Project 1 - Particle trajectory

Consider Earth's magnetic field

$$B_r = -2B_0\left(\frac{R_E}{r}\right)^3 \tag{1}$$

$$B_\theta = -B_0\left(\frac{R_E}{r}\right)^3 \sin(\theta) \tag{2}$$

$$B_\phi = 0 \tag{3}$$

Here the usual spherical co-ordinates (r, θ, ϕ) are used with the magnetic north-south axis along the z direction. $B_0 = 3.12 \times 10^{-5} T$.

An electron with energy 30keV (assume non-relativistic dynamics) starts moving at the magnetic equatorial plane at an altitude of $1R_E$ above Earth's surface. It's velocity is in the north-east direction (45° between north and east). Show the trajectory of this particle in 3 dimensions for different times. Use the RK4 method to solve for the trajectory