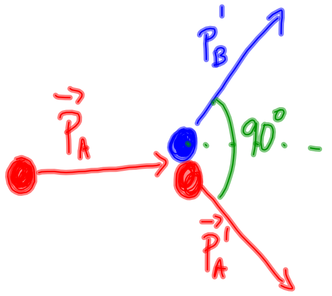
Elastic Collisions

* In an elastic collision, KE is conserved. The total KE before the collision is the same as the total KE after.
* Not every collision is elastic
* You must apply the Law of Conservation of Momentum first to find any missing velocities and then find the total kinetic energy before and after the collision.

Recall: $E_k = \frac{1}{2}mv^2$

A special collision:

Consider two objects of identical mass. One object is stationary and the other object collides in a glancing collision. It is an elastic collision.



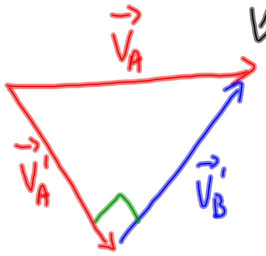
$$\vec{P}_{total} = \vec{P}_{total}'$$

$$\vec{P}_A + \cancel{\vec{P}_B} = \vec{P}_A' + \vec{P}_B'$$

0

$$\cancel{m}\vec{V}_A = \cancel{m}\vec{V}_A' + \cancel{m}\vec{V}_B'$$

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



Since the collision is elastic:

$$E_{K_{total}} = E_{K_{total}}'$$

$$E_{K_A} + \cancel{E_{K_B}} = E_{K_A}' + E_{K_B}'$$

0

$$\cancel{\tfrac{1}{2}}\cancel{m}V_A^2 = \cancel{\tfrac{1}{2}}\cancel{m}V_A'^2 + \cancel{\tfrac{1}{2}}\cancel{m}V_B'^2$$

$$V_A^2 = V_A'^2 + V_B'^2$$

$c^2 = a^2 + b^2$

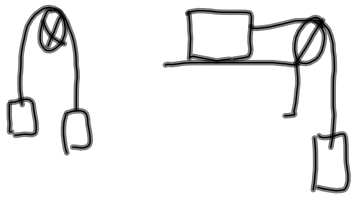
∴ we have a right triangle and $V_A' \perp V_B'$

In any 2D <u>elastic</u> collision that involves identical masses with one mass initially at rest, the objects will travel in paths that are perpendicular after the collision

① Look over MP|514

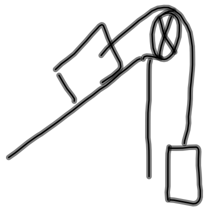
③ PP|515

TEST



10-2 Connected Masses

- draw FBD
- set up an F_{net} expression for each mass ($\vec{F}_{net} = m\vec{a}$)
- solve system of equations (a and T)



10-3 Static Equilibrium + Torque

- 2 conditions
  - → $F_{net} = 0$
  - → $\tau_{net} = 0$ ⇒ $\sum \tau_{ccw} = \sum \tau_{cw}$
- FBD are essential!
- Torque: $\tau = r_{\perp} F$

  $\tau = rF\sin\theta$

10-4 2D Collisions

- Law of Conservation of Momentum ($\vec{p} = m\vec{v}$)

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

  1. x-y chart ⇒ BEFORE/AFTER
  2. momentum vector addition diagram

- Elastic collisions ⇒ KE is conserved.