The Magnetic Field Due to a Spinning Ring of Charge

1. Use the Biot-Savart law
$$\vec{B}(\vec{r}) = \frac{\mu_0}{4\pi} \int \frac{\vec{J}(\vec{r}\,') \times (\vec{r} - \vec{r}\,')}{|\vec{r} - \vec{r}\,'|^3} \, d\tau'$$
to find the magnetic field everywhere in space due to a spinning charged ring with radius R, total charge Q, and period T.

2. Evaluate your expression for the special case that $\vec{r}$ is on the z-axis.

3. Evaluate your expression for the special case that $\vec{r}$ is on the x-axis.

4. Find a series expansion for the electrostatic potential at these special locations:

   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.