

LETTERS TO THE EDITOR

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A Note on Self-Reciprocal Functions

I WILL say that a function is $\pm R_\nu$, according as it is self-reciprocal or skew-reciprocal for Hankel Transforms of order ν ; that is, according as it satisfies the integral equation

$$f(x) = \pm \int_0^\infty \sqrt{xy} J_\nu(xy) f(y) dy, (\nu > -1)$$

with the upper or the lower sign.

In a recent paper¹ I have proved the theorem: If $f(x)$ is R_ν , the function

$$\phi(x) = a^\alpha f(xv^\alpha) \pm \frac{1}{a^\alpha} f\left(\frac{x}{v^\alpha}\right),$$

where $a > 0$, $v > 0$, is $\pm R_\nu$.

The object of this note is to give an easy generalisation of this theorem.

2. Theorem I.—If $f(x)$ is R_ν , the function

$$\phi(x) = F(a) f\{xF^2(a)\} \pm \frac{1}{F(a)} f\left\{\frac{x}{F^2(a)}\right\}, \tag{2.1}$$

where a is a constant, and $F(a) \neq 0$, is R_ν .

We have

$$\begin{aligned} & \int_0^\infty \sqrt{xt} J_\nu(xt) \phi(t) dt \\ &= \int_0^\infty \sqrt{xt} J_\nu(xt) \left[F(a) f\{tF^2(a)\} \right. \\ & \quad \left. \pm \frac{1}{F(a)} f\left\{\frac{t}{F^2(a)}\right\} \right] dt \end{aligned}$$

$$\begin{aligned} &= F(a) \int_0^\infty \sqrt{xt} J_\nu(xt) f\{tF^2(a)\} dt \\ & \pm \frac{1}{F(a)} \int_0^\infty \sqrt{xt} J_\nu(xt) f\left\{\frac{t}{F^2(a)}\right\} dt \\ &= \frac{1}{F(a)} \int_0^\infty \sqrt{\frac{xu}{F^2(a)}} J_\nu\left\{\frac{xu}{F^2(a)}\right\} f(u) du \\ & \pm F(a) \int_0^\infty \sqrt{xu F^2(a)} J_\nu\{xuF^2(a)\} f(u) du \\ &= \frac{1}{F(a)} f\left\{\frac{x}{F^2(a)}\right\} \pm F(a) f\{xF^2(a)\} \\ &= \pm \phi(x). \end{aligned}$$

Theorem II.—If $f(x)$ is $-R_\nu$, the function (2.1) is $\mp R_\nu$.

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March 18, 1939.

¹ "A few Self-Reciprocal Functions," *Proc. Physico-Math. Society of Japan*, 1934, 273-74.

Benzylidene-Flavanones considered as Chalkones

PANSE AND WHEELER¹ have shown that Benzylidene-Coumaranones like chalkones condense with acetoacetic ester, desoxybenzoin, cyclohexanone, etc. It is now found that

Benzylidene-Flavanones of the type (I) which contain the group $-\text{CO}-\overset{\cdot}{\text{C}}:\text{CH}-$ present in chalcones also undergo the above types of reactions, (II) and (III) being obtained by the condensation of the corresponding benzylidene-flavanones with acetoacetic ester and desoxy-

benzoin respectively. The oxides (IV) and (V) analogous to chalcone oxides have also been prepared. Similar compounds have been obtained from other arylidene-flavanones.

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¹*Curr. Sci.*, 1938, 7, 181.

A New Synthesis of 3-Aminocoumarin

ERLENMEYER, JUN. AND BADE¹ state that salicylaldehyde does not condense with glycine to give α -amino- β -hydroxy acids by the method associated with the name of Erlenmeyer. Linch² has published a paper on 3-aminocoumarin; he found that salicylaldehyde and glycine did combine, in the presence of sodium acetate and acetic anhydride by Perkin's method, to give 3-acetyl-aminocoumarin, which on hydrolysis gave 3-aminocoumarin, but that the yield of the former was very unsatisfactory, being 25-30 per cent. at best. He has therefore followed a roundabout method of condensing salicylaldehyde with ethylacetoacetate (Knoevenagel) to obtain 3-acetylcoumarin, the oxime of which on undergoing the Beckman transformation, gave 3-acetylaminocoumarin and this on careful hydrolysis gave the base. The exact yield calculated on the first starting materials is not stated, but the method is said to be advantageous.³

We now find that salicylaldehyde and glycine, when heated directly together at 130-140° for five hours, give the 3-aminocoumarin in about 23 per cent. yield, and that yield can be further augmented by the use of a trace of pyridine. The ultimate yields obtained by suitable modifications, are exceedingly good. In two experiments the yields were 80 per cent. and the condensation of salicylaldehyde and glycine proceeded very well. Salicylaldehyde (1.5 mol.), glycine (1 mol.) and a trace of pyridine were heated together for five hours at 130-140°. The product crystallised from water melted at

