Name: _____ **Key** _____ Id#: _____ Sect.#: _____

Consider the following two vectors: $A = 2i + 3j + 4k$ and $B = -3i + 5j + 2k$.
(a) Calculate the value of the angle between them.
(b) Calculate the projection of **B** along the direction of **A**.

a) $\vec{A} \cdot \vec{B} = AB \cos\theta$

$$-6 + 15 + 8 = \sqrt{29}\ \sqrt{38}\ \cos\theta$$

$$17 = 33.2\ \cos\theta$$

$$\cos\theta = 0.51 \qquad \theta = \cos^{-1}(0.51) = \boxed{59.2^\circ}$$

b) $B\cos\theta = \dfrac{\vec{A} \cdot \vec{B}}{A} = \dfrac{17}{\sqrt{29}} = \boxed{3.2}$

Name: _____ Key _____ Id#: _____ Sect.#:

Consider the following three vectors: $\mathbf{A} = 2\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$, $\mathbf{B} = -3\mathbf{i} + 5\mathbf{j} - 2\mathbf{k}$ and $\mathbf{C} = 5\mathbf{i} - 3\mathbf{j} - \mathbf{k}$
Calculate $\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C})$

$$\vec{D} = \vec{B} \times \vec{C} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ -3 & 5 & -2 \\ 5 & -3 & -1 \end{vmatrix}$$

$$\vec{D} = (-5-6)\hat{i} - (3+10)\hat{j} + (9-25)\hat{j}$$

$$= -11\hat{i} - 13\hat{j} - 16\hat{k}$$

$$\vec{A} \cdot \vec{D} = (2\hat{i} - 3\hat{j} + 4\hat{k}) \cdot (-11\hat{i} - 13\hat{j} - 16\hat{k})$$
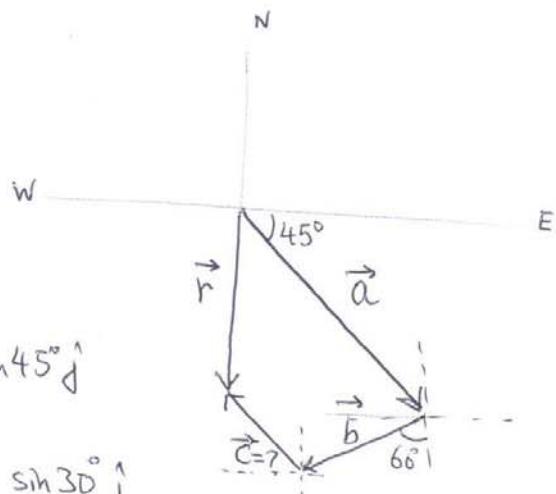
$$= -11 + 39 - 64 = \boxed{-47}$$

Name: **Key**   Id#:   Sect.#:

A hiker begins a trip by first walking 25 km South East, then 10 km in a direction 60^0 West of South. What is the magnitude and direction of the third displacement for the hiker to end up 20 Km South of the starting point?

$$\vec{r} = \vec{a} + \vec{b} + \vec{c}$$

$$\vec{c} = \vec{r} - \vec{a} - \vec{b}$$

$$\vec{a} = 25\cos45°\hat{\imath} - 25\sin45°\hat{\jmath}$$

$$\vec{b} = -10\cos30°\hat{\imath} - 10\sin30°\hat{\jmath}$$

$$\vec{r} = 0\hat{\imath} - 20\hat{\jmath}$$

$$\vec{c} = (0 - 25\cos45° + 10\cos30)\hat{\imath} + (-20 + 25\sin45° + 10\sin30)\hat{\jmath}$$

$$= -9\hat{\imath} + 2.7\hat{\jmath}$$

← the vector is in the <u>second</u> quadrant

$$|\vec{c}| = 9.4$$

$$\theta = \tan^{-1}\left(\frac{2.7}{-9}\right) = -16.7°$$