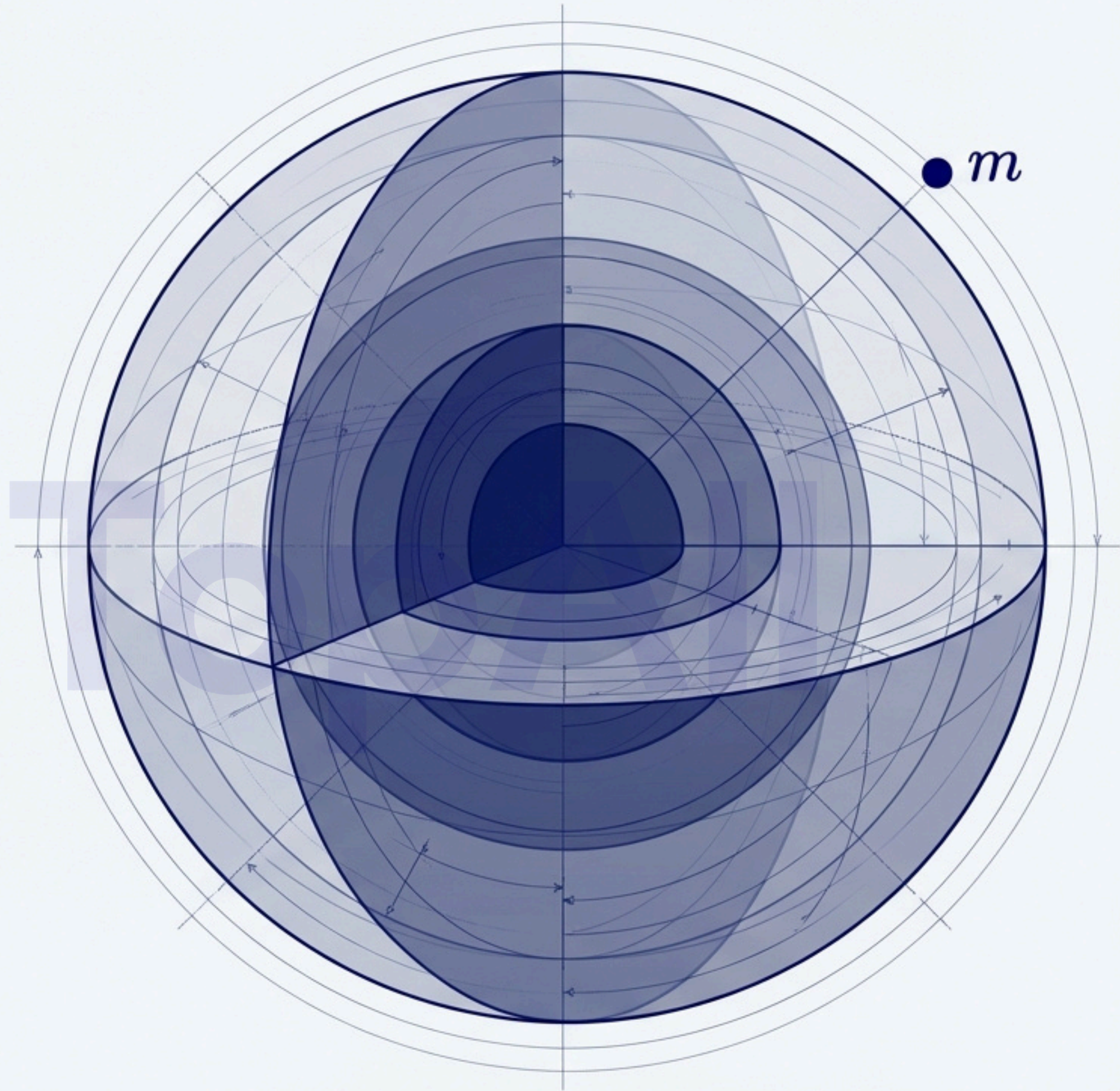
