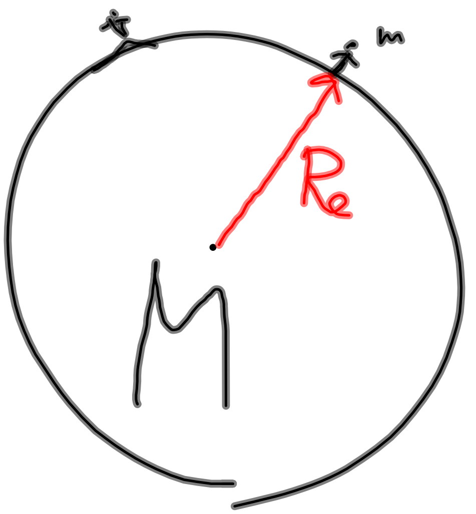
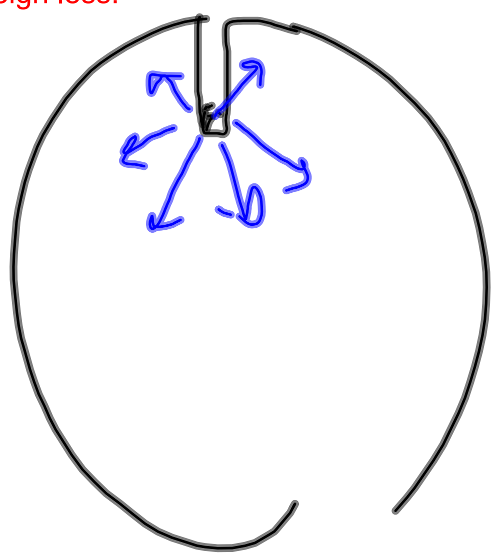
Climbing a mountain...

On a mountain, you are farther from Earth's CM, so you weigh less

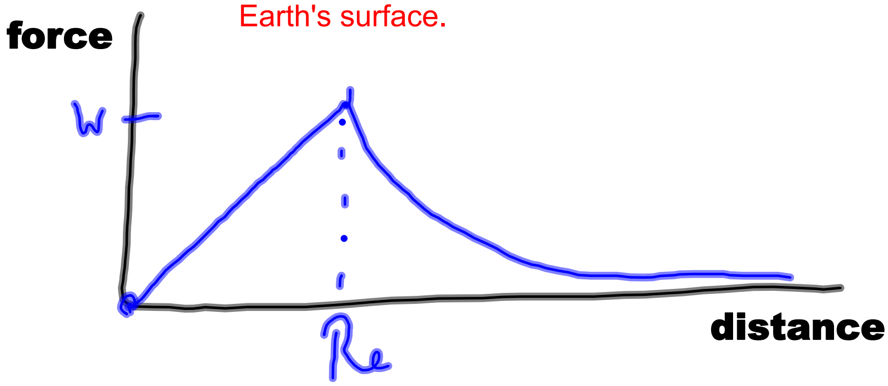


Digging into Earth...

If you dig into Earth, some Earth is above you pulling you up, canceling out part of your weight. Again, you weigh less!



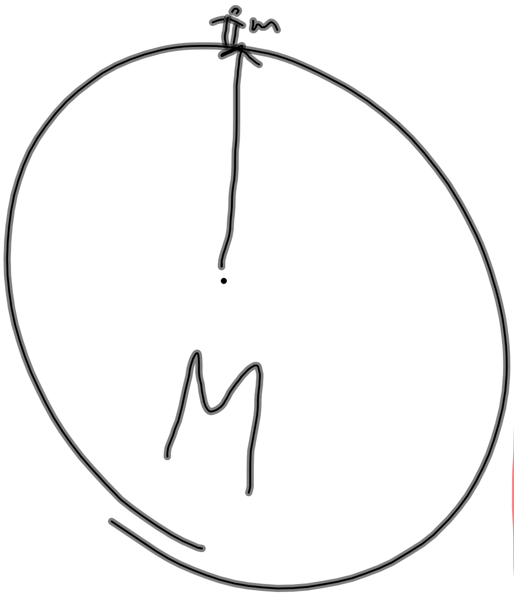
You have maximum weight at the Earth's surface.



Gravitational Field Strength g

Force is always between two objects, but we want to be able to characterize how strong gravity is at a certain spot near a planet without specifying what mass it's pulling on

$$\frac{F}{m} = \frac{\frac{GMm}{r^2}}{m}$$



So we divide out the small mass

gravitational field strength equation

$$g = \frac{GM}{r^2}$$

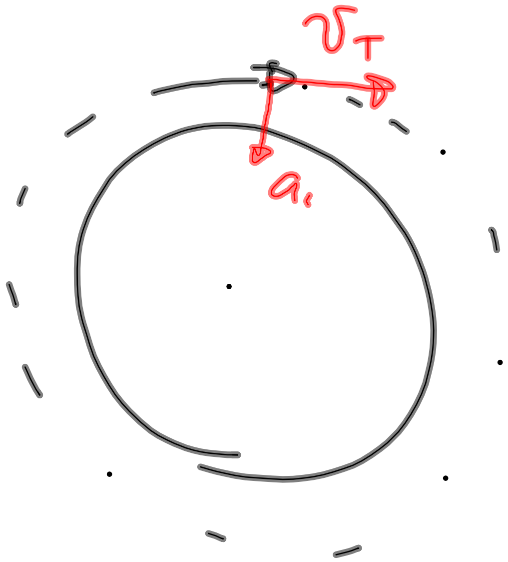
$$g = \frac{(6.67\times10^{-11})(5.97\times10^{24})}{(6.378\times10^{6})^2}$$

If you calculate it for Earth, you get 9.8 (of course!)

$$g = 9.8\ \mathrm{N/kg}$$

Orbital Velocity
(circular orbit)

$$a_c = \frac{v_T^2}{r}$$



$$g = a_c$$

In orbit, gravity provides the centripetal acceleration

$$\frac{GM}{r^{\not 2}} = \frac{v_T^2}{\not r}$$

$$\frac{GM}{r} = v_T^2$$

$$\sqrt{\frac{GM}{r}} = v_T$$

This is the formula to figure out the correct tangential velocity to stay in orbit