Conservation of Momentum in 2D

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

In 2D => OPTION A → draw a momentum vector addition diagram (good if you have 3 momentum vectors)

OPTION B → x-y chart before + after

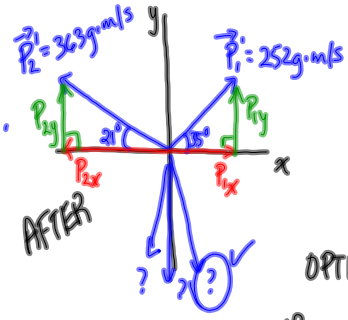
MP|511

Since the firecracker was at rest initially, its momentum was zero and the total momentum of all the pieces after the explosion MUST also be ZERO!

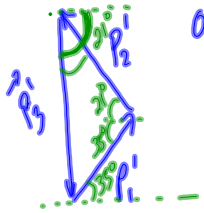
$m_1 = 6.0\,g$ $\vec{v}_1' = 42\,m/s$ [35° to + x-axis] $\vec{p}_1' = 252\,g\cdot m/s$ [35°]

$m_2 = 11\,g$ $\vec{v}_2' = 33\,m/s$ [21° CW to − x-axis] $\vec{p}_2' = 363\,g\cdot m/s$ [21°]

$m_3 = 8\,g$ $\vec{v}_3' = ??$



Vector Addition Diagram OPTION A



OPTION B – set up x-y chart before/after

AFTER

	x	y
p_1	$252\cos 35°$ 206.4	$252\sin 35°$ 144.5
p_2	$-363\cos 21°$ −338.9	$363\sin 21°$ 130.1
p_3	x	y
p_{total}	0	0

x-axis

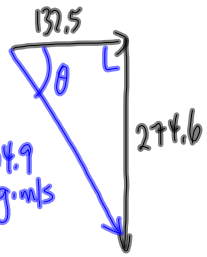
$206.4 - 338.9 + x = 0$

$x = 132.5\,g\cdot m/s$

y-axis

$144.5 + 130.1 + y = 0$

$y = -274.6\,g\cdot m/s$



$\tan\theta = \frac{274.6}{132.5}$

$\theta = 64.2°$

$\vec{p}_3' = 304.9\,g\cdot m/s$ [64.2° CW from + x-axis]

$\vec{v}_3' = \frac{304.9\,g\cdot m/s}{8g}$ [64.2° CW from + x-axis]

$\vec{v}_3' = 38\,m/s$ [64° CW from + x-axis]

TO DO: PP|509

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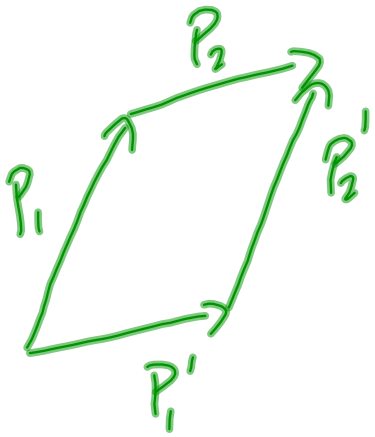
p_2
p_2'
p_1
p_1'