Brockton High School
Content: Math II
Week of: June 15 – June 24, 2020
Greetings Math II Students! We hope you are safe and well with your families!
This assignment is for the week, use your time wisely. **You do not have to complete this in one sitting**. Here is the lesson plan for this week:

Goals for this week: Module 6 on Mathia

Learning Objectives:
Students will be able to:
1. Explore probability including independent events and conditional probability.
(Standards S.CP.1, S.CP.2, S.CP.8(+), S.CP.7)

Literacy Objectives:
Students will be able to:
1. to compute, interpret and explain numbers.
2. to read, break down, and solve a word problem.
3. to explain and/or interpret relationships of space and time.

(https://www.bpsma.org/schools/brockton-high-school/about-us/mission-literacy-charts)

Carnegie Learning (use with Carnegie Resources provided below)

(Log-in through Clever)

Instructional Video Links: Please watch these videos to help guide you.
1. Independent Probability
2. Compound Probability with Tables
3. Sample Spaces
4. Compound Probability

Printable Resources:
Skills Practice:
- Module 5 Skills practice

Practice Activities:
On-Line:
All students now have access to an on-line program called Mathia!
- Mathia- If you are already in Mathia, please continue to work in the program.
- If you are new to Mathia: Please see the log-in information below.

Key Terms:
- **Independent events:** two events in which the outcome of the first event does not affect the probability of the second event.

Example: Flipping a coin and getting heads and rolling a number cube and rolling a 5 are independent because of the outcome of "heads" does not affect the probability of rolling a 5.
- **Sample Space:** The set of all possible outcomes of an experiment

Example: For the random experiment of rolling a six-sided number cube the sample space is the set of numbers 1, 2, 3, 4, 5, and 6.
- **Frequency Table:** A table that organizes data values into intervals

Example:

Data Intervals	0-0.9	1-1.9	2-2.9	3-3.9
Tally	ll	l	lll	l
Frequency	2	1	3	1

- **Relative Frequency:** The ratio of the number of items given in a category to the total number of items

Example:

Forty students in a class took a math test. The number of students who scored points in each of the categories is shown below:

Range of Scores	Frequency
0-24	2
25-49	10
50-74	20
75-100	8

The relative frequency of students who scored between 50 and 74 points is $\frac{20}{40} = \frac{1}{2}$.

Extension Activities:

Stretch

1. A game includes a deck of cards with a color on each card. The table shows the numbers of each type of card. When a card is chosen, it is not replaced in the deck.
   a. A player draws out ten cards. What is the probability that all the cards are red except the last card, which is teal?
   b. A player draws out five cards. What is the probability that none of the cards are orange?

Number of Cards	Color on Card
15	red
12	yellow
10	green
14	blue
16	orange
15	purple
20	teal

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Log-in Information

1. http://studentintranet.bpsma.org/
2. Click on Clever
3. Under Math, click on Carnegie Learning (CL)
4. Username: 6-digit BHS school ID # @bpsma.org
   Password: Date of birth bps 1920
   Example: Student (Michael) with ID #:123456
   Date of birth: January 1st, 2000
   Username: 123456@bpsma.org
   Password: 01012000bps1920

Additional Support

Email:

- Please email your math teacher with specific questions.

Office Hours:

- Click here for teacher Office hours!

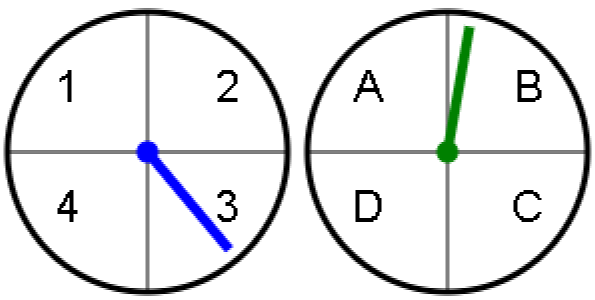
Carnegie Learning Resource

Notes to help you:

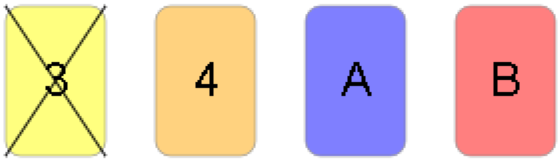
Independent Events

Two events are independent events if the occurrence of one event does not affect the probability of the other event occurring. Consider these cards, in two different sets.

