

# Momentum 4

① Before

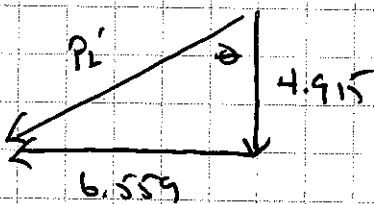
	N	E
$m_1 v_1$	0	$-(2)(5)$
$m_2 v_2$	0	0
<hr/>		
total	0	-10

After

	N	E
$m_1 v_1'$	$(2)(3) \cos 35$	$-(2)(3) \sin 35$
$m_2 v_2'$	-4.915	-6.559
<hr/>		
total	0	-10

these should be the same

$P_2'$



$$\theta = \tan^{-1} \left( \frac{6.559}{4.915} \right) = 53.2^\circ$$

$$P_2' = \sqrt{4.915^2 + 6.559^2}$$

$$P_2' = 8.196$$

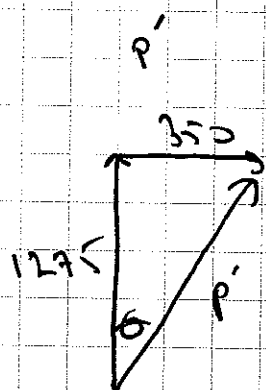
$$v_2' = \frac{P_2'}{m} = \frac{8.196}{2} = \boxed{4.1 \text{ m/s } [53^\circ \text{ W of S}]}$$

② Before

	N	E
$m_1 v_1$	85(15)	0
$m_2 v_2$	0	(70)(5)
total	1275	350

After

	N	E
$(m_1 + m_2) v$	1275	350
total	1275	350



$$\theta = \tan^{-1} \left( \frac{350}{1275} \right) = 15.4^\circ$$

$$p' = \sqrt{350^2 + 1275^2}$$

$$p' = 1322.167$$

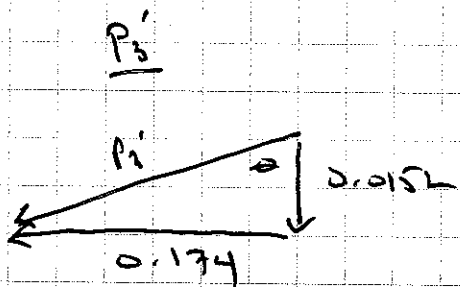
$$v' = \frac{p'}{m_1 + m_2} = \frac{1322.167}{155} = \boxed{8.5 \text{ m/s } [15^\circ \text{ E of N}]}$$

② Before

	N	E
total	0	0

After

	N	E
$m_1 v_1$	$(0.1)(10)$	0
$m_2 v_2$	$-(0.2)(5) \cos 10$	$(0.2)(5) \sin 10$
$m_3 v_3$	$-0.0152$	$-0.174$
total	0	0



$$\theta = \tan^{-1} \left( \frac{0.174}{0.0152} \right) = 85^\circ$$

$$p_3' = \sqrt{0.174^2 + 0.0152^2}$$

$$p_3' = 0.175$$

$$v_3' = \frac{p_3'}{m_3} = \frac{0.175}{0.2} = 0.87 \text{ m/s } [85^\circ \text{ W of S}]$$

or

$$\boxed{0.87 \text{ m/s } [5^\circ \text{ S of W}]}$$

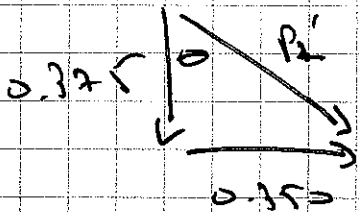
④ Before

	$\hat{z}$	$\hat{r}$
$m_1 v_1$	0	$(0.5)(2)$
$m_2 v_2$	0	0
total	0	1

After

	$\hat{z}$	$\hat{r}$
$m_1 v_1'$	$(0.5)(1.5)\sin 30$	$(0.5)(1.5)\cos 30$
$m_2 v_2'$	-0.375	0.350
total	0	1

$P_2'$



$$\theta = \tan^{-1}\left(\frac{0.350}{-0.375}\right) = 43^\circ$$

$$P_2' = \sqrt{0.375^2 + 0.350^2}$$

$$P_2' = 0.513$$

$$v_2' = \frac{P_2'}{m_2} = \frac{0.513}{0.3} = \boxed{1.7 \text{ m/s } [43^\circ \text{ E of S}]}$$