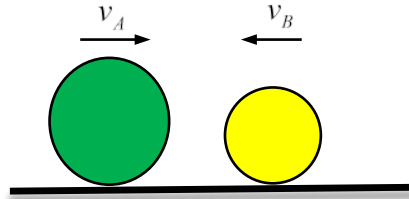


2-23. Two balls A and B are moving on a smooth ground in opposite directions. They collide with initial velocities $v_A \sim N(2, 0.2^2)$ m/s and $v_B \sim N(1, 0.1^2)$ m/s. After collision, the two balls move together. If $m_A = 10$ kg and $m_B = 4$ kg, determine the probability that their common velocity is smaller than 1 m/s just after the collision.



$$m_A v_A - m_B v_B = (m_A + m_B) v$$

$$v = \frac{m_A v_A - m_B v_B}{m_A + m_B}$$

$$\mu_v = \frac{m_A \mu_{v_A} - m_B \mu_{v_B}}{m_A + m_B} = 1.14 \text{ m/s}$$

$$\sigma_v = \sqrt{\left(\frac{m_A \sigma_{v_A}}{m_A + m_B}\right)^2 + \left(\frac{m_B \sigma_{v_B}}{m_A + m_B}\right)^2} = 0.15 \text{ m/s}$$

$$\Pr\{v < 1\} = \Phi\left(\frac{1 - \mu_v}{\sigma_v}\right) = \Phi\left(\frac{1 - 1.14}{0.15}\right) = 0.18$$

Therefore, $\Pr\{v < 1\} = 0.18$.

Ans.