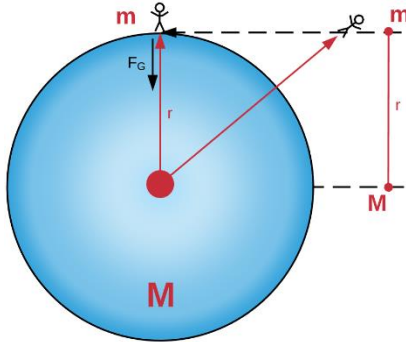


CONCEPT: Gravitational Force Inside Earth

- Remember: The force of gravity acts as if all the mass _____ you was concentrated at the center of mass.

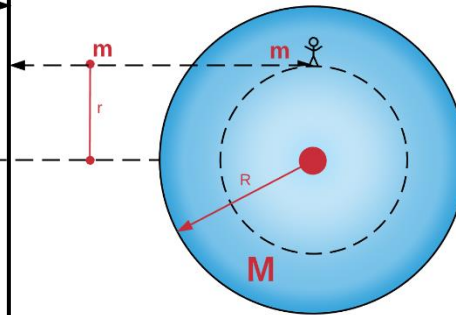
On/Outside Earth

$$F_G = \frac{GMm}{r^2} \rightarrow r \geq R$$

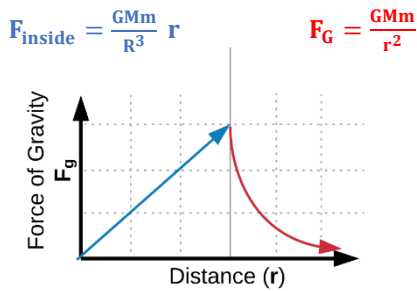


Inside Earth

$$F_{\text{inside}} = \frac{GM_{\text{inside}}m}{r^2} = \text{_____} \rightarrow r \text{ _____ } R$$



- This works if we approximate the density of the Earth to be _____.

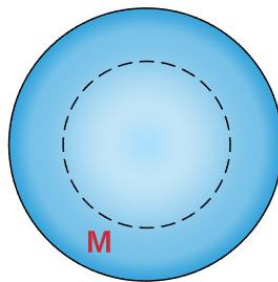


- $F_{g,\text{inside}}$ increases proportional to r .

- F_g decreases proportional to $\frac{1}{r^2}$.

- At Earth's center, you'd be _____!

EXAMPLE: A person with a surface weight of 780N drills a hole in the Earth and ventures down. How far from the center of the Earth would their weight be 80% of the surface value? Express this as a multiple of the Earth's radius.



EQUATIONS	CONSTANTS
$F_G = \frac{Gm_1m_2}{r^2}$ $r = R + h$	$G = 6.67 \times 10^{-11} \frac{\text{m}^3}{\text{kg s}^2}$
$g_{\text{surf}} = \frac{GM}{R^2}$ $g = \frac{GM}{r^2}$	$M_E = 5.97 \times 10^{24} \text{ kg}$
$F_{G(\text{inside})} = \frac{GMm}{R^3} r$	$R_E = 6.37 \times 10^6 \text{ m}$

PRACTICE: A uniform, solid, 1600.0 kg sphere has a radius of 5.00 m. Find the gravitational force this sphere exerts on a 2.10 kg point mass placed at the following distances from the center of the sphere: (a) 5.10 m, and (b) 2.55 m.

EQUATIONS	CONSTANTS
$F_G = \frac{Gm_1m_2}{r^2}$ $r = R + h$	$G = 6.67 \times 10^{-11} \frac{\text{m}^3}{\text{kg} \cdot \text{s}^2}$
$g_{\text{surf}} = \frac{GM}{R^2}$ $g = \frac{GM}{r^2}$	$M_E = 5.97 \times 10^{24} \text{ kg}$
$F_{\text{inside}} = \frac{GMm}{R^3} r$	$R_E = 6.37 \times 10^6 \text{ m}$
	$r_{\text{Sun-Earth}} = 1.5 \times 10^{11} \text{ m}$
	$c = 3 \times 10^8 \text{ m/s}$