1. A 4.0kg object is travelling south at a velocity of 2.8m/s when it collides with a 6.0kg object travelling East at a velocity of 3.0m/s. If these two objects stick together upon collision, at what velocity do the combined masses move immediately after they collide? **2.12m/s@ E 31.9°S**

m_1, m_2

$P_{0x} = P_x$ (same) ← factor

$m_1 V_{1 0x} + m_2 V_{2 0x} = m_1 V_{1x} + m_2 V_{2x}$

zero

$V_{1,2x} = ?$

$6 \times 3 = V_{1,2x}(4+6)$

$\frac{18}{10} = V_{1,2x} = 1.8 \frac{m}{s}$ East (+)

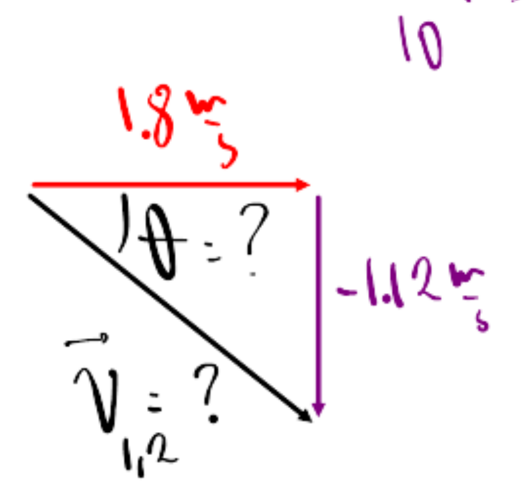
$P_{0y} = P_y$ common factor!

$m_1 V_{10y} + m_2 V_{20y} = m_1 V_{1y} + m_2 V_{2y}$

zero

$4 \times (-2.8) = V_{1,2y}(4+6)$

$\frac{-11.2}{10} = V_{1,2y} = -1.12 \frac{m}{s}$ South (−)



$V_{1,2}^2 = V_{1,2x}^2 + V_{1,2y}^2$

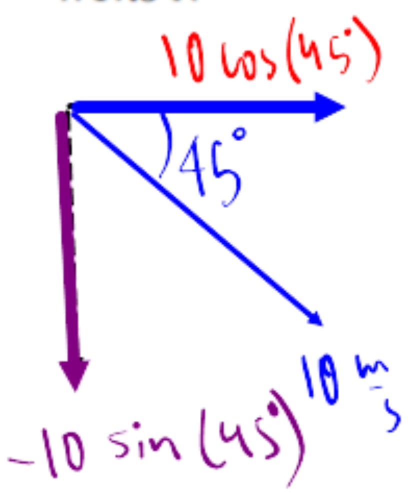
$V_{1,2} = \sqrt{1.8^2 + 1.12^2} = 2.12 \frac{m}{s}$

$\theta = \tan^{-1}\left(\frac{-1.12}{1.8}\right) = -31.9°$ S of E

2. An object explodes into 3 equal masses. One mass moves East at a velocity of 15.0m/s. If a second mass moves at a velocity of 10.0m/s E45oS, what is the velocity of the third mass? **23.2m/s @ W17.8°N**

10 m/s 45° S of E

$P_{0x} = P_{0y} = 0$ not moving (explodes)



$P_{0x} = P_x$?

$0 = m_1 V_{1x} + m_2 V_{2x} + m_3 V_{3x}$ $m_1 = m_2 = m_3 = m$

$0 = m[15 + 10\cos(45°) + V_{3x}]$

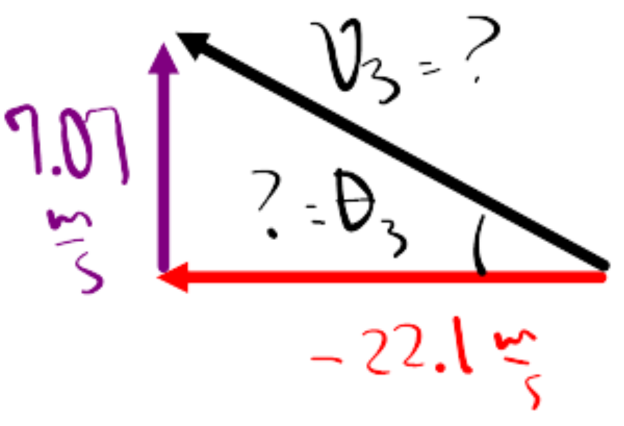
$\frac{0}{m} = 15 + 10\cos(45°) + V_{3x}$

