Gravitation

Gravitational force and acceleration

Force of gravity between two masses

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

Acceleration due to planet's gravity, g

$$g = G\frac{m}{r^2}$$

F - Force, N; m_1, m_2 - mass, kg; m - mass of planet, kg; r - distance between mass' centers, m

Gravitational Constant

$G = 6.67 \times 10^{-11}$

Orbits

Orbital Velocity

$$V_{orb} = \sqrt{G\frac{m}{r}}$$

Orbital Period

$$T = \frac{2\pi r}{V_{orb}}$$

V_{orb} - Orbital velocity, m/s; T - orbital period, sec; m - mass of primary, kg; r- distance to primary center, m

Miscellaneous

Escape Velocity

$$V_{esc} = \sqrt{2G\frac{m}{r}} \qquad V_{esc} = \sqrt{2}\,V_{orb}$$

V_{esc} - Escape velocity, m/s; m - mass of primary, kg; r- distance to primary center, m

Kepler's Third Law: Orbital Period vs Radius

$$\frac{T_1^2}{R_1^2} = \frac{T_2^2}{R_2^2}$$

For solar orbits: $\frac{T^2}{R^2} = 1$