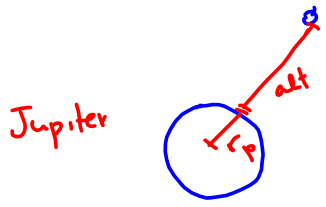
Kepler questions

1. A satellite is put in orbit around Jupiter at an altitude of 6.0×10^7 m.
   a) What is its period of orbit?
   b) What is its orbital speed?



$v = \frac{2\pi r}{T}$

$r = r_p + alt.$

$= 7.15 \times 10^7 + 6.0 \times 10^7 m$

$= 1.315 \times 10^8 m$

Recall: For any object orbiting Jupiter

$K = \frac{r^3}{T^2}$

$\frac{r_{Al}^3}{T_{Al}^2} = \frac{r_{sat}^3}{T_{sat}^2}$

Using Almathea

$r_{Al} = 1.81 \times 10^5 km = 1.81 \times 10^8 m$

$T_{Al} = 11h\ 53m$

$= 11 \times 3600 + 53 \times 60\ s$

$= 42780 s$

$\frac{(1.81 \times 10^8 m)^3}{(42780 s)^2} = \frac{(1.315 \times 10^8 m)^3}{T_{sat}^2}$

$T_{sat}^2 = \frac{(1.315 \times 10^8 m)^3}{(1.81 \times 10^8 m)^3}(42780 s)^2$

a) $T_{sat} = 26492 s$

$v = \frac{2\pi r}{T}$

$= \frac{2\pi(1.315 \times 10^8)}{2.65 \times 10^4}$

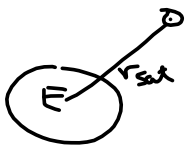
$= 3.1 \times 10^4 m/s$

$= 31 km/s$

Synchronous, geostationary

2. What is the radius of orbit of a geosynchronous satellite orbiting the Earth?

What is the importance/significance of this satellite orbit?



$T_{sat} = 1\ day$

$r_{moon} = 3.84 \times 10^8\ m$

$T_{moon} = 27.3\ day$

$$\frac{r_{moon}^3}{T_{moon}^2} = \frac{r_{sat}^3}{T_{sat}^2}$$

$$\frac{(3.84 \times 10^8 m)^3}{(27.3 d)^2} = \frac{r_{sat}^3}{(1 d)^2}$$

$r_{sat} = 4.24 \times 10^7\ m$

$\sqrt[3]{x}$

$\sqrt[y]{x}$

$x^{1/3}$