1. Mind Map: Newton's Law of Gravitation

Gravitation

Every mass attracts every other mass with a force

Scalar form → Gives only the **magnitude** of gravitational force between 2 masses

$$F = G \times (m_1 \times m_2) / r^2$$

Vector form → Unit vector $\hat{r}$ adds direction, pointing along the line joining the two masses

$$F = G \times (m_1 \times m_2) / r^2 \times r$$
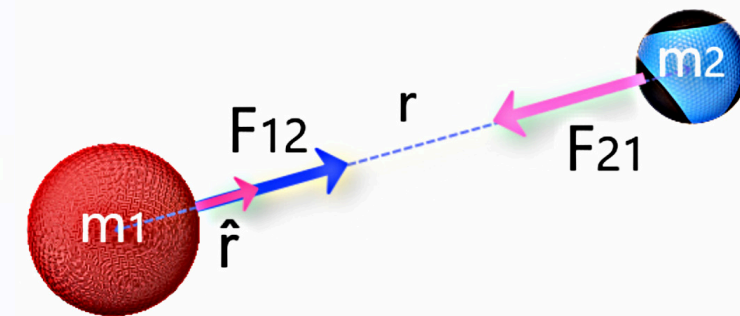
Characteristics of Gravitational Force

1 Both bodies pull on each other equally

2 Always attractive; Never repels — it only pulls

3 Acts at a distance - No physical contact is needed

4 Cannot be shielded - You can't block gravity by placing an object in between — it penetrates everything

$$F_{12} = -F_{21}$$
(Newton's 3rd Law)

Clarifying Common Ideas

Near Earth's surface - Same Acceleration in Free Fall: All objects accelerate at 9.8 m/s², regardless of mass

Gravity Exists Everywhere: Even in deep space, gravity never truly becomes zero — it just weakens with distance.

Normal Force ≠ Reaction to Gravity: Earth pulls you down; your body pulls Earth up. The normal force is a contact force, not a reaction to gravity.

Depends on Mass, Not Size: Gravitational force depends only on mass, not how large or small something looks

$$a = G \times M / r^2 \approx 9.8 \text{ m/s}^2$$
near Earth's surface