3. Our notation is as follows: $x_1 = 0$ and $y_1 = 0$ are the coordinates of the $m_1 = 3.0\,\text{kg}$ particle; $x_2 = 1.0\,\text{m}$ and $y_2 = 2.0\,\text{m}$ are the coordinates of the $m_2 = 8.0\,\text{kg}$ particle; and, $x_3 = 2.0\,\text{m}$ and $y_3 = 1.0\,\text{m}$ are the coordinates of the $m_3 = 4.0\,\text{kg}$ particle.

(a) The x coordinate of the center of mass is

$$\begin{aligned} x_{\text{com}} &= \frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_2} \\ &= \frac{0 + (8.0\,\text{kg})(1.0\,\text{m}) + (4.0\,\text{kg})(2.0\,\text{m})}{3.0\,\text{kg} + 8.0\,\text{kg} + 4.0\,\text{kg}} \\ &= 1.1\,\text{m}\ . \end{aligned}$$

(b) The y coordinate of the center of mass is

$$\begin{aligned} y_{\text{com}} &= \frac{m_1y_1 + m_2y_2 + m_3y_3}{m_1 + m_2 + m_3} \\ &= \frac{0 + (8.0\,\text{kg})(2.0\,\text{m}) + (4.0\,\text{kg})(1.0\,\text{m})}{3.0\,\text{kg} + 8.0\,\text{kg} + 4.0\,\text{kg}} \\ &= 1.3\ \text{m}\ . \end{aligned}$$

(c) As the mass of the topmost particle is increased, the center of mass shifts toward that particle. As we approach the limit as the topmost particle is infinitely more massive than the others, the center of mass becomes infinitesimally close to the position of that particle.