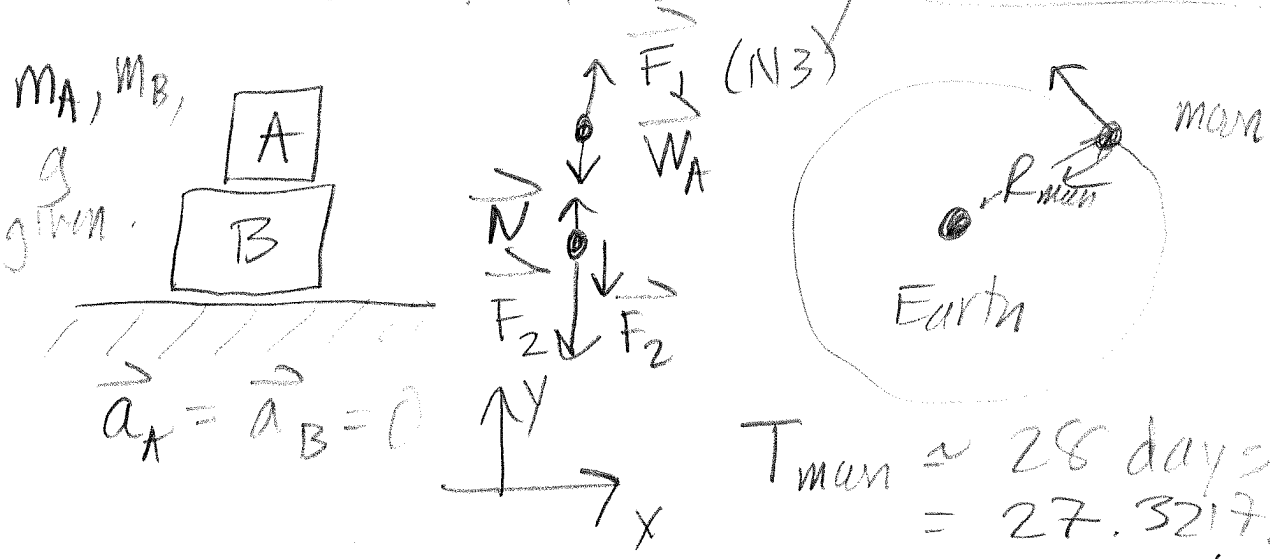
Applying Newton's Laws

(p. 68 of Kleppner)

(0) Take a look and get a feel for what is going on. Any accelerations? Any constraints?



$T_{moon} \simeq 28$ days
$= 27.3217$ d
$= 2.36 \cdot 10^6$ s

$R_m \simeq 3.84 \cdot 10^5$ km
(d miles eg) $\simeq 3.84 \cdot 10^8$ m

$\text{speed} = \frac{2\pi R_m}{T} = 1020\ m/s$

$\text{acceleration} = \frac{\text{speed}^2}{R_m} = 2.72 \cdot 10^{-3}\ m/s^2$

(1) Mentally Divide the system into smaller systems; treat each smaller system as a point mass (FOR NOW).

(2) Draw a force diagram for each mass...

(a) Label each mass.

(b) Draw a force vector for each force acting on it.

In example... $\vec{W}_A = -m_A g \hat{j}$

$W_B = -m_B g \hat{j}$

cannot be all!

all ⊥ to y direction

- $\vec{F}_1$: force of block B on block A
- $\vec{F}_2$: force of block A on block B
- $\vec{N}$: force of table on block B

(3) Draw an inertial (non-accelerating) coordinate system... Earth's Surface ≈ inertial.

Resolve into component equations

Use N2 for each body

$$\vec{F}_1 + \vec{W}_A = m_A \vec{a}_A = 0$$

$$\vec{F}_2 + \vec{W}_B + \vec{N} = m_B \vec{a}_B = 0$$

x-component ... No forces, accelerations (could have multiple it more complicated ..).

y-components:

$$F_1 - W_A = 0$$

$$F_1 = W_A = m_A g$$

$$-F_2 - W_B + N = 0$$

(5) $\vec{a}_A = \vec{a}_B = 0$ is a constraint

"Apply constraints"

(6) What is known, unknown. $W_B = m_B g$

F_1, F_2, N unknown.

$F_1 \rightarrow$ already solved.

(4) Newton's Third Law

$$\vec{F}' = -\vec{F}_2$$

y-components $F' = F_2$, $F = m_A g$

$$-m_A g - m_B g + N = 0$$

$$N = (m_A + m_B) g$$