## 13-6 Probabilities of Mutually Exclusive Events

**Determine whether the events are mutually exclusive or not mutually exclusive. Then find the probability. Round to the nearest tenth of a percent, if necessary.**

8. drawing a card from a standard deck and getting a jack or a six

*SOLUTION:*

Since these two events cannot happen at the same time, these are mutually exclusive. Let event J represent getting a jack from a standard deck. Let event S represent getting a six from a standard deck. There are a total of 52 cards in the deck.

$$\begin{aligned} P(J \text{ or } S) &= P(J) + P(S) \\ &= \frac{4}{52} + \frac{4}{52} \\ &= \frac{8}{52} \\ &= \frac{2}{13} \\ &\approx 15.4\% \end{aligned}$$

*ANSWER:*

mutually exclusive; $\frac{2}{13}$ or 15.4%

10. selecting a number at random from integers 1 to 20 and getting an even number or a number divisible by 3

*SOLUTION:*

18 is between 1 and 20 and is both even and divisible by 3. Since these two events can happen at the same time, these are not mutually exclusive. Use the rule for two events that are not mutually exclusive. Let e represent an even number and d represent divisible by 3.

$$\begin{aligned} P(\text{e or d}) &= P(\text{e}) + P(\text{d}) - P(\text{e and d}) \\ &= \frac{10}{20} + \frac{6}{20} - \frac{3}{20} \\ &= \frac{13}{20} \\ &= 65\% \end{aligned}$$

*ANSWER:*

not mutually exclusive; $\frac{13}{20}$ or 65%

12. drawing an ace or a heart from a standard deck of 52 cards

*SOLUTION:*

Since these two events can happen at the same time, these are not mutually exclusive. Use the rule for two events that are not mutually exclusive.

$$\begin{aligned} P(\text{a or h}) &= P(\text{a}) + P(\text{h}) - P(\text{a and h}) \\ &= \frac{4}{52} + \frac{13}{52} - \frac{1}{52} \\ &= \frac{16}{52} \\ &= \frac{4}{13} \\ &\approx 30.8\% \end{aligned}$$

*ANSWER:*

not mutually exclusive; $\frac{4}{13}$ or 30.8%

14. **SPORTS** The table includes all of the programs offered at a sports complex and the number of participants aged 14-16. What is the probability that a player is 14 or plays basketball?

| Graceland Sports Complex | | | |
|---|---|---|---|
| Age | Soccer | Baseball | Basketball |
| 14 | 28 | 36 | 42 |
| 15 | 30 | 26 | 33 |
| 16 | 35 | 41 | 29 |

*SOLUTION:*

Since some 14 age participants play basketball, these events are not mutually exclusive. Use the rule for two events that are not mutually exclusive. The total number of players is 300.

$$\begin{aligned} P(14 \text{ or b}) &= P(14) + P(\text{b}) - P(14 \text{ and b}) \\ &= \frac{106}{300} + \frac{104}{300} - \frac{42}{300} \\ &= \frac{168}{300} \\ &= 56\% \end{aligned}$$

*ANSWER:*

56%

Determine the probability of each event.

16. rolling a pair of dice and not getting a 3

*SOLUTION:*

Let event C represent getting a 3 when rolling a pair of dice. Out of 36 outcomes, 11 of them have at least one 3 in it.

The outcomes in which a 3 occurs are: (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (1, 3), (2, 3), (4, 3), (5, 3), and (6, 3).

$$P(C) = \frac{11}{36}$$
$$P(\text{not } C) = 1 - P(C)$$
$$= 1 - \frac{11}{36}$$
$$= \frac{25}{36}$$
$$\approx 69.4\%$$

*ANSWER:*

$\frac{25}{36}$ or about 69.4%

18. flipping a coin and not landing on heads

*SOLUTION:*

Let event H represent landing on heads when flipping a coin.

$$P(H) = \frac{1}{2}$$
$$P(\text{not } H) = 1 - P(H)$$
$$= 1 - \frac{1}{2}$$
$$= \frac{1}{2}$$
$$= 50\%$$

*ANSWER:*

$\frac{1}{2}$ or about 50%

20. **RAFFLE** Namid bought 20 raffle tickets. If a total of 500 raffle tickets were sold, what is the probability that Namid will not win the raffle?

*SOLUTION:*

$$P(\text{win}) = \frac{20}{500}$$
$$= \frac{1}{25}$$

$$P(\text{no win}) = 1 - P(\text{win})$$
$$= 1 - \frac{1}{25}$$
$$= \frac{24}{25}$$
$$= 96\%$$

*ANSWER:*

$\frac{24}{25}$ or about 96%

22. **RECYCLING** Suppose 31% of Americans recycle. If two Americans are chosen randomly from a group of 50, what is the probability that at most one of them recycles?

*SOLUTION:*

$$P(one) = P(1\text{st only}) + P(2\text{nd only}) + P(\text{neither})$$
$$= (0.31)(0.69) + (0.69)(0.31) + (0.69)(0.69)$$
$$\approx 0.9039$$

So, the probability that at most one of them recycles is about 90.4%.

*ANSWER:*

about 90.4%

CARDS Suppose you pull a card from a standard 52-card deck. Find the probability of each event.

24. The card is red.

*SOLUTION:*

$$P(\text{red card}) = \frac{26}{52}$$
$$= \frac{1}{2}$$
$$= 50\%$$

*ANSWER:*

$\frac{1}{2}$ or 50%

26. The card is not a face card.

*SOLUTION:*

King, Queen, and Jack are face cards. So, the number of face cards is 12.

$$P(\text{face card}) = \frac{12}{52}$$
$$= \frac{3}{13}$$
$$P(\text{not face card}) = 1 - \frac{3}{13}$$
$$= \frac{10}{13}$$
$$\approx 76.9\%$$

*ANSWER:*

$\frac{10}{13}$ or 76.9%

28. **CCSS CRITIQUE** Tetsuya and Mason want to determine the probability that a red marble will be chosen out of a bag of 4 red, 7 blue, 5 green, and 2 purple marbles. Is either of them correct? Explain your reasoning.


*SOLUTION:*

$$P(R) = \frac{red}{total}$$
$$= \frac{4}{18}$$

$1 - \frac{4}{18} = \frac{14}{18}$, and $\frac{14}{18} \neq \frac{4}{18}$

$\frac{4}{17} \neq \frac{4}{18}$

Therefore, neither student is correct.

*ANSWER:*

Neither; sample answer: The probability that a red marble will be chosen is $\frac{4}{18}$ or $1 - \frac{14}{18}$.

**REASONING** Determine whether the following are mutually exclusive. Explain.

30. choosing a quadrilateral that is a square and a quadrilateral that is a rectangle

*SOLUTION:*

If the two events cannot happen at the same time, they are mutually exclusive.

Since squares are rectangles, but rectangles are not necessarily squares, a quadrilateral can be both a square and a rectangle, and a quadrilateral can be a rectangle but not a square. They are not mutually exclusive.

*ANSWER:*

Not mutually exclusive; sample answer: Since squares are rectangles, but rectangles are not necessarily squares, a quadrilateral can be both a square and a rectangle, and a quadrilateral can be a rectangle but not a square.