6. [9 points] At a park, there are two circular tracks that are centered at a common flagpole (at point \( P \)). The two tracks have radii 2 and 5 km respectively (see the figure below). A street that runs in the east-west direction is located \( k \) kilometers south of the flagpole.

![Diagram of the tracks and flagpole](image)

a. [4 points] Albert decides to run on the tracks starting at the point \( A \) on the east end of the longer track. He runs along the longer track counterclockwise until he reaches point \( B \). Then he runs from point \( B \) towards the flagpole until point \( C \) on the shorter track. He continues clockwise along the shorter track until point \( D \). From there, he runs east to point \( A \) (see the bolded path in the figure). If the distance Albert ran along the longer track between the points \( A \) and \( B \) is 7 km, what is the total distance he ran?

Answer: ________________.

b. [3 points] John starts running at point \( E \), which is the furthest point directly west of the flagpole on the longer track. He plans to run on the track in the counterclockwise direction to the point \( G \), which is directly south of the flagpole. He stops at point \( F \) which is a third of the way between point \( E \) and \( G \) on the track. What is John’s distance \( d \) (in kilometers) to the street at this point? Your answer may depend on \( k \).

\[ d=\______________ \]

Problem continues on the next page
The statement of the problem is included here for your convenience.

At a park, there are two circular tracks that are centered at a common flagpole (at point $P$). The two tracks have radii 2 and 5 km respectively (see the figure below). A street that runs in the east-west direction is located $k$ kilometers south of the flagpole.

![Diagram of two circular tracks and a location $k$ km south of the flagpole]

**c.** [2 points] Directly south of the flagpole, there is a street light on the street. A car is parked 6 km from the streetlight along the street, and the line connecting the car with the flagpole makes an angle $\theta$ with the street (see the figure). Find a formula for the distance $k$ (in kilometers) between the flagpole and the street light in terms of $\theta$.

\[ k = \text{______________________}. \]