2. (2 pts) $\|\vec{a}\| = \sqrt{16+1} = \boxed{\sqrt{17}}$ $\quad 12\vec{b} = \boxed{\langle -96, -60\rangle}$ $\quad 6\vec{a} - 7\vec{b} = \langle 25, 6\rangle - \langle -56, -35\rangle = \boxed{\langle 80, 41\rangle}$

4. (2 pts for part b ONLY)

(a) $\|\vec{w}\| = \sqrt{25+4+36} = \sqrt{65}$ $\quad \boxed{\vec{u} = \frac{\vec{w}}{\|\vec{w}\|} = \left\langle \frac{5}{\sqrt{65}}, \frac{2}{\sqrt{65}}, \frac{-6}{\sqrt{65}} \right\rangle}$

(b) $\|\vec{v}\| = \sqrt{1+25+16} = \sqrt{42}$ $\quad \boxed{\vec{u} = -\frac{\vec{v}}{\|\vec{v}\|} = -\frac{1}{\sqrt{42}}\vec{i} - \frac{5}{\sqrt{42}}\vec{j} + \frac{4}{\sqrt{42}}\vec{k}}$

8. (2 pts) $\cos\theta = \frac{\vec{x}\bullet\vec{y}}{\|\vec{x}\|\|\vec{y}\|} = \frac{0}{\sqrt{54}\sqrt{180}} = 0 \quad \rightarrow \quad \theta = \cos^{-1}(0) = \frac{\pi}{2} \text{ radians}$

So, the two vectors are orthogonal.

9. (2 pts) $\vec{a}\bullet\vec{b} = 32$ $\quad \|\vec{a}\|^2 = 94$ $\quad \text{proj}_{\vec{a}}\,\vec{b} = \frac{32}{94}\langle 2, 9, -3\rangle = \left\langle \frac{32}{47}, \frac{144}{47}, -\frac{48}{47} \right\rangle$

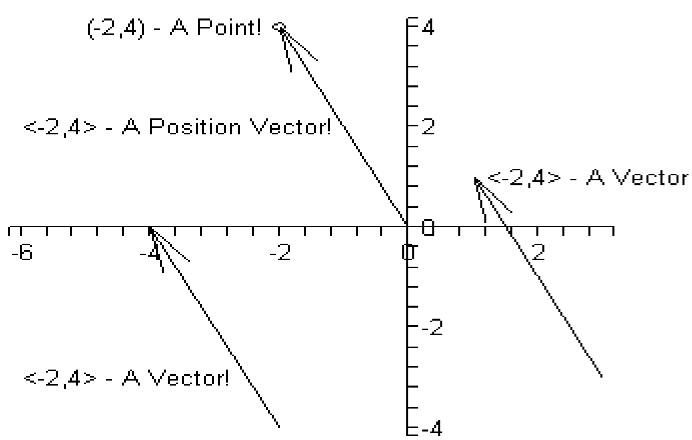
11. (2 pts)

$$\vec{v}\times\vec{w} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 4 & 1 & -8 \\ 3 & -2 & 7 \end{vmatrix} \begin{matrix} \vec{i} & \vec{j} \\ 4 & 1 \\ 3 & -2 \end{matrix} = 7\vec{i} - 24\vec{j} - 8\vec{k} - 28\vec{j} - 16\vec{i} - 3\vec{k} = \boxed{-9\vec{i} - 52\vec{j} - 11\vec{k}}$$

$$\vec{w}\times\vec{v} = -(\vec{v}\times\vec{w}) = \boxed{9\vec{i} + 52\vec{j} + 11\vec{k}}$$

Not Graded

1. $(-2, 4)$ is a point and $\langle -2, 4\rangle$ is a vector. Here's a sketch of the point and several possible representation of the vector.



3.

$$\|\vec{a}\| = \sqrt{25+49} = \boxed{\sqrt{74}} \qquad 12\vec{b} = \boxed{12\vec{i} - 108\vec{j} - 48\vec{k}}$$

$$6\vec{a} - 7\vec{b} = 30\vec{i} - 42\vec{j} - \left(7\vec{i} - 63\vec{j} - 28\vec{k}\right) = \boxed{23\vec{i} + 21\vec{j} + 28\vec{k}}$$

5. $\vec{a} \bullet \vec{b} = 10 - 9 - 28 = \boxed{-27}$

6. $\vec{a} \bullet \vec{b} = \|\vec{a}\|\|\vec{b}\|\cos\left(\frac{5\pi}{9}\right) = (18)(5)(-0.1736) = \boxed{-15.624}$

7.

$$\cos\theta = \frac{\vec{p} \bullet \vec{q}}{\|\vec{p}\|\|\vec{q}\|} = \frac{-92}{\sqrt{68}\sqrt{325}} = -0.61886 \qquad \rightarrow \qquad \theta = \cos^{-1}(-0.61886) = 2.2381 \text{ radians}$$

So, the angle is not 0, $\frac{\pi}{2}$, or π and so the vectors are neither parallel or perpendicular.

10. $\vec{a} \bullet \vec{b} = 32 \qquad \|\vec{b}\|^2 = 85 \qquad \text{proj}_{\vec{b}}\, \vec{a} = \frac{32}{85}\langle 7, 0, -6\rangle = \langle \frac{224}{85}, 0, -\frac{192}{85}\rangle$

12. *P*=(3, -2, 2), *Q*=(1, -7, 2) and *R*=(1, -1, 3). Form two vectors and then the cross product will be the normal vector.

$$\overrightarrow{QP} = \langle 2, 5, 0\rangle \qquad \overrightarrow{QR} = \langle 0, 6, 1\rangle$$

$$\vec{n} = \overrightarrow{QP} \times \overrightarrow{QR} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 2 & 5 & 0 \\ 0 & 6 & 1 \end{vmatrix} \begin{matrix} \vec{i} & \vec{j} \\ 2 & 5 \\ 0 & 6 \end{matrix} = \boxed{5\vec{i} - 2\vec{j} + 12\vec{k}}$$

13. $\vec{a} = \langle 0, 2, 3\rangle$, $\vec{b} = \langle -1, 1, 0\rangle$ and $\vec{c} = \langle 8, 3, -4\rangle$

$$\vec{a} \bullet \left(\vec{b} \times \vec{c}\right) = \begin{vmatrix} 0 & 2 & 3 \\ -1 & 1 & 0 \\ 8 & 3 & -4 \end{vmatrix} = 0 + 0 + (-9) - 24 - 8 - 0 = -41 \neq 0$$

This quantity is not zero and so they are **not** in the same plane.