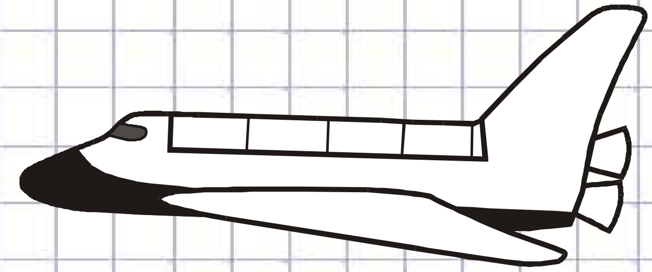
Particle F=ma (n-t): Example Problem 3

A space shuttle orbits the earth. On board, the astronauts are seen floating. Does this mean that there is ‘zero gravity’ at the shuttle?



For example, if the space shuttle is in low earth orbit (LEO), i.e. at an altitude of around 500 km (310 miles), determine its speed.

[Numbers used: earth's radius = 6378 km, radius to shuttle = 6378 + 500 = 6878 km, earth's mass $M = 5.976 \cdot 10^{24}$ kg, gravitational constant $G = 66.73 \cdot 10^{-12}\ m^3/(kg \cdot s^2)$].

Gravity at the shuttle:

$g = GM/r^2 = 8.43\ m/s^2 = v^2/r = v^2/(6878 \cdot 10^3\ m)$

$v = 7614$ m/s = 17,037 mph (Very fast, to maintain LEO. At this speed, the shuttle circles the earth every 95 minutes.)