1-23-13 P4A

Ch 1 and 4

Ch1 What is a scientific theory?

See 1.1

answer: a system of thought based on a scientific hypothesis.

1. observations
2. hypothesis
3. consequences of hypothesis
4. experiment to disprove hypothesis; test of "wrongness"

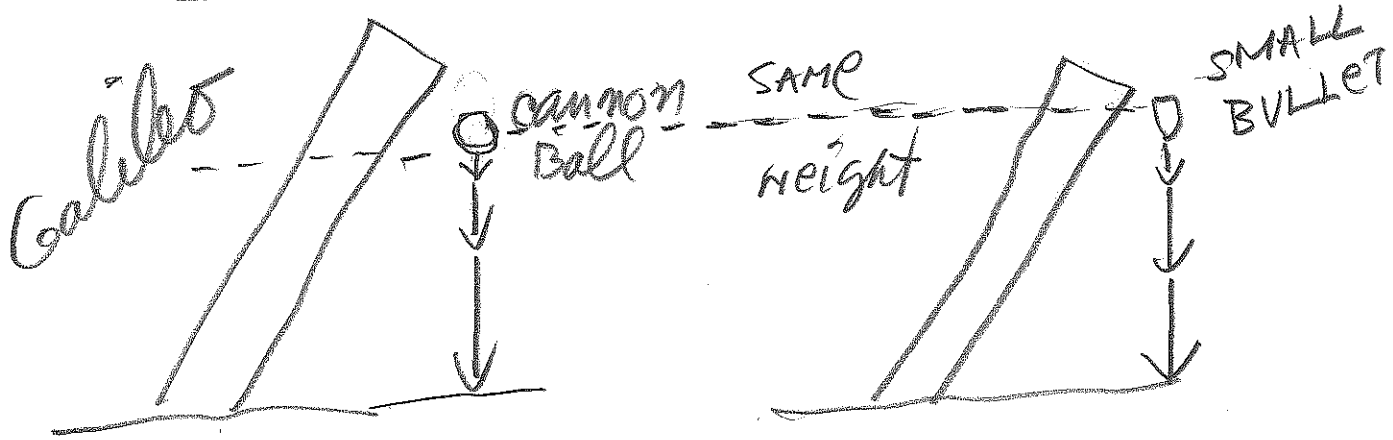
5. Theory is a system of other other consequences of hypothesis.

Example:

Hypothesis

"All objects fall toward Earth with the same speed and acceleration."

Experiment to prove hypothesis wrong.



Galileo failed to prove hypothesis wrong ⇒ hypothesis is correct within the limits and errors of experimental set up.

sec 1.1

Background

ARISTOTLE SAID

heavy objects hit ground with more speed, less time.

CH 4

ARISTOTLE

one natural state of motion.

rest

VS. galileo

2 natural states of motion

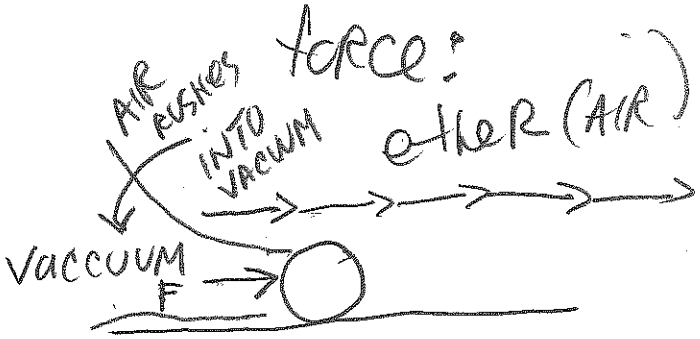
(i) REST

(ii) constant speed,

NOTE: natural state of motion means NET FORCE is ZERO.

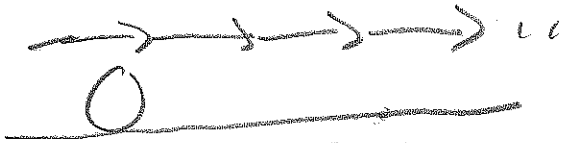
ARISTOTLE vs. Galileo

cause of an object moving at constant speed in a straight line is "VACCUUM force:



F = "AIR FORCE"

cause of 2ND Natural state is called INERTIA



INERTIA causes BALL TO ROLL at constant speed.

