

**The conditional probability** of an event B is the probability that the event will occur given the knowledge that an event A has already occurred. This probability is written  $P(B|A)$ , notation for the probability of B given A. In the case where events A and B are independent (where event A has no effect on the probability of event B), the conditional probability of event B given event A is simply the probability of event B, that is  $P(B)$ .

If events A and B are not independent, then the probability of the intersection of A and B (the probability that both events occur) is defined by  $P(A \text{ and } B) = P(A)P(B|A)$ .

From this definition, the conditional probability  $P(B|A)$  is easily obtained by dividing by  $P(A)$ :

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}$$

**Example 1:** Consider the following contingency table:

	Have pets	Do not have pets	Total
Male	0.41	0.08	0.49
Female	0.45	0.06	0.51
Total	0.86	0.14	1

What is the probability a randomly selected person is male, given that they own a pet?

$$P(\text{Male}|\text{OwnsPet}) = P(\text{Male and OwnsPet})/P(\text{Owns a Pet}) = 0.41 / 0.86 = 0.477$$

**Example 2:** Each student in a random sample of seniors at a local high school participated in a survey. These students were asked to indicate their gender and their eye color. The following table summarizes the results of the survey.

		Eye color			
		Brown	Blue	Green	Total
Gender	Male	50	40	20	110
	Female	40	40	10	90
	Total	90	80	30	200

**2.1** Suppose that one of these seniors is randomly selected. What is the probability that the selected student is a male?

ANS: 11/20

**2.2** Suppose that one of these seniors is randomly selected. What is the probability that the selected student has blue eyes?

ANS: 2/5

**2.3** Suppose that one of these seniors is randomly selected. What is the probability that the selected student is a male and has blue eyes? ANS: 1/5

**2.4** Suppose that one of these seniors is randomly selected. What is the probability that the selected student is a male or has blue eyes? ANS: 3/4

**2.5** Suppose that one of these seniors is randomly selected. What is the probability that the selected student has blue eyes, given that the student is male? ANS: 4/11

**2.6** Suppose that one of these seniors is randomly selected. What is the probability that the selected student is a male, given that the student has blue eyes? ANS: 1/2