

## Gravitational Field and Gravitational Potential

Define the gravitational field  
as

$$\vec{g} = \frac{\vec{F}_g}{m} = \vec{a}_g$$

not to be  
confused  
with  $g = 9.807 \text{ m/s}^2$



The gravitational field is independent of the mass placed in the field.

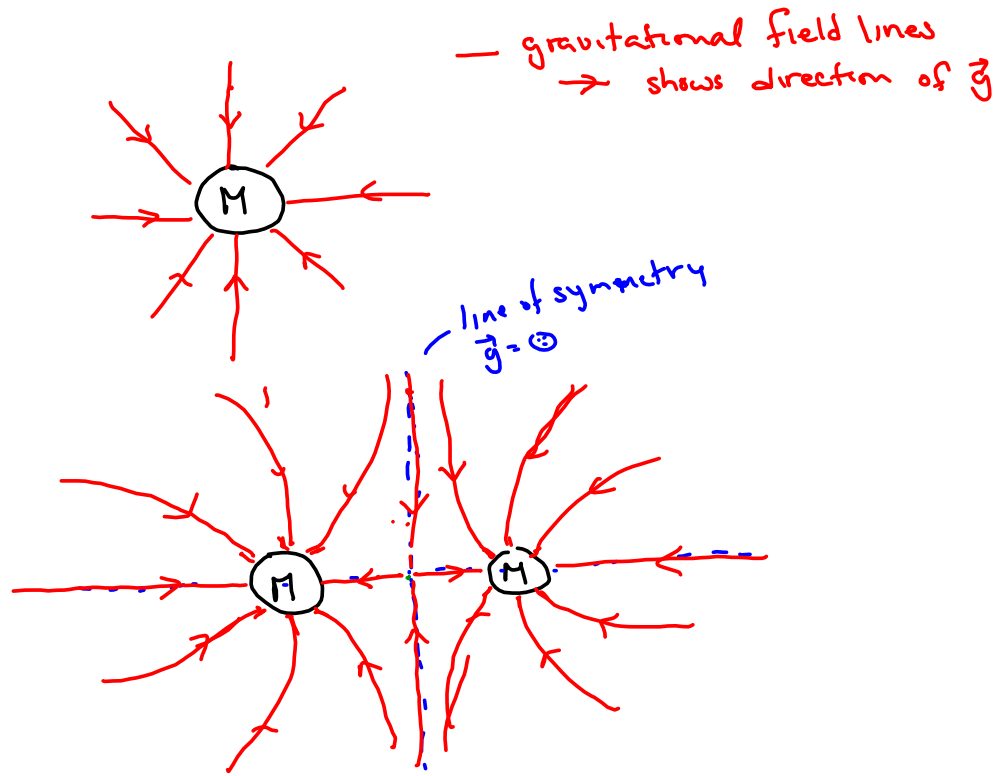
Near earth

$$\vec{g} = \frac{\vec{F}_g}{m} = \frac{-mg \hat{r}}{m} = -g \hat{r}$$

$r \gg r_E$

$$\vec{g} = - \frac{GM_E m}{r^2} \hat{r} = - \frac{GM_E}{r^2} \hat{r}$$

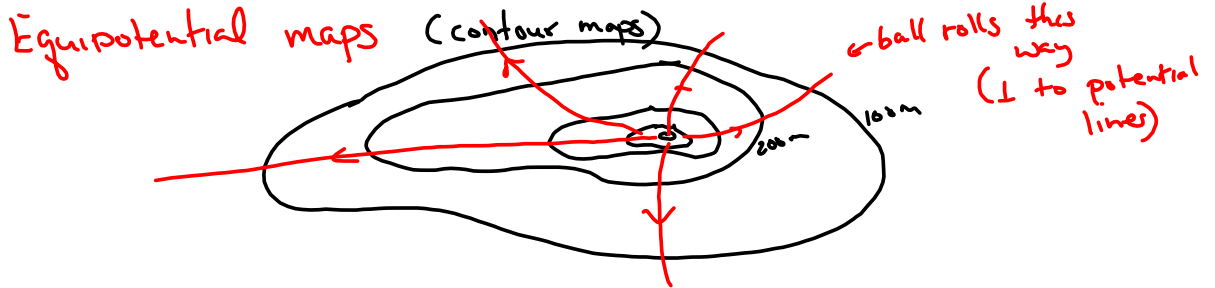
# Field Lines



## Gravitational Potential

Define  $V_g = \frac{PE_g}{m}$

Near earth  $V_g = \frac{mgh}{m} = gh$



Far from Earth

$$V_g = \frac{PE_g}{m} = \frac{-GMm}{r} \div m = -\frac{GM}{r}$$

