CMA A mass $M$ is connected to two massless springs with the same spring constant $k$, as in the figures below. Originally the springs are not stretched and have length $L$.

a) First assume that the mass executes small oscillations along the $x$-axis. Write down the equation of motion and find the angular frequency $\omega$ for the oscillation.

![Diagram of mass M connected to two springs](image1)

b) Now both springs are stretched by the same amount $S$ and the mass $M$ undergoes small oscillations in the $x - y$ plane. Find the potential energy of the system $V(x, y) - V(0, 0)$ to second order in $x$ and $y$. Calculate the normal frequencies and normal modes. (**Hint:** Use symmetry to argue that there is no $xy$ term, so you can compute the $y^2$ term by assuming that $x = 0$, and similarly for the $x^2$ term.)

![Diagram of mass M connected to two stretched springs](image2)

c) When both springs are stretched by the same amount $S$ as in (b), the mass undergoes circular motion with a small radius $\rho$ in the $y - z$ plane perpendicular to the $x$ axis. Determine the rotational frequency $\omega$ around the $x$-axis. Compare your $\omega$ with the result of (b) by relating the circular motion to your solutions to part (b).

![Diagram of mass M connected to two springs with circular motion](image3)