The Electrostatic Potential Due to a Ring of Charge

1. Use the superposition principle for the electrostatic potential due to a continuous charge distribution:

$$V(\vec{r}) = \frac{1}{4\pi\epsilon_0} \int \frac{\rho(\vec{r}')}{|\vec{r} - \vec{r}'|} \, d\tau', \tag{1}$$

   to find the electrostatic potential everywhere in space due to a uniformly charged ring with radius R and total charge Q.

   Check with a teaching team member before moving on to subsequent parts below.

2. Evaluate your expression for the special case of the potential on the z-axis.

3. Evaluate your expression for the special case of the potential on the x-axis.

4. Find a series expansion for the electrostatic potential in these special regions:

   a) Near the center of the ring, in the plane of the ring;

   b) Near the center of the ring, on the axis of the ring;

   c) Far from the ring on the axis of symmetry;

   d) Far from the ring, in the plane of the ring.