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Chapter 11 - Problem Solving Set A

Set A Bronze

$$\begin{aligned} \text{a) } \vec{BC} &= \vec{BA} + \vec{AC} \\ &= -(5i+12j) + (12i+5j) \\ &= -5i - 12j + 12i + 5j \\ &= \underline{\underline{7i - 7j}} \end{aligned}$$

$$\text{b) } |\vec{AB}| = \sqrt{5^2 + 12^2} = 13$$

$$|\vec{AC}| = \sqrt{12^2 + 5^2} = 13$$

$$|\vec{BC}| = \sqrt{7^2 + 7^2} = 7\sqrt{2}$$

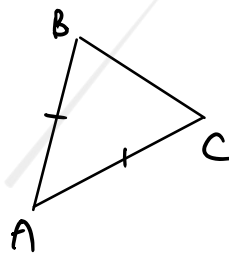
$$\text{c) } (BC)^2 = (AB)^2 + (AC)^2 - 2(AB)(AC)\cos(\angle BAC)$$

$$(7\sqrt{2})^2 = (13)^2 + (13)^2 - 2(13)(13)\cos(\angle BAC)$$

$$98 = 338 - 338\cos(\angle BAC)$$

$$\cos(\angle BAC) = \frac{338 - 98}{338}$$

$$\angle BAC = \cos^{-1}\left(\frac{338 - 98}{338}\right) = \underline{\underline{44.8^\circ}}$$



Chapter 11 - Problem Solving Set A

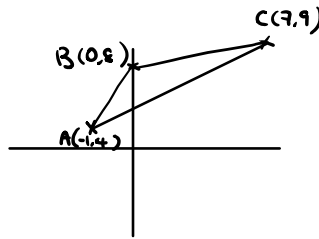
Set A Silver

$$\begin{aligned} \text{a) } \vec{BC} &= \vec{BO} + \vec{OC} \\ &= -(8\mathbf{j}) + (7\mathbf{i} + 9\mathbf{j}) \\ &= \underline{\underline{7\mathbf{i} + \mathbf{j}}} \end{aligned}$$

$$\text{b) } |\vec{AB}| = \sqrt{(0-1)^2 + (8-4)^2} = \sqrt{17}$$

$$|\vec{BC}| = \sqrt{7^2 + 1^2} = 5\sqrt{2}$$

$$|\vec{AC}| = \sqrt{(7-1)^2 + (9-4)^2} = \sqrt{89}$$



$$(\vec{BC})^2 = (\vec{AB})^2 + (\vec{AC})^2 - 2(\vec{AB})(\vec{AC})\cos(\angle BAC)$$

$$\cos(\angle BAC) = \frac{(\vec{AB})^2 + (\vec{AC})^2 - (\vec{BC})^2}{2(\vec{AB})(\vec{AC})}$$

$$\angle BAC = \cos^{-1}\left(\frac{17 + 89 - 50}{2 \times \sqrt{17} \times \sqrt{89}}\right) = \underline{\underline{44.0^\circ}}$$

$$\text{c) } \text{Area} = \frac{1}{2}ab\sin C$$

$$= \frac{1}{2}(\vec{AB})(\vec{AC})\sin(\angle BAC)$$

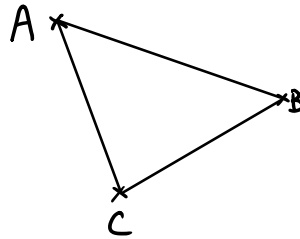
$$= \frac{1}{2}(\sqrt{17})(\sqrt{89})\sin(44) = \underline{\underline{\frac{27}{2} \text{ units}^2}}$$

must use exact value from (b).

Chapter 11 - Problem Solving Set A

Set A Gold

$$\begin{aligned}\vec{BC} &= \vec{BA} + \vec{AC} \\ &= -\begin{pmatrix} 8 \\ -2 \end{pmatrix} + \begin{pmatrix} 2 \\ -7 \end{pmatrix} \\ &= \begin{pmatrix} -8 \\ 2 \end{pmatrix} + \begin{pmatrix} 2 \\ -7 \end{pmatrix} \\ &= \begin{pmatrix} -6 \\ -5 \end{pmatrix}\end{aligned}$$



$$|\vec{AB}| = \sqrt{8^2 + (-2)^2} = 2\sqrt{17}$$

$$|\vec{AC}| = \sqrt{2^2 + (-7)^2} = \sqrt{53}$$

$$|\vec{BC}| = \sqrt{6^2 + 5^2} = \sqrt{61}$$

$$(AB)^2 = (AC)^2 + (BC)^2 - 2(AC)(BC) \cos(\angle ACB)$$

→ Alternatively you can find $\angle ABC$ or $\angle CAB$.

$$\angle ACB = \cos^{-1}\left(\frac{(AC)^2 + (BC)^2 - (AB)^2}{2(AC)(BC)}\right)$$

$$= \cos^{-1}\left(\frac{53 + 61 - 68}{2(\sqrt{53})(\sqrt{61})}\right) = 66.14^\circ$$

$$\begin{aligned}\text{Area} &= \frac{1}{2}(AC)(BC) \sin(\angle ACB) \\ &= \frac{1}{2}(\sqrt{53})(\sqrt{61}) \sin(66.14^\circ) \\ &= \underline{\underline{26}}\end{aligned}$$