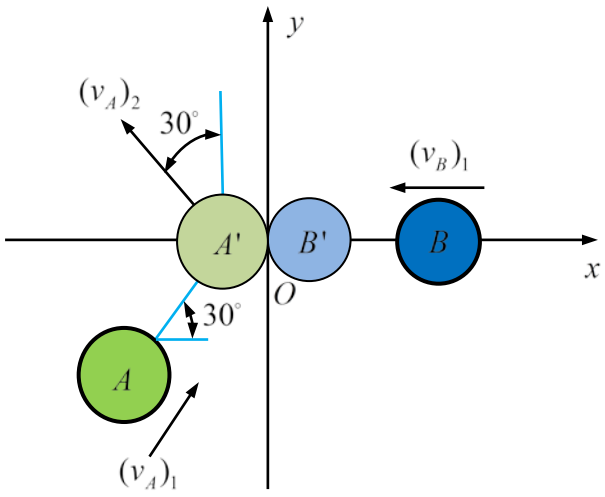
2-35. Two smooth balls A and B are moving toward the origin O with initial velocities $(v_A)_1 \sim N(5, 0.5^2)$ m/s and $(v_B)_1 \sim N(2, 0.2^2)$ m/s, respectively. If $m_A = 1\,\text{kg}$ and $m_B = 1\,\text{kg}$, determine the velocity of ball B in the x-axis after collision. Assume $(v_A)_1$ and $(v_B)_1$ are independent.



$$\Sigma m v_1 = \Sigma m v_2$$

$$(\rightarrow +)\ m_A(v_A)_1 \cos\theta_1 - m_B(v_B)_1 = -m_A(v_A)_{2x} + m_B(v_B)_{2x}$$

$$(\uparrow +)\ m_A(v_A)_1 \sin\theta_1 = m_A(v_A)_{2y}$$

$$(v_A)_{2y} = (v_A)_1 \sin\theta_1 \uparrow$$

$$(v_A)_{2x} = (v_A)_{2y} \tan\theta_2 = (v_A)_1 \sin\theta_1 \tan\theta_2 \leftarrow$$

$$(v_B)_{2x} = \frac{m_A(\cos\theta_1 + \sin\theta_1 \tan\theta_2)(v_A)_1}{m_B} - (v_B)_1$$

$$\mu_{(v_B)_{2x}} = \frac{m_A(\cos\theta_1 + \sin\theta_1 \tan\theta_2)\mu_{(v_A)_1}}{m_B} - \mu_{(v_B)_1}$$

$$= \frac{1(\cos 30^\circ + \sin 30^\circ \tan 30^\circ)(5)}{1} - 2$$

$$= 3.77 \text{ m/s}$$

$$\mu_{(v_B)_{2x}} = \sqrt{\left(\frac{m_A(\cos\theta_1 + \sin\theta_1 \tan\theta_2)\sigma_{(v_A)_1}}{m_B}\right)^2 + \left(\sigma_{(v_B)_1}\right)^2}$$

$$= \sqrt{\left(\frac{1(\cos 30^\circ + \sin 30^\circ \tan 30^\circ)(0.5)}{1}\right)^2 + 0.2^2}$$

$$= 0.61 \text{ m/s}$$

Therefore, $(v_B)_{2x} \sim N(3.77, 0.61^2)$ m/s. **Ans.**