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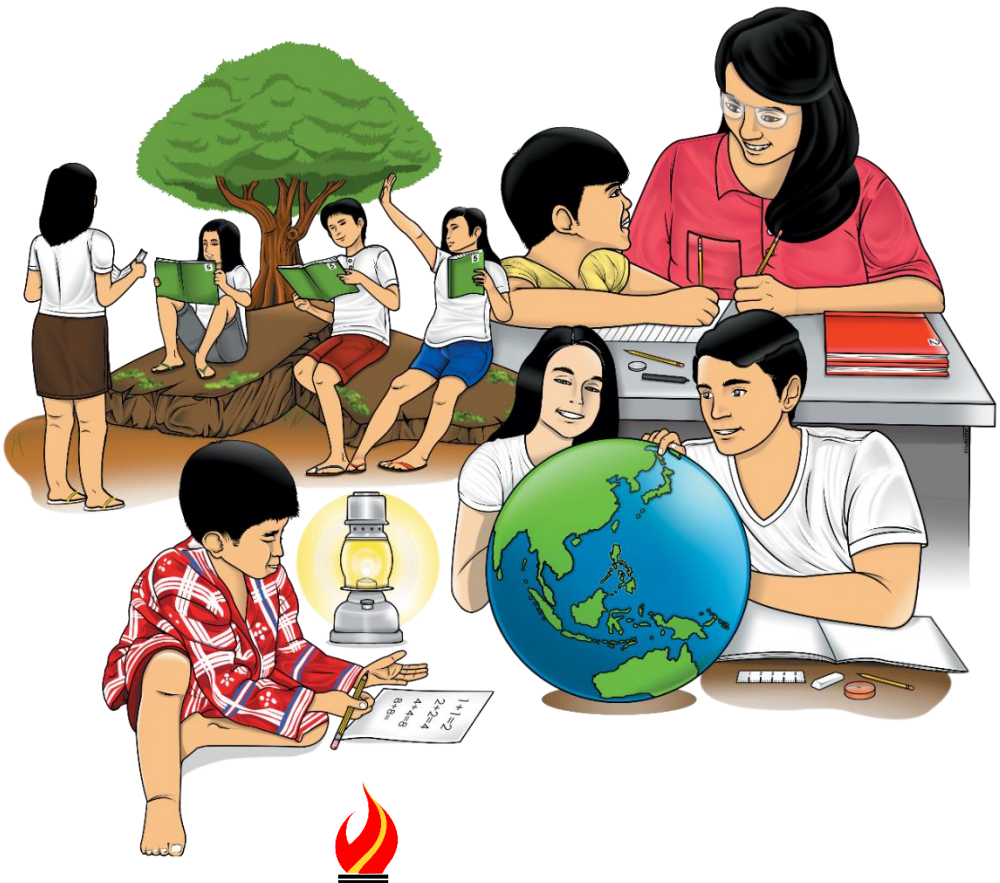
DEPARTMENT OF EDUCATION

Mathematics

Quarter 4 – Module 9
Illustrating Experimental Probability and Theoretical Probability



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Mathematics

Quarter 4 – Module 9

Illustrating Experimental Probability and Theoretical Probability

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

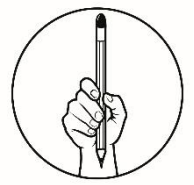
What I Need to Know

This module was designed and written with you in mind. It is here to help you master the skills of illustrating experimental probability and theoretical probability. You are provided with varied activities to process the knowledge and skills learned and to deepen and transfer your understanding of the lesson. The scope of this module enables you to use it in many different learning situations. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

This module contains lesson on illustrating an experimental probability and a theoretical probability (M8GE-IVi-1).

After going through this module, you are expected to:

1. define experimental and theoretical probability;
2. differentiate experimental from theoretical probability; and
3. identify the type of probability manifested in a given situation.



What I Know

Pre-Assessment:

Directions: Answer each of the following items. Write the letter of the correct answer on a separate sheet of paper.

1. Which of the following is true about theoretical probability?
   A. It is the relative approximation of probability of an event.
   B. Experiment needs to be done to get the probability of an event.
   C. It is the probability of the event that a person is expecting to happen.
   D. It is an approach that bases the probability on the possible chances of an event to happen.

