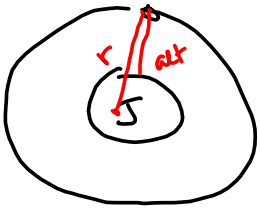
Kepler questions

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?



$r = alt + r_{Jupiter}$ ← from data sheet.

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

$= 1.315 \times 10^8 m$

Recall $K = \frac{r^3}{T^2}$ for anything orbiting Jupiter.

Using Almathea

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

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

$= [11 \times 3600 + 53 \times 60]$

$= 42780 s$

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

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

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

$= 7.02 \times 10^8$

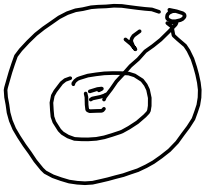
a) $T = 26492 s$

b) $v = \frac{2\pi r}{T} = \frac{2\pi (1.315 \times 10^8 m)}{2.65 \times 10^4 s}$

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

$T = 24h = 1\ day$

2. What is the radius of orbit of a geosynchronous satellite orbiting the Earth?
What is the importance/significance of this satellite orbit?



$T_{sat} = 1\ day$

Moon $\Rightarrow$ $r = 3.82 \times 10^8\ m$

$T = 27.3\ d$

3.82 EYP 8

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

$$r_{sat}^3 = \frac{(3.82 \times 10^8\ m)^3}{(27.3)^2} = 7.48 \times 10^{22}\ m^3$$

$\sqrt[3]{x}$

1 2nd 3 1/x

$$r = 4.21 \times 10^7\ m$$