SUMMARY: ARISTOTLE; NO FORCE, NO MOTION
Galileo; NO FORCE, motion* possible
* constant velocity.

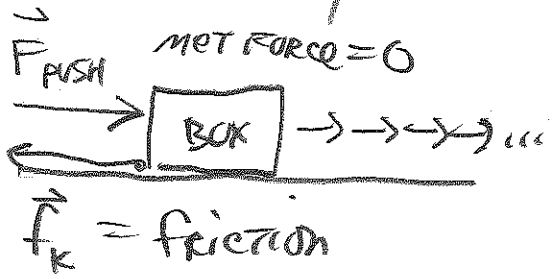
CH 4 AFTER BREAK

sec 4.2

State: newton's 1ST LAW
consistent w/ galileo:

If net force = 0,

then (i) REST



(ii) constant velocity*

* constant speed, STRAIGHT line.

MINI-SYLLABUS

START CH. 4 : 4.1, 4.2 ONLY

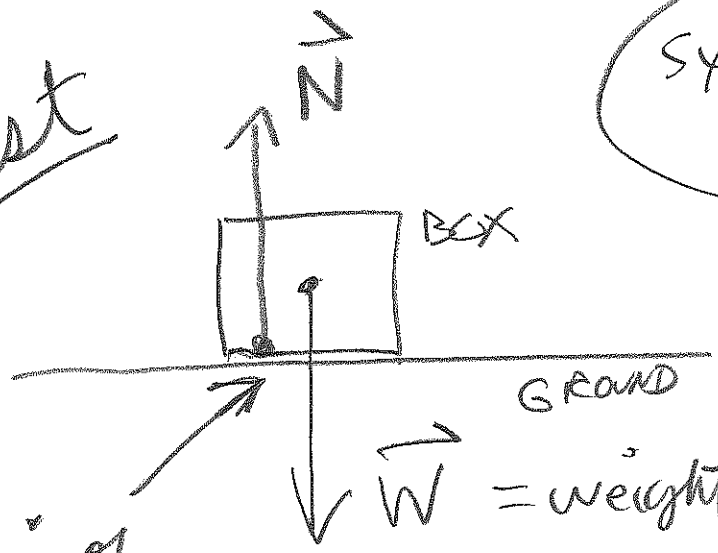
continue CH. 1 : 1.7, 1.8 only

4.1 FORCES (PUSHES OR PULLS)

SYMBOLS $\vec{A}$

$|\vec{A}|$ = length of arrow (magnitude)

rest



$\vec{W}$ = weight (DOWN)

magnitude $= |\vec{W}| = m \cdot g$

$|\vec{N}| = |\vec{W}|$

Equal magnitudes

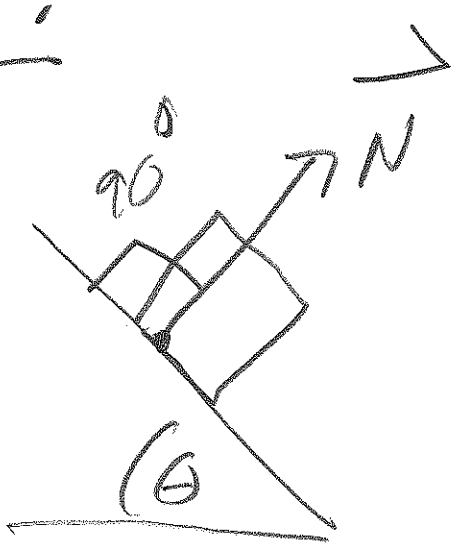
m = mass (kg)

$g = 9.8\ m/s^2$

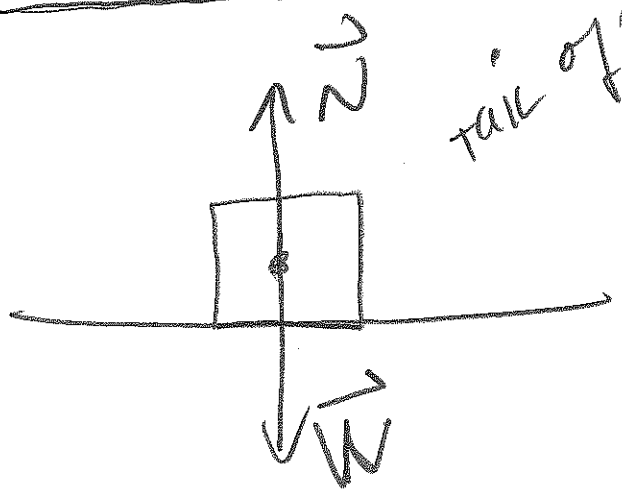
$\vec{W}$ = force of entire Earth on BOX.

