Problem 138A

A finite difference method applied to a partial differential equation utilizes a mesh with a uniform node spacing, h, in the x and y directions. Find the finite difference approximation for the term

$$\frac{\partial^4 \phi}{\partial x^4}$$

at the node labelled 0 in terms of the values of ϕ at 0 and the neighbouring nodes 1, 3, 5 and 7 as follows: