The acceleration of an object moving in the gravitational field of the Earth is

$$\mathbf{a} = -\frac{GM_E\mathbf{r}}{r^3} \tag{0.1}$$

where $\mathbf{r}$ is the position vector directed from the center of the Earth toward the object. Choosing the origin to be at the center of the Earth and assuming that the small object is moving in the xy plane, the rectangular (Cartesian) components of its acceleration are

$$a_x = -\frac{GM_E x}{(x^2+y^2)^{3/2}} \tag{0.2}$$

$$a_y = -\frac{GM_E y}{(x^2+y^2)^{3/2}} \tag{0.3}$$

Using Python, model the motion of an object orbiting the earth. Assume that the initial position of the object is $x = 0$, $y = 2R_E$ (R_e is the radius of the earth). Give the object an initial velocity of 5000 m/s in the x-direction. Use $dt = 5$ s.

1. Make a plot of the trajectory for one orbit around the earth.
2. Determine $\mathbf{r}$, $\mathbf{v}$ and $\mathbf{a}$ at $t = 4000$ seconds.