1. a. $\langle 1,1,1\rangle$, $\langle 3,-2,-1\rangle$

Dot product

$\langle 1,1,1\rangle \cdot \langle 3,-2,-1\rangle$

$= 1\cdot 3 + (-2)\cdot 1 + (-1)\cdot 1$

$= 3 + (-2) + (-1)$

$= 0$

Therefore $\langle 1,1,1\rangle$ and $\langle 3,-2,-1\rangle$ are orthogonal

b. $\langle 4,3\rangle$, $\langle 2,-4\rangle$

Dot product

$\langle 4,3\rangle \cdot \langle 2,-4\rangle$

$= \cancel{8}\ 2\cdot 4 + (3)\cdot(-4)$

$= 8 + (-12)$

$= -4$

$\cos\theta = A\cdot B / (|A||B|) = -4 / (|A||B|)$

$= -4 / (\sqrt{4^2+3^2}\sqrt{2^2+(-4)^2})$

$= -4 / 10\sqrt{5}$

$= -\frac{2}{5\sqrt{5}}$

$\cos^{-1}(-\frac{2}{5\sqrt{5}}) \approx 1.751 \approx 100.305°$

Therefore $\cancel{\measuredangle}$ the angle between $\langle 4,3\rangle$ and $\langle 2,-4\rangle$ is obtuse.

2. $V = \langle 0, 1, -1 \rangle$, $w = \langle 1, -1, 0 \rangle$

$$v \times w = \begin{vmatrix} i & j & k \\ 0 & 1 & -1 \\ 1 & -1 & 0 \end{vmatrix}$$

$$= i(1 \cdot 0 - (-1) \cdot (-1)) - j(0 \cdot 0 - 1 \cdot (-1)) + k(0 \cdot (-1) - 1 \cdot 1))$$

$$= -i - j + (-k)$$

$$= \langle -1, -1, -1 \rangle$$