1.12 $|\hat{n};+\rangle = \cos\frac{\beta}{2}|+\rangle + e^{i\alpha}\sin\frac{\beta}{2}|-\rangle$

and for this problem $\alpha=0$, $\beta=\gamma$

so

$$|\hat{n};+\rangle = \cos\frac{\gamma}{2}|+\rangle + \sin\frac{\gamma}{2}|-\rangle$$

$$\langle S_x;+|\hat{n};+\rangle = \cos\frac{\gamma}{2}\langle S_x;+|+\rangle + \sin\frac{\gamma}{2}\langle S_x;+|-\rangle$$

$$\langle S_x;+|\pm\rangle = \frac{1}{\sqrt{2}}$$

so

$$\langle S_x;+|\hat{n};+\rangle = \frac{1}{\sqrt{2}}\left(\cos\frac{\gamma}{2} + \sin\frac{\gamma}{2}\right)$$

$$|\langle S_x;+|\hat{n};+\rangle|^2 = \frac{1}{2}\left(\cos\frac{\gamma}{2}+\sin\frac{\gamma}{2}\right)^2 = \frac{1}{2}\left(1+2\cos\frac{\gamma}{2}\sin\frac{\gamma}{2}\right) = \frac{1}{2}(1+\sin\gamma)$$

$$(\Delta S_x)^2 = \langle S_x^2\rangle - \langle S_x\rangle^2$$

$$\langle S_x^2\rangle = \langle\hat{n};+|S_x^2|\hat{n};+\rangle$$

$$S_x = \frac{\hbar}{2}\left(|+\rangle\langle-| + |-\rangle\langle+|\right)$$

$$S_x^2 = \frac{1}{2}\{S_x, S_x\} = \left(\frac{\hbar}{2}\right)^2 \mathbb{1}$$

so

$$\langle S_x^2\rangle = \left(\frac{\hbar}{2}\right)^2\left(|\langle\hat{n};+|+\rangle|^2 + |\langle\hat{n};+|-\rangle|^2\right)$$

$$= \left(\frac{\hbar}{2}\right)^2\left(\cos^2\frac{\gamma}{2} + \sin^2\frac{\gamma}{2}\right) = \left(\frac{\hbar}{2}\right)^2$$

$$\langle S_x\rangle = \frac{\hbar}{2}\left(\langle\hat{n};+|+\rangle\langle-|\hat{n};+\rangle + \langle\hat{n};+|-\rangle\langle+|\hat{n};+\rangle\right)$$

$$= \frac{\hbar}{2}\left(\cos\frac{\gamma}{2}\sin\frac{\gamma}{2} + \sin\frac{\gamma}{2}\cos\frac{\gamma}{2}\right) = \frac{\hbar}{2}\sin\gamma$$

$$\Rightarrow \langle S_x\rangle^2 = \left(\frac{\hbar}{2}\right)^2\sin^2\gamma \quad \text{so} \quad (\Delta S_x)^2 = \left(\frac{\hbar}{2}\right)^2\left(1-\sin^2\gamma\right)$$