I deduced the forces which keep the planets in their orbs must be reciprocally as the squares of their distances from the centers about which they revolve; and thereby compared the force requisite to keep the Moon in her orb with the force of gravity at the surface of the Earth; and found them answer pretty nearly.

Isaac Newton
→ A universal law. Life on Earth, life out there.

**Input:**
- \( r_m = 3.84 \times 10^8 \text{ m} \)
- \( T_m = 27.3 \text{ days} \)
- N2L applied to the moon’s orb.
- \( m_m g_{\text{at moon}} = m_m \left( \frac{v_m^2}{r_m} \right) \)
- \( v_m = \frac{2\pi r_m}{T_m} \)

**Output:**
- \( g_{\text{at moon}} = 0.00272 \text{ m/s}^2 \).
- \( \frac{g_{\text{at moon}}}{g_{\text{on earth}}} = \frac{1}{3600} \) compared to.....
- \( \frac{r_m}{R_e} = 60.2 \)
\( r \) is the distance between the centers.

\[ F_{1 \text{ on } 2} = F_{2 \text{ on } 1} = \frac{Gm_1m_2}{r^2}, \quad (2) \text{ attractive}, \quad (3) \ G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2 \]
→ Little g and altitude.

\[ mg = \frac{GM_e m}{r^2} \]

\[ g = \frac{GM_e}{(R_e + h)^2} \]

\[ g = \left( \frac{GM_e}{R_e^2} \right) \ast \frac{1}{(1 + h/R_e)^2} \]

\[ g = \frac{g_{\text{earth}}}{(1 + h/R_e)^2} \]

→ \( g_{\text{earth}} = 9.83 \text{ m/s}^2 \)

→ \( R_e = 6.37E6 \text{ m} \)
Low Earth Orbit (LEO): $h < 2000 \text{ km}$

Medium Earth Orbit (MEO): $2000 \text{ km} < h < 35786 \text{ km}^1$

High Earth Orbit (HEO): $35786 \text{ km} < h$

For you to do: GPS satellites orbit with a period of 11 hours and 58 minutes (half a sidereal day).\(^2\) For a GPS satellite’s orbit, find its:

- radius.
- altitude.
- $n$ where \[ h = n \times R_e \].

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\(^1\) Why so specific? 35786 km is the altitude for a geosynchronous orbit.

\(^2\) A sidereal day is the time for Earth to rotate one time around on its axis relative to the stars. Due to earth’s orbital motion it is almost four minutes shorter than a solar day.