3. Gravitation (6 pts)

1) $g_0 = \gamma M/R^2$, where R can be found from the relationship $\frac{4}{3}\pi R^3 \rho = M$. Hence,

$$g_0 = \gamma M \left(\frac{4\pi\rho}{3M}\right)^{2/3}.$$

2) Taking a piece of ground from a certain point of the planet surface and carrying it into another point, the free fall acceleration can be changed (the sign of the change depends on the direction of the transport).

3) Let use the polar coordinates with the origin at the point where the free fall acceleration is to be maximized. Let the axis $\phi = 0$ be given by the direction of the acceleration. Carrying a small piece of ground from a point (r_1, ϕ_1) to another point (r_2, ϕ_2) must keep the modulus of the acceleration vector $\vec{g}$ constant, i.e. the vector of the small change must be perpendicular to the vector $\vec{g}$. Consequently, $\cos\phi_1/l_1^2 = \cos\phi_2/l_2^2$, hence $l = l_0\sqrt{\cos\phi}$.