Problem Sheet 13 - MP170/180

Planetary motion

1. The eccentricity of the orbit of the planet Mercury is 0.205 and its average distance from the Sun is 0.387 AU. What is its maximum distance from the Sun?

   (AU : Astronomical unit. One AU is approximately 149.6 million kilometres. lt is close to the average distance from the Earth to the Sun. The AU is often used as a unit of distance within the solar system.)

2. The mass of the sun is approximately 1.9891×10^{30} kg. The eccentricity of the elliptical orbit of Mars is $e = 0.093$ and the minimum distance from Mars to the sum is 1.382 AU. Use this information to calculate the number of Earth years in a Martian year.

   Note : Be careful with the units because here the distances are given in AU. Also, note the units of G, the universal gravitational constant.

3. Show that the curve whose equation in polar coordinates is $\frac{2}{r} = 1+\cos\theta$ has the equation $y^2 = 4 - 4x$ in Cartesian coordinates and hence is a parabola. Draw a rough sketch of this curve.