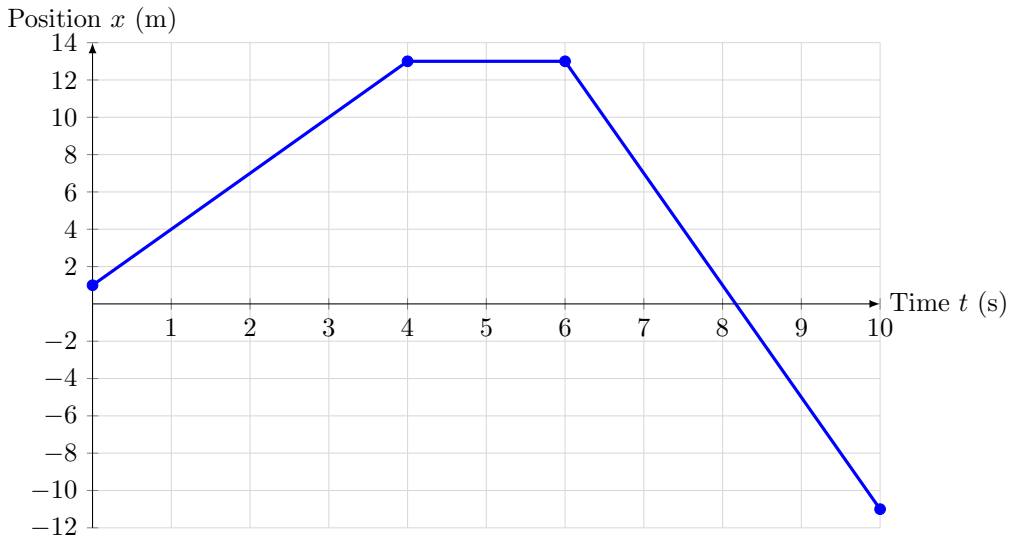


1. Question 1

   (a) Describe in words the motion of the object shown in the position–time graph above. In your description, be sure to state where the object starts, how fast and in which direction it moves during each portion of the trip, and when (if ever) it is at rest.

   (b) What is the velocity at 2 seconds?

   (c) What is the average velocity between $t = 1$ and $t = 6$ seconds?

2. Question 2 A particle is at rest 6 m away from the origin in the positive direction. After 5 s, the particle moves toward the origin at a constant speed, reaching $x = 0$ m at $t = 8$ s. It sits at rest for 1 s before moving in the positive x direction at a constant speed of 3 m/s for four seconds, before immediately turning back around and reaching $x = 2$ m at $t = 15$ s.

   (a) Draw a position vs. time plot for the motion described.

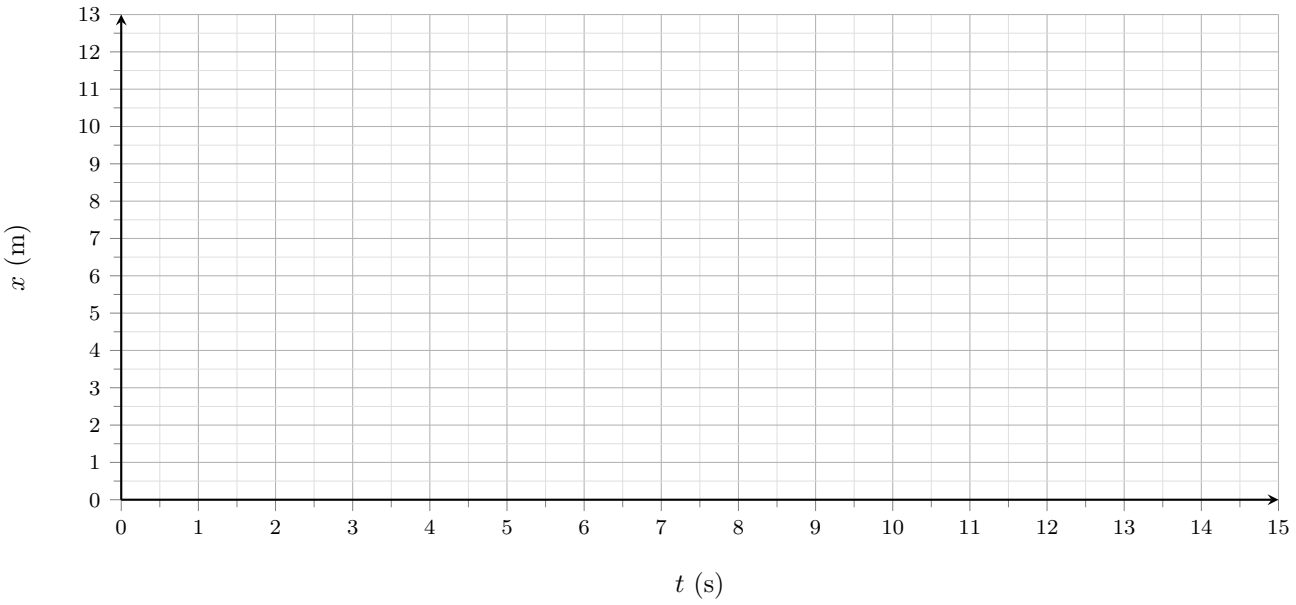
   (b) Calculate the velocity of the particle between $t = 5$ s and $t = 8$ s.

   (c) Calculate the velocity of the particle between $t = 13$ s and $t = 15$ s.

