Problem 1. Consider the torus of revolution $T_{a,b}$ obtained by rotating the circle $\gamma(u) = (a + b \cos \frac{u}{b}, b \sin \frac{u}{b})$ about the $z$ axis. It has parametrization

$$f(u,v) = \left((a + b \cos \frac{u}{b}) \cos v, (a + b \cos \frac{u}{b}) \sin v, b \sin \frac{u}{b}\right)$$

where $0 < u < 2\pi b$ and $0 < v < 2\pi$ and $a > b > 0$. Note that $\gamma$ is an arc-length parametrization.

1. Compute the first fundamental form of $T_{a,b}$.
2. Compute the Gauss curvature $K$ and the mean curvature $H$ of $T_{a,b}$.
3. Compute the integral

$$W(a,b) = \int_{T_{a,b}} H^2 dA$$

as a function of $(a,b)$ and show that $W(a,b) \geq 2\pi^2$ with equality achieved when $a/b = \sqrt{2}$.

Problem 2. Consider the surface $S$ described by the equation $z = xy$. Determine the lines of curvature and the asymptotic curves of $S$. 