

## Lesson 5: Chance Experiments with Outcomes that are Not Equally Likely

### Classwork

In previous lessons, you learned that when the outcomes in a sample space are equally likely, the probability of an event is the number of outcomes in the event divided by the number of outcomes in the sample space. However, when the outcomes in the sample space are *not* equally likely, we need to take a different approach.

#### Example 1

When Jenna goes to the farmer's market she usually buys bananas. The numbers of bananas she might buy and their probabilities are shown in the table below.

Number of Bananas	0	1	2	3	4	5
Probability	0.1	0.1	0.1	0.2	0.2	0.3

- What is the probability that Jenna buys exactly 3 bananas?
- What is the probability that Jenna doesn't buy any bananas?
- What is the probability that Jenna buys more than 3 bananas?
- What is the probability that Jenna buys at least 3 bananas?
- What is the probability that Jenna doesn't buy exactly 3 bananas?

Notice that the probabilities in the table add to 1. ( $0.1 + 0.1 + 0.1 + 0.2 + 0.2 + 0.3 = 1$ ) This is always true; when we add up the probabilities of all the possible outcomes, the result is always 1. So, taking 1 and subtracting the probability of the event gives us the probability of something NOT occurring.

### Exercises 1–2

Jenna's husband, Rick, is concerned about his diet. On any given day, he eats 0, 1, 2, 3, or 4 servings of fruit and vegetables. The probabilities are given in the table below.

Number of Servings of Fruit and Vegetables	0	1	2	3	4
Probability	0.08	0.13	0.28	0.39	0.12

- On a given day, find the probability that Rick eats:
  - Two servings of fruit and vegetables.
  - More than two servings of fruit and vegetables.
  - At least two servings of fruit and vegetables.
- Find the probability that Rick does not eat exactly two servings of fruit and vegetables.

**Example 2**

Luis works in an office, and the phone rings occasionally. The possible numbers of phone calls he receives in an afternoon and their probabilities are given in the table below.

Number of Phone Calls	0	1	2	3	4
Probability	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{2}{9}$	$\frac{1}{3}$	$\frac{1}{9}$

- Find the probability that Luis receives 3 or 4 phone calls.
- Find the probability that Luis receives fewer than 2 phone calls.
- Find the probability that Luis receives 2 or fewer phone calls.
- Find the probability that Luis does not receive 4 phone calls.

**Exercises 3–6**

When Jenna goes to the farmer's market, she also usually buys some broccoli. The possible number of heads of broccoli that she buys and the probabilities are given in the table below.

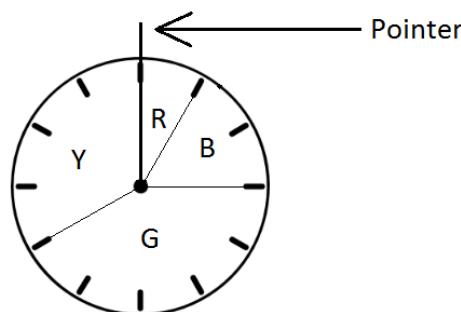
Number of Heads of Broccoli	0	1	2	3	4
Probability	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{5}{12}$	$\frac{1}{4}$	$\frac{1}{12}$

Find the probability that Jenna:

- buys exactly 3 heads of broccoli.
- does not buy exactly 3 heads of broccoli.
- buys more than 1 head of broccoli.
- buys at least 3 heads of broccoli.

**Exercises 7–10**

The diagram below shows a spinner designed like the face of a clock. The sectors of the spinner are colored red (R), blue (B), green (G), and yellow (Y).



Spin the pointer, and award the player a prize according to the color on which the pointer stops.

- Writing your answers as fractions in lowest terms, find the probability that the pointer stops on:
  - red:
  - blue:
  - green:
  - yellow:

8. Complete the table of probabilities below.

Color	Red	Blue	Green	Yellow
Probability				

9. Find the probability that the pointer stops in either the blue region or the green region.

10. Find the probability that the pointer does not stop in the green region.

### Lesson Summary

In a probability experiment where the outcomes are not known to be equally likely, the formula for the probability of an event does not necessarily apply:

$$P(\text{event}) = \frac{\text{Number of outcomes in the event}}{\text{Number of outcomes in the sample space}}.$$

For example:

- To find the probability that the score is greater than 3, add the probabilities of all the scores that are greater than 3.
- To find the probability of not getting a score of 3, calculate  $1 - (\text{the probability of getting a 3})$ .

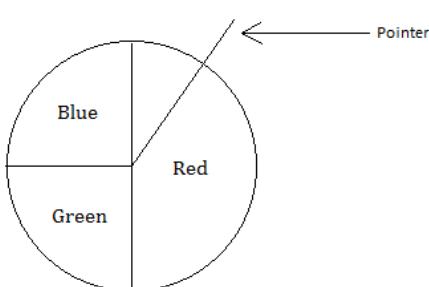
### Problem Set

1. The “Gator Girls” are a soccer team. The possible numbers of goals the Gator Girls will score in a game and their probabilities are shown in the table below.

Number of Goals	0	1	2	3	4
Probability	0.22	0.31	0.33	0.11	0.03

Find the probability that the Gator girls

- score more than two goals.
  - score at least two goals.
  - do not score exactly 3 goals.
2. The diagram below shows a spinner. The pointer is spun, and the player is awarded a prize according to the color on which the pointer stops.



- What is the probability that the pointer stops in the red region?
- Complete the table below showing the probabilities of the three possible results.

Color	Red	Green	Blue
Probability			

- c. Find the probability that the pointer stops on green or blue.
- d. Find the probability that the pointer does not stop on green.
3. Wayne asked every student in his class how many siblings (brothers and sisters) they had. Survey results are shown in the table below. (Wayne included himself in the results.)

Number of Siblings	0	1	2	3	4
Number of Students	4	5	14	6	3

(Note: The table tells us that 4 students had no siblings, 5 students had one sibling, 14 students had two siblings, and so on.)

- a. How many students are there in Wayne's class?
- b. What is the probability that a randomly selected student does not have any siblings? Write your answer as a fraction in lowest terms.
- c. The table below shows the possible number of siblings and the probabilities of each number. Complete the table by writing the probabilities as fractions in lowest terms.

Number of Siblings	0	1	2	3	4
Probability					

- d. Writing your answers as fractions in lowest terms, find the probability that the student:
- has fewer than two siblings.
  - has two or fewer siblings.
  - does not have exactly one sibling.

Carol is sitting on the bus on the way home from school and is thinking about the fact that she has three homework assignments to do tonight. The table below shows her estimated probabilities of completing 0, 1, 2, or all 3 of the assignments.

Number of Homework Assignments Completed	0	1	2	3
Probability	$\frac{1}{6}$	$\frac{2}{9}$	$\frac{5}{18}$	$\frac{1}{3}$

- Writing your answers as fractions in lowest terms, find the probability that Carol completes
  - exactly one assignment.
  - more than one assignment.
  - at least one assignment.
- Find the probability that the number of homework assignments Carol completes is not exactly 2.
- Carol has a bag of colored chips. She has 3 red chips, 10 blue chips, and 7 green chips in the bag. Estimate the probability (as a fraction or decimal) of Carol reaching into her bag and pulling out a green chip.