2. Which of the following illustrates experimental probability?
   A. In rolling a die once, the probability of getting a 6 is $\frac{1}{6}$.
   B. In flipping a coin once, the probability of getting a head is ½.
   C. The probability of drawing a non-spade card from a deck of 52 cards is $\frac{3}{4}$.
   D. In tossing a coin 500 times, head turned up 235 times, then the probability of the tail turning up is $\frac{265}{500}$.

For items 3 - 5, consider the results of the experiment "tossing 3 coins 5 times" as shown below then answer the questions that follow.

Trial	**Outcomes**			
	3H or 0T	2H1T	1H2T	0H or 3T
1		HHT		
2				TTT
3	HHH			
4				TTT
5		HTH		
Frequency	1	2	0	2

3. What is the experimental probability of the outcome "no heads"?

A. $\frac{1}{8}$ B. $\frac{1}{5}$ C. $\frac{1}{4}$ D. $\frac{2}{5}$

4. Which of the following events did not occur in the experiment?

A. THT and TTH B. HHH and HHT C.THH and TTT D. HHH and TTT

5. What is the experimental probability of the outcome "2 heads"?

A. $\frac{1}{8}$ B. $\frac{1}{5}$ C. $\frac{1}{4}$ D. $\frac{2}{5}$

For items 6 - 8, consider the situation "A coin is flipped four times."

6. How many possible outcomes are there?

A. 4 B. 8 C. 16 D. 32

7. What is the probability of obtaining 4 heads?

A. $\frac{1}{32}$ B. $\frac{1}{16}$ C. $\frac{1}{8}$ D. $\frac{1}{4}$

8. Which two events have equal probabilities?

A. 4H and 1H B. 2H and 0H C. 3H and 1H D. 3H and 2H

For items 9 - 13, consider the situation below to answer the questions that follow.

Fifty (50) people were surveyed on the type of movie they prefer to watch, and the following results were obtained.

Movie Genre	Frequency
Action	12
Comedy	7
Drama	9
Horror	12
Romance	10

9. The probability that a randomly chosen person from those who were surveyed prefers to watch comedy movie is $\frac{7}{50}$. What is $\frac{7}{50}$ as a probability?

A. Theoretical B. Experimental C. Subjective D. All of the above

10. Which of the following movies in the experiment is least preferred by the respondents?
    A. Comedy B. Drama C. Horror D. Romance

11. Which of the following movies were equally chosen by those who were surveyed?
    A. Action and Drama
    B. Action and Horror
    C. Drama and Horror
    D. Drama and Romance

12. What is the probability that a person chosen at random likes to watch an action movie?
    A. $\frac{1}{5}$ B. $\frac{6}{25}$ C. $\frac{5}{12}$ D. $\frac{1}{2}$

13. What is the probability that a person chosen at random likes to watch a drama movie?
    A. $\frac{9}{50}$ B. $\frac{1}{5}$ C. $\frac{6}{25}$ D. $\frac{5}{9}$

14. How does experimental probability differ from theoretical probability?
    A. There is no difference between experimental probability and theoretical probability of an event.
    B. Experimental probability is observation-based probability while theoretical probability is expected probability.
    C. Experimental probability is based on the expected outcome while theoretical probability is based on the observations in the experiment.
    D. Experimental probability is the ratio of the number of favorable outcomes to the total number of possible outcomes while theoretical probability is the ratio of the number of times the event occurred to the total number of trials.

15. Which of the following is true about the relationship of the experimental probability and theoretical probability of an event when the number of trials is increased?
    A. If the number of trials increases, the experimental probability is higher than the theoretical probability.
    B. If the number of trials is increases, the experimental probability is equal to theoretical probability of an event.
    C. If the number of trials increases, the experimental probability gives more accurate and actual results, its value gets closer to the theoretical probability.
    D. If the number of trials increases, the experimental probability does not give accurate and actual results, its value gets farther from the theoretical probability.

Lesson 1 Illustrating Experimental and Theoretical Probability

When you toss a coin once, the probability of a tail to turn up is ½ or 50%. What if the same coin is tossed 20 times, do you think the tail will turn up 10 times, or does the probability of the tail turning up remain ½ or 50%? Although there is a possibility that tail will come out as an outcome half of the number of times it is tossed, this rarely happens. You will be helped to understand the underlying concept of this situation by learning theoretical and experimental probabilities.

What's In

Directions: Match each problem in Column A with its corresponding answer in Column B. Write the letter of the correct answer on a separate sheet of paper.

