1. In your report, page 8, eq. (12), there seems to be a minor typo (missing "+" for one of the terms). You will also notice that the a_T parameter arising within the $w_{2p}(\phi)$ term can also be substituted in terms of β^2. Thus, everything on the RHS of eq. (12) will be functions of ϕ and β (your k parameter is just a placeholder for ϕ). You will also note that $\sin(2k)$ equals $\cos(2\phi)$ (simple trig identities); likewise, the $2\sin^2(k)$ term from w_{3p} can be replaced by $(1-\cos(2k))$ and further, $\cos(2k) = -\sin(2\phi)$. All this will lead to a cleaner looking expression for $w_p(\phi)$ entirely expressed in terms of ϕ and β^2.

2. Using your results from part~(b) before (pages 12-13, for a given value of β, numerically evaluate the value of $\phi = \phi_m$ such that $y_p(\phi_m) = 0$. Next, define $\delta = 1/\beta^2$ and using an interval $\delta \in (0.001, 1)$, compute ϕ_m such that $y_p(\phi_m) = 0$. Express these results in a plot of ϕ_m versus δ. Qualitatively speaking, as $\mathrm{a}_T \to 0$ (vanishingly small thrust magnitude), $\beta \to \infty$, and accordingly, $\delta \to 0$. Conversely, $\delta \to 1$ implies $\beta^2 \to 1$ which indicates the maximum allowed thrust acceleration that maintains prograde motion. You will also note that y_p has the physical meaning of radial velocity and thus, when y_p becomes zero, the orbit reaches maximum altitude. Accordingly, if you evaluate $w_p(\phi_m)$ (i.e., the flight direction angle), it should be exactly unity (up to numerical error). That will be a good sanity check.

3. Using the same interval $\delta \in (0.001, 1)$, compute ϕ_m that minimizes $w_p(\phi)$. Generate a plot of ϕ_m versus δ.