

## Probability Worksheet 2

NAME:

Remember to leave your answers as unreduced fractions.

We will work with the example of picking poker cards out of a deck. A poker deck contains four suits: diamonds, hearts, spades, and clubs. The diamonds and hearts are red and the spades and clubs are black. Each suit has thirteen cards: Ace, 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, and King. This makes a total of 52 cards. A face card will be defined to be a Jack, Queen, or King.

### **Addition Rule for mutually exclusive events:**

1a. I will select one card from the deck. What is the probability that it is red?

1b. I will select one card from the deck. What is the probability that it is the Queen of Spades?

I will select one card from the deck. The two events “Red” and “Queen of spades” are mutually exclusive, meaning both events cannot happen at the same time. **What is the probability I will get a red card or the Queen of Spades?** You can do this problem two different ways. The two methods are outlined below.

1c. The number of total possibilities is 52. Count the number of successes in a deck, that is the number of cards that are red or the Queen of Spades. Form the probability by dividing the two.

1d. The formula for the probability of two mutually exclusive events A or B occurring is as follows.  **$P(A \text{ or } B) = P(A) + P(B)$**

Use this formula and the answers in parts a and b to compute the desired probability. Notice it matches the answer gotten in part c. (Show work.)

**Addition Rule for non-mutually exclusive events:**

2a. I will select one card from the deck. What is the probability that I will select a face card?

2b. I will select one card from the deck. What is the probability that I will select a red card?

2c. I will select one card from the deck. What is the probability that I will select a face card that is red (event “red and face card”)?

I will select one card from the deck. The two events “Red” and “face card” are not mutually exclusive, meaning they could happen at the same time. **What is the probability that I will get a red card or a face card?** You can do this problem two different ways. The two methods are outlined below.

2d. The number of total possibilities is 52. Count the number of successes in a deck, that is the number of cards that are face cards or red. Form the probability by dividing the two.

2e. The formula for the probability of two non-mutually exclusive events A or B occurring is as follows.  **$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$**   
Use this formula and the answers in parts a through c to compute the desired probability. Notice it matches the answer gotten in part d. (Show work.)

**Multiplication Rule for Independent events:**

3a. I will select two cards from a deck by selecting one, replacing it in the deck, and then selecting another. What is the probability that the first card is red?

3b. I will select two cards from a deck by selecting one, replacing it in the deck, and then selecting another. What is the probability that the second card is a Queen?

3c. I will select two cards from a deck by selecting one, replacing it in the deck, and then selecting another. **What is the probability that I select a red card and then a Queen?** Notice the two events “first red” and “second Queen” are independent since the occurrence of one does not affect the other (because we are replacing the first card before selecting the second).

The formula for the probability of independent events A and B occurring is as follows.  
 **$P(A \text{ and } B) = P(A) * P(B)$**

Use this formula and the answers to parts a and b to answer the question “What is the probability that I select a red card and then a Queen?”

**Multiplication Rule for non-independent events:**

4a. I will select a card from the deck, and without replacing it, select another. What is the probability the first card is red?

4b. I will select a card from the deck, and without replacing it, select another. Assuming the first card is red, what is the probability the second card is red? (Think about the total number of possibilities and the number of successes left in the deck.) This probability will be denoted by  $P(\text{"second red"} \text{ given } \text{"first red"})$ .

4c. I will select a card from the deck, and without replacing it, select another. **What is the probability both cards are red?** The formula for the probability of two non-independent events A and B occurring is as follows.  **$P(\mathbf{A \text{ and } B}) = P(\mathbf{A}) * P(\mathbf{B \text{ given } A})$**

Use this formula and the answers to parts a and b to answer the question "What is the probability both cards are red?"

**More practice:**

For the following problems, think about the events involved. Are they independent or mutually exclusive? What are the individual probabilities? What formula will you use?

5. I roll a six-sided die and toss a coin. What is the probability I get a Heads and a 6?

6. I roll three dice. What is the probability that I get three ones?

7. I draw a card from a poker deck, replace it, and draw another. What is the probability I get two Aces?

8. I draw a card from a poker deck, and without replacing it, draw another. What is the probability I get two Aces?

9. I roll a white six-sided die and a red six-sided die. What is the probability that I get a 1 on either die? (To be a success here, either the white die is 1, the red die is 1, or both dice are 1.)

10. I roll a six-sided die. What is the probability that I get a 5 or 6?