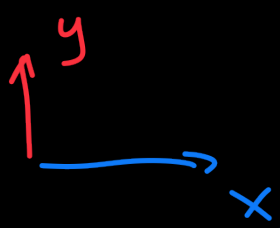
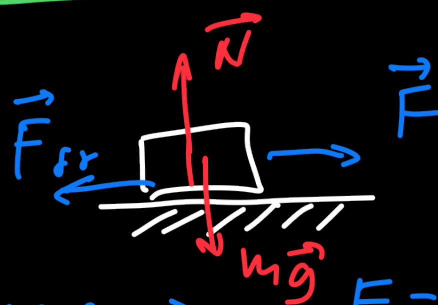
Homework 11.

N1.





x-dir: $F - F_{fr} = m \cdot a \Rightarrow F = \frac{1}{2} \cdot N + m \cdot a$

y-dir: $N - mg = 0 \Rightarrow N = 100N$

$\Rightarrow F = 50N + 20N = 70N$

N3

x-dir: $F_1 = 50N + m \cdot a = 80N$

$\boxed{F_1, F\ ?}$

spring is not moving:

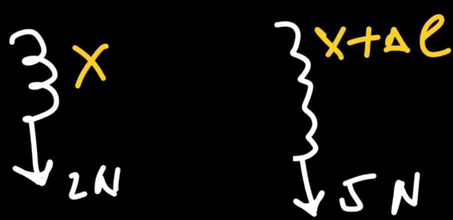
$\boxed{F - F_1 = m_{sp.} a}$ $\longleftrightarrow$ $\boxed{F - F_1 = 0}$

$a \to 0$

$F = \Delta l \cdot K \Rightarrow \Delta l = F/K = \frac{80N}{20\, N/cm} = 4cm$

$\boxed{\text{N4: parall: } \frac{1}{K_{eff.}} = \frac{1}{K_1} + \frac{1}{K_2}}$

N2.



6cm.

$\boxed{F = \Delta l \cdot K}$

$2N = x \cdot K$

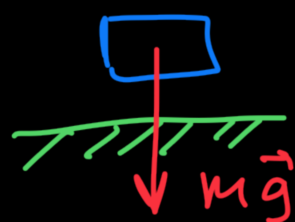
$5N = (x + \Delta l) \cdot K.$ $\longrightarrow$ $5N - 2N = 6cm \cdot K.$

$\frac{5N}{K} = 10cm.$

$K = \frac{1}{2} \frac{N}{cm} = 50 \frac{N}{m}$

Classwork: Universal law of gravitation.

$\boxed{F = mg} \rightarrow$ not universal!

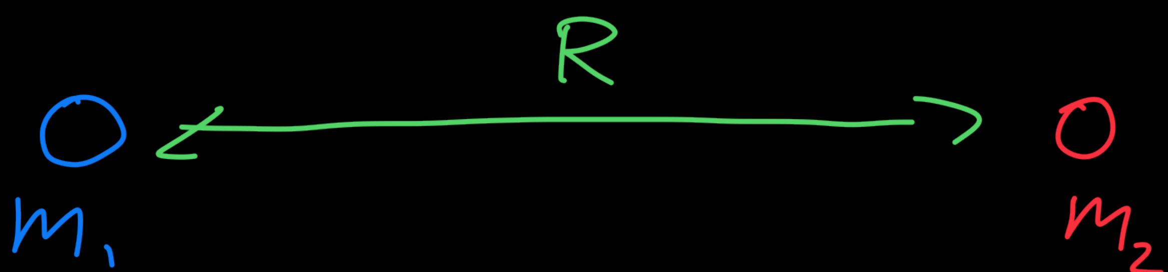


1. What if the box is in space?

   $F \rightsquigarrow 0$

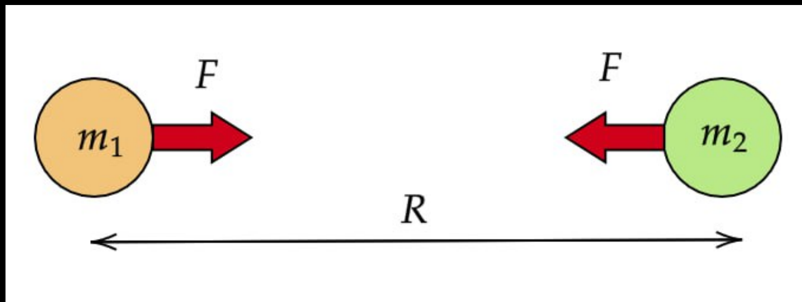
2. Take Mars, is $\vec{g}$ the same?

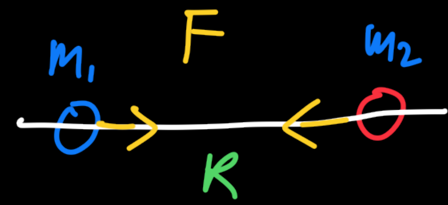
3. What about small objects?

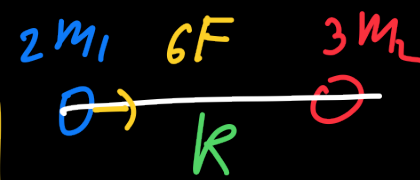


Newton: there is a gravitational force between any two massive objects!

$\rightarrow m_1, \; m_2, \; R$



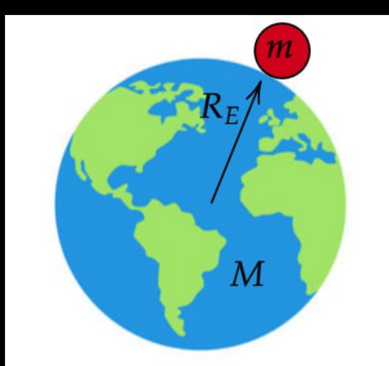


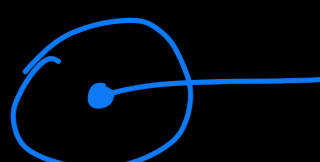


$$\boxed{F = \frac{G \cdot m_1 \, m_2}{R^2}}$$

$$G = 6.67 \cdot 10^{-11} \, \frac{N \cdot m^2}{kg^2}$$

$$N = \frac{[G] \cdot kg^2}{m^2}$$





$$\boxed{F = \frac{G \cdot M \cdot m}{R_E^2}}$$

$$mg = \frac{G \cdot M \cdot m}{R_E^2} \Rightarrow \boxed{g = \frac{G \cdot M_E}{R_E^2}}$$