$0 - 15 - 10\cos(45°) = V_{3x} = -22.1 \frac{m}{s}$ West (−)

$P_{0y} = P_y$

$0 = m[0 - 10\sin(45°) + V_{3y}]$

$10\sin(45°) = V_{3y} = 7.07 \frac{m}{s}$ North (+)



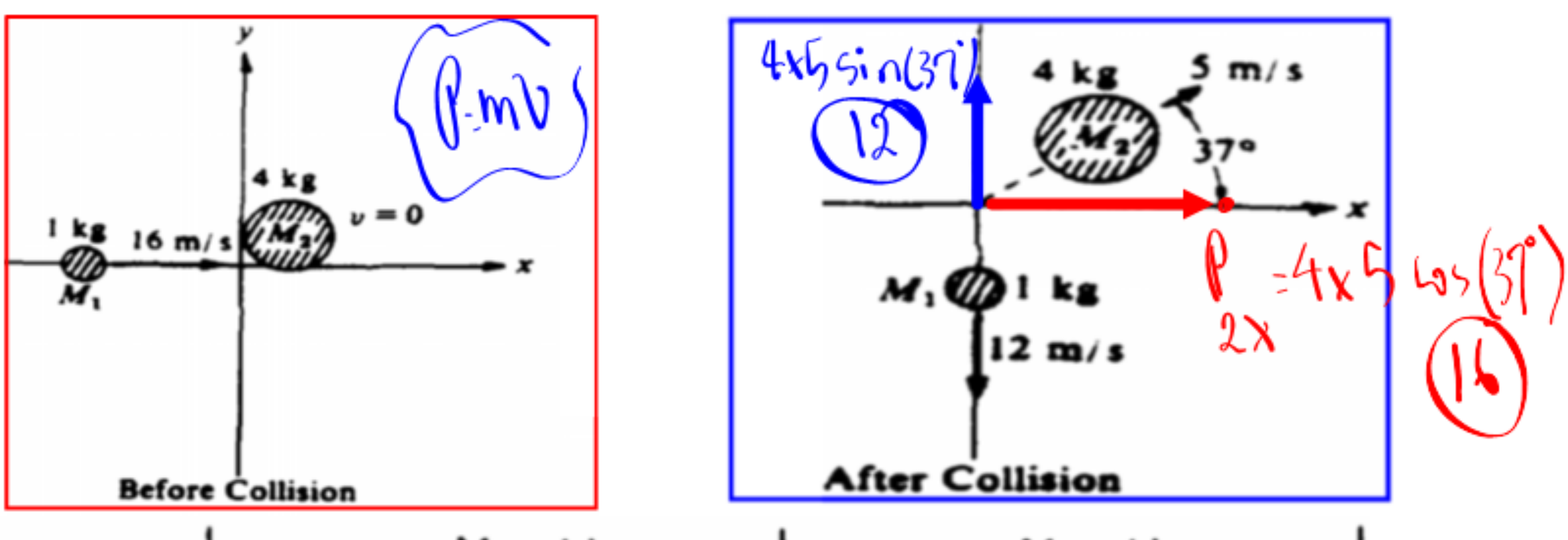
$V_3 = \sqrt{22.1^2 + 7.07^2}$

$V_3 = 23.2 \frac{m}{s}$

$\theta = \tan^{-1}\left(\frac{7.07}{-22.1}\right)$

$\theta = -17.8$ N of W

Next one letter c and d, are HW, it is posted in your HW tab.



	$M_1 = 1$ kg $p_x\left(\frac{kg \cdot m}{s}\right)$	$M_1 = 1$ kg $p_y\left(\frac{kg \cdot m}{s}\right)$	$M_2 = 4$ kg $p_x\left(\frac{kg \cdot m}{s}\right)$	$M_2 = 4$ kg $p_y\left(\frac{kg \cdot m}{s}\right)$
Before Collision	16	0	0	0
After Collision	0	−12	16	12

b. Show, using the data that you listed in the table, that linear momentum is conserved in this collision.
c. Calculate the kinetic energy of the two-object system before and after the collision.
d. Is kinetic energy conserved in the collision?

b) $P_{0x} = P_x$

$16 + 0 = 0 + 16$ → Yes Conserves on X-axis

$P_{0y} = P_y$

c) HW
d)

$0 + 0 = -12 + 12$ → Yes Conserves on Y-axis