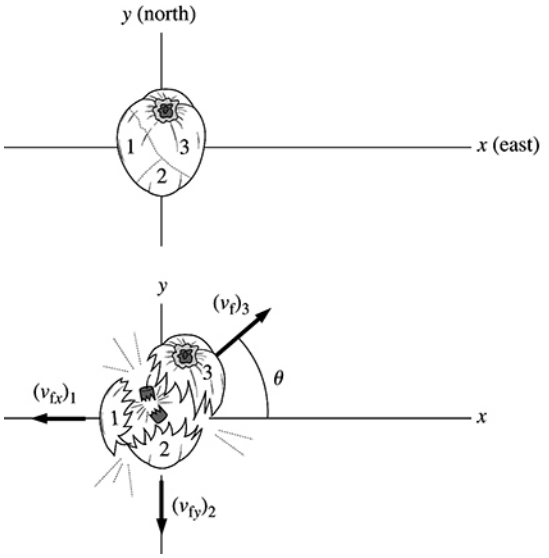
9.39. Model: This problem deals with a case that is the opposite of a collision. Our system is comprised of three coconut pieces that are modeled as particles. During the blow up or "explosion," the total momentum of the system is conserved in the *x*-direction and the *y*-direction.

Visualize:

Pictorial representation



Known

$m_1 = m_2 = m$

$m_3 = 2\,m$

$(v_{fx})_1 = (v_{fy})_2 = -20$ m/s

Find

$(v_f)_3$ and θ

Solve: The initial momentum is zero. From $p_{fx} = p_{ix}$, we get

$$+m_1(v_{fx})_1 + m_3(v_f)_3\cos\theta = 0 \text{ kg m/s} \Rightarrow (v_f)_3\cos\theta = \frac{-m_1(v_{fx})_1}{m_3} = \frac{-m(-20 \text{ m/s})}{2m} = 10 \text{ m/s}$$

From $p_{fx} = p_{ix}$, we get

$$+m_2(v_{fy})_2 + m_3(v_f)_3\sin\theta = 0 \text{ kg m/s} \Rightarrow (v_f)_3\sin\theta = \frac{-m_2(v_{fy})_2}{m_3} = \frac{-m(-20 \text{ m/s})}{2m} = 10 \text{ m/s}$$

$$\Rightarrow (v_f)_3 = \sqrt{(10 \text{ m/s})^2 + (10 \text{ m/s})^2} = 14.1 \text{ m/s} \quad \theta = \tan^{-1}(1) = 45°$$

The velocity is 14.1 m/s at 45° east of north.