

The Electrostatic Potential Due to a Ring of Charge

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

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

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.