Suppose Event N is spinning 3 on the left spinner, and Event L is spinning B on the right spinner. If Event N occurs (a 3 is spun on the left spinner), the probability of spinning B on the right spinner $P(L)$, is not affected. It is still $\frac{1}{4}$. So, Events L and N are independent events.



However, consider the set below. Suppose that Event N is selecting the number 3, and Event L is selecting the letter B, each from the same set. If Event N occurs (a 3 is chosen from the set), the probability of choosing B changes from $\frac{1}{4}$ to $\frac{1}{3}$. So, Events L and N are not independent events.



Conditional Probability

The conditional probability of an event is the probability of the event, given that another event has occurred. The conditional probability of the event A, given that the event B has occurred is written as $P(A \mid B)$.

The conditional probability of Event A, given Event B, $P(A \mid B)$, is equal to $\frac{P(A \text{ and } B)}{P(B)}$, and the conditional probability of Event B, given Event A, $P(B \mid A)$, is equal to $\frac{P(A \text{ and } B)}{P(A)}$.

A 5-sided letter die with faces labeled A, B, C, D, and E is rolled twice. The table shows the sample space of possible outcomes. Each row of the table shown represents a roll of the first die, and each column represents a roll of the second die.

	A	B	C	D	E
A	A, A	A, B	A, C	A, D	A, E
B	B, A	B, B	B, C	B, D	B, E
C	C, A	C, B	C, C	C, D	C, E
D	D, A	D, B	D, C	D, D	D, E
E	E, A	E, B	E, C	E, D	E, E

What is the probability of rolling a B or D on the second roll, given that the first roll was a consonant, $P(B \text{ or } D \mid \text{consonant})$?

Since the first roll was a consonant (B, C, or D), the sample space is reduced from 25 total possible outcomes to just 15, which is the total number of outcomes in the B, C, and D rows.

The 6 intersections of the B, C, and D rows with the B and D columns show the outcomes of rolling a consonant first and a B or D on the second roll, out of a total of 15 possible outcomes. So, the probability of rolling a B or D on the second roll, given that the first roll was a consonant, is $\frac{6}{15} = \frac{2}{5}$.

Reading a Two-Way Frequency Table

The two-way frequency table shows the number of students from each grade who plan to attend this year's homecoming football game.

	Freshmen	Sophomores	Juniors	Seniors	Total
Attending Homecoming Game	**31**	**28**	**25**	**32**	**116**
Not Attending Homecoming Game	**17**	**24**	**11**	**6**	**58**
Total	**48**	**52**	**36**	**38**	**174**

From the table, you can see that **24** sophomores are not attending the homecoming game, and a total of **58** students are not attending the game. The table represents a sample space, with **174** total students surveyed.

We can ask, "What is the probability of a sophomore not attending the homecoming game?" This is the same as asking, "What is the probability that a randomly selected student is not attending the homecoming game, given that he or she is a sophomore?" This can be represented by the conditional probability:

$$P(\textbf{not attending} \mid \textbf{sophomore}) = \frac{P(\text{sophomore and not attending})}{P(\text{sophomore})}$$

The probability that a random student from the survey is both a sophomore and not attending is $\frac{24}{174}$, or approximately $\mathbf{0.138}$. The probability that a student from the survey is a sophomore is $\frac{52}{174}$, or approximately $\mathbf{0.299}$. The probability that a randomly selected student is not attending the homecoming game, given that he or she is a sophomore is approximately $\frac{0.138}{0.299} \approx \mathbf{0.462}$. This is equal to the quotient of the values in the table: $\frac{24}{52} \approx \mathbf{0.462}$.

Probabilities from a Table

A 5-sided letter die with faces labeled A, B, C, D, and E is rolled twice. The table shows the sample space of possible outcomes. Each row of the table shown represents a roll of the first die, and each column represents a roll of the second die.

	A	B	C	D	E
A	A, A	A, B	A, C	A, D	A, E
B	B, A	B, B	B, C	B, D	B, E
C	C, A	C, B	C, C	C, D	C, E
D	D, A	D, B	D, C	D, D	D, E
E	E, A	E, B	E, C	E, D	E, E

What is the probability of rolling a B on the first roll, $P(B \textbf{ on the first roll})$?

The row labeled **B** shows all the outcomes for rolling a B on the first roll. There are 5 outcomes out of 25 total possible outcomes, so the probability of rolling a B on the first roll is $\frac{5}{25} = \frac{1}{5}$.

What is the probability of rolling a B on the first roll, $P(B \textbf{ on the first roll})$?

