1.) Sparke & Gallagher Problem 5.12 (on spiral arm pitch angle)

2.) Show that if the rotation curve $V(R)$ is flat, then $\kappa = \sqrt{2} \Omega(R)$. What is the local value (in the Milky Way near the Sun) of the epicyclic frequency $\kappa$, assuming a locally flat rotation curve?

From the inequality that describes the condition where density waves can persist, derive the radial ranges where two-armed and four-armed spirals can persist. Show that the zone where two-armed spiral waves can persist is almost three times larger than that for four-armed spirals.

Sketch the curves of $\Omega$, $\Omega \pm \kappa/2$, and $\Omega \pm \kappa/4$ in a disk where $V(R)$ is constant everywhere. Indicate the radial extent of two-armed and four-armed spirals, assuming a pattern speed of $\Omega_p = 25 \text{ km s}^{-1} \text{ kpc}^{-1}$. 