$\vec{N}$ = force of ELECTRICAL REPULSION of GROUND on BOX

NOTE:



TYPICAL NOTATION:



tail of $\vec{N}$ at center

APPROXIMATION

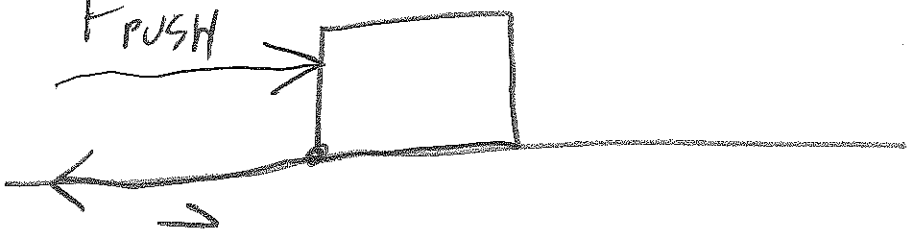
see 4.1 (fig 4.1 p 105)

friction force(s)

(i) STATIC friction

at rest

$\vec{f}_s$ = static friction

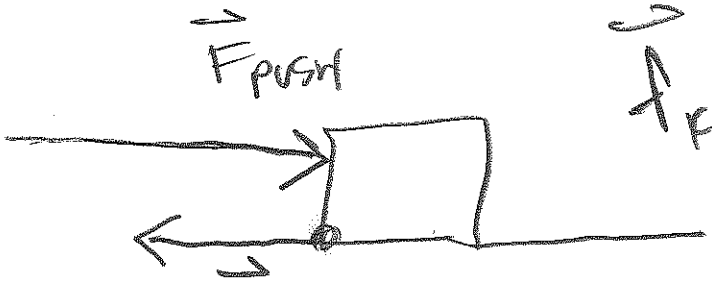


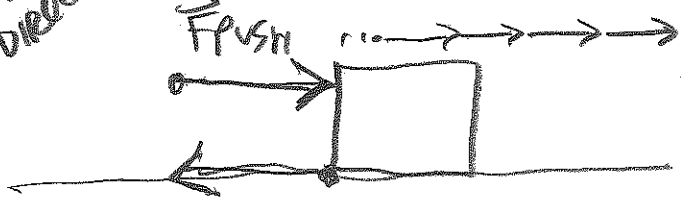
$|\vec{f}_s| = |\vec{F}_{PUSH}|$

(at rest)

(ii)

$\vec{f}_k$ = kinetic friction





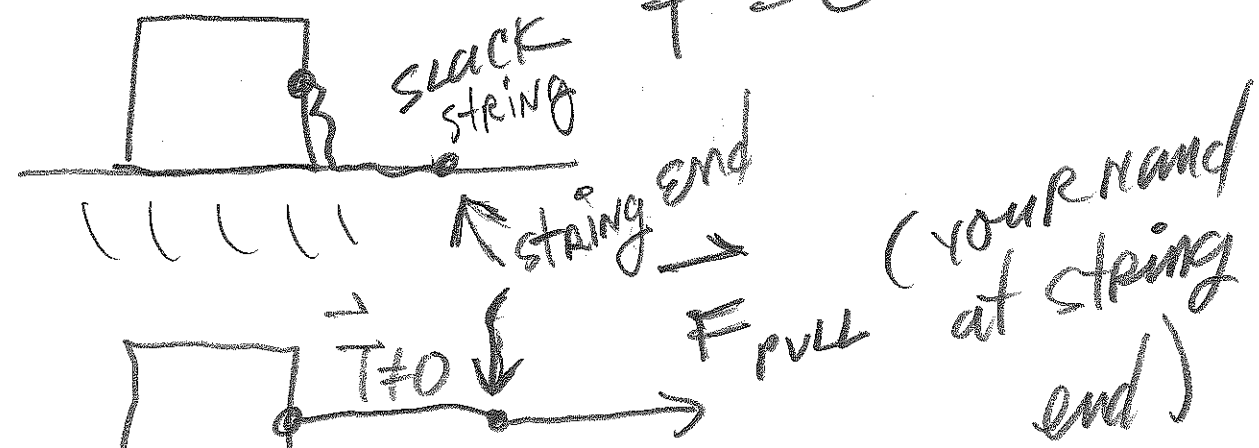
<u>NOTE</u>: IF $|\vec{F}_{PUSH}| = |\vec{f}_k|$, then motion is at <u>CONSTANT</u> velocity.*

