IITK problem statement

December 2020

Frame of reference (O,X,Y) has its origin at O and X,Y are orthogonal directions. O is the centroid of an equilateral triangle with vertices P1, P2 and P3 which have large point masses. P1, P2 and P3 each are at a distance of 1 unit from the centroid. The line OX is parallel to line segment P2-P3. At time=0 seconds, a mass P having unit mass is placed at coordinate (0.5,0) units and given a push with speed $v = 1.8$ units per sec at an angle = 80 degrees counterclockwise from OX direction. Assume that gravitation is the only force acting in this system and masses P1, P2 and P3 each having gravitational parameter of 1 $unit^3/sec^2$. P1, P2 and P3 each have fixed positions. The gravitational acceleration caused by a large mass to unit mass P is given by the following relation:

$$a = -\frac{\mu}{||\vec{r}||^3}\vec{r} \tag{1}$$

where, a is the gravitational acceleration, $\vec{r}$ is the relative position of the unit mass P w.r.t the large mass, μ is the gravitational parameter, $||.||$ is the euclidean norm of a vector.

Find out the first time, no less than 1 second from initial time, at which the point P will come back within a euclidean distance of $\epsilon = 0.03$ units with respect to the initial position.

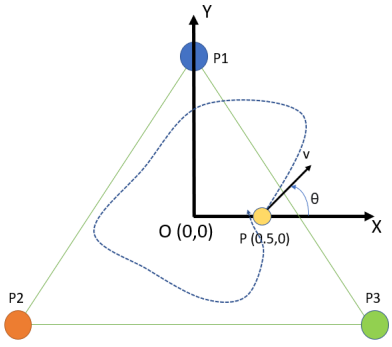

Figure 1: The universe