Conditional Probability and Tables

Conditional Probability: The *conditional probability* of an event B is the probability that the event will occur given that an event A has already occurred.

We can write this as:

Conditional Probability: $P(B \mid A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{P(A \cap B)}{P(A)}$

* *This expression is only valid when P(A) is not equal to 0.*
* In the case where events A and B are *independent* (when event A has no effect on the probability of event B), the conditional probability of event B given A is just the probability of event B: $P(B)$.

One way to solve problems with 2 or more conditions is to use tables.
Puzzles:
Suppose jurors make the right decisions about guilt and innocence 90% of the time and that 80% of all defendants are truly guilty.

	Acquitted	**Convicted**	**Totals**
Innocent			
Guilty			
Totals			**100**

What's the probability that a person is convicted given that they are innocent?

What's the probability that a person is innocent, given that they are convicted?

Medical Tests:
Let's say that 50% of women who take pregnancy tests are actually pregnant. Suppose there is a new pregnancy test and we know the following information: 92% of women who are pregnant will correctly get a positive result and 6% of women who are not pregnant will also get a positive result. Fill in the following table for a sample of 10,000 women and answer the questions below.

	Tests Positive	Tests Negative	Total
Pregnant			
Not Pregnant			
Total			10,000

A woman gets a positive test result, what's the chance she's actually pregnant?

Given that a woman is not pregnant, what's the chance she'll get a negative result?

What's the probability of getting a false positive?

In general, is the probability of A given B always the same as the probability of B given A?