2. Find a x b and verify that it is orthogonal to both a and b.

$$a = \langle 5,1,4 \rangle \quad b = \langle -1,0,2 \rangle$$

a×b $2i - 4j + 0k - (-k + 0i + 10j) = \boxed{2i - 14j + k}$

$$\begin{vmatrix} i & j & k & i & j \\ 5 & 1 & 4 & 5 & 1 \\ -1 & 0 & 2 & -1 & 0 \end{vmatrix}$$
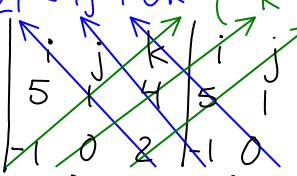
$(a \times b) \cdot a = \langle 2, -14, 1 \rangle \cdot \langle 5,1,4 \rangle = 10 - 14 + 4 = 0$

$(a \times b) \cdot b = \langle 2, -14, 1 \rangle \cdot \langle -1,0,2 \rangle = -2 + 0 + 2 = 0$

10-11 ▪ Find $|u \times v|$ and determine whether $u \times v$ is directed into the page or out of the page.

10.

$|u| = 5$ 60° $|v| = 10$
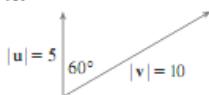
$$|u \times v| = |u||v| \sin \theta$$
$$|u \times v| = (5)(10) \sin(60)$$
$$= \boxed{25\sqrt{3}}$$

into the page

23. Find the area of the parallelogram with vertices $A(-2, 1)$, $B(0, 4)$, $C(4, 2)$, and $D(2, -1)$.
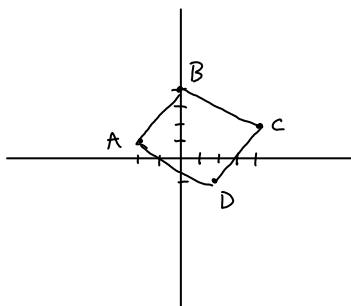

$$\vec{AB} = \langle 2,3 \rangle$$
$$\vec{AD} = \langle 4, -2 \rangle$$

$$\vec{AB} \times \vec{AD} = \begin{vmatrix} 2 & 3 \\ 4 & -2 \end{vmatrix} = |-4 - 12| = |-16| = \boxed{16}$$

29-30 ▪ Find the volume of the parallelepiped determined by the vectors a, b, and c.

29. $a = \langle 6,3,1 \rangle \quad b = \langle 0,1,2 \rangle \quad c = \langle 4,-2,5 \rangle$
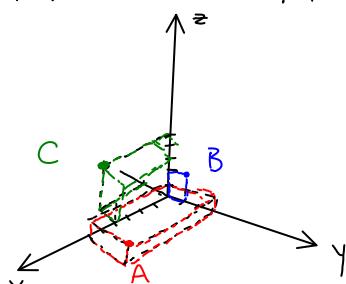
$$V = a \cdot (b \times c)$$

$b \times c = 5i + 8j + 0k - (4k - 4i + 0j) = 9i + 8j - 4k$

$$\begin{vmatrix} i & j & k & i & j \\ 0 & 1 & 2 & 0 & 1 \\ 4 & -2 & 5 & 4 & -2 \end{vmatrix}$$
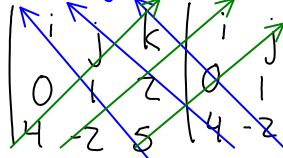
$a \cdot (b \times c) = \langle 6,3,-1 \rangle \cdot \langle 9,8,-4 \rangle = 54 + 24 + 4 = \boxed{82}$

45. Suppose that $a \neq 0$

      (a) no   (c) yes

      (b) no