

EXAMPLE 4 Find a conditional probability

WEATHER The table shows the numbers of tropical cyclones that formed during the hurricane seasons from 1988 to 2004. Use the table to estimate (a) the probability that a future tropical cyclone is a hurricane and (b) the probability that a future tropical cyclone in the Northern Hemisphere is a hurricane.

Type of Tropical Cyclone	Northern Hemisphere	Southern Hemisphere
Tropical depression	199	18
Tropical storm	398	200
Hurricane	545	215



Solution

a. $P(\text{hurricane}) = \frac{\text{Number of hurricanes}}{\text{Total number of cyclones}} = \frac{760}{1575} \approx 0.483$

b. $P(\text{hurricane} | \text{Northern Hemisphere})$

$$= \frac{\text{Number of hurricanes in Northern Hemisphere}}{\text{Total number of cyclones in Northern Hemisphere}} = \frac{545}{1142} \approx 0.477$$

EXAMPLE 5 Comparing independent and dependent events

SELECTING CARDS You randomly select two cards from a standard deck of 52 cards. What is the probability that the first card is not a heart and the second is a heart if (a) you replace the first card before selecting the second, and (b) you do *not* replace the first card?

Solution

Let A be “the first card is not a heart” and B be “the second card is a heart.”

- a. If you replace the first card before selecting the second card, then A and B are independent events. So, the probability is:

$$P(A \text{ and } B) = P(A) \cdot P(B) = \frac{39}{52} \cdot \frac{13}{52} = \frac{3}{16} \approx 0.188$$

- b. If you do not replace the first card before selecting the second card, then A and B are dependent events. So, the probability is:

$$P(A \text{ and } B) = P(A) \cdot P(B|A) = \frac{39}{52} \cdot \frac{13}{51} = \frac{13}{68} \approx 0.191$$

AVOID ERRORS

It is important to first determine whether A and B are independent or dependent in order to calculate $P(A \text{ and } B)$ correctly.



GUIDED PRACTICE for Examples 4 and 5

4. **WHAT IF?** Use the information in Example 4 to find (a) the probability that a future tropical cyclone is a tropical storm and (b) the probability that a future tropical cyclone in the Southern Hemisphere is a tropical storm.

Find the probability of drawing the given cards from a standard deck of 52 cards (a) with replacement and (b) without replacement.

5. A spade, then a club 6. A jack, then another jack