Quantum Calculations on a Ring I

Consider the following normalized abstract quantum state on a ring:

$$\Phi(\phi) = \sqrt{\frac{8}{5\pi}} \cos^3(2\phi)$$

1) If you measured the z-component of angular momentum, what is the probability that you would obtain $2\hbar$? $-3\hbar$?

2) If you measured the z-component of angular momentum, what other possible values could you obtain with non-zero probability?

3) If you measured the energy, what possible values could you obtain with non-zero probability?

4) What is the expectation value of $\hat{L}_z$ in this state? the expectation value of energy?

by Corinne Manogue