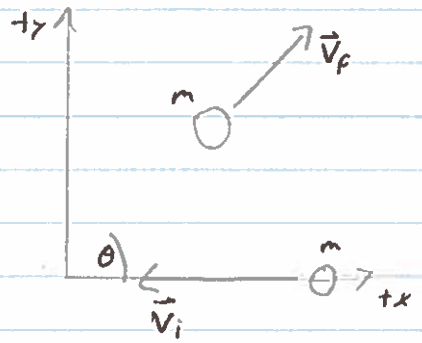
Ex 8-3
p 246

The kick that provides the impulse occurs at the origin.



$V_{ix} = -|\vec{V}_i|$
$V_{iy} = 0$
$V_{fx} = |\vec{V}_f| \cos\theta$
$V_{fy} = |\vec{V}_f| \sin\theta$

Impulse, $\vec{J} = \Delta\vec{p}$

x & y components: $J_x = \Delta p_x = p_{fx} - p_{ix}$
$J_y = \Delta p_y = p_{fy} - p_{iy}$

$p = mv$:

$$J_x = m(V_{fx} - V_{ix}) = m(|\vec{V}_f| \cos\theta + |\vec{V}_i|)$$

$$= (0.40\,kg)[(30\,ms^{-1})\cos 45° + 20\,ms^{-1}]$$

$$\underline{J_x = 16.5\,kg\,ms^{-1}}$$

$$J_y = m(V_{fy} - V_{iy}) = m|\vec{V}_f| \sin\theta$$

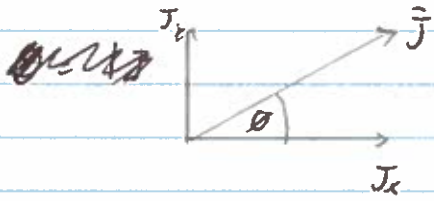
$$= (0.40\,kg)(30\,ms^{-1}) \sin 45°$$

$$\underline{J_y = 8.5\,kg\,ms^{-1}}$$

$$|\bar{J}| = \sqrt{J_x^2 + J_y^2}$$

$$= \sqrt{(16.5\ kg\ ms^{-1})^2 + (8.5\ kg\ ms^{-1})^2}$$

$$= 18.56\ kg\ ms^{-1}$$



$$\theta = \tan^{-1}\frac{|J_y|}{|J_x|} = \tan^{-1}\left[\frac{(8.5\ kg\ ms^{-1})}{(16.5\ kg\ ms^{-1})}\right]$$

$$\theta = 27.3°$$

Force: $F_x = \frac{J_x}{\Delta t} = \frac{16.5\ kg\ ms^{-1}}{0.010} = 1650\ N$

$$F_y = \frac{J_y}{\Delta t} = \frac{8.5\ kg\ ms^{-1}}{0.010} = 850\ N$$

$$F = \sqrt{F_x^2 + F_y^2} = \sqrt{(1650\ N)^2 + (850\ N)^2}$$

$F = 1900\ N$ along θ