Center of mass is an example of an average: it is the position average with respect to mass.

\[ x_{cm} = \frac{\sum m_i x_i}{\sum m_i} \]

Find the center of mass of the 1g and 2g masses:

\[ x_{cm} = \frac{(2g)(25cm) + (1g)(100cm)}{3g} = 50cm \]

Find the average velocity in the graph below:

\[ \langle v \rangle = \frac{\sum \vec{v}_i \Delta t_i}{\sum \Delta t_i} = \frac{(1m/s)(1s-0) + 2m/s(3s-1s) + 0}{4s} = \frac{1m + 4m}{4s} = 1.25 \frac{m}{s} \]

Careful! the derivative of this graph is undefined at 1s & 3s, \( a = \frac{dv}{dt} \to \infty \)

For general curves, integral calculus is required to find the average, but for linear graphs (or graph segments) the average of the graph is just the average of the end points.

\[ \langle y \rangle = \frac{y_0 + y_f}{2} \] for a linear graph segment.

This is an example of the relationship between the area under a curve and its average:

\[ \langle y \rangle \Delta x = \text{area under } y \text{ vs. } x \text{ from } x_0 \text{ to } x_f \]