The row labeled **B** shows all the outcomes for rolling a B on the first roll. There are 5 outcomes out of 25 total possible outcomes, so the probability of rolling a B on the first roll is $\frac{5}{25} = \frac{1}{5}$.

What is the probability of rolling a vowel on the second roll, $P(\textbf{vowel on the second roll})$?

The columns labeled with vowels (**A** and **E**) show all the outcomes for rolling a vowel on the second roll. There are $5 + 5$, or 10, outcomes out of 25 total possible outcomes, so the probability of rolling a vowel on the second roll is $\frac{10}{25} = \frac{2}{5}$.

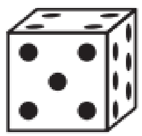
Skills Practice

Name ____________________ Date ____________

I. Modeling Probability

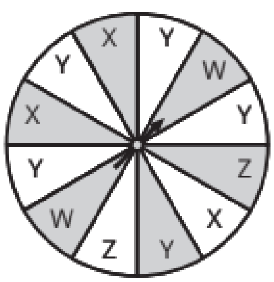
A. Identify the sample space for each situation.

1. A number cube with sides labeled with 1 to 6 dots is rolled once.



2. An ice cream shop has a sale for its most popular ice cream flavors. Customers can have one scoop of ice cream in a cup or a cone, and the flavors on sale are chocolate, vanilla, and strawberry. It can be served with or without sprinkles.

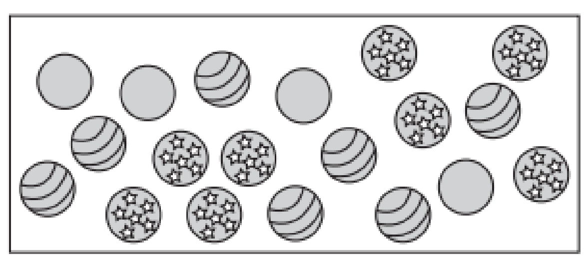
3. You spin the spinner one time.



4. A jar contains 3 red marbles, 4 blue marbles, 2 green marbles, and 1 yellow marble.

5. An even number between 1 and 15 is chosen at random.

6. A ball is chosen at random from the box.



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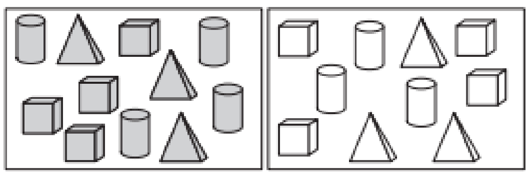
C. For each situation, identify the following.

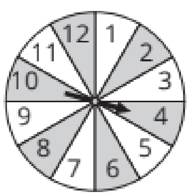
- What are the actions?
- What are the outcomes of each action?
- Do the outcomes of each action belong to disjoint sets or intersecting sets?
- What events are described?
- Are the events independent or dependent?

1. You randomly choose one shaded block and one unshaded block. The result is a shaded cylinder and an unshaded cube.



2. A teacher randomly chooses 2 students from a class, Matt and Mia, to solve a math problem on the board.

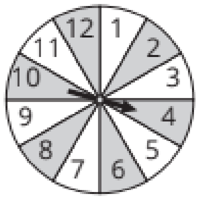
3. You spin the spinner and flip a coin, resulting in a 3 and tails up.



4. You randomly choose a number between 1 and 50. Your friend chooses a number between 51 and 100. Your choice is 6 and your friend's choice is 77.

E. Determine the probability of each event, $P(E)$, and its complement, $P(E^c)$.

1. You spin the spinner one time.



$P(\text{greater than 7}) =$

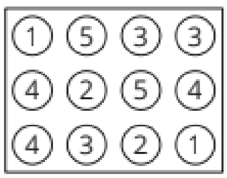
$P(\text{not greater than 7}) =$

2. You write the letters A to K on separate index cards. Then you choose a card at random.

$P(\text{vowel}) =$

$P(\text{not a vowel}) =$

3. You choose a ball at random from the box.



$P(5) =$

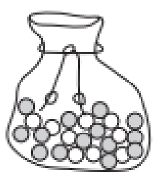
$P(\text{not a } 5) =$

4. You have 5 quarters, 2 dimes, 3 nickels, and 6 pennies. You choose a coin at random.

$P(\text{a coin worth more than 5 cents}) =$

$P(\text{not a coin worth more than 5 cents}) =$

5. There is a total of 30 balls, half of which are shaded. You choose a ball at random from the bag.



$P(\text{shaded}) =$

$P(\text{not shaded}) =$

6. Among the students in a class, 10 ride the bus, 3 walk, and 5 ride a car to school. A student is chosen at random.

$P(\text{walk}) =$

$P(\text{not walk}) =$

F. Use the Counting Principle to determine the number of possible outcomes for each situation. Show your calculations.

1. There are 5 students scheduled to read their essays aloud in an English class one day. The teacher will randomly choose the order of the students. In how many different orders can the students read their essays?