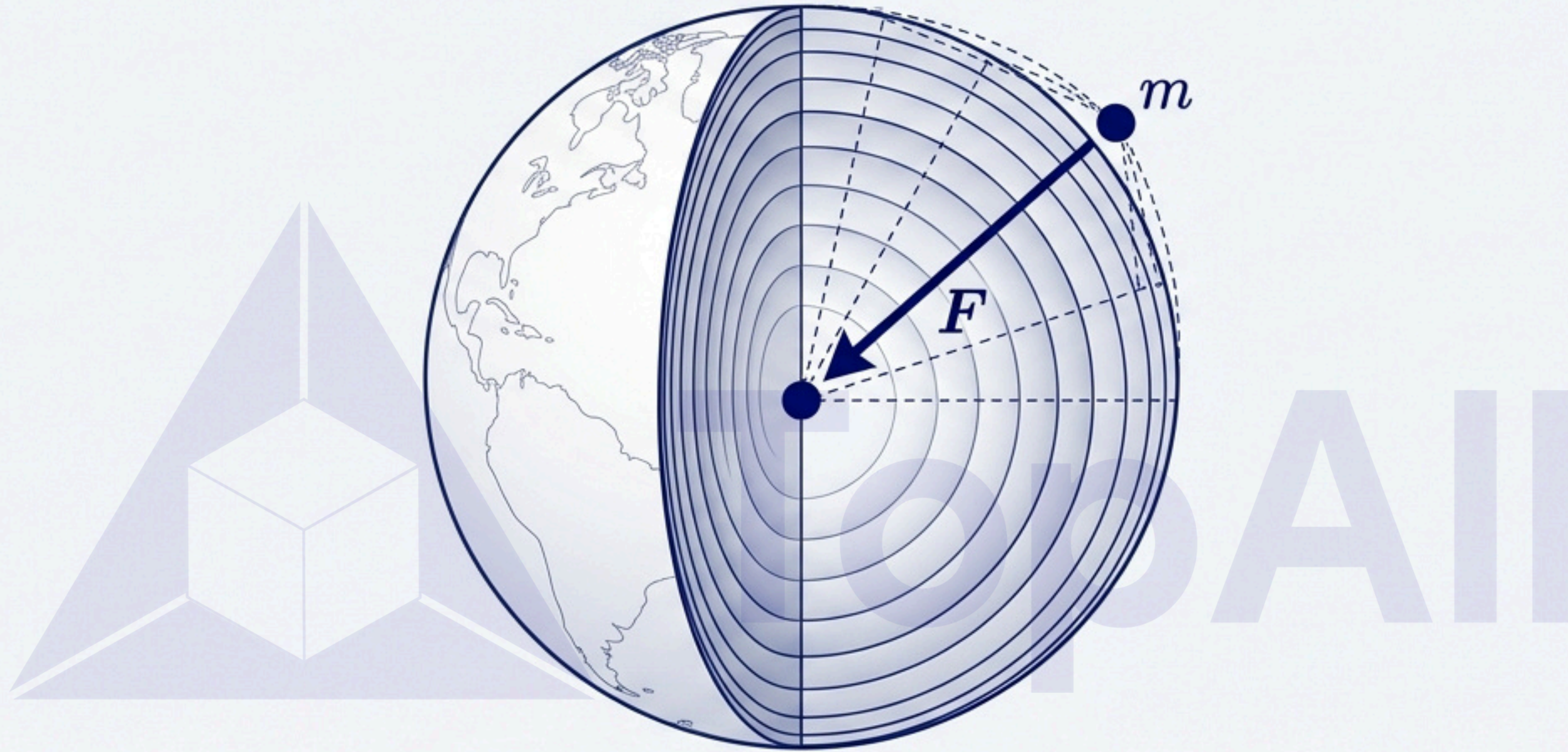


