§ 7-3 Conservation of Momentum

Recall Newton's Third Law:

$$\vec{F}_A = -\vec{F}_B$$

Recall
$\vec{J} = \vec{F}\Delta t$
$\vec{J} = \Delta\vec{p}$

$$\longrightarrow \quad \vec{F}_A \Delta t = -\vec{F}_B \Delta t$$

$$\Delta\vec{p}_A = -\Delta\vec{p}_B$$

(Think of object A's loss in momentum being equal to object B's gain in momentum)

$$\vec{p}_A' - \vec{p}_A = -(\vec{p}_B' - \vec{p}_B)$$

$$\vec{p}_A' - \vec{p}_A = -\vec{p}_B' + \vec{p}_B$$

$$\vec{p}_A' + \vec{p}_B' = \vec{p}_A + \vec{p}_B$$

Law of Conservation of Momentum $\longrightarrow$ flip sides

$$\vec{p}_{total} = \vec{p}'_{total}$$

↑ obeyed in an isolated system (i.e. no friction)

* In PHY11, we only deal with 1 dimensional collisions.

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	BEFORE		AFTER
	Car A	Car B	Car (A+B)
m	1.75×10^4 kg	2.00×10^4 kg	3.75×10^4 kg
East + v	+5.45 m/s	0	v
p	95375 kg·m/s	0	$(3.75\times10^4\text{ kg})v$

Recall: $\vec{p} = m\vec{v}$

$\vec{p}_{total}$ $\vec{p}'_{total}$

$\vec{p}_{total} = \vec{p}'_{total}$

$\vec{p}_A + \vec{p}_B = \vec{p}_{(A+B)}$

$95375\text{ kg}\cdot\text{m/s} = (3.75\times10^4\text{ kg})v$

$v = +2.54$ m/s

$\vec{v} = 2.54$ m/s [EAST]

Recoil of a Canoe

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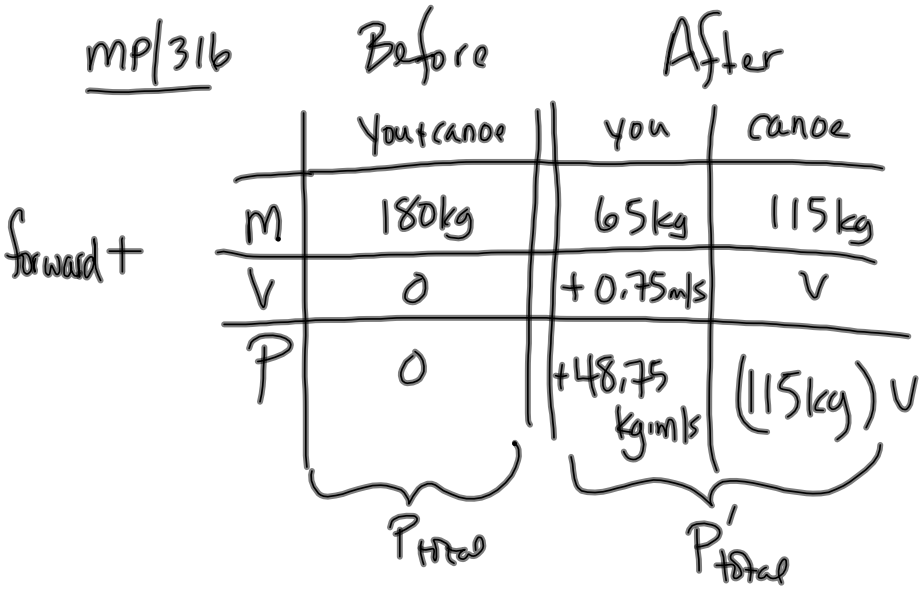

$\vec{p}_{total} = \vec{p}'_{total}$

$\vec{p}_{your\ canoe} = \vec{p}_{you} + \vec{p}_{canoe}$

mv

$0 = 48.75\ kg \cdot m/s + (115kg)v$

$-48.75\ kg \cdot m/s = (115kg)v$

$v \doteq -0.42\ m/s$

$\vec{v} = 0.42\ m/s$ [backward]

TO DO:

① PP/315

② PP/317