Measuring the Mass of Jupiter Lab

Newton's General form of Kepler's Third Law

$$\left(M_1 + M_2\right) P^2 = a^3$$

M in Solar Units (mass of Sun)

P in Years

a in Astronomical Units (AU)

In this case,

- M_1 = Mass of Jupiter = M_J
- M_2 = Mass of a moon (small compared to M_J)

Simplifying Things

But, the mass of the moon is much less than the mass of Jupiter so we can say it is very close to zero so….

$$\left(M_{\mathrm{J}} + 0\right)P^2 = a^3$$

or

$$M_{\mathrm{J}} = \frac{a^3}{P^2}$$

Observations

- We need to measure the period P and the semi-major axis a of the orbit of the moons.
  - Watch the moons over the course of several days.
- We can only observe from the Earth

Reading the Chart