CONCEPT: Gravitational Force Inside Earth

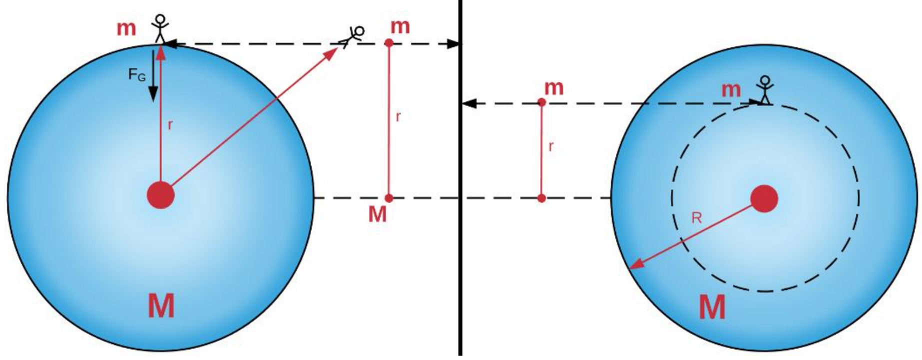
● Remember: The force of gravity acts as if all the mass ____________ you was concentrated at the center of mass.

On/Outside Earth

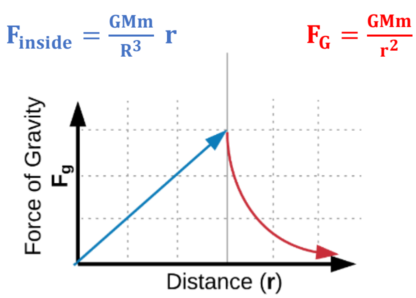
$$F_G = \frac{GMm}{r^2} \rightarrow r \geq R$$

Inside Earth

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



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

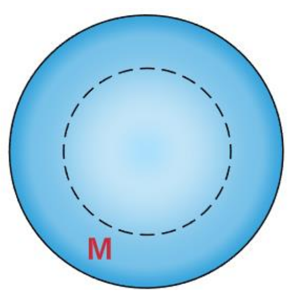


● $F_{g,inside}$ increases proportional to **r**.

● 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
$F_G = \frac{Gm_1m_2}{r^2}$	$r = R + h$	$G = 6.67\times10^{-11} \frac{m^3}{kg \cdot s^2}$
$g_{surf} = \frac{GM}{R^2}$	$g = \frac{GM}{r^2}$	$M_E = 5.97\times10^{24}$ kg
$F_{G(inside)} = \frac{GMm}{R^3} r$		$R_E = 6.37\times10^6$ 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
$F_G = \frac{Gm_1m_2}{r^2}$ $r = R + h$	$G = 6.67\times10^{-11}\ \frac{m^3}{kg\cdot s^2}$
$g_{surf} = \frac{GM}{R^2}$ $g = \frac{GM}{r^2}$	$M_E = 5.97\times10^{24}$ kg
$F_{inside} = \frac{GMm}{R^3}r$	$R_E = 6.37\times10^6$ m $r_{Sun\text{-}Earth} = 1.5\times10^{11}$ m $c = 3\times10^8$ m/s