$$F = \frac{GMm}{r^2}$$

$$\frac{mv^2}{r} = \frac{GMm}{r^2}$$

$$v^2 = \frac{GM}{r}$$

$$v = \sqrt{\frac{GM}{r}} = \sqrt{GM} \; r^{-1/2}$$

$$v^2(R) = \frac{GM_{\mathrm{enc}}}{R}$$

$$M_{\mathrm{enc}} = \int_0^R 4\pi r^2 \, dr \; \rho(r)$$

$$v \propto R$$

$$\rho(r) = \rho_0 \; r^{\alpha}$$

$$M_{\mathrm{enc}} = \int_0^R 4\pi r^2 \, dr \; \rho_0 \; r^{\alpha} = 4\pi\rho_0 \int_0^R r^{2+\alpha} \, dr$$

$$M_{\mathrm{enc}} = \left(\frac{4\pi\rho_0}{3+\alpha}\right) R^{3+\alpha}$$

$$v^2 = \frac{GM_{\mathrm{enc}}}{R} \propto \frac{R^{3+\alpha}}{R} \propto R^{2+\alpha}$$

$$\rho(r) = \rho_0 \; r^{-2.2}$$

$$\mu = -k \; r$$

$$\mu \propto \ln(I)$$

$$\ln(I) \propto -k \; r \quad \Rightarrow \quad I(r) \propto e^{-kr}$$

$$v(r) = v_{\odot} \times \left(\frac{r}{r_{\odot}}\right)^{-1/2}$$

$$M_{\mathrm{enc}} \propto r^{N}$$

$$M_{\mathrm{enc}} \propto r^{3+\alpha}$$