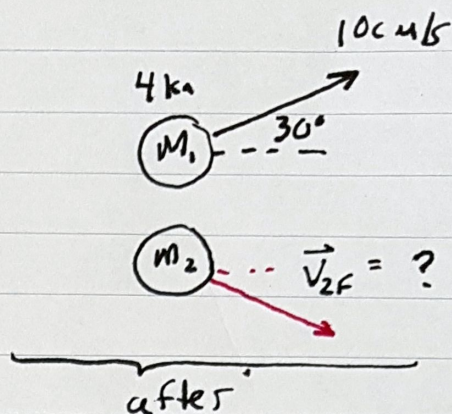
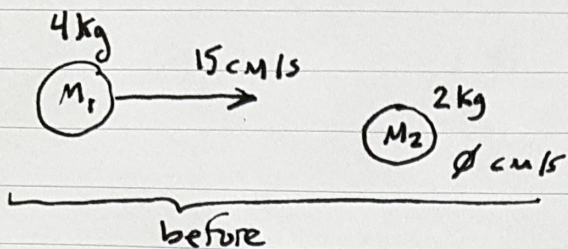


## 2D COLLISION PROBLEMS

#1)



x-dir

$$M_1 V_{1xi} + M_2 V_{2xi} = M_1 V_{1xf} + M_2 V_{2xf}$$

$$M_1 V_{1i} \cos \theta_1 + M_2 V_{2i} \cos \theta_2 = M_1 V_{1f} \cos \theta_3 + M_2 V_{2f} \cos \theta_4$$

$$(4)(15) \cos \theta + (2)(\cancel{0}) \cos \theta = (4)(10) \cos 30 + (2) V_{2f} \cos \theta$$

$$60 = 34.64102 + 2 V_{2f} \cos \theta$$

$$\textcircled{1} \quad 12.67949 = V_{2f} \cos \theta$$

y-dir

$$M_1 V_{1yi} + M_2 V_{2yi} = M_1 V_{1yf} + M_2 V_{2yf}$$

$$M_1 V_{1i} \sin \theta_1 + M_2 V_{2i} \sin \theta_2 = M_1 V_{1f} \sin \theta_3 + M_2 V_{2f} \sin \theta_4$$

$$(4)(\cancel{15}) \sin \theta + (2)(\cancel{0}) \sin \theta = (4)(10) \sin(+30) + (2) V_{2f} \sin \theta$$

$$\theta = 20 + 2 V_{2f} \sin \theta$$

$$\textcircled{2} \quad -10 = V_{2f} \sin \theta$$

from  $\textcircled{1}$   $V_{2f} = \frac{12.67949}{\cos \theta}$  sub into  $\textcircled{2}$   $-10 = \left( \frac{12.67949}{\cos \theta} \right) \sin \theta$

$$V_{2f} = \frac{12.67949}{\cos(-38.3)} = 16.2 \text{ cm/s}$$

$$-0.788675 = \tan \theta$$

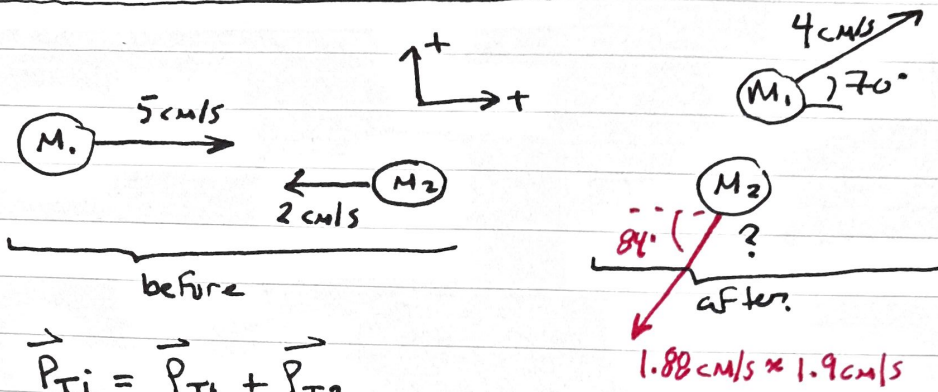
$$\theta = -38.3^\circ$$

$$\therefore \vec{V}_{2f} = 16.2 \text{ cm/s } [-38.3]$$



## 2D COLLISION PROBLEMS

#3.



