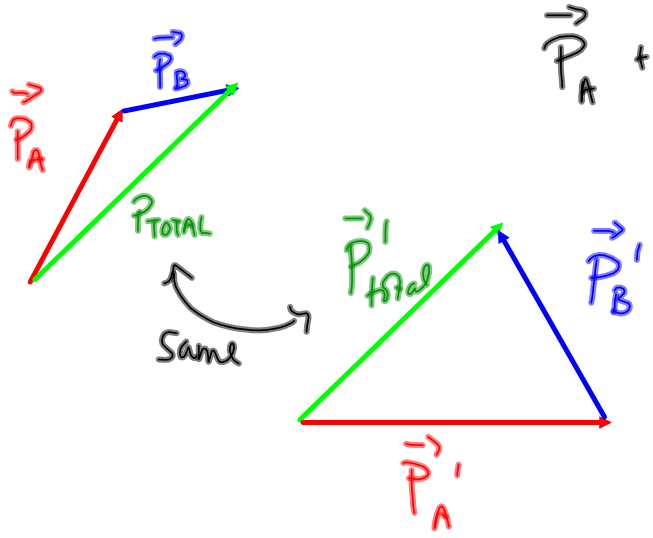
2D Collisions

Law of Conservation of momentum: $\vec{P}_{total} = \vec{P}'_{total}$

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



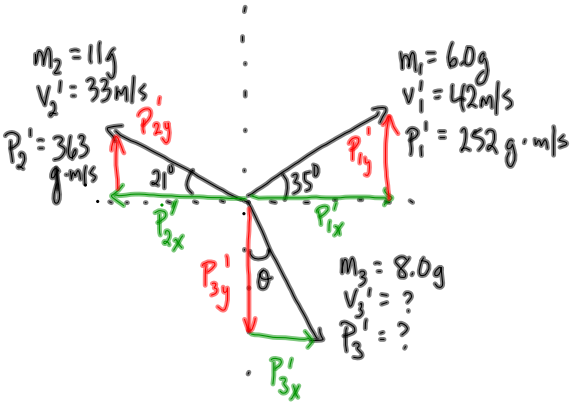
MP|511 · An exploding firecracker

$m_{total} = 25\,g$

$m_1 = 6.0\,g$

$m_2 = 11\,g$

$m_3 = 8.0\,g$



BEFORE

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

$\left(\vec{P}'_{x\,total} = 0 \text{ and } \vec{P}'_{y\,total} = 0\right)$

AFTER

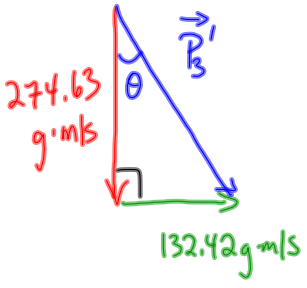
	x	y
P_1'	$252\cos 35^\circ$ 206.47	$252\sin 35^\circ$ 144.54
P_2'	$-363\cos 21^\circ$ −338.89	$363\sin 21^\circ$ 130.09
P_3'	P_{3x}'	P_{3y}'
P_{total}'	0	0

Along the x-axis: $206.47 - 338.89 + P_{3x}' = 0$

$P_{3x}' = 132.42\ g\cdot m/s$

Along the y-axis: $144.54 + 130.09 + P_{3y}' = 0$

$P_{3y}' = -274.63\ g\cdot m/s$



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

$c^2 = (274.63)^2 + (132.42)^2$

$c = 304.89\ g\cdot m/s$

$\tan\theta = \frac{132.42\ g\cdot m/s}{274.63\ g\cdot m/s}$ $\therefore P_3' = 304.89\ g\cdot m/s$

$\theta = \tan^{-1}(\text{stuff})$

$\theta = 26^\circ$

$V_3' = \frac{304.89\ g\cdot m/s}{8.0\ g}$

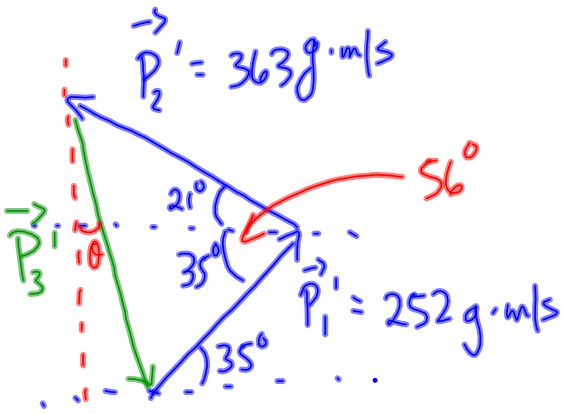
$V_3' = 38\ m/s$

The velocity of the third fragment is 38 m/s 26° CCW from −y-axis

Using Momentum Vector Addition Instead:

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

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



TO DO:

① PP|509 (from yesterday)

② PP|513