In 2D or 3D,

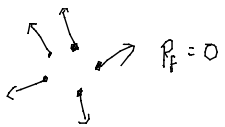
$$\Delta\vec{p} = \vec{p}_f - \vec{p}_i$$

if no net external force on system

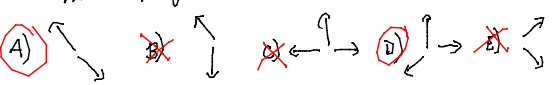
$$\vec{p}_f = \vec{p}_i$$

$$p_{fx} = p_{ix} \qquad p_{fy} = p_{iy} \qquad p_{fz} = p_{iz}$$

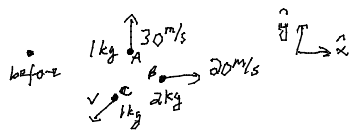
e.g. Explosions — an internal force

$p_i = 0$  $p_f = 0$

A bomb at rest explodes into 2 or 3 fragments. Which of these might show the path of those fragments? (Could be multiple.)



explosion



What is speed of C?

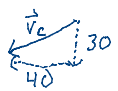
A) 20 m/s B) 30 m/s C) 40 m/s D) 50 m/s
E) 60 m/s F) 100 m/s

$$\vec{p}_A = 30\,\frac{kg\,m}{s}\,\hat{y} \qquad \vec{p}_B = 40\,kg\,\frac{m}{s}\,\hat{x}$$

$$0 = \vec{p}_A + \vec{p}_B + \vec{p}_C = 30\hat{y} + 40\hat{x} + \vec{p}_C$$

$$-30\hat{y} - 40\hat{x}\,\frac{kg\,m}{s} = \vec{p}_C$$

$$\vec{v}_C = \frac{\vec{p}_C}{m} = \frac{-30\hat{y} - 40\hat{x}\,\frac{kg\,m}{s}}{1\,kg} = -30\hat{y} - 40\hat{x}\,\frac{m}{s}$$



speed $v = |\vec{v}|$

$$v = \sqrt{(40)^2 + (30)^2}$$

$$v = 50\,m/s$$