Mathematical Notes.

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EDITED BY P. PINKERTON, M.A., D.Sc.

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Graphical Solution of Equations of the form $a\cos\theta + b\sin\theta = c$, without the aid of tables.

Put
$$\cos\theta = x,$$
$$\sin\theta = y,$$
and we have
$$\left.\begin{aligned} x^2 + y^2 &= 1 \\ ax + by &= c \end{aligned}\right\}.$$

If P and Q are the common points of this circle and line, then OP and OQ are the bounding radii for the two values of θ, supposing these angles to be traced in the usual way by a revolving radius starting from the position OX.

The angles may be measured by the protractor.

The method is not susceptible of great refinement, but it gives a rough approximation very readily. One can even form a fair mental estimate of the results in a few moments. The idea may also be found helpful when equations are to be set offhand so as to have roots in desired quadrants, or roots close together.

Ex. 1. Roots in the second and third quadrants. Considering the intercepts of the line $ax + by = c$ on the axes, we see that if c is positive, a is negative and greater than c, b positive and less than c; say
$$-7\cos\theta + 4\sin\theta = 6.$$

Ex. 2. Nearly equal roots in the fourth quadrant. Take a positive, b negative, c positive and slightly less than $\sqrt{a^2 + b^2}$; say
$$7\cos\theta - 4\sin\theta = 8.$$

JOHN DOUGALL