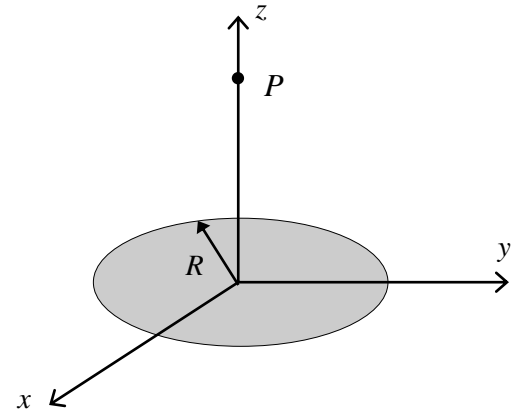


Lesson #29: Biot-Savart Law

Name: _____

Study section 5.1-5.2, especially examples 5.5 and 5.6, then answer the following questions. Express your answers in terms of the given parameters and fundamental constants.

A phonograph record (radius R) carries a uniform charge density σ . It rotates at angular velocity ω in a direction that is ccw for an observer looking down on the record from point P .



1. The spinning disk of charge constitutes a surface current; write down an expression for the surface current density in terms of given parameters:

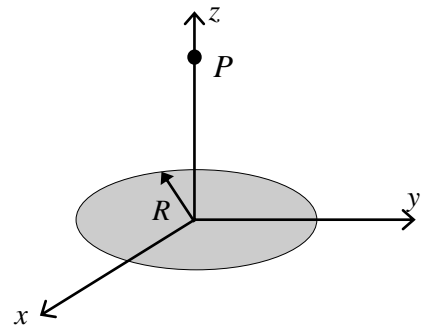
$\mathbf{K} =$

2. Sketch and label the vector \mathbf{K} , the surface current density, for two different points on the disk.
3. The spinning disk will create a magnetic field; sketch and label a few field lines on the figure above.
4. Does your sketch show that $\nabla \cdot \mathbf{B} = 0$? Explain how your sketch satisfies this equation.

5. Write down an expression for the magnetic field, \mathbf{B} , in terms of \mathbf{K} and \mathbf{r} , the separation vector:

$\mathbf{B} =$

6. Sketch the vectors \mathbf{r} , \mathbf{r}' and \mathbf{r} on the figure to the right.



7. Plug in expressions for \mathbf{K} and \mathbf{r} to solve for the magnetic field at Point P . Set up and completely specify the integral that needs to be solved; you don't need to evaluate it.

$\mathbf{B} =$