

## Problem 2

Three non-collinear points  $P_1$ ,  $P_2$  and  $P_3$ , with known masses  $m_1$ ,  $m_2$  and  $m_3$ , interact with one another through their mutual gravitational forces only; they are isolated in free space and do not interact with any other bodies. Let  $\sigma$  denote the axis going through the center-of-mass of the three masses, and perpendicular to the triangle  $P_1P_2P_3$ . What conditions should the angular velocities  $\omega$  of the system (around the axis  $\sigma$ ) and the distances:

$$P_1P_2 = a_{12}, \quad P_2P_3 = a_{23}, \quad P_1P_3 = a_{13},$$

fulfill to allow the shape and size of the triangle  $P_1P_2P_3$  unchanged during the motion of the system, i.e. under what conditions does the system rotate around the axis  $\sigma$  as a rigid body?