6f continued

so $|\Psi_t\rangle = e^{-\frac{2it}{\hbar}}\frac{i}{2}(|1\rangle + i|2\rangle) + \frac{1}{2}|1\rangle - \frac{i}{2}|2\rangle$

$= \frac{i}{2}\left[e^{-\frac{2it}{\hbar}}+1\right]|1\rangle + \frac{i}{2}\left[e^{-\frac{2it}{\hbar}}-1\right]|2\rangle$

Subsequent measurements of $\hat{A}$ would give either 1 or 2 (but never 3) with probabilities (relative to each other)

$\left|\frac{i}{2}\left(e^{-\frac{2it}{\hbar}}+1\right)\right|^2$ and $\left|\frac{i}{2}\left(e^{-\frac{2it}{\hbar}}-1\right)\right|^2$

respectively. i.e. $\left(1+\cos\frac{2t}{\hbar}\right)^2$ and $\left(1-\cos\frac{2t}{\hbar}\right)^2$

Thus the probabilities of 1 and 2 are respectively

$\frac{1}{2} + \frac{\cos\phi}{1+\cos^2\phi}$ and $\frac{1}{2} - \frac{\cos\phi}{1+\cos^2\phi}$

where $\phi = \frac{2t}{\hbar}$

The expectation value of $\hat{A}$ i.e. $\langle\hat{A}\rangle$ is $\sum$ value·p

$\langle\hat{A}\rangle = \frac{1}{2} + \frac{\cos\phi}{1+\cos^2\phi} + 2\left(\frac{1}{2} - \frac{\cos\phi}{1+\cos^2\phi}\right) = \frac{3}{2} - \frac{\cos\phi}{1+\cos^2\phi}$ where $\phi = \frac{2t}{\hbar}$

The remeasurement would give 2 at those t where $\left|e^{-\frac{2it}{\hbar}}+1\right|^2$ i.e. $\cos\phi = -1$ $\therefore t = \frac{(2n+1)\pi}{2}$

n integer.