

STEP II, 2004, Q5

- 5 Evaluate $\int_0^\pi x \sin x \, dx$ and $\int_0^\pi x \cos x \, dx$.

The function f satisfies the equation

$$f(t) = t + \int_0^\pi f(x) \sin(x+t) \, dx. \quad (*)$$

Show that

$$f(t) = t + A \sin t + B \cos t, \quad (**)$$

where $A = \int_0^\pi f(x) \cos x \, dx$ and $B = \int_0^\pi f(x) \sin x \, dx$.

Use the expression (**) to find A and B by substituting for $f(t)$ and $f(x)$ in (*) and equating coefficients of $\sin t$ and $\cos t$.



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