

78. (a) We use Eq. 9-5 to compute the center of mass coordinates.

$$\begin{aligned}x_{\text{com}} &= \frac{(4\text{ kg})(0) + (3\text{ kg})(7\text{ m}) + (5\text{ kg})(3\text{ m})}{4\text{ kg} + 3\text{ kg} + 5\text{ kg}} = 3.00\text{ m} \\y_{\text{com}} &= \frac{(4\text{ kg})(0) + (3\text{ kg})(3\text{ m}) + (5\text{ kg})(2\text{ m})}{4\text{ kg} + 3\text{ kg} + 5\text{ kg}} = 1.58\text{ m}\end{aligned}$$

(b) Using Eq. 9-17 and SI units, we obtain

$$\begin{aligned}\vec{v} &= \frac{(4\text{ kg})\left(1.5\hat{i} - 2.5\hat{j}\right) + (3\text{ kg})(0) + (5\text{ kg})\left(2.0\hat{i} - 1.0\hat{j}\right)}{4\text{ kg} + 3\text{ kg} + 5\text{ kg}} \\&= 1.33\hat{i} - 1.25\hat{j}\text{ m/s} .\end{aligned}$$

(c) Multiplying the previous result by the total mass yields $\vec{P} = 16.0\hat{i} - 15.0\hat{j}$ in SI units (kg·m/s). This can also be gotten by adding up the individual momenta.