The gravitational constant \( g = 6.67 \times 10^{-8} \frac{\text{cm}^3}{\text{gm} \cdot \text{s}^2} \).

- A sugar cube is about 1 gm and about 1 cm\(^3\).
- The numerical value of \( g \) is telling us that two sugar cubes placed 1 cm apart in space take about \( \sqrt{\frac{g}{c}} \) seconds \( \approx 1 \text{hr} \) to come together. Natural units for gravity are thus "cglh" because they make \( g \approx 1 \).

\[ \vec{F}_1 = -\vec{F}_2; \quad M_1 \vec{r}_1 + M_2 \vec{r}_2 = 0 \]

- Integrate 1 time w.r.t. time
  \[ M_1 \vec{r}_1 + M_2 \vec{r}_2 = \vec{a} \quad \text{constant vector} \]

- Integrate another time w.r.t. time.
  \[ M_1 \vec{r}_1 + M_2 \vec{r}_2 = \vec{a} t + \vec{b} \]

**Defn. of center of mass:**
\[ \vec{R} = \frac{M_1 \vec{r}_1 + M_2 \vec{r}_2}{M_1 + M_2} \]

\[ \Rightarrow \vec{R} = \frac{\vec{a}}{m_1 + m_2} = (\text{constant}) \]

\[ \Rightarrow \vec{R} = \frac{\vec{a} t + \vec{b}}{m_1 + m_2} \]

The momentum of the 2-body system is conserved, and the center of mass moves with constant velocity.

\[ \text{knowing the motion of the system as a whole, all that is required is to know the motion of body 1 w.r.t. body 2.} \]