① False. They are correlated.
$x(t) = a_0 + a_1 x(t-1) + \varepsilon_t$. This means
that ACF(1) is the correlation between
$x(t)$ and $x(t-1)$ which is $= a_1$.
If we expand a_1 we see that $x(t-1) =$
$a_0 + a_1[a_0 + a_1 x(t-2) + \varepsilon_{t-1}] + \varepsilon$.
Therefore $ACF(2) = corr(x(t), x(t-2)) = a_1^2$.

② True. If the ACF of a stationary
series displays a sharp cutoff then
we must consider adding an MA term to the
model. The lag at which the ACF cuts off
is the indicated number of MA terms.
We should see a spike at lag 1 followed
by nonsignificant values for lags past
1. For the MA(1) model, all autocorrelat-
ions for lags past 1 should be 0.

③ Using the arima function we find that arima(0,0,3) produces residuals in the acf and pacf plot that are very close to 0. This means that the data follows an MA(3) model.

④ arima(3,1,4) produces the most residuals close to zero. This means that we have data that follows AR(3) and MA(4).