Centripetal acceleration

When moving along a circular path of radius R, with constant speed v, an object has acceleration directed towards the center, called Centripetal Acceleration:

$$a = \frac{v^2}{R}$$

Newton's Law of Gravity

Two masses, m_1 and m_2 , experience *gravitational attractive force* to each other, that depends on distance between them, r:

$$F = -\frac{Gm_1m_2}{r^2}; \qquad G = 6.7\times10^{-11}\frac{m^3}{kg\cdot s^2}$$

G is called Gravitational Constant.

Homework

Problem 1.

a) Find the speed of the orbital motion of *the International Space Station* around the Earth. Note that its orbit is located **400 km** above the ground. This is much smaller than the Earth radius **R=6370.** This means that you can assume the gravitational force acting on the space station of mass ***M*** to be the same as on Earth surface, ***Mg***.

b) What is the period of this orbital motion (time to make a full tern around Earth)?

Problem 2.

By combining (i) Newtons Law of Gravity with (ii) the 2nd Newtons Law, and (iii) the formula for centripetal acceleration, derive the formula for the speed of a planet that orbits a star of mass ***M***. Radius of the orbit is ***R***. Mass of the planet is ***m*** (does it matter?)