1 Bumpy cars

The springs of a car of mass 1200 kg give it a bounce period of 0.5 seconds for small vertical oscillations. The oscillation, unfortunately for the passengers, is not damped at all.

(a) How far does the car sink when a driver and 3 passengers, each of mass 75 kg, get into the car?

(b) The car with passengers hits a sudden rise in the pavement of 5 cm. The effect is to instantaneously raise the wheels and the bottom of the springs by 5 cm. By computing the maximum acceleration from the resulting simple harmonic motion, determine if the passengers fly clear of their seats (they are, unfortunately, not wearing seat belts.)

2 Buoys

An object floating in a fluid is buoyed up by a force equal to the weight of the displaced fluid. A uniform cylinder of density $\rho$ and length $l$ is floating with its axis vertical in a fluid of density $\rho_0$. What is the frequency of vertical oscillation?