SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

A car travels south for 5 minutes with a speed of \( v = 50 \) 
mp, then turns 45° north of west and travels at a speed of \( v = 45 \) 
mp for 10 minutes and then heads 60° east of north at \( v = 55 \) 
mp for 5 minutes.

(a) Find the total displacement of the car (both magnitude and direction). Illustrate your solution on the graph below.
(b) What is the total distance traveled by the car?
(c) Calculate the average velocity of the car (both magnitude and direction).
(d) Determine the average speed of the car?

\[
\begin{align*}
\vec{\Delta r}_1 &= v_1 \cdot t_1 = -4.16 \text{ miles} \\
\vec{\Delta r}_2 &= v_2 \cdot t_2 = -5.30i + 5.30j \text{ miles} \\
\vec{\Delta r}_3 &= v_3 \cdot t_3 = 3.96i + 2.29j \text{ miles} \\
\vec{\Delta r} &= \Delta r_1 + \Delta r_2 + \Delta r_3 = -1.34i + 3.43j \text{ miles}
\end{align*}
\]

\[
\begin{align*}
\vec{v}_1 &= -50j \text{ mph} \\
\vec{v}_2 &= -45 \sin 45° \text{ i} + 45 \sin 45° \text{ j mph} = -31.8i + 31.8j \text{ mph} \\
\vec{v}_3 &= 55 \sin 60° \text{ i} + 55 \cos 60° \text{ j mph} = 47.6i + 27.5j \text{ mph}
\end{align*}
\]

\[|\vec{\Delta r}| = 3.68 \text{ miles}
\]

\[\theta = 68.6° \text{ or } 21° \text{ at west of North}\]
\[ \text{distance} = d_1 + d_2 + d_3 = |\overrightarrow{v}_1| \cdot t_1 + |\overrightarrow{v}_2| \cdot t_2 + |\overrightarrow{v}_3| \cdot t_3 = \]

\[ = 50 \cdot \frac{5}{60} + 45 \cdot \frac{10}{60} + 55 \cdot \frac{5}{60} = 16.25 \text{ miles.} \]

\[ \overrightarrow{V}_{\text{average}} = \frac{\Delta \overrightarrow{r}}{\Delta t} \]

\[ |\overrightarrow{V}_{\text{average}}| = 11.0 \text{ mph}, \text{ also at 210° west of North} \]

\[ \text{average speed} = \frac{\text{total distance}}{\text{total time}} = \frac{16.25}{\frac{20}{60}} \]

\[ \text{average speed} = 48.75 \text{ mph} \]