Original Problem:

12. ‖ **FIGURE EX2.12** shows the velocity-versus-time graph for a particle moving along the x-axis. Its initial position is $x_0 = 2.0$ m at $t_0 = 0$ s.

What are the particle's position, velocity, and acceleration at $t = 1.0$ s?

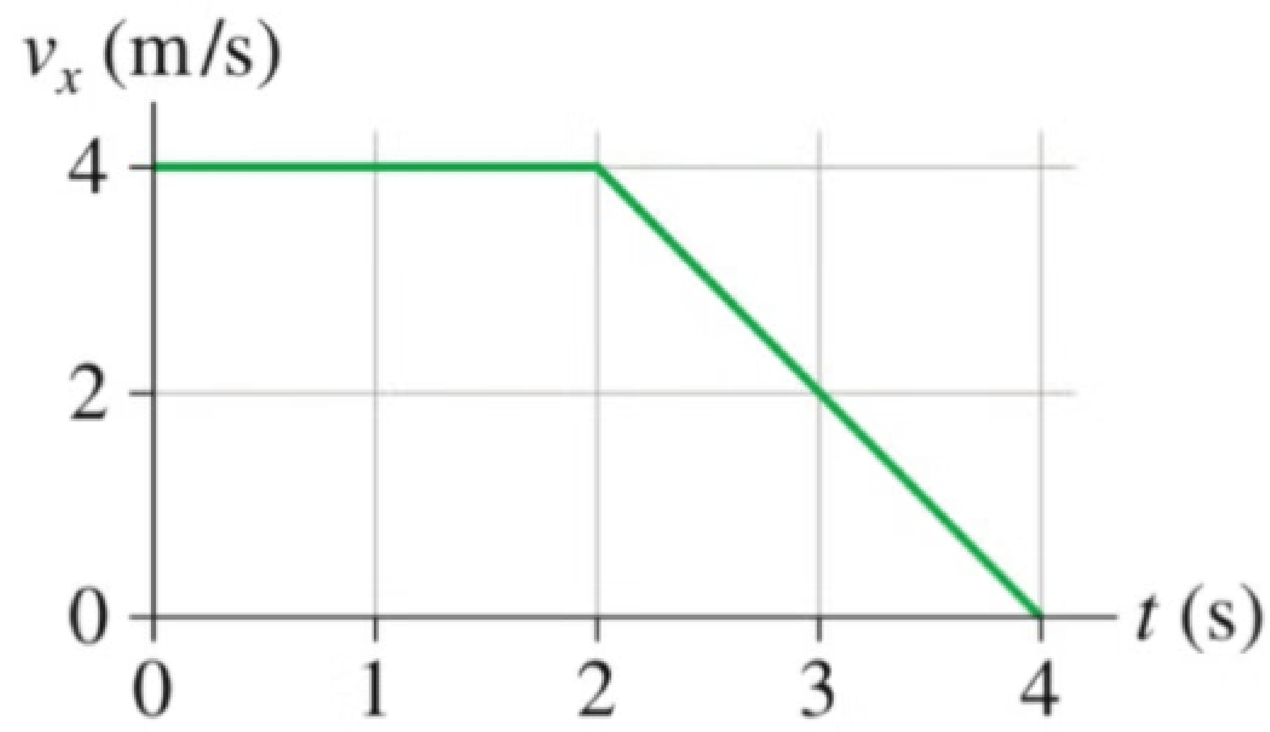

FIGURE EX2.12

Provided Solution:

2.12. Solve: Using the equation

$$x_f = x_i + \text{area under the velocity-versus-time graph between } t_i \text{ and } t_f$$

we have

$$x(\text{at } t = 1 \text{ s}) = x(\text{at } t = 0 \text{ s}) + \text{area between } t = 0 \text{ s and } t = 1 \text{ s}$$
$$= 2.0 \text{ m} + (4 \text{ m/s})(1 \text{ s}) = 6 \text{ m}$$

Reading from the velocity-versus-time graph, $v_x(\text{at } t = 1 \text{ s}) = 4$ m/s. Also, $a_x = \text{slope} = \Delta v/\Delta t = 0 \text{ m/s}^2$.

Blue pen: Original work / 1st attempt @ solution ("draft")

Red pen: Graded version, with comments, reflections, etc. ("corrections")

Black pen: Comments about each solution... would this receive full credit?

Sol #1

Position

$$\Delta x = \int_{t_0}^{t_f} V_x \, dt = \int_{0s}^{1s} [4 \tfrac{m}{s}] \, dt = 4m$$

$$x_f = x_0 + \Delta x = 2m + 4m = \boxed{6m}$$

Velocity: From the graph, $V_x(t=1s) = \boxed{4 \, m/s}$

Acceleration: Zero slope of $V_x(t)$ @ $t = 1s$

$$\Rightarrow \quad a_x = \frac{dv_x}{dt} = \boxed{0 \, m/s^2}$$

This solution would NOT receive full credit. Although the solution is correct and pretty well-explained, there are no corrections / it was not graded. Even a simple checkmark for each part is sufficient — some indication that the student's work was compared (by the student) to the provided solution. Even though a checkmark is the bare minimum for "correct" work, comments / reflections are preferred.

Sol # 2 I'm not sure how to do this one.

[Corrections version has the solutions copied almost verbatim]

This solution would NOT receive full credit. "I'm not sure how to do this problem" (or similar) is not a reasonable attempt to solve the problem. You must explicitly state, to the best of your ability, why you are stuck, what you don't understand, etc.

Also, the point of the solutions is not for you to copy them down. They are provided for you to help address the specific points of confusion that you (are supposed to) raise in your draft version. Showing understanding of the solution is required, regurgitating the solution is not.

Sol # 3 The graph isn't moving, so the position is constant (2m, the starting point). $v = 4$ from the graph, and $a = \frac{\Delta v}{\Delta t} = \frac{4}{1} = 4$.

The graph says that velocity (speed) is a constant $4\,m/s$ for the first 2 seconds, so the position changes from 2m to $2m + (4\,m/s)(1s) = 6m$ @ 1sec. I got the velocity correct (should have had units $\frac{m}{s}$), but the acceleration was wrong. Even though I wrote $a = \frac{\Delta v}{\Delta t}$ (which is true for average acceleration), I used it incorrectly ($\Delta v = 0$, not 4), and I also should have used instantaneous acceleration $a = \frac{dv}{dt} = 0$ since we're talking about the instant $t = 1.0$ sec.

This would receive full credit. Even though the draft work was incorrect, the student showed understanding of the solution in the corrections.

Sol #4

Position

$$\Delta x = \int_{t_0}^{t_f} V_x\,dt = \int_0^1 4\,dt = 4\ m/s$$

Units

$$x_f = x_0 + \Delta x = 2m + 4m = \boxed{6m}$$

Velocity: From the graph, $V_x(t=1s) = \boxed{4\ m/s}$ ✓

Acceleration: Zero slope of $V_x(t)$ @ $t=1s$

$$\Rightarrow a_x = \frac{dv_x}{dt} = \boxed{0\ m/s^2}$$ ✓

Correct, but I was a little sloppy with units in the intermediate steps. As long as I always use SI units I think this is okay.

This would receive full credit. Note this is basically the same as Sol. #1, but this student obviously graded/reflected on their work. It's possible to get the right answer yet still learn something from the solutions. [e.g. point out that you did the problem differently from the solutions manual, but both are valid].