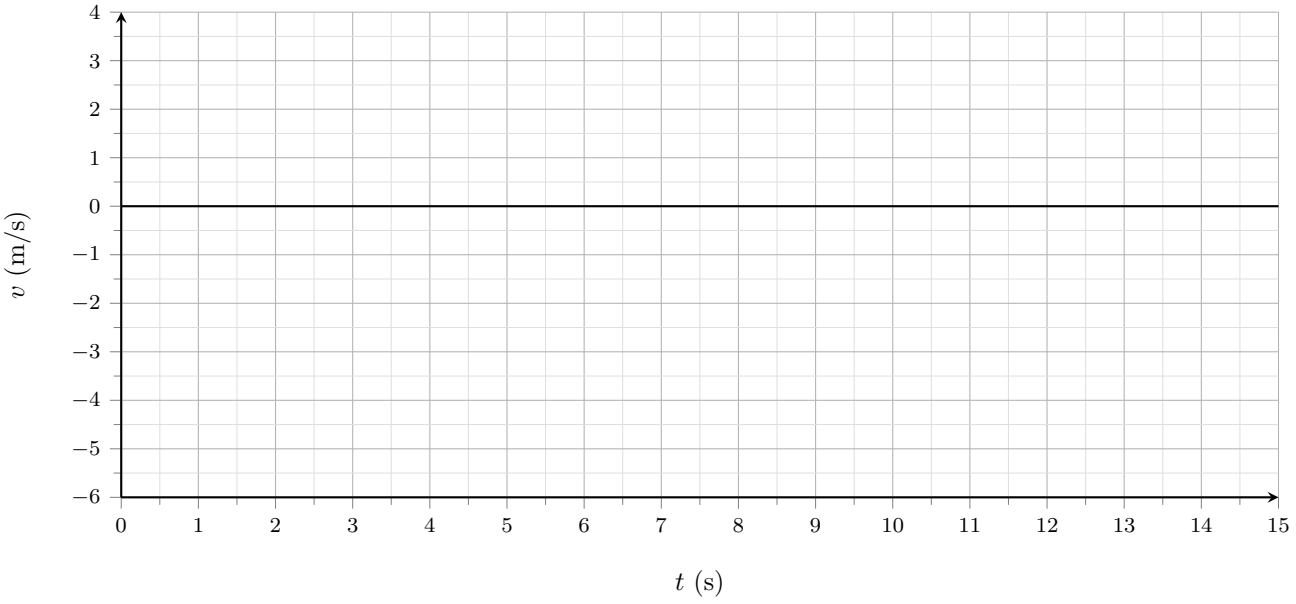
   (d) Draw a velocity vs. time plot for the motion described.

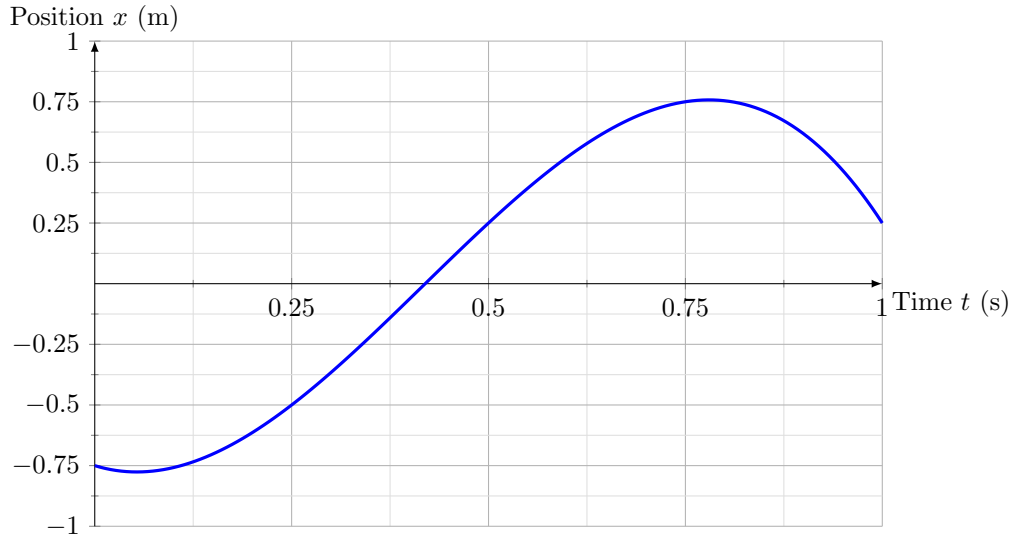
   (e) Calculate the average velocity from $t = 0$ s to $t = 15$ s.

(a) Position vs. time



(d) Velocity vs. time





3. Question 3

   (a) Find the average velocity of the particle for the following time ranges.

      i. $0\text{ s} \leq t \leq 0.25\text{ s}$

      ii. $0.75\text{ s} \leq t \leq 1\text{ s}$

      iii. $0\text{ s} \leq t \leq 1\text{ s}$

   (b) Estimate (by a geometrical method) the instantaneous velocity of the particle at $t = 0.5$ s

   (c) Mark with small filled-in circles the points on the plot where the instantaneous velocity is zero.

   (d) The curve in the figure above is described by

$$x(t) = -8t^3 + 10t^2 - t - \frac{3}{4};$$

   compute exactly (using a derivative) the velocity as a function of time, $v(t)$.

   (e) Evaluate $v(t)$ for $t = 0.5$ s and compare to the estimate you made in part (b).

   (f) Now take the derivative of $v(t)$ with respect to t to compute the acceleration as a function of time.