$$m_1\vec{v}_1' = \left|\vec{v}_1' = u - \vec{v}_1\right| = m_1\vec{u} - m_1\vec{v}_1 = m_1\mu\left(\vec{v}_1/m_2 + \vec{v}_2/m_1\right) - m_1\vec{v}_1 =$$

$$= \frac{m_1}{m_2}\frac{m_1 m_2}{m_1 + m_2}\vec{v}_1 + \frac{m_1 m_2}{m_1 + m_2}\vec{v}_2 - m_1\vec{v}_1 = m_1\vec{v}_1\left(\frac{m_1}{m_1 + m_2} - 1\right) + \mu\vec{v}_2 =$$

$$= m_1\vec{v}_1\left(\frac{m_1 - m_1 - m_2}{m_1 + m_2}\right) + \mu\vec{v}_2 = \mu(\vec{v}_2 - \vec{v}_1)$$