## [lex192] Electric potential of charged ring I

Consider a ring of radius $R$ centered at the origin of the $xy$-plane. The ring is uniformly charged with charge per unit length $\lambda$.
(a) Calculate the electric potential at a point on the $z$-axis. Start from the general expression $\phi(\mathbf{x})$ in [lln5] for the electric potential of a continuous charge distribution. Then simplify that expression systematically into a function $\Phi(z, R, q)$, where $q$ is the total charge on the ring, by taking advantage of symmetry and reduced dimensionality.
(b) Infer from the function $\Phi(z, R, q)$ the electric field $E_z(z, R, q)$, which is the main result of [lex2] in a more direct calculation.

**Solution:**