

Chapter 2 Problem 20 †

Given

Figure 2.15 in the text.

Solution

a) Find the greatest velocity in the +x direction.

The greatest positive velocity is where the line is increasing with the greatest slope, which is around $t = 2 \text{ s}$. To find this slope estimate the times when the line is at 2 m and 4 m . These times are 1.6 s and 2.3 s respectively. The velocity (slope) is then

$$v = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} = \frac{4 \text{ m} - 2 \text{ m}}{2.3 \text{ s} - 1.6 \text{ s}} = 2.9 \text{ m/s}$$

b) Find the greatest velocity in the -x direction.

The greatest negative velocity is where the line is decreasing with the greatest slope, which is around $t = 4 \text{ s}$. To find this slope estimate the times when the line is at 4 m and 3 m . These times are 3.6 s and 4.25 s respectively. The velocity (slope) is then

$$v = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} = \frac{3 \text{ m} - 4 \text{ m}}{4.25 \text{ s} - 3.6 \text{ s}} = -1.5 \text{ m/s}$$

c) Find the times when the object is at rest.

The object is at rest when the tangent to the curve is horizontal. This occurs around $t = 3 \text{ s}$ and $t = 5 \text{ s}$.

d) Find the average velocity over the interval shown.

The average velocity is calculated by taking the initial point $(0 \text{ m}, 0 \text{ s})$ and the final point $(3 \text{ m}, 6 \text{ s})$.

$$v = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i} = \frac{3 \text{ m} - 0 \text{ m}}{6 \text{ s} - 0 \text{ s}} = 0.5 \text{ m/s}$$

†Problem from Essential University Physics, Wolfson