Column A	Column B
1. What is the probability of getting a perfect square number when rolling a die once?	A. $\frac{2}{3}$
2. What is the probability of drawing a heart from a deck of 52 playing cards if you draw one card?	B. $\frac{3}{5}$
3. You and your friend played a computer game 50 times. Your friend won 20 times. What is the probability that your friend will win the game?	C. $\frac{1}{3}$
4. You tossed a coin 300 times and got 100 heads and 200 tails. What is the probability that the tail turned up?	D. $\frac{1}{2}$
5. You surveyed 2,000 students about their preferred school type: The results are: 800 preferred private school and 1200 preferred public school. What is the probability that a student, chosen at random, preferred public school?	E. $\frac{2}{5}$
	F. $\frac{1}{4}$

Guide Questions:

1. How did you find the probability of each simple event?
2. How would you describe the obtained probability of each simple event?

What's New

Situation: Suppose that a coin is tossed 20 times and the actual results are recorded on the table below. Supply the missing information and answer the questions that follow.

Trial	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Outcome Head (H) or Tail (T)	H	T	T	H	H	T	H	H	H	H	T	T	H	H	H	H	H	H	T	H

Outcomes	Frequency
Heads	?
Tails	?
Total	?

Questions:

1. What is the expected probability of getting a head when tossing a coin once? What is also the probability of getting a tail?
2. Based on the results of the experiment, what is the probability of getting a head? What about getting a tail?
3. Based on the results of the experiment, which between the tail and head occurred more frequently? Did you expect this to happen?
4. Suppose that you will continue tossing the coin 50 times or more, what do you think will happen to the probability of getting the head? What about getting the tail?

What is it

This section will help you understand the underlying concepts why the ½ or 50% chance of the occurrence of tails sometimes differs to the actual result when a coin is tossed 20 times, as presented in the previous section. The following sections are prepared to discuss theoretical and experimental probabilities.

I. Differentiating Theoretical Probability from Experimental Probability

Situation: Suppose you will toss a coin three times.

The possible outcomes in tossing a coin three times are contained in the sample space below.

$$S = \{HHH,\ HHT,\ HTH,\ THH,\ HTT,\ THT,\ TTH,\ TTT\}$$

A. Determining the probability of each outcome.

Possible Outcome	Expected Probability $P(event) = \frac{No.\ of\ Favorable\ Outcomes}{Total\ No.\ of\ Possible\ Outcomes}$	Expected number of occurrence of outcome
3H or 0T $\{HHH\}$	$\frac{1}{8}$	1
2H $\{HHT, HTH, THH\}$	$\frac{3}{8}$	3
1H $\{HTT, THT, TTH\}$	$\frac{3}{8}$	3
0H $\{TTT\}$	$\frac{1}{8}$	1
T O T A L	$\frac{8}{8} = 1$	8

The probabilities presented in the table are **theoretical probabilities**. By definition, **theoretical probability** is the ratio of the number of favorable outcomes to the total number of possible outcomes, provided that all outcomes are equally probable. Tossing a fair coin has 2 possible outcomes, either a head or a tail. The probability of each outcome is $\frac{1}{2}$. The table above gives the theoretical probability and the expected number of occurrence of each outcome when a coin three times. Tossing a coin three times has 8 possible outcomes as shown in the sample space above. The table above shows that there is one chance out of 8 possible outcomes for three heads (3H) to occur in tossing a coin thrice, 3 out of 8 for 2 heads (2H) to occur, 3 out of 8 for 1 head (1H) to occur, and there is one chance for zero head or 3 tails (0H) to occur.

Will the actual tossing of the coin three times yield the same probability for 2 heads to turn up? This question will be answered in the next section.

B. Determining the Probability of an event as outcome of an experiment.

Suppose that the actual tossing of the coin three times yielded the outcomes as presented in the table below.

Trial	1	2	3	$P(event) = \frac{No.\ of\ Times\ the\ Event\ Occurs}{Total\ No.\ of\ Trials}$
Outcome	H	T	H	
Outcome		Frequency		Probability
Head		2		$P(head) = \frac{2}{3}$
Tail		1		$P(tail) = \frac{1}{3}$

The table in A shows all possible occurrences of the head (H) and tail (T) when a coin is tossed 3 times, while the table above shows the actual occurrences of the head and tail when the experiment is done.

