1) a) (1/4)

$$\langle c|c\rangle = 1 = \left(A^* \sum_m (c^m)^* \langle m|\right)\left(A \sum_m c^m |m\rangle\right) = |A|^2 \sum_{m=0}^{\infty} |c|^{2m} = \frac{|A|^2}{1-|c|^2}$$

$\langle m|m\rangle = \delta_{mm}$; geometrijska vrsta

$$A = \sqrt{1-|c|^2}$$

b) (1/4)

$$|c,t\rangle = \sqrt{1-|c|^2} \sum_m c^m e^{-i\omega(m+\frac{1}{2})t} |m\rangle = e^{-i\frac{\omega}{2}t} |ce^{-i\omega t}\rangle$$

$H|m\rangle = \hbar\omega(m+\frac{1}{2})|m\rangle$

c) (1/4)

$$p = |\langle c|c,t\rangle|^2 = \left|\left(\sqrt{1-|c|^2}\sum_m (c^m)^* \langle m|\right)\left(\sum_m (ce^{-i\omega t})^m |m\rangle \sqrt{1-|c|^2} e^{-i\frac{\omega}{2}t}\right)\right|^2$$

$$= \left|(1-|c|^2)\sum_{m=0}^{\infty}(|c|^2 e^{-i\omega t})^m\right|^2 = \left|\frac{1-|c|^2}{1-|c|^2 e^{-i\omega t}}\right|^2 =$$

$$= \frac{(1-|c|^2)^2}{1-2|c|^2\cos\omega t + |c|^4} = \frac{(1-|c|^2)^2}{1-2|c|^2(1-2\sin^2\frac{\omega t}{2})+|c|^4} = \frac{1}{1+\frac{4|c|^2}{(1-|c|^2)^2}\sin^2\frac{\omega t}{2}}$$

d) (1/4 +)

$$\langle H\rangle = \frac{3}{2}\hbar\omega = \langle c|H|c\rangle = (1-|c|^2)\sum_m |c|^{2m}\hbar\omega(m+\tfrac{1}{2}) =$$

$$= \hbar\omega\left(\tfrac{1}{2} + (1-|c|^2)\sum_m |c|^{2m}\cdot m\right) =$$

$$= \hbar\omega\left(\tfrac{1}{2} + (1-|c|^2)\cdot|c|^2\sum_{m=0}^{\infty}|c|^{2(m-1)} m\right) =$$

$$= \hbar\omega\left(\tfrac{1}{2} + (1-|c|^2)|c|^2\frac{d}{d|c|^2}\sum_{m=0}^{\infty}|c|^{2m}\right) =$$

$$= \hbar\omega\left(\tfrac{1}{2} + (1-|c|^2)|c|^2\frac{d}{d|c|^2}\frac{1}{1-|c|^2}\right) =$$

$$= \hbar\omega\left(\tfrac{1}{2} + (1-|c|^2)|c|^2\frac{1}{(1-|c|^2)^2}\right) = \hbar\omega\left(\tfrac{1}{2} + \frac{|c|^2}{1-|c|^2}\right) \Rightarrow \frac{|c|^2}{1-|c|^2} = 1$$

$$|c| = \frac{1}{\sqrt{2}}$$

2) a) (1/4)

$$\langle S_x\rangle = \langle\psi|S_x|\psi\rangle = \langle\psi|\hbar|\psi\rangle = \hbar$$

b) (1/2)

$$|\psi\rangle = \frac{1}{2}|11\rangle + \frac{1}{\sqrt{2}}|10\rangle + \frac{1}{2}|10\rangle \quad \text{(iz vaj)}$$

rezultat	verjetnost	valovna funkcija takoj po meritvi
$\hbar$	1/4	$\|11\rangle$
0	1/2	$\|10\rangle$
$-\hbar$	1/4	$\|1-1\rangle$

c) (1/4 +)

$$\langle S_x\rangle = \langle 1m|S_x|1m\rangle = \langle 1m|\frac{S_+ + S_-}{2}|1m\rangle = 0 \text{ za vsak } m$$