$$a_{gravity} = \frac{\mu}{r^2}$$

$$\vec{r}(t)$$

$$\vec{a}_{gravity} = -\frac{\mu}{|\vec{r}|^3}\vec{r}$$

$$\vec{a}_{gravity} = \frac{d\vec{v}}{dt} = \frac{d^2\vec{r}}{dt^2}$$

$$\vec{a}_{gravity} = \dot{\vec{v}} = \ddot{\vec{r}}$$

$$\iint \vec{a}_{gravity}\, dt^2 = \int \vec{v}\, dt = \vec{r}(t)$$

$$\int \vec{a}_{gravity}\, dt = \vec{v}(t)$$

$$\int \vec{v}\, dt = \vec{r}(t)$$

$$\iint a_{gravity_x}\, dt^2 = \int v_x\, dt = r_x(t)$$

$$\iint a_{gravity_y}\, dt^2 = \int v_y\, dt = r_y(t)$$

$$\iint a_{gravity_z} \, dt^2 = \int v_z \, dt = r_z(t)$$