p 147, ctd

[2.1] $\langle -2, 2, 3\rangle \cdot \langle 4, 5, 6\rangle$

$= (-2)(4) + (2)(5) + (3)(6)$

$= -8 + 10 + 18$

$= 20$

[2.2] $\vec{a} = 4\vec{e}_1 + 3\vec{e}_2 - \vec{e}_3$

$\vec{b} = -2\vec{e}_1 + \vec{e}_2 + 3\vec{e}_3$

$= (-2)(4) + (3)(1) + (-1)(3)$

$= -8 + 3 - 3$

$= -8$

P 148

[3.1] $\vec{a} = \langle -1, 0, 1\rangle$, $\vec{b} = \langle -1, 2, 2\rangle$

$$\cos\theta = \frac{\vec{a}\cdot\vec{b}}{|\vec{a}|\,|\vec{b}|} = \frac{(-1)(-1) + (0)(2) + (1)(2)}{\sqrt{2}\ \sqrt{9}} = \frac{3}{3\sqrt{2}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$\therefore\ \theta = 45°$

[3.2] $\vec{a} = \langle -3, 2, 1\rangle$, $\vec{b} = \langle 2, 1, 4\rangle$

$$\cos\theta = \frac{-6+2+4}{\sqrt{14}\ \sqrt{21}} = 0$$

$\therefore\ \theta = 90°$

[1.1] $\vec{AB} \cdot \vec{AF}$

$= |\vec{AB}||\vec{AF}| \cos\theta$

$= (a)(a\sqrt{2}) \cos 45$

$= a^2\sqrt{2}\left(\frac{\sqrt{2}}{2}\right)$

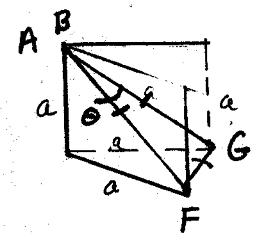
$= a^2$

[1.2] $\vec{AF} \cdot \vec{BG}$

$= |\vec{AF}||\vec{BG}| \cos 60^\circ$

$= (a\sqrt{2})(a\sqrt{2})\left(\frac{1}{2}\right)$

$= a^2$



$|\vec{AF}| = a\sqrt{2}$
$|\vec{BG}| = a\sqrt{2}$
$|\vec{FG}| = a\sqrt{2}$

∴ AFG EQUILATERAL Δ

Each of AF, BG, GF IS a diagonal of a square face edge a. So all equal.

[1.3]
$\vec{BG} \cdot \vec{DE}$

$= 0$, ∵ BG ⊥ DE

[1.4] $\vec{DE} \cdot \vec{FC}$

$= 1$, ∵ $\vec{DE} \parallel \vec{FC}$

[4] $\vec{a} = \langle 2,-1,4\rangle$

$\vec{b} = \langle -4, 5, 3\rangle$

§ $\vec{a} - k\vec{b} \perp \vec{a}$

Then

$$(\vec{a} - k\vec{b}) \cdot \vec{a} = 0$$

$$\vec{a}\cdot\vec{a} - k(\vec{a}\cdot\vec{b}) = 0$$

$$k = \frac{\vec{a}\cdot\vec{a}}{\vec{a}\cdot\vec{b}}$$

So that

$$k = \frac{\langle 2,-1,4\rangle \cdot \langle 2,-1,4\rangle}{\langle 2,-1,4\rangle \cdot \langle -4,5,8\rangle}$$

$$= \frac{4+1+16}{-8-5+12}$$

$$= \frac{21}{-1}$$

$$= -21$$

$\therefore\ k = -21$

CHECK $\langle 2,-1,4\rangle + 21\langle -4,5,3\rangle = \langle -82, 104, 67\rangle$

$$\langle -82, 104, 67\rangle \cdot \langle 2,-1,4\rangle$$

$$= -164 - 104 + 268$$

$$= 0$$