)$ is decomposed are to be grouped should in any instance become material, the last paragraph will have to be modified accordingly.

7. (*Supplement to p.* 384 *of the last volume.*)—Let $n = 4$, and add a term, $N\varphi(x^v)$, to the right-hand side of (3.); then a product similar to (4.) may be obtained by means of the principle, that "$\varphi_1, \varphi_2, \ldots \varphi_{n-1}$ being linear and homogeneous functions of x_1, x_2, x_n, and $\varphi^{(r)}$ denoting the result of substituting $x^{(r)}$ for x in φ; then, when π is composed of symmetric functions of x, &c., $\pi^{\backslash\backslash} (=\Sigma\{\varphi_1\varphi_2 .. \varphi'_{n-2}\varphi''_{n-1}\})$ consists of symmetric functions of $x_1 .. x'_1 \ldots x''_n$:" so that, when $x'' = x'$, $\pi^{\backslash\backslash} = \pi''$. By means of the obvious extensions of this principle, which is a branch of one of numerous classes of the same kind as that used in paragraph 3, we may add to (3.) as many terms as we please, for any values of n. These remarks are made with reference to paragraphs 5 and 6. It is possible that in all these investigations we may be able to derive some aid from the quaternion theory, a different distribution of α, &c.; and it will be borne in mind that a want of symmetry in the

coefficients of an equation sometimes disappears in its roots, as is the case with the equation

$$w^2 + y_1 w + \frac{1}{4}\{y_1^2 - (y_2 + y_3)^2\} = 0,$$

which has *one* root symmetric with respect to y.

Birchington, near Margate,
August 29, 1845.

XLVI. *On the Action of Bleaching Powder on the Salts of Copper and Lead.* *By* WALTER CRUM, *Esq., F.R.S.**

IN February 1843 I read to the Philosophical Society of Glasgow an account of a rose-coloured oxide of copper which I had obtained by the action of bleaching powder and lime upon nitrate of copper. Although I had then made numerous analyses of this substance, prepared under a variety of circumstances, I had been unable to obtain from it the full amount of oxygen which a definite compound must contain, and delayed therefore to make it further known until I should have the opportunity of producing it in a purer form. In the mean time the rose-coloured substance was observed, and correctly described, by Krüger of Berlin, as a combination of the oxide of copper, or, as he calls it, cupric acid, with lime. Having completed my experiments on this subject as far as my leisure will permit, I shall now state the results I have obtained.

When the hydrated oxide of copper is added to a solution of bleaching powder it changes colour and becomes brown. Oxygen gas is then plentifully disengaged, and the effervescence continues till the whole of the hypochlorite of lime is decomposed. The brown precipitate suffers no change during this decomposition. When separated from the soluble matters, it is found to contain no chlorine and no excess of oxygen. It is anhydrous oxide of copper. Hypochlorite of soda produces the same effect.

If we add nitrate of copper to a solution of bleaching powder containing a considerable quantity of lime, and previously cooled to below the freezing-point of water, a bluish-green precipitate is formed. When the precipitate subsides, we find the solution of a fine blue colour and containing copper; but in what state I have not examined. As the heat advances to the ordinary temperature, the copper in solution, as well as

* Communicated by the Chemical Society; having been read April 21, 1845.