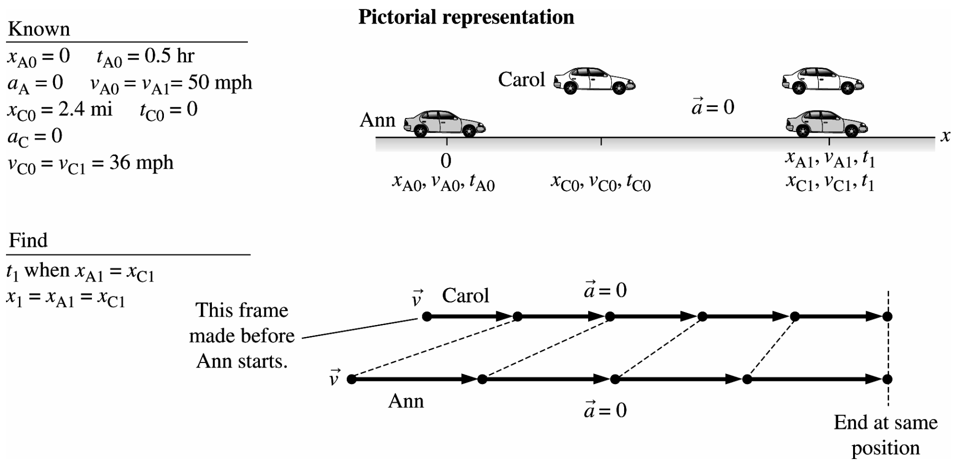
2.56. Model: The cars are represented as particles.

Visualize:



Solve: (a) Ann and Carol start from different locations at different times and drive at different speeds. But at time t_1 they have the *same* position. It is important in a problem such as this to express information in terms of *positions* (that is, coordinates) rather than distances. Each drives at a constant velocity, so using constant velocity kinematics gives

$$x_{A1} = x_{A0} + v_A(t_1 - t_{A0}) = v_A(t_1 - t_{A0}) \qquad x_{C1} = x_{C0} + v_C(t_1 - t_{C0}) = x_{C0} + v_C t_1$$

The critical piece of information is that Ann and Carol have the same position at t_1, so $x_{A1} = x_{C1}$. Equating these two expressions, we can solve for the time t_1 when Ann passes Carol:

$$v_A(t_1 - t_{A0}) = x_{C0} + v_C t_1$$

$$\Rightarrow (v_A - v_C)t_1 = x_{C0} + v_A t_{A0}$$

$$\Rightarrow t_1 = \frac{x_{C0} + v_A t_{A0}}{v_A - v_C} = \frac{2.4 \text{ mi} + (50 \text{ mph})(0.5 \text{ h})}{50 \text{ mph} - 36 \text{ mph}} = 2.0 \text{ h}$$

(b) Their position is $x_1 = x_{A1} = x_{C1} = x_{C0} + v_C t_1 = 74$ miles.

(c) Note that Ann's graph doesn't start until t = 0.5 hours, but her graph has a steeper slope so it intersects Carol's graph at $t \approx 2.0$ hours.