

6. Average velocity over $[t, t + h]$ is

$$\begin{aligned} & \frac{3(t+h)^2 - 12(t+h) + 1 - (3t^2 - 12t + 1)}{(t+h) - t} \\ &= \frac{6th + 3h^2 - 12h}{h} = 6t + 3h - 12 \text{ m/s.} \end{aligned}$$

This average velocity approaches $6t - 12$ m/s as h approaches 0.

At $t = 1$ the velocity is $6 \times 1 - 12 = -6$ m/s.

At $t = 2$ the velocity is $6 \times 2 - 12 = 0$ m/s.

At $t = 3$ the velocity is $6 \times 3 - 12 = 6$ m/s.