$$\vec{P}_{Ti} = \vec{P}_{T1i} + \vec{P}_{T2i}$$

x-dir

$$M_1 v_{1xi} + M_2 v_{2xi} = M_1 v_{1xf} + M_2 v_{2xf}$$

$$(2)(5) + (4)(-2) = (2)(4) \cos 70 + (4) v_{2xf}$$

$$2 = 2.73616 + 4 v_{2xf}$$

①  $-0.18404 = v_{2f} \cos \theta$

y-dir

$$M_1 v_{1yi} + M_2 v_{2yi} = M_1 v_{1yf} + M_2 v_{2yf}$$

$$0 = (2)(4) \sin 70 + (4) v_{2f} \sin \theta$$

②  $-1.87939 = v_{2f} \sin \theta$

from ①  $v_{2f} = \frac{-0.18404}{\cos \theta}$  sub into ②  $-1.87939 = \frac{-0.18404}{\cos \theta} \sin \theta$

$$10.212 = \tan \theta$$

sub  $\theta$  in  $v_{2f} = -1.885 \text{ cm/s}$

$\theta = 84.4^\circ (-95.6^\circ)$   
from right

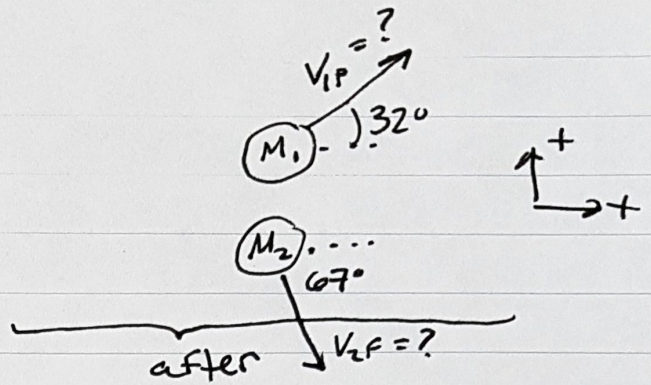
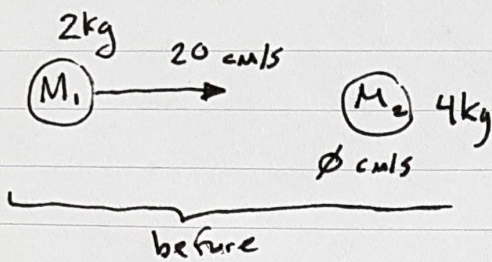
$$\vec{v}_{2f} = -1.9 \text{ cm/s } [+84.4^\circ]$$

$$\underline{or} = 1.9 \text{ cm/s } [-95.6^\circ]$$



## 2D COLLISION PROBLEMS

#4



x-dir

$$M_1 V_{1xi} + M_2 V_{2xi} = M_1 V_{1xf} + M_2 V_{2xf}$$

$$(2)(20)\cos\phi = (2)V_{1f}\cos 32 + (4)V_{2f}\cos 67$$

$$\textcircled{1} \quad 40 = 1.696096 V_{1f} + 1.5629245 V_{2f}$$

y-dir

$$M_1 V_{1yi} + M_2 V_{2yi} = M_1 V_{1yf} + M_2 V_{2yf}$$

$$0 = (2)V_{1f}\sin 32 + (4)V_{2f}\sin(-67)$$

$$\textcircled{2} \quad 0 = 1.059938 V_{1f} - 3.68202 V_{2f}$$

from  $\textcircled{2}$   $V_{1f} = 3.47413 V_{2f}$

sub into  $\textcircled{1}$   $40 = 1.696096(3.47413 V_{2f}) + 1.5629245 V_{2f}$

$$V_{2f} = 5.4 \text{ cm/s} \quad \checkmark$$

sub in  $\textcircled{2}$

$$V_{1f} = 3.47413(5.36) = 18.6 \text{ cm/s} \quad \checkmark$$