

## PROPERTIES

- $u \times u = 0$
- $u \times v = -(v \times u)$
- $d(u \times v) = (du) \times v = u \times (dv)$
- $u \times (v+w) = (u \times v) + (u \times w)$
- $u \times v$  is orthogonal to  $u$  AND  $v$  <sup>BOTH</sup>
- $\|u \times v\| = \|u\| \cdot \|v\| \sin \theta$

5.  $u = 3i - j + 2k$

$$v = 4i + j - 5k$$

$$u \times v = \begin{vmatrix} i & j & k \\ 3 & -1 & 2 \\ 4 & 1 & -5 \end{vmatrix}$$

$$= i \begin{vmatrix} -1 & 2 \\ 1 & -5 \end{vmatrix} - j \begin{vmatrix} 3 & 2 \\ 4 & -5 \end{vmatrix} + k \begin{vmatrix} 3 & -1 \\ 4 & 1 \end{vmatrix}$$

$$= \boxed{3i + 23j + 7k}$$

4.  $v = i + j + k$

$$w = 5i - 2k$$

$$a) v \times w = \begin{vmatrix} i & j & k \\ 1 & 1 & 1 \\ 5 & 0 & -2 \end{vmatrix}$$

$$= i \begin{vmatrix} 1 & 1 \\ 0 & -2 \end{vmatrix} - j \begin{vmatrix} 1 & 1 \\ 5 & -2 \end{vmatrix} + k \begin{vmatrix} 1 & 1 \\ 5 & 0 \end{vmatrix}$$

$$= \boxed{-2i + 7j - 5k}$$

b)  $w \times v = \boxed{2i - 7j + 5k}$

c)  $w \times w = 0$

d)  $v \times v = 0$

6.  $v \times v = 0$

7.  $u = 3i - j + 2k$

$$v = 4i + j - 5k$$

$$(-2v) \times u$$

$$[-2(4i + j - 5k)] \times [3i - j + 2k]$$

$$[-8i - 2j + 10k] \times [3i - j + 2k]$$

$$= \begin{vmatrix} i & j & k \\ -8 & -2 & 10 \\ 3 & -1 & 2 \end{vmatrix}$$

$$= \boxed{6i + 46j + 14k}$$