A high performance sports car is proceeding south along a straight stretch of I-15 at 48.0 m/s when the driver notices the flashing lights of a police car behind her. The sports car driver begins braking uniformly at 2.00 m/s² until the speed of the sports car is 34.0 m/s, just inside the legal limit for that stretch of road. The police car is traveling at 55.0 m/s towards the sports car and is 600. m behind it when the sports car starts braking.

A. [20 pts.] How far has the sports car traveled during the braking period and how long did it take the sports car driver to slow from 48.0 m/s to 34.0 m/s?

\[ \text{DIST \SPORTS \ CAR \ TRAVELED} \]
\[ v^2 = v_0^2 + 2a(x-x_0) \]
\[ \text{DIST} = x-x_0 = \frac{v^2 - v_0^2}{-2a} \]
\[ \text{DIST} = \frac{(34.0 \text{ m/s})^2 - (48.0 \text{ m/s})^2}{(-2 \times 2.00 \text{ m/s}^2)} = \frac{\sqrt{32}}{11} \text{ m} \]
\[ x-x_0 = \left( \frac{v + v_0}{2} \right) t \]
\[ t = \frac{2(x-x_0)}{v + v_0} = \frac{(11)(28) \text{ m}}{82 \text{ m/s}} = 7.00 \text{ s} \]

B. [10 pts.] After the braking period, how far behind the sports car is the police car?

\[ \text{DIST \ POLICE \ CAR \ TRAVELED} \]
\[ (x-x_0) = v_pc t = (55 \text{ m/s})(11) \]
\[ \text{DIST} = 385 \text{ m} \]
\[ 600 \text{ m} - (385 - 28) \text{ m} \]
\[ = 502 \text{ m} \]

C. [10 pts.] When the sports car gets to 34.0 m/s, it stops braking and proceeds at a constant 34.0 m/s. After how many additional seconds does the police car catch up to the sports car?

Let \( x_0 = 0 \) at end of braking period

Let \( x_{pc} = 0 \) and \( x_{sc} = 502 \text{ m} \). Then at time \( t \)

\[ x_{pc} = x_{sc} \]
\[ x_{pc} + v_{pc} t = x_{sc} + v_{sc} \]
\[ \left( v_{pc} - v_{sc} \right) t = x_{sc} - x_{pc} \]
\[ t = \frac{x_{sc} - x_{pc}}{v_{pc} - v_{sc}} = \frac{502 \text{ m}}{55 \text{ m/s} - 34 \text{ m/s}} \]
\[ t = 23.95 \text{ s} \]