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## CHAPTER 1 FUNDAMENTAL CONCEPTS: VECTORS

- 1.1 (a)  $\vec{a} + \vec{b} = (i + j) + (j + k) = i + 2j + k$   
 $|\vec{a} + \vec{b}| = (1 + 4 + 1)^{1/2} = \sqrt{6}$
- (b)  $3\vec{a} - 2\vec{b} = 3(i + j) - 2(j + k) = 3i + j - 2k$
- (c)  $\vec{a} \cdot \vec{b} = (1)(1) + (1)(1) + (0)(0) = 1$
- (d)  $\vec{a} \times \vec{b} = \begin{vmatrix} i & j & k \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{vmatrix} = i(1 \cdot 1 - 0 \cdot 1) + j(1 \cdot 0 - 1 \cdot 1) + k(1 \cdot 1 - 0 \cdot 1) = i - j + k$   
 $|\vec{a} \times \vec{b}| = (1 + 1 + 1)^{1/2} = \sqrt{3}$
- 1.2 (a)  $\vec{a} \cdot (\vec{b} + \vec{c}) = (2i + j) \cdot (i + j + k) = (2)(1) + (1)(1) + (0)(1) = 3$   
 $(\vec{a} \times \vec{b}) \cdot \vec{c} = (3i + j - k) \cdot (i + j + k) = (3)(1) + (1)(1) + (-1)(1) = 3$
- (b)  $\vec{a} \cdot (\vec{b} \times \vec{c}) = \begin{vmatrix} 2 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} = 2(1 \cdot 1 - 0 \cdot 1) - 1(1 \cdot 1 - 0 \cdot 1) = 1$   
 $(\vec{a} \times \vec{b}) \cdot \vec{c} = 3$
- (c)  $\vec{a} \cdot (\vec{b} \times \vec{c}) - (\vec{a} \cdot \vec{b})(\vec{a} \cdot \vec{c}) + (\vec{a} \cdot \vec{c})(\vec{a} \cdot \vec{b}) - (\vec{a} \cdot \vec{a})(\vec{b} \cdot \vec{c}) = 1 - (2 \cdot 1)(2 \cdot 1) + (2 \cdot 1)(1) - (2 \cdot 2)(1 \cdot 1) = 1 - 4 + 2 - 4 = -5$   
 $-\vec{a} \cdot (\vec{b} \times \vec{c}) + (\vec{a} \cdot \vec{b})(\vec{a} \cdot \vec{c}) - (\vec{a} \cdot \vec{c})(\vec{a} \cdot \vec{b}) + (\vec{a} \cdot \vec{a})(\vec{b} \cdot \vec{c}) = 5$

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