* velocity = speed, direction

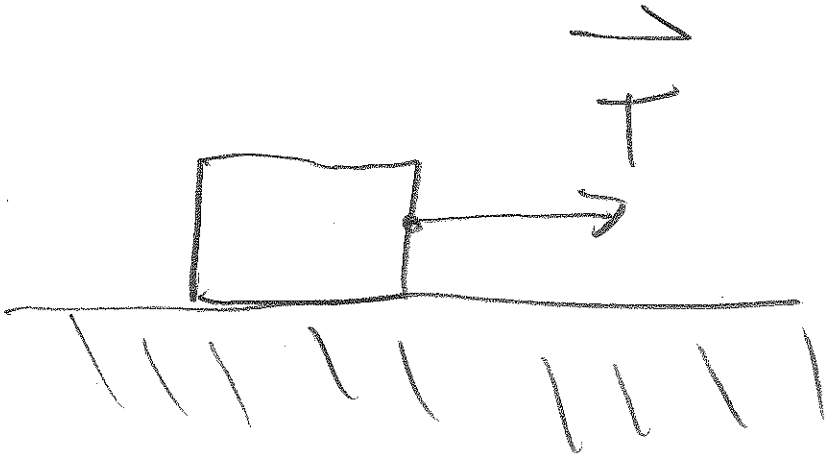
Next force to look at:

tension force $\vec{T}$.

string attached to box:

