109. (Fifth problem of **Cluster 1**)

The problem consists of two parts, where part 1 (A to B) involves constant velocity motion for $t_1 = 5.00$ s and part 2 (B to C) involves uniformly accelerated motion. Assuming the coordinate origin is at point A and the positive axis is directed towards B and C, then we have $x_C = 250$ m, $a_2 = -0.500$ m/s^2, and $v_C = 0$.

(a) We set up the uniform velocity equation for part 1 ($\Delta x = vt$) and Eq. 2-16 for part 2 ($v^2 = v_0^2 + 2a\Delta x$) as a simultaneous set of equations to be solved:

$$\begin{aligned} x_B - 0 &= v_1(5.00) \\ 0^2 &= v_B^2 + 2(-0.500)\,(250 - x_B)\ . \end{aligned}$$

Bearing in mind that $v_A = v_1 = v_B$, we can solve the equations by, for instance, substituting the first into the second – eliminating x_B and leading to a quadratic equation for v_1:

$$v_1^2 + 5v_1 - 150 = 0\ .$$

The positive root gives us $v_1 = 13.5$ m/s.

(b) We obtain the duration t_2 of part 2 from Eq. 2-11:

$$v = v_0 + at_2 \implies 0 = 13.5 + (-0.500)t_2$$

which yields the value $t_2 = 27.0$ s. Therefore, the total time is $t_1 + t_2 = 32.0$ s.