Directions after a collision

$$m_1 v_1 - m_2 v_2 = -m_1 v_a + m_2 v_b$$

Sample Problem

A 3 kg crate of raspberry donut moving 10 m/s filling collides with a 15 kg tub of lime Kool Aid moving 6 m/s toward it on a frictionless surface. Which way and how fast does the Kool Aid rebound?

answer: Let's draw v to the right in the after picture.

$$3(10) - 6(15) = -3(4.5) + 15v \quad \Rightarrow \quad v = -3.1 \text{ m/s}$$

Since v came out negative, we guessed wrong in drawing v to the right, but that's OK as long as we interpret our answer correctly.

After the collision the lime Kool Aid is moving 3.1 m/s to the left.

before

after