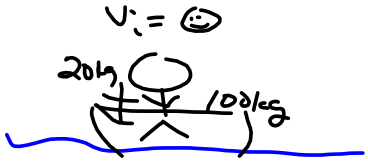
Homework:

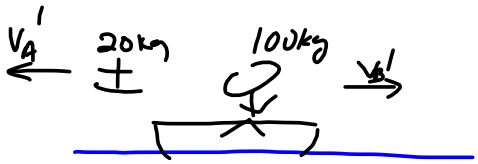
A plate is dropped on the floor and shatters into three pieces. The first piece (m=50 g) slides to the right across the floor at 1.5 m/s. The second piece (m=150 g) slides at 120^0 to the first piece at 1.0 m/s. The third piece has a mass of 300 g - what is it's velocity?

Relative Velocities

- Frames of Reference

Let's assume a person can throw a 20 kg anchor at a speed of 5 m/s. If we put them in a boat (assume total mass of person and boat is 100 kg), how fast will the person and boat be travelling after the anchor is thrown?





relative to water

$V_A' = 5 - V_B'$

$(V_A' + V_B' = 5$ or $|\vec{V}_B - \vec{V}_A| = 5)$

$\Sigma \vec{p} = \Sigma \vec{p}'$

$0 = m_B V_B' - m_A V_A'$

$20(5 - V_B') = 100 V_B'$

$100 = 120 V_B'$

$V_B' = 0.83 \text{ m/s}$

$V_A' = 4.17 \text{ m/s}$

A person (m=60 kg) is stuck on ice (μ=0). If they have two boots (each with a mass of 2 kg) and can throw them at a speed of 10 m/s each, would they be better to throw them simultaneously or individually (which would result in a greater speed for the person)?

Both together

$v' = 10 - v_B'$

$$\Sigma \vec{p} = \Sigma \vec{p}'$$

$$0 = m_B v_B' - m v'$$

$$60(10 - v_B') = 4 v_B'$$

$$64 v_B' = 600$$

$$v_B' = 9.375 \quad \text{so } v' = 0.625 \text{ m/s}$$

One boot at a time

1st boot

$v' = 10 - v_B'$

$$0 = m_B v_B' - m v'$$

$$62(10 - v_B') = 2 v_B'$$

$$620 = 64 v_B'$$

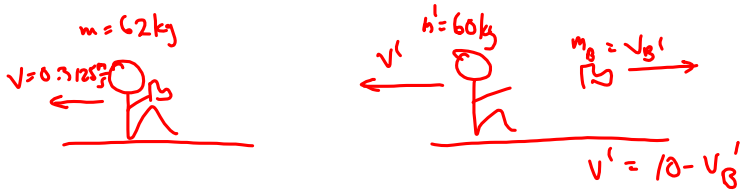
$$v_B' = \frac{620}{64} = 9.6875$$

$\frac{155}{16}$

$9\frac{11}{16}$

$v' = 0.3125$ m/s

2nd boot



$v' = 10 - v_B'$

$$\Sigma \vec{p} = \Sigma \vec{p}'$$

$$-mv = -m'v' + m_B v_B$$

$$-62(0.3125) = -60(10 - v_B') + 2 v_B'$$

$$600 - 19.375 = 62 v_B'$$

$$\frac{580.625}{62} = v_B'$$

$$v_B' = 9.3649 \text{ m/s}$$

$$v' = 10 - 9.3649 = 0.6351 \text{ m/s} > 0.625 \text{ m/s}!$$

Homework: Sheet # 2,3 , Text p.513, # 38
Work on problem set: due TBA