FUNDAMENTALS OF ELECTROMAGNETIC FIELDS – July 11, 2016

Name:
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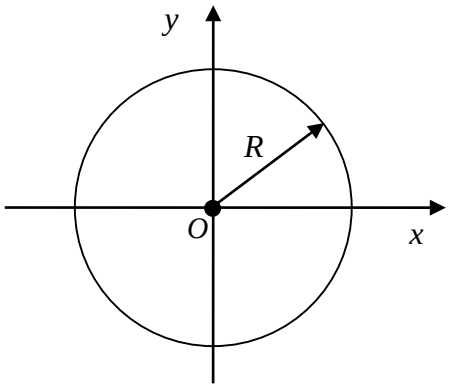
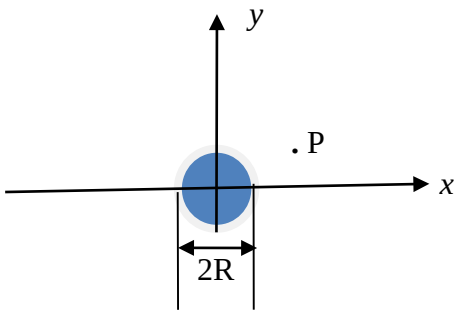
Problem 1 - Consider the uniformly charged **cylinder** of radius R = 1 cm in the figure. A charge per unit length $\boldsymbol{Q = 0.35}$ C/m (charge per unit length) is uniformly distributed over its surface. Calculate
a) the x-component of the electric field at the point P(x=0.3cm, y=0.2cm).
b) the potential at the same point knowing that the potential at P_0(x=2cm, y=0cm) is 0.

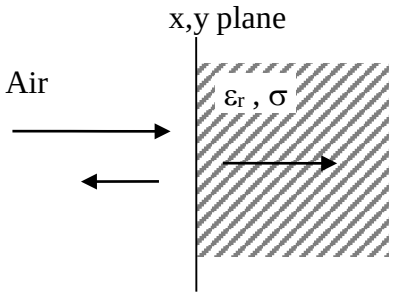


Problem 2 - Consider the wire in the figure, whose conductivity is $\sigma = 200$ S/m. It is placed at the origin, its radius R is 5 mm and it carries a current of 2 A uniformly distributed and directed along z. Find

- the magnitude and the direction of the magnetic field at P(x=1cm, y=0.5 cm)
- the power dissipated on a length of 1 m.



Problem 3 - A plane wave is incident onto the half-space shown in the figure. The parameters of the half-space are $\varepsilon_r = 3$, $\tan\delta = 0.1$. The **reflected** power density is 5 W/m^2 at 2 GHz. Find
a) the magnitude of the **incident** electric field (medium 1);
b) the magnitude of the **trasmitted** magnetic field at 10 cm from the interface.



Problem 4 - A source with an open circuit voltage V_0 = 20 V and R_g = 75 Ω internal impedance is connected to a load R_L = 75 Ω by a coaxial line having outer diameter *a*=5 mm, characteristic impedance 50 Ω and dielectric constant ε_r = 2.2, tanδ = 0.01. The line length is *l*=4 m, the frequency is 1 GHz and the conductors are made with copper ($\sigma = 5 \cdot 10^7$ S/m). Find

a) The power absorbed by the load;
b) The power lost on the line.