§10-4 Collisions and Explosions

Law of Conservation of momentum:

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

Methods to solve problems:

① Components

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

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

② Momentum Vector Addition Diagram

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

If one of these is zero, then this method is good!

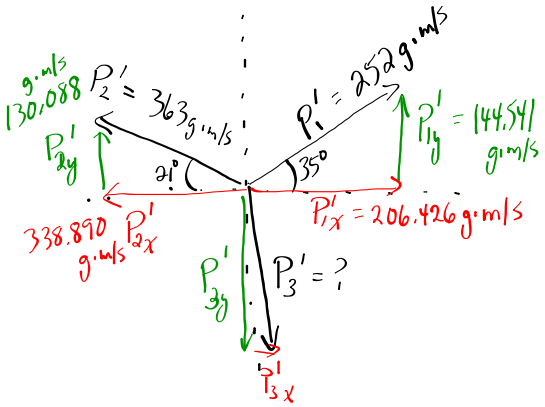
MP 511 - An explosion

$m_1 = 6.0\,g$
$v_1' = 42\,m/s$
$m_2 = 11\,g$
$v_2' = 33\,m/s$
$m_3 = 8.0\,g$
$v_3' = ?$

Before

$\vec{P}_{total} = 0$

After



Method 1 - Components

Before: $P_{total} = 0$

After:

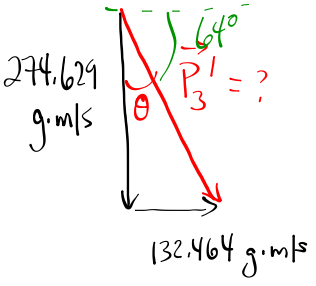
	x	y
P_1'	206.426	144.541
P_2'	−338.890	130.088
P_3'	x	y
P_{total}	0	0

Along x-axis: $206.426 - 338.890 + x = 0$

$x = 132.464\ g\cdot m/s$

Along y-axis: $144.541 + 130.088 + y = 0$

$y = -274.629\ g\cdot m/s$



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

$c^2 = (274.629)^2 + (132.464)^2$

$c = 304.906\ g\cdot m/s$

$\tan\theta = \frac{132.464}{274.629}$

$\theta = 26°$

$p = mv$

$v = \frac{p}{m}$

$v = \frac{304.906\ g\cdot m/s}{8.0\,g}$

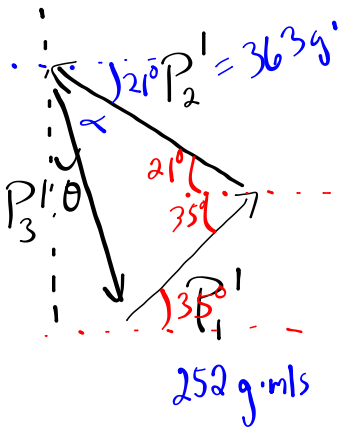
$v = 38\ m/s$

The velocity of the 3rd piece is 38 m/s [64° CW from + x-axis]

Method 2 - Momentum Vector addition Diagram

$$P_{total} = P'_{total}$$

$$0 = \vec{P}'_1 + \vec{P}'_2 + \vec{P}'_3$$



Law of Cosines

$c^2 = a^2 + b^2 - 2ab\cos C$

$c^2 = 252^2 + 363^2 - 2(252)(363)\cos 56°$

$c = 305$ g·m/s

Law of Sines

$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{252}{\sin \alpha} = \frac{305}{\sin 56°}$

$\alpha = 43°$

$\frac{305}{8} = 38$ m/s [64° CW from + x-axis]

$21° + 43° = 64°$

TO DO

* PP|509
* PP|513