Problem 2.7. Find the electric field a distance z from the center of a spherical surface of radius R (Fig. 2.11) that carries a uniform charge density σ. Treat the case $z < R$ (inside) as well as $z > R$ (outside). Express your answers in terms of the total charge q on the sphere. [*Hint:* Use the law of cosines to write $\mathscr{r}$ in terms of R and θ. Be sure to take the *positive* square root: $\sqrt{R^2 + z^2 - 2Rz} = (R - z)$ if $R > z$, but it's $(z - R)$ if $R < z$.]

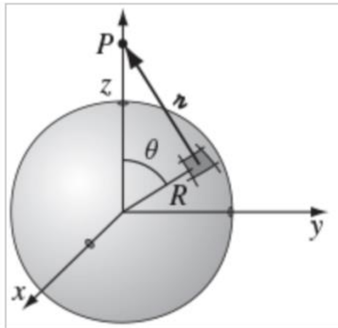

Fig. 2.11

Fig. 2.11

$$\int \frac{z - Ru}{(R^2 + z^2 - 2Rz\cos\theta)^{3/2}}\,du = \frac{zu - R}{z^2(R^2 + z^2 - 2Rz\cos\theta)^{1/2}}$$

Problem 2.12. Use Gauss's law to find the electric field inside and outside a spherical shell of radius R that carries a uniform surface charge density σ. Compare your answer to Prob. 2.7; notice how much quicker and easier Gauss's method is.

Problem 2.17. A long coaxial cable (Fig. 2.26) carries a uniform *volume* charge density ρ on the inner cylinder (radius a), and a uniform *surface* charge density σ on the outer cylindrical shell (radius b). This surface charge is negative and is of just the right magnitude that the cable as a whole is electrically neutral. Find the electric field in each of the following three regions: (i) inside the inner cylinder $(s < a)$, (ii) between the cylinders $(a < s < b)$, (iii) outside the cable $(s > b)$. Plot $|\mathbf{E}|$ as a function of s.

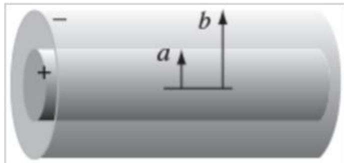

Fig. 2.26

Fig. 2.26

• **Problem 2.23.** Find the potential a distance s from an infinitely long straight wire that carries a uniform line charge λ. Compute the gradient of your potential, and check that it yields the correct field.