A police car is sitting at an intersection when a car goes speeding past it at a constant speed of 32.0 m/s. The officer waits 4.00 s to make sure there is no other traffic near the intersection and then takes off after the speeder at a constant acceleration of 4.80 m/s².

\[ S = \text{SPEDDER} \quad P = \text{POLICE OFFICER} \]

A. [8 pts.] How much time does it take the police officer to reach the same speed as the speeder from the instant the police car starts accelerating?

\[ \begin{align*}
S &= 32.0 \text{ m/s} \\
P &= 4.80 \text{ m/s}² \\
V_P &= 0 \\
V_S &= 32.0 \text{ m/s} \\
\frac{\Delta v}{\Delta t} &= a_P \\
\frac{V_S - V_P}{\Delta t} &= a_P \\
\Delta t &= \frac{V_S - V_P}{a_P} \\
\Delta t &= \frac{32.0 - 0}{4.80} \\
\Delta t &= 6.67 \text{ s}
\end{align*} \]

B. [16 pts.] How much time elapses between when the officer starts accelerating and when she catches up to the speeder?

\[ \begin{align*}
\text{POLICE CAR CATCHES THE SPEEDER AT} \quad \Delta t &= \text{SECONDS AFTER LEAVING THE INTERSECTION AT POSITION} \\
X_S &= X_Px \\
X_S &= x_0 + V_{0s}t + \frac{1}{2} a_s t^2 \\
&= 128 \text{ m} + V_{0s}t \\
&= \frac{1}{2} a_P t^2 \\
128 + (32 \text{ m/s})t &= (2.4 \text{ m/s}²) t^2 \\
2.4t^2 - 32t - 128 &= 0 \\
\Delta t^2 + 64 - 96 &= 0 \\
\Delta t &= \frac{32 \pm \sqrt{(32)^2 + (4)(2.4)(128)}}{4.8} \\
\Delta t &= \frac{32 \pm 41.5}{4.8} \\
\Delta t &= 16.65, -3.23 \text{ s}
\end{align*} \]

POLICE OFFICER CATCHES SPEEDER \( 16.65 \) \text{ s} AFTER LEAVING INTERSECTION.

C. [8 pts.] How far does the officer's car travel from the intersection to the point when she catches the speeder?

\[ \begin{align*}
\text{HOW FAR} = x_P = x_S &= \frac{1}{2} a_P t^2 = (2.4 \text{ m/s}²)(16.65)^2 \\
&= 661 \text{ m}
\end{align*} \]