Answer on Question #71048, Physics / Mechanics | Relativity

Question. In an attempt to escape his island, Gilligan builds a raft and sets to sea. The wind shifts a great deal during the day, and he is blown along the following straight lines:

$2.5\ km$ $45°$ north of west; then

$4.70\ km$ $60°$ south of east; then

$5.1\ km$ straight east; then

$7.2\ km$ $55°$ south of west; and finally

$2.8\ km$ $10°$ north of east.

What is his final position relative to the island?

Solution.

His journey consists of five vectors. Let's convert the angles first to be relative to $+x-axis$. We get

$$A: 2.5\ km\ 135°$$
$$B: 4.70\ km\ 300°$$
$$C: 5.1\ km\ 0°$$
$$D: 7.2\ km\ 235°$$
$$E: 2.8\ km\ 10°$$

So

$$\vec{A} = 2.5 \cdot \cos 135°\vec{\imath} + 2.5 \cdot \sin 135°\vec{\jmath} = -1.77\vec{\imath} + 1.77\vec{\jmath}$$
$$\vec{B} = 4.7 \cdot \cos 300°\vec{\imath} + 4.7 \cdot \sin 300°\vec{\jmath} = 2.35\vec{\imath} - 4.07\vec{\jmath}$$
$$\vec{C} = 5.1 \cdot \cos 0°\vec{\imath} + 5.1 \cdot \sin 0°\vec{\jmath} = 5.1\vec{\imath}$$
$$\vec{D} = 7.2 \cdot \cos 235°\vec{\imath} + 7.2 \cdot \sin 235°\vec{\jmath} = -4.13\vec{\imath} - 5.90\vec{\jmath}$$
$$\vec{E} = 2.8 \cdot \cos 10°\vec{\imath} + 2.8 \cdot \sin 10°\vec{\jmath} = 2.76\vec{\imath} + 0.48\vec{\jmath}.$$

Finally

$$\vec{S} = \vec{A} + \vec{B} + \vec{C} + \vec{D} + \vec{E} = 4.31\vec{\imath} - 7.72\vec{\jmath}$$

$$|\vec{S}| = \sqrt{4.31^2 + 7.72^2} = 8.84\ km.$$

$$\text{tg}\,\alpha = \frac{y}{x} = \frac{-7.72}{4.31} = -1.791 \quad \rightarrow \quad \alpha = -60.8°\ (or\ 60.8°\ \text{south of east})$$

Answer. $|\vec{S}| = 8.84\ km;\ 60.8°$ south of east