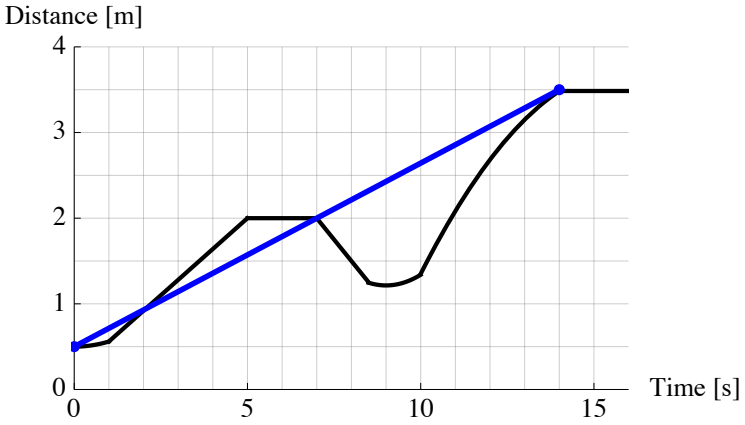
Average Velocity on a Position Graph

The average velocity between any two points of time on a position-time graph is the slope of the secant line that passes between those two points. For example, in the graph below, the average velocity between 0 and 14 seconds is:

$$v_{\text{avg}} = \frac{\Delta \text{ distance}}{\Delta \text{ time}} = \frac{3.5 - 0.5\,m}{14\,s} = \frac{3}{14}\,m/s = 0.214\,m/s$$



Example

The distance an object is from its starting point as a function of time is given by the equation

$$d(t) = t^3 - 8\,t^2 + 10\,t + 5$$

What was its average velocity between $t = 1$ and $t = 5$?

Solution

To solve this problem we only need to find the distances at $t = 1$ and $t = 5$. We can then find the slope of the secant line through those two points, which gives us the average velocity:

$$d(1) = (1)^3 - 8\,(1)^2 + 10\,(1) + 5 = 8$$
$$d(5) = (5)^3 - 8\,(5)^2 + 10\,(5) + 5 = -20$$

So,

$$v_{\text{avg}} = \frac{\Delta\, d}{\Delta\, t} = \frac{d(5) - d(1)}{5 - 1} = \frac{-20 - 5}{4} = \frac{-25}{4} = -6.25\,m/s$$

We can double check this by looking at the graph and the secant line between those two points in time: