

Practical 11 Kepler's Law

Introduction

This isn't really a practical but it is an exercise in using data from a database. A database is a computer programme that allows you to make connections between different bits of data. The college timetable uses a database to make lists of the students in different classes, the teachers in different rooms and what time the different classes happen. When teachers mark a student absent the database makes a list for the advisor so they know when the student missed a class. In this exercise a database containing data about the solar system will be used to plot a graph verifying Kepler's law.

Kepler's Law

For many years before Newton thought of his "Universal Law of Gravity" man was interested in the movement of the planets, this interest led to very precise measurement of their time periods and orbital radii. By manipulating this data Kepler found out that the square of the Time period was proportional to the cube root of the radius.

$$r^3 \propto T^2$$

Later Newton showed how this could be derived from the "Universal law of Gravity".

We know that if a body moves in a circle the force acting toward the centre = mv^2/r

Newton's Law said that this force = GMm/r^2 where M is the mass of the sun.

So

$$\frac{GMm}{r^2} = \frac{mv^2}{r}$$

But the speed of the body $v = 2\pi r/T$ where T= time period

- Substitute this into the equation above and show that $r^3 = \frac{GM}{4\pi^2} T^2$
- Using the data about the solar system found [here](#) (press ctrl and click to open link), plot a graph of r^3 against T^2 .
- Use your graph to find the mass of the sun.
- More info about databases can be found on the [ICT site](#).