Obviously, the theoretical probability of obtaining 2 heads in tossing a coin three times is not equal to the experimental probability of obtaining the same event 2H. It is because of the denominator in the probability formula. The denominator in computing the theoretical probability is the total number of all possible outcomes of the experiment, while in the experimental probability, the denominator is the total number of trials in doing the experiment. By definition, **experimental probability** of an event is the ratio of number of times the outcome occurs to the total number of trials.

C. Comparing Theoretical and Experimental Probability

Consider the experiment of tossing a coin 20 times.

Outcome	Theoretical Probability	Experimental Probability (Actual Results)
Head	10/20	7/20
Tail	10/20	13/20

The $\frac{10}{20}$ theoretical probability for each of the head and tail is based on the expectation that the $\frac{1}{2}$ chance of occurring for each of the head and tail in an un-tossed fair coin will remain the same all throughout the experiment. However, along the actual tossing of the coin for several times, uncontrollable factors like wind flow, force applied in tossing, and contour of the surface where the coin landed will surely affect the chance that a particular face of the coin will come out as an outcome. In effect, the probability of a particular face to turn up may either increase or decrease. This type of probability that is largely based on observations derived from trials or experiments conducted is called experimental probability.

As shown in the table, the experimental probability of the head is $\frac{7}{20}$ which is less than the theoretical probability. On the other hand, the experimental probability of the tail is $\frac{13}{20}$ which is greater than the theoretical probability.

D. Increasing Number of Trials and Comparing the Theoretical Probability with the Experimental Probability

Suppose that the number of trials is increased to 50 and the following results are obtained:

Outcome	Frequency	Probability $P(event) = \frac{No.\ of\ Times\ the\ Event\ Occurs}{Total\ No.\ of\ Trials}$
Head	26	$P(head) = \frac{26}{50}$
Tail	24	$P(tail) = \frac{24}{50}$

It can be observed from the table above, the experimental probability of landing on heads is $\frac{26}{50}$ or that is 52% and the probability of landing on tail is $\frac{24}{50}$ or 48%. Though not equal with the theoretical probability, it can be observed that these probabilities get closer to the theoretical probability which is $\frac{1}{2}$ or 50%. Thus, greater number of trials will bridge the gap between theoretical and experimental probability. In similar manner of saying, the greater the number of trials, the more likely it is for experimental probability to get closer to the theoretical probability.

II. Identifying Situations that Involve Theoretical or Experimental Probability

Problem	Type	Reason
1. You and your friend are playing snake and ladder. Your turn to roll the die has come. The probability of getting a 2 is $\frac{1}{6}$.	Theoretical	Six Possible Outcomes: 1, **2**, 3, 4, 5, 6 $P(E) = \frac{No.\ of\ favorable\ outcomes}{Total\ number\ of\ possible\ outcomes}$ $\boldsymbol{P(2) = \frac{1}{6}}$ The result is based on the **expected outcome** that there is only one 2 in a die.
2. The probability of choosing a heart card from a standard deck of cards is $\frac{13}{52}$ or $\frac{1}{4}$.	Theoretical	52 Possible Outcomes: **13 hearts**, 13 diamonds, 13 spades, 13 clubs $P(E) = \frac{No.\ of\ favorable\ outcomes}{Total\ number\ of\ possible\ outcomes}$ $P(hearts) = \frac{13}{52}\ or \frac{1}{4}$ The result is based on the **expected outcome** that there are 13 heart cards in a standard deck of cards.
3. Given a spinner with seven congruent sectors with the following colors: red, orange, yellow, green, blue, indigo, violet, the probability that the arrow will land on the blue sector is $\frac{1}{7}$.	Theoretical	7 Possible Outcomes: red, orange, yellow, green, **blue**, indigo, violet $P(E) = \frac{No.\ of\ favorable\ outcomes}{Total\ number\ of\ possible\ outcomes}$ $P(blue) = \frac{1}{7}$ The result is based on the expected outcome that there is only one blue sector in the spinner with seven colors.
4. A bag contains 10 red, 8 blue, and 2 yellow marbles. You pick a marble 7 times, of which 4 are blue. The probability of getting a blue	Experimental	$P(event) = \frac{No.\ of\ Times\ the\ Event\ Occurs}{Total\ No.\ of\ Trials}$ $P(blue) = \frac{4}{7}$ The result is based on the observation that in the **experiment** done in 7 times, the blue marble was picked 4

Problem	Type	Reason
marble is $\frac{4}{7}$.		times.
5. Two coins are tossed 3 times. Suppose both heads occurred once. The probability that both heads occurred is $\frac{1}{3}$.	Experimental	$P(event) = \frac{No.\ of\ Times\ the\ Event\ Occurs}{Total\ No.\ of\ Trials}$ $P(HH) = \frac{1}{3}$ The result is based on the observation that in the **experiment** done 3 times, both heads occurred only once.

