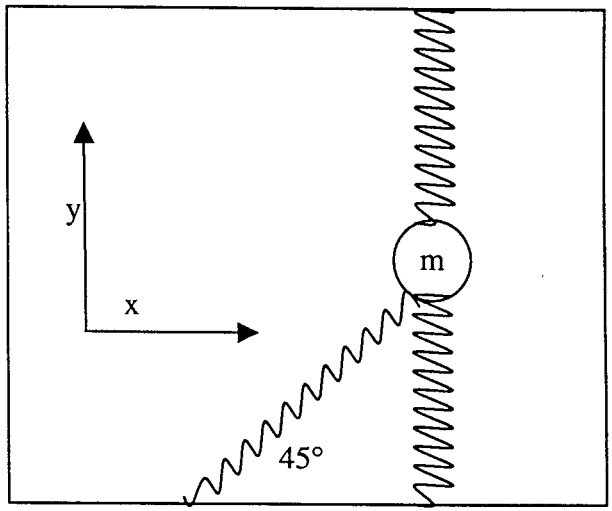
CM Fall00A

The 3 kg mass, m, shown in the figure is constrained to move without friction in the horizontal x-y plane illustrated. It is attached to three springs, with each spring shown at its equilibrium extension. The springs along the y direction each have spring constant 5 N/m. The other spring, at a 45° angle to x and y, has a spring constant of 7 N/m.



These are massless, ideal springs—the force each exerts when extended or compressed is along its length.

A) How many normal modes does this system have? Briefly justify your answer.

B) Calculate the characteristic frequencies of the normal modes. If you cannot solve for these frequencies exactly, you may obtain some partial credit if you give and justify approximate estimates.

C) Without necessarily solving for the actual directions, state and justify a precise relation between the directions along which the characteristic oscillations occur.

D) Now solve precisely for the directions along which the characteristic oscillations occur. Draw a sketch in your exam booklet showing them and labeling the angles precisely.