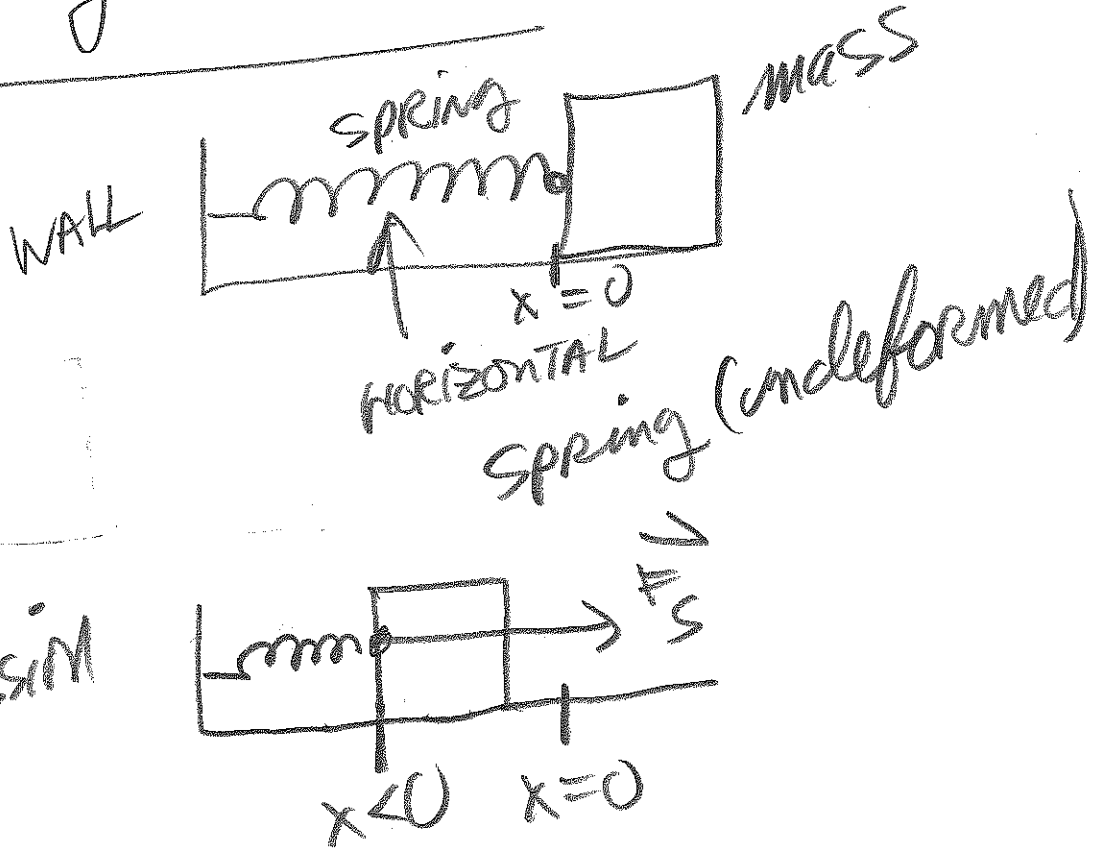


Isolate the box:



Final force for now —

SPRING FORCE



k = force constant $\left(\frac{N}{m}\right)$

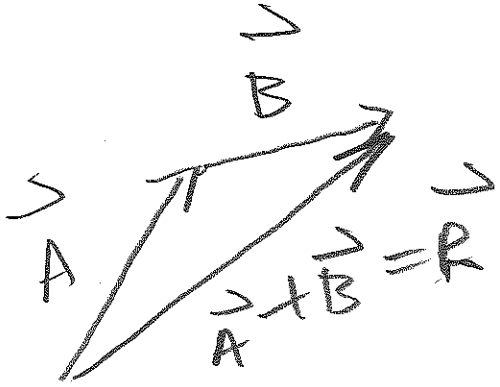
k large: stiff spring.

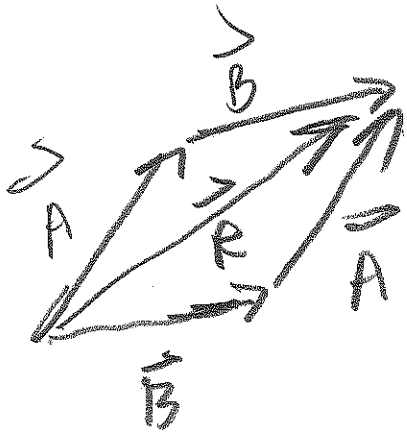
$$|\vec{F}_s| = |k \cdot x|$$

$$|x| = \frac{|\vec{F}_s|}{k}$$

Backtrack sec 1.7

vector addition

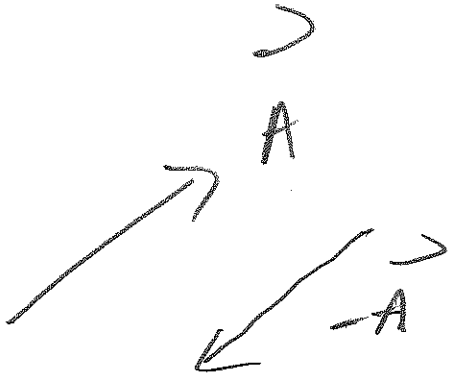




$\vec{R} = \vec{B} + \vec{A}$

NOTE: $\vec{R}$ = diagonal of Parallelogram.

NOTE:



