A firecracker in a coconut blows the coconut into three pieces. Two pieces of equal mass fly off south and west, perpendicular to each other, at 20 m/s. The third piece has twice the mass of the other two. What are the speed and direction of the third piece?

Momentum is conserved.

\[ 2mv \sin \theta - m \times 20 \text{ m/s} = 0 \quad \text{nothing moving at first} \]

\[ 2mv \cos \theta - m \times 20 \text{ m/s} = 0 \quad \Rightarrow \]

So \[ v = \frac{20 \text{ m/s}}{2 \cos \theta} = \frac{20 \text{ m/s}}{2 \sin \theta} \]

This can only be true if \( \cos \theta = \sin \theta \) (hopefully the symmetry was obvious), so \( \theta = 45^\circ \) \( \Rightarrow \) The large block must have the same amount of momentum in \( x \) and \( y \) directions to cancel momenta of other two pieces.

So \[ v = \frac{20 \text{ m/s}}{2 \cos 45^\circ} = \sqrt{14.14} \text{ m/s NE} \]