

## Answer on Question #79467, Physics / Other

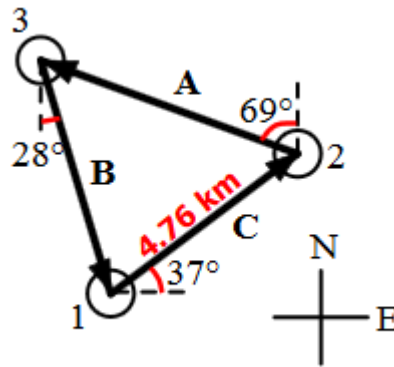
A ferryboat transports tourists among three islands. It sails from the first island to the second island, 4.76 km away, in a direction  $37.0^\circ$  north of east. It then sails from the second island to the third island in a direction  $69.0^\circ$  west of north. Finally, it returns to the first island, sailing in a direction  $28.0^\circ$  east of south.

(a) Calculate the distance between the second and third islands.

(b) Calculate the distance between the first and third islands.

(1<sup>st</sup> way)

**Solution:**



Let  $A$  be the distance between islands (2) and (3).

Let  $B$  be the distance between islands (1) and (3).

$C = 4.76$  km.

For the  $x$  components, we have:

$$\begin{aligned}
 A_x &= C_x + B_x \\
 A \sin(69^\circ) &= C \cos(37^\circ) + B \sin(28^\circ) \\
 0.9336A &= 4.76 \times 0.7986 + 0.4695B \\
 0.9336A &= 3.8013 + 0.4695B \\
 A &= \frac{3.8013 + 0.4695B}{0.9336} = 0.5029 B + 4.072 \quad (i)
 \end{aligned}$$

For the  $y$  components, we have:

$$\begin{aligned}
 B_y &= C_y + A_y \\
 B \cos(28^\circ) &= C \sin(37^\circ) + A \cos(69^\circ) \\
 B \times 0.8829 &= 2.865 + A \times 0.3584 \quad (ii)
 \end{aligned}$$

By substituting (i) into (ii), we have

$$\begin{aligned}
 B \times 0.8829 &= 2.865 + (0.5029 B + 4.072) \times 0.3584 \\
 0.7027 B - 4.3244 &= 0 \\
 B &\approx 6.15 \text{ km}
 \end{aligned}$$

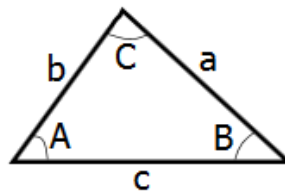
$$A = 0.5029 \times 6.154 + 4.072 \approx 7.17 \text{ km}$$

**Answer:** (a) 7.17 km; (b) 6.15 km.

(2<sup>nd</sup> way)

**Solution:**

Use the law of sines:



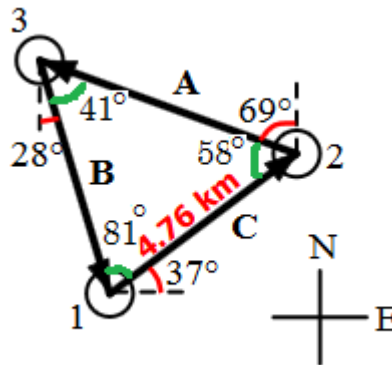
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

In our case:

$$\text{Angle } A = 180 - (90 - 28) - 37 = 81^\circ$$

$$\text{Angle } B = 180 - (90 - 37) - 69 = 58^\circ$$

$$\text{Angle } C = 90 - 28 - (90 - 69) = 41^\circ$$



Let A be the distance between islands (2) and (3).

Let B be the distance between islands (1) and (3).

$C = 4.76$  km.

$$\frac{A}{\sin 81^\circ} = \frac{B}{\sin 58^\circ} = \frac{4.76}{\sin 41^\circ}$$

$$A = \frac{4.76 \times \sin 81^\circ}{\sin 41^\circ} = 7.166 \text{ km} \approx 7.17 \text{ km}$$

$$B = \frac{4.76 \times \sin 58^\circ}{\sin 41^\circ} = 6.153 \text{ km} \approx 6.15 \text{ km}$$

**Answer:** (a) 7.17 km; (b) 6.15 km.

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