



4. A ring of radius  $R$  has a charge  $Q$  uniformly distributed about its perimeter. The principal axis of the ring is the  $z$ -axis, with the origin at the center of the ring. A field point is at a distance  $z$  from the center, at point  $(0, 0, z)$ .
- If the magnitude of the contribution to the field at the field point from a differential segment of the ring is  $dE$ , what is the  $z$ -component of  $dE$ ?
  - What is the magnitude of the field at  $z = 0$ ?
  - What is the magnitude of the field at the field point when  $R = 0$ ?
5. A disk of radius  $R$  carrying charge  $Q$  uniformly distributed about its area is placed so that its center is at the origin and the its principal axis is the  $z$ -axis. A field point is at a distance  $z$  from the center, at point  $(0, 0, z)$ . What is the magnitude of the field at the field point when  $R = \infty$ ?