Assignment 1
Charge Density and Multiple Integrals

Definitions

charge density

- Line charge $\lambda = \frac{dq}{dl}$
- Surface charge $\sigma = \frac{dq}{dA}$
- Volume charge $\rho = \frac{dq}{dv}$

Questions

1. Find the total charge on the semicircle $x^2 + y^2 = R^2$, $z = 0$ for $0 \le \varphi \le \pi$ if $\lambda = \lambda_o$.
2. Find the total charge on the semicircle $x^2 + y^2 = R^2$, $z = 0$ for $0 \le \varphi \le \pi$ if $\lambda = \lambda_o \sin^2(\varphi)$.
3. Find the total charge on the line $y=a$, $z = 0$ for $-a \le x \le a$ if $\lambda = \lambda_o x^2 / a^2$.
4. Find the total charge on the hemisphere $x^2 + y^2 + z^2 = R^2$, $z \ge 0$ if $\sigma = \sigma_o \cos(\theta) \sin^2(\varphi)$.
5. Find the total charge inside the hemisphere $x^2 + y^2 + z^2 = R^2$, $z \ge 0$ if $\rho = \rho_o (r/R)^3 \cos(\theta) \sin^2(\varphi)$.
6. Find the total charge inside the cylinder $x^2 + y^2 = R^2$, $0 \le z \le L$ if $\rho = \rho_o (z/L)^3 \sin^2(\varphi)$.
7. Find the total charge inside the pyramidal cone with a square base of side 2a ($-a \le x \le +a$ and $-a \le y \le +a$) and whose apex is that the point (0,0,h) if the charge density is uniform.
8. Find the total charge inside the pyramidal cone with a square base of side 2a ($-a \le x \le +a$ and $-a \le y \le +a$) and whose apex is that the point (0,0,h) if the charge density is given by $\rho = \rho_o (z/h)$.