EE Qualifying Exam (2011)
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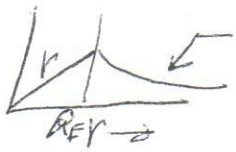
1 Note the similarity of coulomb's law and the gravitational law; i.e. $\bar{E} = \left(\frac{1}{4\pi\epsilon_0}\right)\frac{q}{r^2}\bar{a}_r$ and $\bar{g} = -G\frac{m_1}{r^2}\bar{a}_r$

what is $\bar{g}$ at the center of a (spherical) earth?
why? ans: $g = 0$

2 Derive a Gauss's law equivalent for gravity

ans: $\nabla \cdot \bar{g} = -4\pi G \rho_m$; ρ_m = mass density

3 Find the functional form of $\bar{g}$ versus distance from earth center ans:



4 If the earth were an ellipsoid of revolution how would you do the problem
ans: direct (3D) vectorial integration

5 write the functional form for the escape velocity as a function of ~~r~~ position above the earth's surface. ans $V_{escape} \sim \sqrt{\frac{1}{r}}$

6 for a few very fast students, what law would you use to study a rocket where the mass is changing? ans: conservation of momentum.