What's More

Activity 1

Directions: Consider the situation in every number below. Supply the missing information in the table and answer the questions that follow.

A. Determine the theoretical probability of each possible outcome indicated in the table when a die is rolled once.

Possible Outcome	Theoretical Probability $P(event) = \frac{No.\ of\ Favorable\ Outcomes}{Total\ No.\ of\ Possible\ Outcomes}$	Expected ratio with the total number of outcomes
1	$\frac{1}{6}$	?
2	?	$\frac{2}{12}\ or \frac{1}{6}$
3	?	$\frac{2}{12}\ or \frac{1}{6}$
4	$\frac{1}{6}$	?
5	?	$\frac{2}{12}\ or \frac{1}{6}$
6	$\frac{1}{6}$	$\frac{2}{12}\ or \frac{1}{6}$

Questions:

a. How did you determine the probability of each possible outcome?
b. How did you determine the probability of each outcome out of the 12 rolls of the die?
c. What kind of probability is illustrated in column 2 of the table above?

B. Suppose that a die is rolled 12 times. The following are the results.

Trial	Outcome					
	1	2	3	4	5	6
1	1					
2			3			
3		2				
4				4		
5			3			
6	1					
7				4		
8						6
9				4		
10					5	
11	1					
12			3			
Frequency	?	1	3	?	1	1
Probability	$\frac{3}{12}$ or $\frac{1}{4}$	?	?	$\frac{3}{12}$ or $\frac{1}{4}$	?	$\frac{1}{12}$

Questions:

a. How did you determine the frequency of each outcome?
b. How did you determine the probability of each outcome?
c. What kind of probability is illustrated on the table above?

C. Using the data obtained in A and B, complete the table below and answer the questions that follow.

Outcome	Theoretical Probability	Experimental Probability
1	?	$\frac{1}{4}$
2	$\frac{1}{6}$	?
3	$\frac{1}{6}$	?
4	?	$\frac{1}{4}$
5	$\frac{1}{6}$	?
6	$\frac{1}{6}$	$\frac{1}{12}$

Questions:

a. How is the experimental probability compared with the theoretical probability?
b. Do you think the results would be different if the number of trials is increased?

D. Suppose that the same die is rolled for 24 more times and the following outcomes are obtained.

Outcome	Frequency	Probability $P(event) = \frac{No.\ of\ Times\ the\ Event\ Occurs}{Total\ No.\ of\ Trials}$
1	5	
2	7	$\frac{7}{36}$
3	6	$\frac{6}{36} or \frac{1}{6}$
4	7	
5	5	$\frac{5}{36}$
6	6	$\frac{6}{36} or \frac{1}{6}$

Questions:

a. How is the experimental probability of the outcomes in no. 3 compared with the experimental probability of the outcomes in no. 4?
b. How is the experimental probability of the outcomes in no. 4 compared with the theoretical probability of the outcomes?
c. How does experimental probability relate with the theoretical probability when the number of trials increases?

Acitvity 2

Directions: Determine whether experimental or theoretical probability is used in each of the following cases. Answer the questions that follow.

1. The probability of choosing a freshman from 30 freshmen and 30 sophomores is ½.
2. The probability of getting no heads when tossing three coins simultaneously is $\frac{1}{8} or$ 12.5%.
3. A die is rolled, the probability of getting a number at most 5 is $\frac{5}{6} or$ 83.3%.

Questions:

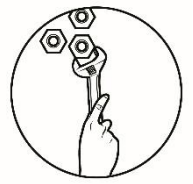
1. What is your basis in identifying the type of probability illustrated in the problem if it is theoretical probability?
2. What is your basis in identifying the type of probability illustrated in the problem if it is experimental probability?

What I Have Learned

Directions: Supply the table below with the information required about theoretical and experimental probability. You may choose your answers from the box provided.

