Find a resource that defines the two-dimensional Fourier transform (in an analogous way to how the 1-dimensional Fourier transform is defined in our text). There are certain results about 1-D Fourier transforms which have made them useful for certain kinds of IVPs or IBVPs. What are the corresponding results for the 2-D transform? (For an extra half point, provide the proofs.) Use this transform to solve the Cauchy planar diffusion problem

\[ u_t = k_1 u_{xx} + k_2 u_{yy}, \quad (x, y) \in \mathbb{R}^2, \quad t > 0, \]
\[ u(x, y, 0) = f(x, y), \quad (x, y) \in \mathbb{R}^2, \]

where \( k_1, k_2 \) are positive constants.