Force due to body J on body i is given

$$F_{iJ} = \frac{G m_i m_J}{|\vec{r}_j - \vec{r}_i|^3} (\vec{r}_J - \vec{r}_i)$$

$$\ddot{r}_i = \sum_{\substack{J=1 \\ i \neq J}}^{N} \frac{F_{iJ}}{m_i}$$

$$= \sum_{i \neq J} \frac{G m_J (\vec{r}_J - \vec{r}_i)}{|r_J - r_i|^3}$$

$$\ddot{r}_1 = \frac{G m_2 (\vec{r}_2 - \vec{r}_1)}{|\vec{r}_2 - \vec{r}_1|^3} + \frac{G m_3 (\vec{r}_3 - \vec{r}_1)}{|\vec{r}_3 - \vec{r}_1|^3}$$

and similarly for $\ddot{r}_2$ and $\ddot{r}_3$,

and 4 more eq^{ns}

So $\boxed{\vec{v}_1 = \dot{\vec{r}}_1}$

and

$$\boxed{\dot{\vec{v}}_1 = \ddot{r}_1 = \frac{G m_2 (\vec{r}_2 - \vec{r}_1)}{|\vec{r}_2 - \vec{r}_1|^3} + \frac{G m_3 (\vec{r}_3 - \vec{r}_1)}{|\vec{r}_3 - \vec{r}_1|^3}}$$

if we write then component wise, we get eqns.

$\boxed{v_{1x} = \dot{r}_{1x}}$ $\boxed{v_{1y} = \dot{r}_{1y}}$

$$\dot{v}_{1x} = \frac{G m_2 (r_{2x} - r_{1x})}{[(r_{2x} - r_{1x})^2 + (r_{2y} - r_{1y})^2]^{3/2}} + \frac{G m_3 (r_{3x} - r_{1x})}{[(r_{3x} - r_{1x})^2 + (r_{3y} - r_{1y})^2]^{3/2}}$$

$$\dot{v}_{1y} = \frac{G m_2 (r_{2y} - r_{1y})}{\left[(r_{2y}-r_{1y})^2 + (r_{2x}-r_{1x})^2\right]^{3/2}} + \frac{G m_3 (r_{3y} - r_{1y})}{\left[(r_{3y}-r_{1y})^2 + (r_{3x}-r_{1x})^2\right]^{3/2}}$$

and similarly we get for masses 2, 3

8 more equations