QA1

Q1 The torque is still into the page. So we still need to gain L into the page. Since $\vec{L}$ is zero initially, it just needs to start rotating about the pivot to develope the necessary $\vec{L}$.

Q2 It precesses (rotates) around z, first coming out of the page.

Q3 It can't do that because it would violate angular momentum conservation. There is no torque in that direction. We would need a torque, ie change it's angular momentum.

Q4 The $|+z\rangle$ state is a stationary state for this operator. So the probability does not change, because the $|z\rangle$ component of $|\psi(0)\rangle$ is constant.

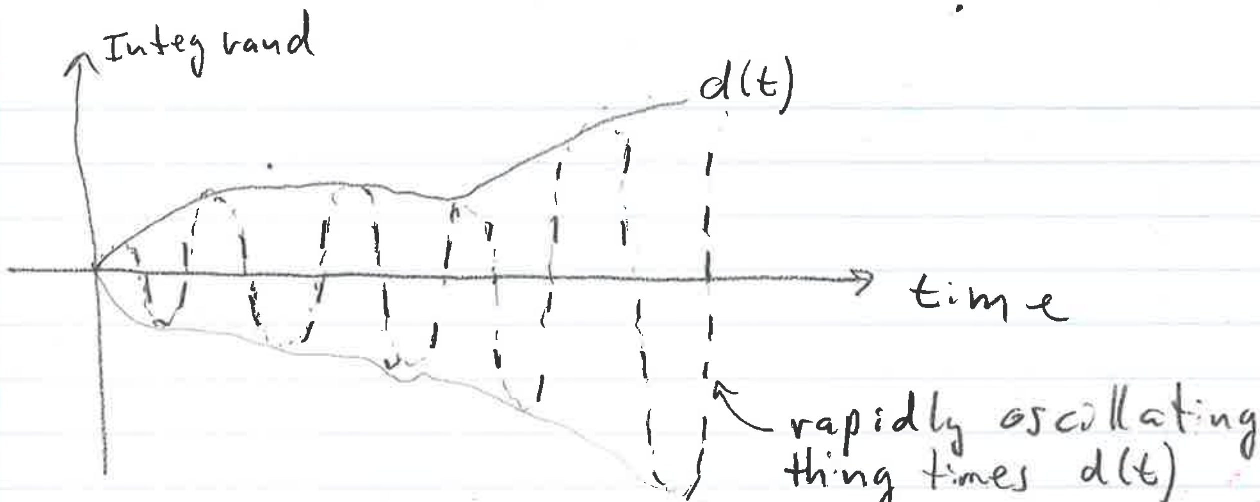
Q5 1) Initially in the $|+z\rangle$ state means $a=1, b=0$ so $|\langle +x|\psi(t)\rangle|^2 = 1/2$, again $|+z\rangle$ is stationary so No time dependence, and $|+z\rangle$ has 50% chance to yield $|+x\rangle$

2) This is $a=b=1/\sqrt{2}$ so $|\langle +x|\psi(t)\rangle|^2 = \frac{1}{2}+\frac{1}{2}\cos\omega_0 t$. So we see that the state is "swinging around the z axis"

3) $|\langle +x|\psi(t)\rangle|^2 = \frac{1}{2}+\frac{3}{10}\cos\omega_0 t$ Since it's mostly aligned with z, I get a small "swinging component" but mosty a 50% mix.

Q6 They should be. See comments above.

Q7



Since the rapidly oscillating thing $\times d(t)$ is negative as much as positive, it integrates to 0. On the other hand, my sample $d(t)$ is always positive.

Q8 $d(t)$ is the new stuff associated with B_x. B_x is supposed to be a small perturbation, that slowly rotates $|+z\rangle$ to $|-z\rangle$. Since B_z is a stronger field ω_0 will be bigger

Q9
$$\ddot{c} = -i\frac{\omega_1}{4} e^{i(\omega_0-\omega)t}\dot{d} + \frac{\omega_1}{4}(\omega_0-\omega)e^{i(\omega_0-\omega)t} d$$

$$= -i\frac{\omega_1}{4}\cancel{e^{i(\omega_0-\omega)t}}\; -i\frac{\omega_1}{4}\cancel{e^{-i(\omega_0-\omega)t}}\, c$$

$$+\frac{\omega_1}{4}(\omega_0-\omega)\cancel{e^{i(\omega_0-\omega)t}}\;\frac{i4}{\omega_1}\cancel{e^{-i(\omega_0-\omega)t}}\,\dot{c}$$

$$= -\frac{\omega_1^2}{4^2}c + i(\omega_0-\omega)\dot{c}$$

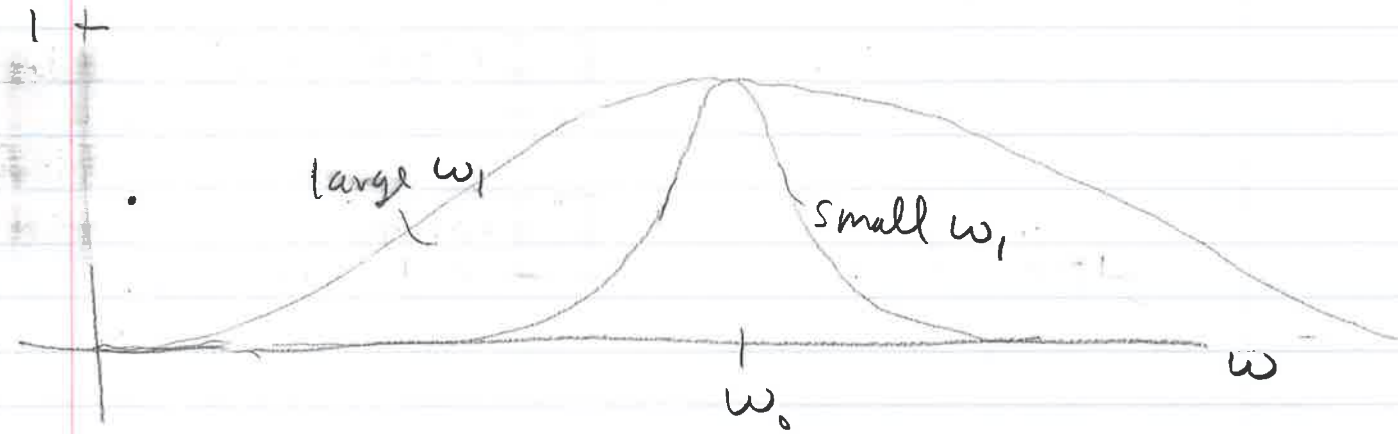
$$\ddot{c} - i(\omega_0-\omega)\dot{c} + \left(\frac{\omega_1}{4}\right)^2$$

Q10 We get $|\langle -z|\psi(t)\rangle|^2 = 0$, so if we start in $|+z\rangle$ we'll never be found in $|-z\rangle$ without the B_x field that makes $\omega_1 \neq 0$

Q11 $\omega = \omega_0$, like driving on resonance.

Q12 Less time, the thing in front of t is bigger

Q13 We can flip spins faster, and the resonance curve gets broader



We have a higher probability to flip off resonance.