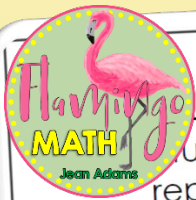


Algebra 2 Honors

Theoretical & Experimental Probability



Using Permutations to Find Probability

Students are given a 4-digit code for computer access no digit can be repeated. Abby received the code 1234. What is the probability that she would receive a code of consecutive numbers?

STEP 1: Find the number of outcomes in the sample space.

$${}_{10}P_4 = \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6!}}{\cancel{6!}} = \underline{\underline{5,040}}$$

STEP 2: Find the number of favorable outcomes.

0123, 1234, 2345, 3456, 4567, 5678, 6789, 14
3210, 4321, 5432, 6543, 7654, 8765, 9876

STEP 3: Find the probability.

$$P(\text{consecutive numbers}) = \frac{14}{5040} = \frac{1}{360}$$

Completely Editable

12.2

Lesson 12.2: Theoretical & Experimental Probability

Vocabulary

PROBABILITY - the measure of how likely an event is to occur. Probabilities are expressed as percentages (0% through 100%) or as real numbers (0 through 1).

OUTCOME - each possible result of an experiment.

SAMPLE SPACE - a set of all possible outcomes.

EVENT - a set of outcomes, a subset of the sample space.

THEORETICAL PROBABILITY - If a sample space has n equally likely outcomes and an event E occurs in m of these outcomes, then the theoretical probability of event E is

$$P(E) = \frac{m}{n} = \frac{\text{number of favorable outcomes}}{\text{number of outcomes in sample space}}$$

COMPLEMENT - The sum of all probabilities in the sample space is 1. The complement of an event E is the set of all outcomes in the sample space that are not in E .

$$P(\text{not } E) = 1 - P(E)$$

EXPERIMENTAL PROBABILITY - In a simulation, you can estimate the probability of an event by using data. Each repetition of an experiment is a trial. (The ratio of frequency to number of trials.)

$$P(E) = \frac{\text{number of times the event occurs}}{\text{number of trials}}$$

Finding Theoretical Probability

EX #1: A jar contains 50 red marbles, 20 white marbles, and 30 blue marbles. Find the theoretical probability of drawing a red marble from the jar at random. Find the theoretical probability of drawing a blue marble from the jar at random.

A. $P(\text{red})$

C. $P(\text{not white})$

Using Permutations to Find Probability

EX #5: Students are given a 4-digit code for computer access no digit can be repeated. Abby received the code 1234. What is the probability that she would receive a code of consecutive numbers?

STEP 1: Find the number of outcomes in the sample space.

STEP 2: Find the number of favorable outcomes.

STEP 3: Find the probability.

EX #6: Six books are labeled A through F are arranged on a shelf. What is the probability that they are arranged in alphabetical order?

EX #7: A four-card hand is to be picked from a deck of 52 cards. What is the probability that the cards will all be face cards?

EX #2: Each of the numbers 1 through 10 are written on a card and placed in a bag. The bag is shaken, and one card is drawn at random.

A. What is the sample space?

B. What is the event of drawing an odd number?

C. What is the probability of drawing a number less than 5?

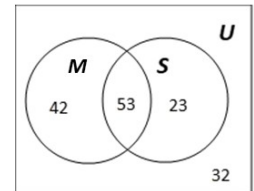
D. What are the odds in favor of getting a number less than 5?

Finding Complements

EX #3: There are 30 students in study hall. The table shows the number of students who are studying a foreign language. What is the probability that a randomly selected student is not studying a foreign language?

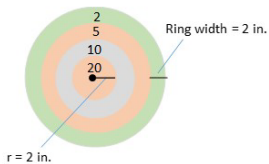
Language	Number
Spanish	14
French	8
Italian	5

76 are taking math (M), 76 are taking science (S), and 76 are taking both. One student is picked at random. Find the probability of picking a student who is taking both math and science.



EX #8: There are 12 balls in a box; 3 each of red, blue, green, yellow, and purple. Find the probability of drawing a red ball from the box at random.

Geometric Probability



Geometric Probability is a form of probability that is based on a ratio of lengths, areas, or volumes.

EX #9: In the dartboard above, suppose that all the points are equally likely to be hit by a dart you throw.

A. Find the probability of scoring at least 10 points.

B. $P(\text{Scoring 20 points})$

Probability and Combinations

Experimental Probability

EX #10: A baseball player got a hit 21 times in 60 at-bats. Find the probability of his getting a hit.