Theoretical Probability	Experimental Probability
Concepts Learned	Concepts Learned
Examples	Examples

what is expected to happen	what actually happened
based on how frequent an outcome occurred relative to the number of trials	based on the number of favorable outcomes relative to the total number of possible outcomes
expected probability	observation-based probability
Toss a coin once and the probability of getting a tail is $\frac{1}{2}$.	The probability of the occurrence of head is $\frac{3}{10}$ when the coin is tossed 10 times and the head came out 3 times.
The probability of getting an odd number is $\frac{1}{2}$ when a die is rolled 20 times and an odd number occurred 10 times.	The probability of having a leap year in 4 years is $\frac{1}{4}$.



What I Can Do

Consider the situation below to answer the questions that follow:

The Department of Health (DOH) recorded a total of 98,232 Coronavirus Disease 2019 (CoVID-19) positive cases in the Philippines of which 2,039 people died from the disease. The probability of fatality is computed as follows:

$$P(fatality) = \frac{Number\ of\ deaths\ from\ disease}{Number\ of\ diagnosed\ case\ of\ disease} \times 100\%$$

$$P(fatality) = \frac{2039}{98232} \times 100\%$$

$$P(fatality) = 0.0208 \times 100\%$$

$$P(fatality) = 2.08\%$$

Questions:

1. What kind of probability is shown above?
2. What does the numerical value of 2.08% indicate?
3. Given the data above, how should the public treat CoVID-19? Explain briefly.

Assessment

Post-Assessment

Directions: Answer each of the following items accurately. Write the letter of the correct answer on a separate sheet of paper.

1. Which of the following refers to experimental probability?
   A. "Chance of an event to happen."
   B. "Chance of an event not to happen."
   C. "Chance of an event that must happen."
   D. "Chance of an event based on what happened."

2. Two dice are rolled 100 times and the sum 4 showed up 7 times. If the probability that the sum 4 occurred 7 times is 7/100, what probability is illustrated?
   A. Expected Probability
   B. Experimental Probability
   C. Subjective Probability
   D. Theoretical Probability

3. Which of the following illustrates theoretical probability?
   A. The probability of drawing a face card from a standard deck of cards is $\frac{3}{13}$.
   B. Sally and Tony played rock-paper-scissor 30 times, If Sally lost 14 times, then probability that Tony won the game is $\frac{16}{30} = \frac{8}{15} or$ 53.3%.
   C. A spinner with 5 congruent sectors colored yellow, red, blue, green and white is rotated 100 times. If the arrow landed on green 20 times, then the probability of getting a color green is $\frac{20}{100} = \frac{1}{5}$ or 20%.
   D. A 6-sided die is rolled 10 times, The results are: a 1 showed up 3 times, a 2 showed up 2 times, a 4 showed up 3 times, and a 6 showed up 2 times. The probability of a 4 showing is $\frac{3}{10}$.

For items 4 - 8, consider the situation below.

A spinner, with congruent sectors colored with red, orange, blue, green, white, pink, violet, brown, black and gray, is rotated eight times and the results are recorded in the table below.

Trial	Outcome									
	Red	Orange	Blue	Green	White	Pink	Violet	Brown	Black	Gray
1							Violet			
2			Blue							
3					White					
4			Blue							
5						Pink				
6								Brown		
7							Violet			
8							Violet			
Frequency	0	0	2	0	1	1	3	1	0	0

4. How many trials were done?
   A. 6 B. 8 C. 10 D. 12

5. Which colors in the experiment appeared at least twice?
   A. Red and Orange C. Blue and Green
   B. Blue and Violet D. Black and Gray

6. Did the arrow ever land on the orange sector?
   A. Yes B. No C. Yes, once D. Yes, twice

7. What is the probability that the arrow landed on the black sector?
   A. 0 B. $\frac{1}{10}$ C. $\frac{1}{8}$ D. 1

8. What is the experimental probability that the arrow landed on the violet sector?
   A. $\frac{1}{10}$ B. $\frac{1}{8}$ C. $\frac{3}{10}$ D. $\frac{3}{8}$

For items 9 - 12, consider the situation below.

The bakeshop manager recorded the number of cakes sold for 4 cake flavors which are mostly preferred by customers on a certain day. Tallying only the customers who bought a single flavor, the number of pieces sold for each flavor are indicated in the table below.

Flavor	Number of sold pieces
Chocolate	39
Ube	15
Mango	20
Vanilla	16

9. How many pieces of vanilla-flavored cake were sold?
   A. 15 B. 16 C. 29 D. 30

10. Which of the following cake flavors has the greatest number of sales?
    A. Chocolate B. Ube C. Mango D. Vanilla

11. What is the probability that a customer buying a single flavor of cake did not buy an ube-flavored cake?
    A. $\frac{1}{3}$ B. $\frac{1}{6}$ C. $\frac{3}{4}$ D. $\frac{5}{6}$

12. What is the probability that a customer bought a chocolate flavored cake?
    A. $\frac{1}{39}$ B. $\frac{13}{30}$ C. $\frac{39}{60}$ D. $\frac{5}{6}$

For items 13-15, consider the situation below.

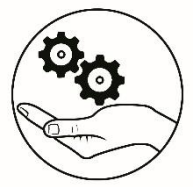
A coin is tossed 100 times, 1,000 times, 10,000 times, the results are recorded in the table below.

Possible Outcome	Ratio of occurrence with 100 trials	Ratio of occurrence with 1,000 trials	Ratio of occurrence with 10,000 trials
H	$\frac{9}{20}$	$\frac{12}{25}$	$\frac{5,039}{10,000}$
T	$\frac{11}{20}$	$\frac{13}{25}$	$\frac{4,961}{10,000}$

13. Which of the following is true between the probabilities of the outcomes with 100 trials and 1,000 trials?
    A. The experimental probability of getting a head in 100 trials is lower than the experimental probability of getting a head in 1,000 trials.
    B. The experimental probability of getting a head in 100 trials is higher than the experimental probability of getting a head in 1,000 trials.
    C. There is no difference between experimental probability of getting a head in 100 trials and the experimental probability of getting a head in 1,000 trials.
    D. The experimental probability of getting a head in 100 trials is equal with the experimental probability of getting a head in 1,000 trials.

14. Which of the following is true between the probabilities of the outcomes with 1,000 trials and 10,000 trials?
    A. The experimental probability of getting a tail in 1,000 trials is lower than the experimental probability of getting a tail in 10,000 trials.
    B. The experimental probability of getting a tail in 1,000 trials is higher than the experimental probability of getting a tail in 10,000 trials.
    C. There is no difference between experimental probability of getting a tail in 1,000 trials and the experimental probability of getting a tail in 10,000 trials.
    D. The experimental probability of getting a tail in 1,000 trials is equal with the experimental probability of getting a tail in 10,000 trials.

15. How does an increase in the number of trials in an experiment affect the experimental probability of an event?
    A. The experimental probability tends to get closer to the theoretical probability of the event.
    B. The experimental probability tends to get farther to the theoretical probability of the event.
    C. The experimental probability and the theoretical probability of the event become equal.
    D. The experimental probability does not have definite relationship to the theoretical probability.



Additional Activities

A die is rolled and a coin is tossed ten times. The yields are recorded in the table below.

Trial	Outcome											
	(1,H)	(1,T)	(2,H)	(2,T)	(3,H)	(3,T)	(4,H)	(4,T)	(5,H)	(5,T)	(6,H)	(6,T)
1	(1,H)											
2						(3,T)						
3		(1,T)										
4			(2,H)									
5					(3,H)							
6				(2,T)								
7				(2,T)								
8							(4,H)					
9				(2,T)								
10							(4,H)					

Questions:

1. What are the possible outcomes when a die is rolled once, and a coin is tossed once?
2. Which of the expected outcomes did not occur?
3. Why do you think some expected outcomes did not occur?
4. What is the experimental probability of getting an odd number on a die and a tail on a coin?
5. What is the theoretical probability of getting an odd number on a die and a tail on a coin?
6. How did the observation-based probability of getting an odd number on a die and a tail on a coin compare with the expected probability of getting an odd number on a die and a tail on a coin?
7. Do you think this would have been different if the number of trials is increased?

Answer Key

What I Know

1. D
2. D
3. D
4. A
5. D
6. C
7. B
8. C
9. B
10. A
11. B
12. B
13. A
14. B
15. C

What's In

1. C
2. F
3. E
4. A
5. B

1. By using the formula in finding the probability of simple events $P(event) = \frac{Number\ of\ ways\ an\ outcome\ can\ occur}{Total\ number\ of\ possible\ outcomes\ (Sample\ Space)}$ as discussed in the previous lesson.

2. The probabilities obtained in items 1 and 2 are based on ideal occurrences, answered theoretically and no experiments are performed. The Probabilities obtained in items 3, 4 and 5 are based on actual results or recorded data in the experiment.

What's New

1. The probability of getting a head when tossing a single coin is ½. And the expected probability of getting a tail is also ½.

2. When the same coin is tossed 20 times, the probability of getting a head is 14/20 or 7/10 and the probability of getting a tail is 6/20 or 3/10.

3. The head is frequently occurring and I did not expect this to happen.

4. There will be changes on the probability of getting a head and the probability of getting a tail if I continue tossing the coin 50 times or more.

What's More

Activity 1

A.

1. $\frac{2}{12}$ or $\frac{1}{6}$
2. $\frac{1}{6}$
3. $\frac{1}{6}$
4. $\frac{2}{12}$ or $\frac{1}{6}$
5. $\frac{1}{6}$

Questions:

a. By using the formula $P(event) = \frac{No.of\ Favorable\ Outcomes}{Total\ No.of\ Possible\ Outcomes}$ and knowing that a die is fair, all the outcomes are equally likely to occur, so each outcome has the same probability of occurrence which is 1/6.
b. Expecting that the probability remains the same when the die is rolled 12 times, each outcome will occur twice out of the 12 times rolling or 2/12.
c. Theoretical Probability

What's More

B.

Frequency	**3**	1	3	**3**	1	1
Probability	$\frac{3}{12}\ or\ \frac{1}{4}$	$\mathbf{\frac{1}{12}}$	$\mathbf{\frac{3}{12}\ or\ \frac{1}{4}}$	$\frac{3}{12}\ or\ \frac{1}{4}$	$\mathbf{\frac{1}{12}}$	$\frac{1}{12}$

a. a. By counting the number of occurrences of the possible outcomes in rolling a die 12 times.
b. b. By using the formula $P(event) = \frac{No.of\ Times\ the\ Event\ Occurs}{Total\ No.of\ Trials}$.
a. c. Experimental Probability

What's More

C.

1. $\frac{1}{6}$
2. $\frac{1}{12}$
3. $\frac{1}{4}$
4. $\frac{1}{6}$
5. $\frac{1}{12}$

What's More

D.

1. $\frac{5}{36}$ 4. $\frac{7}{36}$

a.The experimental probability of the possible outcomes in No.3 is lower than the experimental probability of the possible outcomes in No. 4.
b. The experimental probability of the possible outcomes in No. 4 is higher than the theoretical probability of the possible outcomes.
c.When the number of trials increases, the experimental probability gets closer to the theoretical probability.

What's More

Activity 2

1. Theoretical Probability
2. Theoretical Probability
3. Theoretical Probability
4. Experimental Probability

What I Can Do

1. Experimental Probability

2. It indicates the probability of dying once diagnosed positive from COVID-19

3. Answers may vary.

What I Have Learned

Theoretical Probability	Experimental Probability
Concepts Learned - what should happen - based on the number of favorable outcomes relative to the total possible outcomes - expected probability	Concepts Learned - what did happen - based on how frequent an outcome occurred relative to the number of trials - observation-based probability
Examples -Toss a coin and the probability of getting a tail is $\frac{1}{2}$. -The probability of having a leap year in 4 years is $\frac{1}{4}$.	Examples - The probability of the occurrence of head is $\frac{3}{10}$ when the coin is tossed 10 times and the head came out 3 times. -The probability of getting an odd number is $\frac{1}{2}$ when a die is tossed 20 times and an odd number occurred 10 times.

Assessment

1. D	4. B	7. A	10. A	13. A
2. B	5`. B	8. D	11. D	14. B
3. A	6. B	9. B	12. B	15. A

Additional Activity

1.(1,H),(1,T), (2,H),(2,T),(3,H),(3,T),(4,H),(4,T),(5,H),(5,T),(6,H),(6,T)
2. (4,T), (5,H), (5,T), (6,H), (6,T)
3. There is no assurance that all possible outcomes will show up when a die is rolled, and a coin is tossed 10 times. Or the number of trials is not enough for all possible outcomes to occur.
4. 2/10 or 1/5
5. 3/12 or ¼
6. The observation-based probability of getting an odd number on a die and a tail on a coin is lower than the expected probability of getting an odd number on a die and a tail on a coin.
7. Yes

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