

10.2 - Probability - Day 4

Conditional Probabilities

The probability that an event, B , will occur given that another event, A , has already occurred is called a **conditional probability**.

Essential Understanding Conditional probability exists when two events are dependent.

You write the conditional probability of event B , given that event A occurs, as $P(B | A)$. You read $P(B | A)$ as "the probability of event B , given event A ."



Key Concept Conditional Probability

For any two events A and B with $P(A) \neq 0$,

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

Example 2 Suppose that a survey of 350 college students is taken. Each student is asked the type of college attended (public or private) and the family's income level (low, middle, high). Use the data in the table to

	Public	Private	Total
Low	120	20	140
Middle	110	50	160
High	22	28	50
Total	252	98	350

a.) $P(\text{Not Low Income})$

$$\frac{210}{350} \rightarrow 60\%$$

b.) $P(\text{Public College OR High Income})$

$$\frac{252}{350} + \frac{50}{350} - \frac{22}{350} = \frac{280}{350} = 80\%$$

c.) $P(\text{Private College} | \text{Low Income})$

$$\frac{20}{140} \rightarrow 14.3\%$$

d.) $P(\text{Middle Income} | \text{Public College})$

$$\frac{110}{252} \rightarrow 43.7\%$$

e.) $P(\text{Middle OR High Income} | \text{Private College})$

$$\frac{50}{98} + \frac{28}{98} \rightarrow \frac{78}{98} \approx 79.6\%$$

Example 3 Given a standard 52-card deck, find the probabilities...

a.) P (Seven OR Face Card)

$$\frac{4}{52} + \frac{12}{52} = \frac{16}{52} \quad 30.8\%$$

b.) P (Queen OR Diamond)

$$\frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} \quad 30.8\%$$

c.) P (Ace | Black Card)

$$\frac{2}{26} \quad 7.7\%$$

d.) P (Odd Number | Club)

$$\frac{4}{13} \quad 30.8\%$$

e.) P (King OR Red | Face Card)

$$\frac{4}{12} + \frac{6}{12} - \frac{2}{12} = \frac{8}{12} \quad 66.7\%$$

*f.) Draw two cards...

P (Diamond AND THEN an Ace)



$$f.) \quad P(\spadesuit \text{ (not ace)}) \cdot P(\text{ace}) + P(\text{ace } \spadesuit) \cdot P(\text{ace})$$

$$\frac{12}{52} \cdot \frac{4}{51} + \frac{1}{52} \cdot \frac{3}{51} = \frac{51}{2652} \approx 1.92\%$$