109. Mnemonic for Hyperbolic Formulae
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Further, the printing of negative characteristics will always involve difficulty, additional expense, and risk of error; though of course if once a correct set of 'stereo' plates are made, the expense and risk of error have been overcome.

On the other hand the arbitrary 10 certainly causes difficulty to beginners. It also is apt to lead to carelessness as regards characteristics, whence frequently $L\sin\theta=9{\cdot}7$ when it should be $L\sin\theta=8{\cdot}7$.

The use of logarithm tables is certainly one of those matters where uniformity in practice is desirable. To work out an example before a class with the certainty that the plan one adopts (or better $L\sin\theta=9{\cdot}3$ or $\log\sin\theta=\bar{1}{\cdot}3$) will be resented by half the audience—is a little trying. C. S. J.

[In connection with this Note, Mr. E. T. Whittaker suggests that it is not advisable to make changes in mathematical notation in this country unless there is a reasonable expectation that our practice will be followed on the continent. We suffer already from neglect of this principle.

What we most need at present in the region of function-notation is to replace the English $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, by the continental arcsin, arccos, arctan.]

109. [D. 6. d.] *Mnemonic for hyperbolic formulae.*

Hyperbolic functions are now so constantly used, that a brief mnemonic for their somewhat confusing formulae may not be unwelcome.

In any Trigonometrical formula for θ, 2θ, 3θ, or θ and ϕ, after changing *sin* to *sinh*, *cos* to *cosh*, etc., change the sign of any term that contains (or implies) a *product* of *sinhs*, *e.g.* $\tanh\theta\tanh\phi$ implies a product of sinhs,

$$\therefore\ \tanh(\theta+\phi)=\frac{\tanh\theta+\tanh\phi}{1+\tanh\theta\tanh\phi}.$$

$$\sinh 3\theta=3\sinh\theta+4\sinh 3\theta\,;$$

$$\cosh\theta-\cosh\phi=+2\sinh\frac{\theta+\phi}{2}\sinh\frac{\theta-\phi}{2}\,;$$

and so on. This rule would fail for terms of the 4th degree, but it covers everything that is likely to be required, and is very convenient for teaching purposes. G. OSBORN.

110. [K. 6. a.] *To find the distance between two points, $\alpha_1\beta_1\gamma_1$, $\alpha_2\beta_2\gamma_2$ in trilinear coordinates.*

Let r=distance, θ, ϕ, ψ the direction angles of the straight line joining the points.

$$\therefore\ \frac{\cos\theta}{\alpha_1-\alpha_2}=\frac{\cos\phi}{\beta_1-\beta_2}=\frac{\cos\psi}{\gamma_1-\gamma_2}=\frac{1}{r}\ \text{also}\ \phi-\theta=\pi-C,\ \text{etc.}$$

Now $4\sin(\phi-\theta)\cos\theta\cos\phi=2\sin(\phi-\theta)\cos(\theta+\phi)+2\sin(\phi-\theta)\cos(\phi-\theta)$,

$$=\sin 2\phi-\sin 2\theta+\sin 2(\phi-\theta)\,;$$

$$\therefore\ 4\Sigma\sin C\cos\theta\cos\phi=\Sigma\sin 2A=4\sin A\sin B\sin C\,;$$

$$\therefore\ \frac{1}{r^2}\Sigma\sin C(\alpha_1-\alpha_2)(\beta_1-\beta_2)=\sin A\sin B\sin C,$$

or $$r^2=\Sigma\sin C(\alpha_1-\alpha_2)(\beta_1-\beta_2)/\sin A\sin B\sin C.$$

[Done in Pupil Room by Knox, ma., K. S., Eton College.]

111. [A. 1. c.] *Note on the Multinomial Theorem.*

Let $U=1+c_1x+c_2x^2+c_3x^3+\dots$.

The expansion of U^n in a series of ascending powers of x is not to be found, as far as I know, in text-books of Algebra; but it is not difficult to establish a relation between the coefficients, and this method gives, I think, more definite grip to a theorem that usually strikes a beginner as somewhat ineffective.