$P(A \mid B) = P(B \mid A) * P(A) / P(B)$

A diagnostic test has a 98% probability of giving a positive result when applied to a person suffering from Thripshaw's Disease, and 10% probability of giving a (false) positive when applied to a non-sufferer. It is estimated that 0.5 % of the population are sufferers. Suppose that the test is now administered to a person whose disease status is unknown. Calculate the probability that the test will:

1. Be positive
   i. Intuition - 10.5%
   ii. P = P(test+ | infected) + P(test+ | non-infected) = (0.98)*(0.005) + (0.10)(0.995) = 10.44%
2. Correctly diagnose a sufferer of Thripshaw's
   i. Intuition - 98%
   ii. P = P(test + | infected) = P(infected | test+) * P(test+)/P(infected) = (0.005)*(0.1044) * (0.1044/0.005) = 1.09%
3. Correctly identify a non-sufferer of Thripshaw's
   i. Intuition - 90%
   ii. P(test - | non-infected) = P(non-infected | test-) * P(test-)/P(non-infected) = (0.995)*(1 - 0.1044) * ((1-0.1044) / 0.995) = 80.21%
4. Misclassify the person
   i. Intuition - 12%
   ii. P(test - | infected) + P(test+ | non-infected) = [P(infected)*P(test-) * P(test-)/P(infected)] + [P(non-infected)*P(test+) * P(test+)/P(non-infected) = (0.005)*(1-0.1044) * ((1-0.1044)/0.005) + (0.995*0.1044) * (0.1044/0.995) = 0.8021 + 0.0109 = 81.30%