

# PRACTICE QUIZ 5

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1. One of the consequences of Gauss's law is that the flux of a gravitational vector field through a closed surface is proportional to the amount of mass enclosed within that surface. Use this observation to prove that there exists no gravitational force inside a *hollow planet* (a spherical shell with uniform density).

*Hints:* Let  $p$  be a fixed point inside the planet,  $F$  be the gravitational vector-field, and  $S$  be a sphere which passes through  $p$  and has the same center as the planet.

(i) Note that by Gauss's law  $\int_S F \cdot n \, dS = 0$ .

(ii) Use symmetry to show that  $\int_S F \cdot n \, dS = \|F(p)\| \text{Area}(S)$ .

*Note:* The above problem could also be solved by means of a direct integration, see pages 382-384 of Marsden and Tromba.