EX #11: Your class rolled a die recorded their results shown in the table below. What is the experimental probability of rolling each number?

Number	1	2	3	4	5	6
Occurrences	43	45	41	46	48	47

NOTES

Name _____ Date _____

12.2

Theoretical & Experimental Probability Practice

Problems 1 – 4, A quarter, dime, and nickel are flipped. Find the probability of each of the following.

- | | |
|---------------------------------------|--|
| 1. The quarter lands on tails. | 2. The dime and nickel lands on heads. |
| 3. All three coins land the same way. | 4. One coin will land on heads. |

Problems 5 – 8, find the probability.

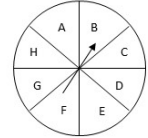
- What is the probability that a randomly chosen number from 1 – 100 is a multiple of 4?
- There are 15 marbles in a bag: 4 blue, 5 green, 3 red, and 3 yellow. Three marbles are chosen at random, without replacement. Find the probability that all 3 marbles are green.
- A letter is chosen at random from the word MATHEMATICS. What is the probability that the letter is a vowel?
- Each letter of the alphabet is written on a card. What is the probability that a letter before the letter M is drawn without looking?
- A pair of dice are rolled. What is the probability that the sum of the numbers is greater than six?

Problems 11 – 14, a bag contains colored building blocks. There are 32 red, 45 green, 20 yellow, and 18 purple blocks. If you pick one block from the bag at random, find each theoretical probability.

- | | |
|----------------------|-------------------------|
| 11. P (purple) | 12. P (green) |
| 13. P (not yellow) | 14. P (yellow or red) |

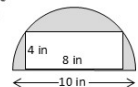
Problems 15 – 20, use the spinner at right to find the probability.

- P (consonant)
- P (vowel or G)
- P (not a letter in the word DEAF)
- P (A, B, or C)
- P (vowel)
- P (a letter in the word GIRAFFE)

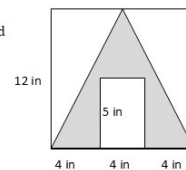


Problems 21 – 23, use geometry and ratios to find the geometric probability.

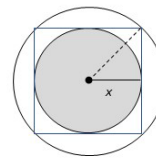
- A rectangle is inscribed in a semicircle, shown at right. If a point inside the figure is chosen at random, what is the probability that the point is inside the shaded region?



- By placing a rectangle inside a triangle inside a square, the figure at right was created. If a point inside the figure is chosen at random, what is the probability that the point is inside the shaded region?

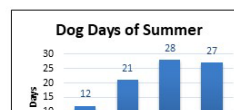


- The two circles circumscribe and inscribe the square, as shown at right. Find the probability that a random point in the large circle is within the inner circle. [Hint: Pythagorean Theorem]



Problems 24 – 26, the table below shows the number of days that the temperature in Central Florida was above 90° in a recent year. Use the chart to complete the following.

- What is the experimental probability that the temperature will be greater than 90° F on any given day in July?



Practice Sets

Lesson Warm-Ups

In a survey of 120 students, 85 students said "YES," 18 responded "NO", and 17 were "NOT SURE."
Find the experimental probability

3. P (answer was "YES")

4. P (answer was "NO")

Name _____ Date _____ Period _____

Lesson 12.2: Theoretical & Experimental Probability

Warm-Up #2

You select a number at random from the sample space {1, 2, 3, 4, 5}. Find the theoretical probability

1. P (the number is 4)

2. P (the number is even)

In a survey of 150 students, 90 students said "YES," 36 responded "NO", and 24 were "NOT SURE."
Find the experimental probability

3. P (answer was "YES")

4. P (answer was "NO")

Form A

12.2 Theoretical & Experimental Probability

Form B

Name _____
Date _____ Period _____

1. Given the letters A through J, what is the probability of randomly drawing a vowel?

2. Given the letters A through J, what is the probability of randomly not drawing a vowel?

3. Two dice are rolled. What is the probability that the sum of the dots showing will be less than 9?

4. The table below shows the results from a spinner experiment. Find the probability of spinning an odd number.

2. Given the numbers 1 through 10, what is the probability of randomly drawing a number less than 5?

3. Two dice are rolled. What is the probability that the sum of the dots showing will be less than 8?

4. The table below shows the results from a spinner experiment. Find the probability of spinning a number greater than 2.

Daily Lesson Quiz

Grade:

Grade: