In this scenario, the null hypothesis is that a patient is not infected with HIV and it can only be rejected if the rate of positive tests is p<0.05. However, because the rate of false positives is equal to 5% (0.05), the null hypothesis cannot be rejected. Therefore, it is not statistically significant and there might be a chance that the patient is not infected.

Comparing to the Theorem:

Data= test

Hypothesis= infected

I was having issues with my MATLAB license and I was not able to formulate a complete code, but these are the steps I would take:

1. Define the parameters: population size and the rate for false positives
2. I would create an array for the infection rates ranging from 0 to 1 in steps of 0.1
3. I would start calculating the probabilities based on Bayes theorem:
   1. P(A|B)= (P(B|A) X P(A))/ P(B)
      1. P(A|B) is the probability of getting a positive test and being infected with HIV
      2. P(A) is the infection rate
      3. P(B) is the overall probability of getting a positive test, which can be calculated by: P(A) x P(A|B) + (1- infection rate)(false positives rate)
4. Put these calculations into a for loop to get a value for P(A|B) for every infection rate
5. Display a table with the probability of being infected given a positive test corresponding to the infection rate
6. I should notice that the higher the infection rate, the higher the probability of being infected given a positive test.

Exercise 2: asking for the posterior probability

* Infected proportions: prior/ the true distribution of the population
* Show how changing the prior probability, the posterior changes
* Likelihood: the probability of positive test given that you are infected