$$|-\vec{A}| = |\vec{A}|$$

$$A = A$$

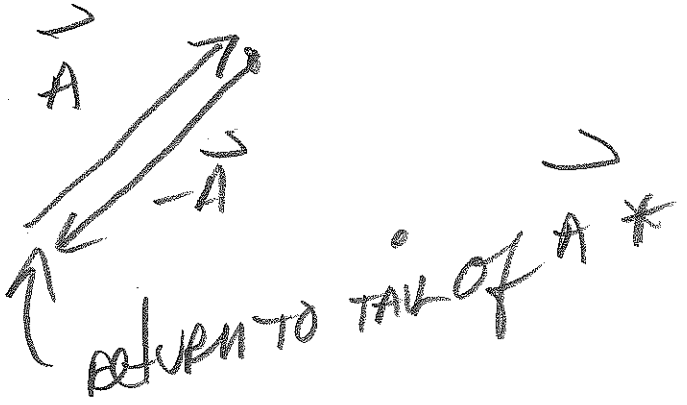
relevant to Newton's 1ST LAW

$$|\vec{A}| = A.$$

$$\vec{A} + (-\vec{A}) = 0^{*}$$

NET vector

$$\vec{R} = 0$$



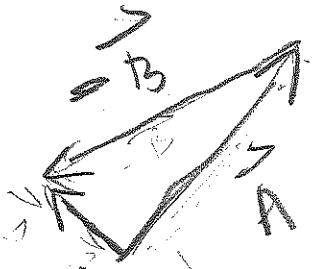
Vector Subtraction

$\vec{D} = \vec{A} - \vec{B} = ?$

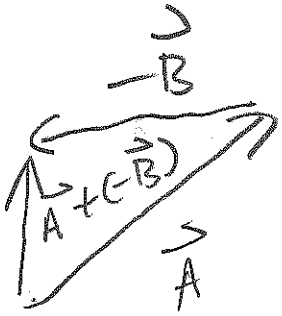
Answer $\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$

Math 55 (05)

$\vec{A} + (-\vec{B}) = \vec{D}$



$\vec{A}+(-\vec{B})=\vec{A}-\vec{B}$

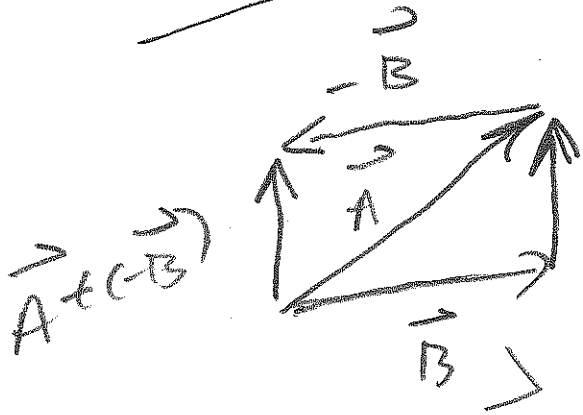


(x4)

Instructor contribution

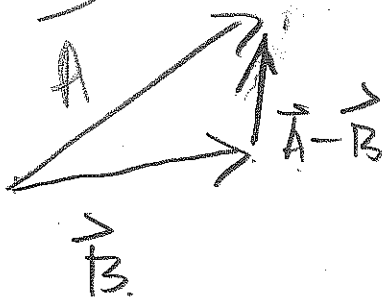
Student BOARD WORK

SHORT CUT!

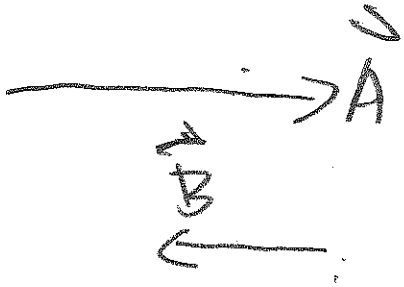


$\vec{A}+(-\vec{B})=\vec{A}-\vec{B}$

SHORT CUT: TAIL-TO-TAIL.

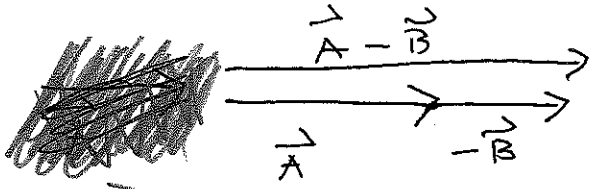


SPECIAL CASE:



VOLUNTEER: $\vec{A}-\vec{B}$

$\vec{A} + (-\vec{B})$



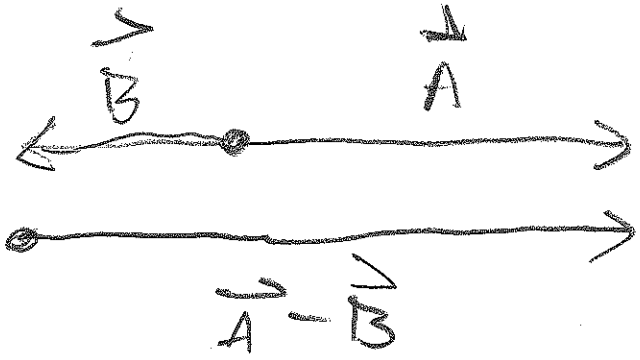
(15

student work

$-\vec{B}$

ALSO TAIL-TO-TAIL.

(re-scale)



INSTRUCTOR CONTRIBUTION.