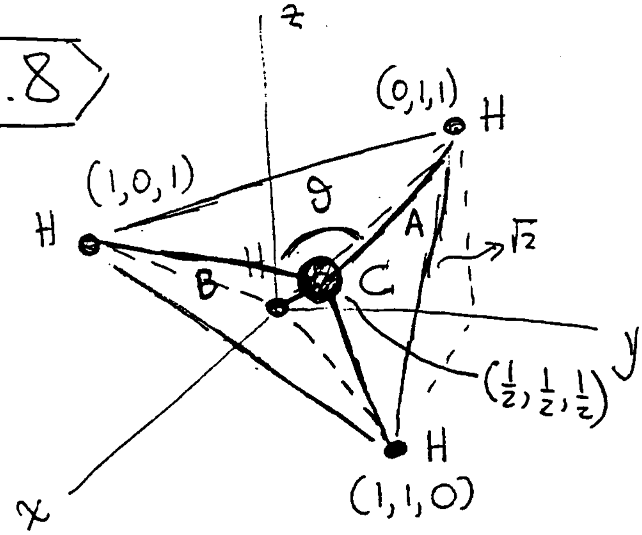
3.2.8



$$\cos\vartheta = \frac{A^T B}{\|A\|\,\|B\|}$$

$$A = (0,1,1) - (\tfrac{1}{2},\tfrac{1}{2},\tfrac{1}{2}) = (-\tfrac{1}{2},\tfrac{1}{2},\tfrac{1}{2})$$

$$B = (1,0,1) - (\tfrac{1}{2},\tfrac{1}{2},\tfrac{1}{2}) = (\tfrac{1}{2},-\tfrac{1}{2},\tfrac{1}{2})$$

$$A^T B = (-\tfrac{1}{4}) + (-\tfrac{1}{4}) + (\tfrac{1}{4}) = -\tfrac{1}{4}$$

$$\|A\| = \|B\| = \frac{\sqrt{3}}{2}$$

$$\boxed{\cos\vartheta = -1/\sqrt{3}} \Rightarrow \vartheta = 109.5^\circ$$

3.2.11 (a) The projection matrix onto line through vector a is

$$P_a = \frac{aa^T}{a^Ta}\ ;\ \text{here } a = \begin{pmatrix}1\\3\end{pmatrix},\ a^Ta = 10\ ;\ P = \frac{1}{10}\begin{pmatrix}1 & 3\\ 3 & 9\end{pmatrix}$$

vector $b \perp a$ is $b = \begin{pmatrix}3\\-1\end{pmatrix}$; $P_b = \frac{1}{10}\begin{pmatrix}9 & -3\\ -3 & 1\end{pmatrix}$

b) $P_a + P_b = \begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}$ (sum of projections on two mutually orthogonal directions equals original)

$P_a P_b = 0$; projects first onto b, then onto a. Since $a \perp b$, get always 0.