72. (a) We estimate $x \approx 2$ m at $t = 0.5$ s, and $x \approx 12$ m at $t = 4.5$ s. Hence, using the definition of average velocity Eq. 2-2, we find

$$v_{\text{avg}} = \frac{12 - 2}{4.5 - 0.5} = 2.5 \text{ m/s} \quad .$$

(b) In the region $4.0 \le t \le 5.0$, the graph depicts a straight line, so its slope represents the instantaneous velocity for any point in that interval. Its slope is the average velocity between $t = 4.0$ s and $t = 5.0$ s:

$$v_{\text{avg}} = \frac{16.0 - 8.0}{5.0 - 4.0} = 8.0 \text{ m/s} \quad .$$

Thus, the instantaneous velocity at $t = 4.5$ s is 8.0 m/s. (Note: similar reasoning leads to a value needed in the next part: the slope of the $0 \le t \le 1$ region indicates that the instantaneous velocity at $t = 0.5$ s is 4.0 m/s.)

(c) The average acceleration is defined by Eq. 2-7:

$$a_{\text{avg}} = \frac{v_2 - v_1}{t_2 - t_1} = \frac{8.0 - 4.0}{4.5 - 0.5} = 1.0 \text{ m/s}^2 \ .$$

(d) The instantaneous acceleration is the instantaneous rate-of-change of the velocity, and the constant x vs. t slope in the interval $4.0 \le t \le 5.0$ indicates that the velocity is constant during that interval. Therefore, $a = 0$ at $t = 4.5$ s.