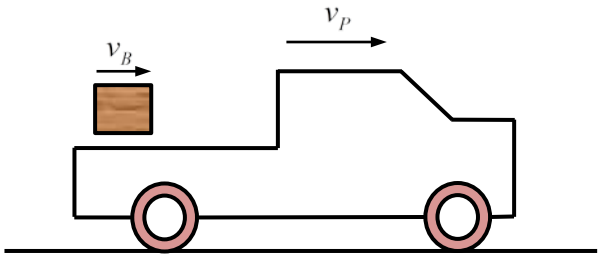
2-27. A 500-kg block was loaded to a 2000-kg pickup truck. Just before the block was loaded, the pickup truck has a normally distributed velocity $v_P \sim N(5, 0.5^2)$ m/s; and the block has a horizontal component of velocity relative to the pickup truck of $v_{B/P} \sim N(4, 0.4^2)$ m/s. Determine the velocity just after the block was loaded.



$$v_B = v_P + v_{B/P}$$

$$\Sigma m(v)_1 = \Sigma m(v)_2$$

$$m_B v_B + m_P v_P = (m_B + m_P)v$$

$$v = \frac{m_B v_B + m_P v_P}{m_B + m_P} = \frac{m_B(v_P + v_{B/P}) + m_P v_P}{m_B + m_P} = v_P + \frac{m_B v_{B/P}}{m_B + m_P}$$

$$\mu_v = \mu_{v_P} + \frac{m_B \mu_{v_{B/P}}}{m_B + m_P} = 5 + \frac{500(4)}{500 + 2000} = 5.8 \text{ m/s}$$

$$\sigma_v = \sqrt{\left(\sigma_{v_P}\right)^2 + \left(\frac{m_B \sigma_{v_{B/P}}}{m_B + m_P}\right)^2} = \sqrt{(0.5)^2 + \left(\frac{500(0.4)}{500 + 2000}\right)^2} = 0.51 \text{ m/s}$$

Therefore, $v \sim N(5.8, 0.51^2)$ m/s. **Ans.**