Problem 1 (1.2)

No - counterexample: $\vec{A} = \hat{x}$, $\vec{B} = \hat{x}$, $\vec{C} = \hat{y}$, then

$(\vec{A}\times\vec{B})\times\vec{C} = (\hat{x}\times\hat{x})\times\hat{y} = 0$ but

$\vec{A}\times(\vec{B}\times\vec{C}) = \hat{x}\times(\hat{x}\times\hat{y}) = \hat{x}\times\hat{z} = -\hat{y} \neq 0.$

Problem 2 (1.4)

Let $\vec{A} \equiv 3\hat{z} - \hat{x}$ & $\vec{B} \equiv 2\hat{y} - \hat{x}$, then $\hat{n} \parallel \vec{B}\times\vec{A}$

$$\vec{B}\times\vec{A} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ -1 & 2 & 0 \\ -1 & 0 & 3 \end{vmatrix} = 6\hat{x} + 3\hat{y} + 2\hat{z} \equiv \vec{n}$$

& $n = (36+9+4)^{1/2} = 7$ & $\hat{n} = \vec{n}/n = 1/7(6\hat{x} + 3\hat{y} + 2\hat{z})$.

Problem 3

$\vec{B} = B^x\hat{x} + B^y\hat{y}$, $\vec{C} = C^x\hat{x} + C^y\hat{y}$ $\quad \vec{A} = A^x\hat{x} + A^y\hat{y} + A^z\hat{z}$

$$\vec{B}\times\vec{C} = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ B^x & B^y & 0 \\ C^x & C^y & 0 \end{vmatrix} = \hat{z}(B^xC^y - B^yC^x) \equiv \vec{D}$$

so
$$\vec{A}\times(\vec{B}\times\vec{C}) = \begin{vmatrix} \hat{x} & \hat{y} & \hat{z} \\ A^x & A^y & A^z \\ 0 & 0 & D^z \end{vmatrix} = \hat{x}(A^yD^z) - \hat{y}A^xD^z$$

$$= (B^xC^y - B^yC^x)[A^y\hat{x} - A^x\hat{y}]$$

$$\vec{B}(\vec{A}\cdot\vec{C}) - \vec{C}(\vec{A}\cdot\vec{B}) = (A^xC^x + A^yC^y)(B^x\hat{x} + B^y\hat{y}) - (A^xB^x + A^yB^y)(C^x\hat{x} + C^y\hat{y})$$

$$= (B^xC^y - B^yC^x)A^y\hat{x} + (B^yC^x - B^xC^y)A^x\hat{y}$$

$$= (B^xC^y - B^yC^x)(A^y\hat{x} - A^x\hat{y}) = \vec{A}\times(\vec{B}\times\vec{C})$$

Problem 4

$\vec{A} = 3\hat{x} - 2\hat{y} + \hat{z}$, $\vec{B} = 2\hat{x} + \hat{y} - 2\hat{z}$ w/ $A = \sqrt{14}$, $B = 3$

$\vec{A}\cdot\vec{B} = 6 - 2 - 2 = 2 = 3\sqrt{14}\cos\theta \Rightarrow \cos\theta = \frac{2}{3\sqrt{14}} \Rightarrow \theta = \cos^{-1}\left(\frac{2}{3\sqrt{14}}\right) \approx 1.39$

or $\theta = 1.39 \cdot \frac{360^\circ}{2\pi} \approx 79.6^\circ$