(67) First diagonalise the Hamiltonian

clearly $|3\rangle$ is ~~a~~ eigenstate with eigenvalue

let $|a\rangle = \alpha|1\rangle + i\beta|2\rangle$

$$\hat{H}|a\rangle = \alpha\hat{H}|1\rangle + i\beta\hat{H}|2\rangle = \alpha|1\rangle + i\alpha|2\rangle + i\beta|2\rangle + \beta|1\rangle$$

$$= (\alpha+\beta)|1\rangle + i(\alpha+\beta)|2\rangle$$

For eigenstates $(\alpha+\beta)|1\rangle + i(\alpha+\beta)|2\rangle = \gamma(\alpha|1\rangle + i\beta|2\rangle)$

so $|a_+\rangle = \frac{1}{2}(|1\rangle + i|2\rangle)$ is an eigenstate

$$\hat{H}|a_+\rangle = 2|a_+\rangle$$

and $|a_-\rangle = \frac{1}{2}(|1\rangle - i|2\rangle)$ is another eigenstate

$$\hat{H}|a_-\rangle = 0.$$

At $t=0$ $\hat{A}$ is measured and found to give 1 $\therefore$ soon afterwards the state is $|\Psi(t=0)\rangle = |$

This state evolves as

$$|\Psi_t\rangle = e^{-\frac{i\hat{H}t}{\hbar}}|\Psi_0\rangle$$

But $|\Psi_0\rangle = |1\rangle = [|a_+\rangle + |a_-\rangle]$

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