Flipping Physics Lecture Notes:

2D Conservation of Momentum using Air Hockey Discs and Unit Vectors
http://www.flippingphysics.com/conservation-of-momentum-unit-vectors.html

Example: A 28.8 g yellow air hockey disc elastically strikes a 26.9 g stationary red air hockey disc. If the velocity of the yellow disc before the collision is $33.6\hat{i}\,\frac{cm}{s}$ and after the collision it is $\left[4.79\hat{i}-9.57\hat{j}\right]\frac{cm}{s}$, what is the velocity of the red disc after the collision?

Knowns: $m_1 = 28.8g;\ m_2 = 26.9g;\ \vec{v}_{2i} = 0;\ \vec{v}_{1i} = 33.6\hat{i}\,\frac{cm}{s};\ \vec{v}_{1f} = \left[4.79\hat{i}-9.57\hat{j}\right]\frac{cm}{s};\ \vec{v}_{2f} = ?$

In the x-y plane the net force during the collision is zero, so linear momentum is conserved:

$$\sum \vec{F}_{x-y\ plane} = \frac{d\vec{p}}{dt} = 0 \Rightarrow \sum \vec{p}_i = \sum \vec{p}_f \Rightarrow m_1\vec{v}_{1i} + m_2\vec{v}_{2i} = m_1\vec{v}_{1f} + m_2\vec{v}_{2f}$$

$$\Rightarrow \left(28.8\right)\left(33.6\hat{i}\right) = \left(28.8\right)\left(4.79\hat{i}-9.57\hat{j}\right) + 26.9\vec{v}_{2f}$$

$$\Rightarrow 967.68\hat{i} = 137.952\hat{i} - 275.616\hat{j} + 26.9\vec{v}_{2f}$$

$$\Rightarrow 26.9\vec{v}_{2f} = 967.68\hat{i} - 137.952\hat{i} + 275.616\hat{j} = 829.728\hat{i} + 275.616\hat{j}$$

$$\Rightarrow \vec{v}_{2f} = 30.8449\hat{i} + 10.2459\hat{j} \approx \left[30.8\hat{i} + 10.2\hat{j}\right]\frac{cm}{s}\left(predicted\right)$$

$$\vec{v}_{2f} = \left[31.2\hat{i} + 7.20\hat{j}\right]\frac{cm}{s}\left(observed\right)$$

Please notice this is much easier than when we did this before[1] not using unit vectors. ☺

[1] http://www.flippingphysics.com/2d-momentum.html