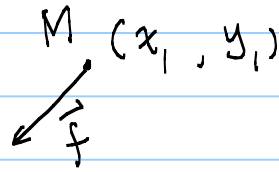


Two - Body Problem

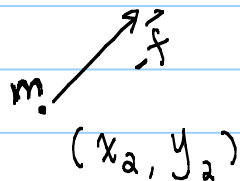
Note Title

11/26/2008



Assume

$$GM = 1$$



$$\vec{f} = [\text{magnitude}] \cdot [\text{direction}]$$

$$\frac{GM \cdot m}{r^2} \cdot \frac{1}{r} \begin{bmatrix} x_2 - x_1 \\ y_2 - y_1 \end{bmatrix} = \frac{GMm}{r^3} \begin{bmatrix} x_2 - x_1 \\ y_2 - y_1 \end{bmatrix}$$

$$r = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\cancel{m} \begin{bmatrix} \ddot{x}_1 \\ \ddot{y}_1 \end{bmatrix} = \frac{GMm}{r^3} \begin{bmatrix} x_2 - x_1 \\ y_2 - y_1 \end{bmatrix}$$

$$\cancel{M} \begin{bmatrix} \ddot{x}_2 \\ \ddot{y}_2 \end{bmatrix} = - \frac{GMm}{r^3} \begin{bmatrix} x_2 - x_1 \\ y_2 - y_1 \end{bmatrix}$$

Obviously, we need substitution

$$u_1 = x_1, u_2 = y_1, u_3 = x_2, u_4 = y_2$$

$$u_5 = \dot{x}_1, u_6 = \dot{y}_1, u_7 = \dot{x}_2, u_8 = \dot{y}_2$$

1st: Pencil work: write down the equation

$$\left\{ \begin{array}{l} \ddot{u}_1 = \\ \ddot{u}_2 = \\ \vdots \\ \ddot{u}_8 = \end{array} \right. \quad t \in [0, ?]$$
$$u_1(0) = \dots, u_2(0) = \dots$$

Case 2: $G \cdot M = 1, \quad G \cdot m = \frac{1}{2}$