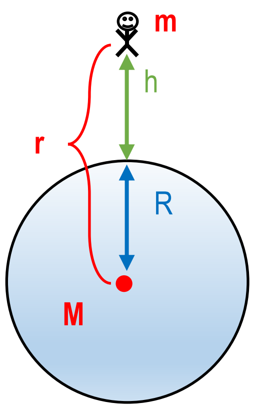
CONCEPT: Acceleration Due to Gravity

● Use Newton's Law of Gravity to determine the acceleration due to gravity **($a_g \rightarrow g$)** at different distances from a planet.

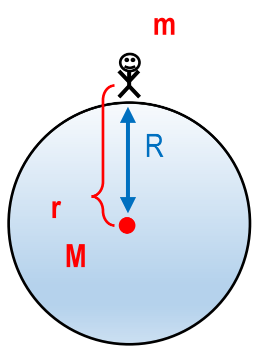
Any Distance

$g =$ ______



On Surface

$g_{surf} =$ ______



- Use **g** when specifically given/asked for __________. Use **g_{surf}** when on the ____________. ("surface gravity")

- Note that both **g's** only depends on **(M | m)**

- **g_{surf}** is a local constant, **g** decreases as **r** _____________.

● Your weight at *any* distance from a planet is the force of gravity → $W = F_G = \frac{GMm}{r^2} =$ ________.

- On the surface, W = _______.

EXAMPLE: Compare the exact acceleration due to gravity on the top of Mount Everest, which has a height of 8.85km, with the surface gravity of the Earth.

GRAV. CONSTANTS
$G = 6.67\times10^{-11}\ \frac{m^3}{kg\cdot s^2}$
$M_E = 5.97\times10^{24}$ kg
$R_E = 6.37\times10^{6}$ m

PRACTICE: You stand on the surface of a mysterious planet with a mass of 6×10^{24} kg and measure the surface gravity to be 7 m/s^2. What must the radius of the planet be?

EQUATIONS		GRAV. CONSTANTS
$F_G = \frac{Gm_1m_2}{r^2}$	$r = R + h$	$G = 6.67\times10^{-11}\ \frac{m^3}{kg\cdot s^2}$
$g = \frac{GM}{r^2}$	$g_{surf} = \frac{GM}{R^2}$	$M_E = 5.97\times10^{24}$ kg
		$R_E = 6.37\times10^{6}$ m

EXAMPLE: An astronaut drops a rock from rest on the surface of an unknown planet. It takes 0.6 seconds to fall 1.5m. If the radius of this unknown planet is 4×10^{6} m, what is the mass?

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$g = \frac{GM}{r^2}$	$g_{surf} = \frac{GM}{R^2}$	$M_E = 5.97\times10^{24}$ kg
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PRACTICE: How far would you have to be above Earth's surface for ***g*** to be ½ of its surface value?

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