Name-code: _____

3. Consider a spherical density distribution of the form

$$\rho(r) = \rho_0 \frac{1}{(r/r_0)(1+r/r_0)^3},$$

where ρ_0 is a (constant) density scale and r_0 is a (constant) length scale. Find the mass profile $M(r)$ and the gravitational potential $\Psi(r)$ for this extended mass distribution. In particular find the total mass M_∞ and total depth Ψ_0 of the gravitational potential well:

$$M_\infty = \lim_{r\to\infty} M(r) \quad \text{and} \quad \Psi(0) = \lim_{r\to 0} \Psi(r).$$