Acceleration Due to Gravity

in Inter, Medium, H2:
Where g comes from



Earth as a Spherical Body



The Point Mass Assumption

The Earth is modeled as a massive sphere made of countless concentric shells. For any object on or outside its surface, the combined gravitational pull of all these shells acts exactly as if the Earth's entire mass were concentrated at a single point in the center.

Defining g

Newton's Second Law

$$F = mg$$

40px

Universal Gravitation

$$F = \frac{GM_E m}{R_E^2}$$

The acceleration due to gravity (g) is mathematically defined as the force-per-unit-mass acting on an object: $g = \frac{F}{m}$.



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$$E=mc^2$$



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Derivation at Earth's Surface

1. Equate the forces

$$mg = \frac{GM_E m}{R_E^2}$$

2. Mass of the object cancels out

$$\cancel{mg} = \frac{GM_E \cancel{m}}{R_E^2}$$

Universal Gravitational
Constant

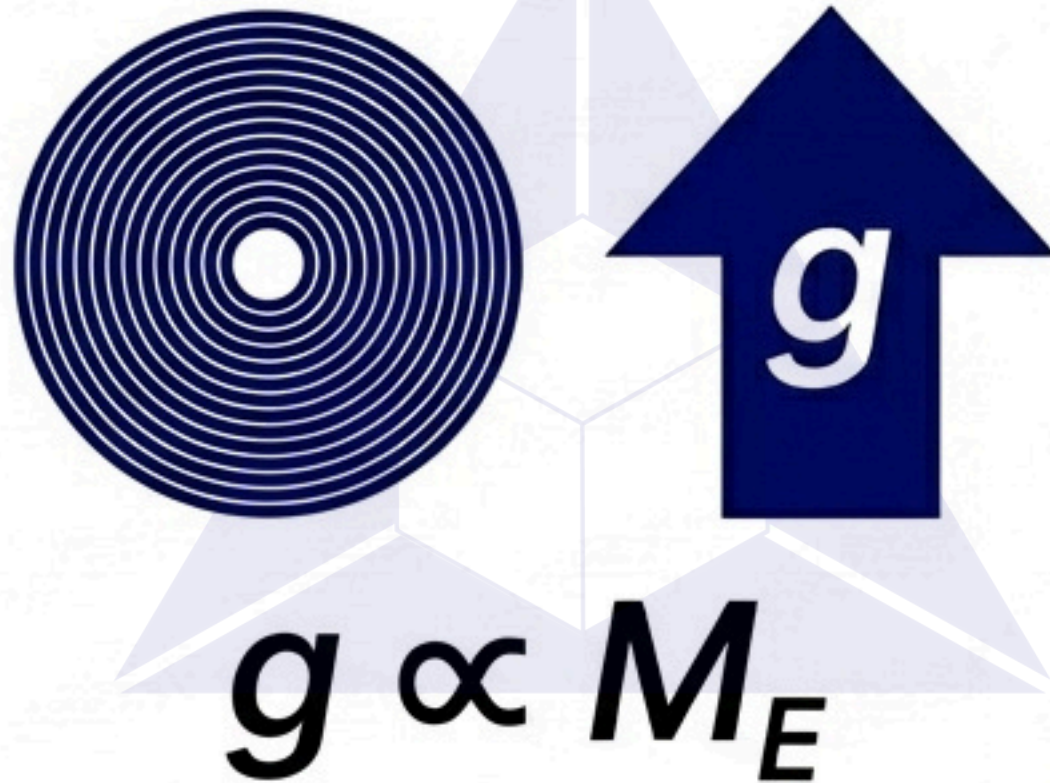
$$g = \frac{GM_E}{R_E^2}$$

Mass of the Earth

Radius of the Earth

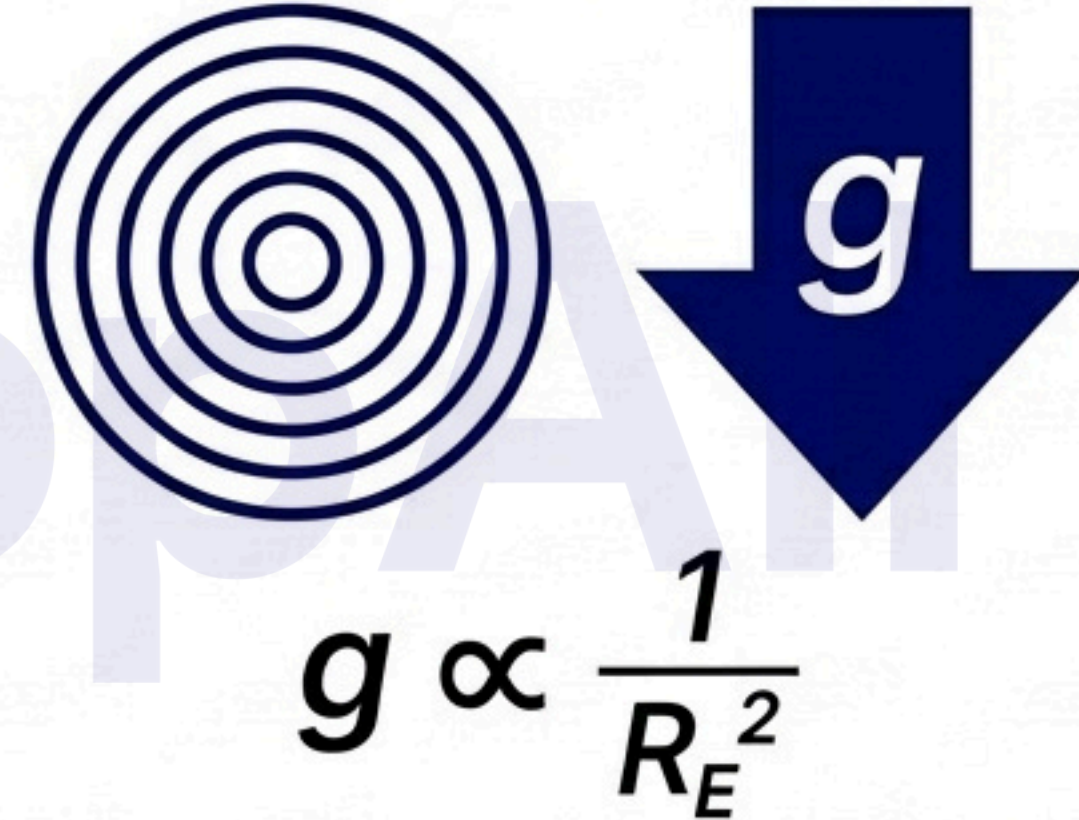
The Meaning of the Formula

The Mass Effect



Direct Proportionality. If a planet has more mass (and the same radius), its gravitational pull is stronger, resulting in a larger g .

The Radius Effect



Inverse Square Law. If a planet has a larger radius, its surface is farther from the center mass. This distance significantly weakens the pull, resulting in a smaller g .

Key Takeaways



1. The Cause

g is the acceleration caused entirely by Earth's gravitational force acting on an object.



2. The Model

For mathematical purposes, the Earth behaves like a central point mass for all objects located on or outside its surface.



3. The Dependencies

The value of g depends only on the Earth's mass (M_E) and radius (R_E). Because the object's mass (m) cancels out, heavy and light objects fall at the exact same rate.



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