The discrete ordinates method is a deterministic technique for solving the linear boltzmann transport equation. A modified algorithm has been developed for solving the equation from anisotropically emitting photon point sources. The algorithm builds upon conventional discrete ordinate calculations by discretizing the angular variable as a function of each pixel value in a two-dimensional, cartesian calculation matrix. Homogeneous and heterogeneous calculation geometries were used to test the method and compare with a conventional ray-tracing algorithm. Agreement between the modified algorithm and the ray-trace algorithm is excellent with the discrete ordinates calculation being slightly faster with respect to calculation time. The modified discrete ordinates algorithm was also used to calculate kerma scatter distributions from monoenergetic photons in homogeneous or CT-based heterogeneous geometries. Good agreement was achieved compared with a Monte Carlo calculation of the same simulation geometry. Implementation of the algorithm for polyenergetic photon spectra and three-dimensional cartesian geometries is discussed.