

# AP - solutions

(HW#3)

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$$a = \langle a_1, a_2, a_3 \rangle$$

$$b = \langle b_1, b_2, b_3 \rangle$$

$$a \times b = \begin{vmatrix} i & j & k \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = \begin{vmatrix} a_2 & a_3 \\ b_2 & b_3 \end{vmatrix} i - \begin{vmatrix} a_1 & a_3 \\ b_1 & b_3 \end{vmatrix} j + \begin{vmatrix} a_1 & a_2 \\ b_1 & b_2 \end{vmatrix} k$$

$$= \langle a_2 b_3 - a_3 b_2, -a_1 b_3 + a_3 b_1, a_1 b_2 - a_2 b_1 \rangle$$

$$(a \times b) \cdot b = \langle a_2 b_3 - a_3 b_2, -a_1 b_3 + a_3 b_1, a_1 b_2 - a_2 b_1 \rangle \cdot \langle b_1, b_2, b_3 \rangle$$

$$= (a_2 b_3 - a_3 b_2) b_1 + (-a_1 b_3 + a_3 b_1) b_2 + (a_1 b_2 - a_2 b_1) b_3$$

$$= \cancel{a_2 b_3 b_1} - \cancel{a_3 b_2 b_1} - \cancel{a_1 b_3 b_2} + \cancel{a_3 b_1 b_2} + \cancel{a_1 b_2 b_3} - \cancel{a_2 b_1 b_3}$$

$$= 0$$

so  $(a \times b) \perp b$

