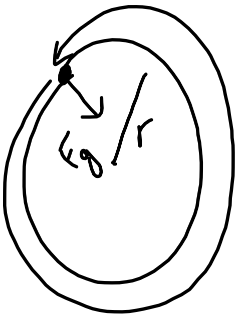
p571/18



a) $V = \frac{2\pi r}{T}$

radius of earth

24 h

b) $F_{net} = ma$

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

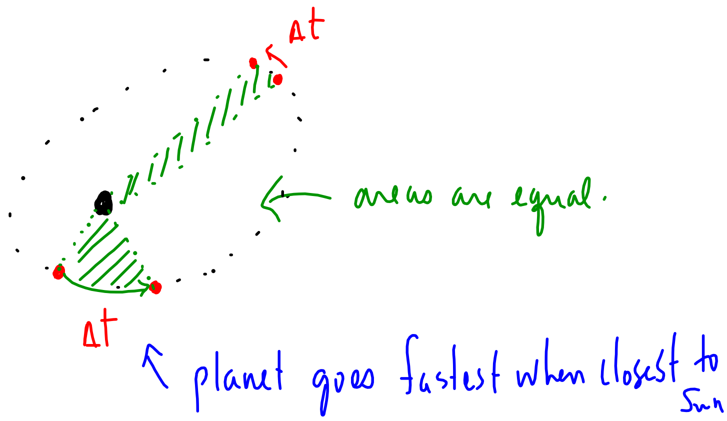
Chapter 12- Universal Gravitation

§12-1 Newton's Law of Universal Gravition

Kepler was one scientist who made proposals about the solar system which laid the groundwork for Newton.
(Read p 574-575 to find out about the others)

Kepler's Laws

1. Planets move in elliptical orbits with the Sun at the focus of the ellipse.
2. Planets sweep equal areas in equal times



3. The ratio of R^3/T^2 is a constant for any orbiting body. This ratio is called Kepler's Constant and it is $3.35 \times 10^{18}\ m^3/s^2$ for the planets orbiting the sun.

Other central bodies will have a different constant.

$$K = \frac{R^3}{T^2} \quad \text{OR} \quad \frac{R_A^3}{T_A^2} = \frac{R_B^3}{T_B^2}$$

(for any two objects orbiting the same central body)

Newton's Law of Universal Gravitation

Newton proposed that $F_g \propto m_1$, $F_g \propto m_2$, $F_g \propto \frac{1}{r^2}$

$$F_g \propto \frac{m_1 m_2}{r^2}$$

$$F_g = \frac{G m_1 m_2}{r^2}$$

g

where F_g is the force of gravity (N)

m_1 and m_2 are masses (kg)

r is the separation distance (m)

G is $6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$ (Constant of Universal Gravitation)

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$m_1 = 65.0 kg$

$m_2 = 7.35 \times 10^{22} kg$

$r = 1.74 \times 10^3 km$ → $1.74 \times 10^6 m$

$F_g = ?$

$$F_g = \frac{G m_1 m_2}{r^2}$$

$$F_g = \frac{\left(6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2}\right)(65.0 kg)(7.35 \times 10^{22} kg)}{(1.74 \times 10^6 m)^2}$$

$$F_g = 105 N$$

TO DO

① PP|272 (FoP) ~ Kepler's Law

② PP|580