2. A restaurant offers a special price for customers who order a sandwich, soup, and a drink for lunch. The diagram shows the restaurant's menu. How many different lunches are possible?

Lunch Menu		
Sandwiches	**Soup**	**Drinks**
Cheese	Minestone	Cola
Chicken	Chicken Noodle	Tea
Ham and Egg	Vegetable	Coffee
Turkey Club		

II. Calculating Conditional Probability

A. A five-sided letter die with faces labeled A, B, C, D, and E is rolled twice. The table shows the sample space of possible outcomes. Use the table to determine each probability. Express your answers as fractions in simplest form.

		Second Roll				
		A	B	C	D	E
First Roll	A	A, A	A, B	A, C	A, D	A, E
	B	B, A	B, B	B, C	B, D	B, E
	C	C, A	C, B	C, C	C, D	C, E
	D	D, A	D, B	D, C	D, D	D, E
	E	E, A	E, B	E, C	E, D	E, E

1. *P*(B on the first roll)

2. *P*(vowel on the second roll)

3. *P*(consonant on the second roll)

4. *P*(A or B on the first roll)

5. *P*(A on the first roll and consonant on the second roll)

6. *P*(vowel on the first roll and vowel or D on the second roll)

7. *P*(B or D on the second roll, given that the first roll was a consonant)

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8. P(consonant on the second roll, given that the first roll was a vowel)

9. P(A on the second roll, given that the first roll was a vowel)

10. P(vowel on the second roll, given that the first roll was not an A)

B. Determine each conditional probability.

1. Given $P(A) = 0.25$, $P(B) = 0.3$, and $P(A \text{ and } B) = 0.1$, determine $P(B|A)$.

2. Given $P(A) = \frac{2}{9}$, $P(B) = \frac{3}{10}$, and $P(A \text{ and } B) = \frac{2}{15}$, determine $P(A|B)$.

3. Given $P(A) = \frac{5}{6}$, $P(B) = \frac{1}{2}$, and $P(A \text{ and } B) = \frac{1}{12}$, determine $P(B|A)$.

4. Given $P(A) = 0.12$, $P(B) = 0.2$, and $P(A \text{ and } B) = 0.05$, determine $P(A|B)$.

5. Given $P(A) = 0.15$, $P(B) = 0.21$, and $P(A \text{ and } B) = 0.03$, determine $P(B|A)$.

6. Given $P(A) = \frac{1}{4}$, $P(B) = \frac{2}{5}$, and $P(A \text{ and } B) = \frac{1}{8}$, determine $P(A|B)$.

C. The jar on Mrs. Wilson's desk contains 20 green paper clips, 30 red paper clips, 15 white paper clips, and 10 black paper clips. She selects a paper clip without looking, does not replace it, and selects another. Determine each probability. Round each answer to the nearest tenth of a percent if necessary.

1. P(both paper clips are red)

2. P(both paper clips are white)

3. P(second paper clip is green|first paper clip is black)

4. P(second paper clip is white|first paper clip is red)

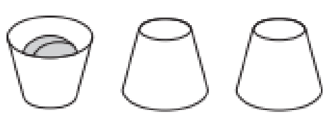
5. P(second paper clip is green|first paper clip is not green)

6. P(second paper clip is not red|first paper clip is red)

III. Calculating Probabilities of Independent Events

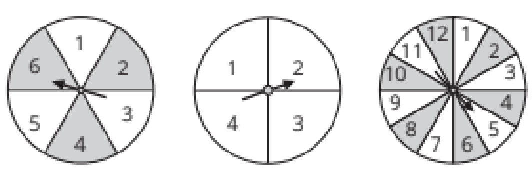
A. Determine the probability of each individual event. Then, determine the probability of each compound event. Show your calculations.

1. The “shell game” consists of placing three opaque cups, representing shells, upside down on a table and hiding a ball under one of the cups. A player, who has not seen where the ball is hidden, has to choose one of the cups. If the ball is hidden under it, the player wins. What is the probability that a player will win 5 times in a row?

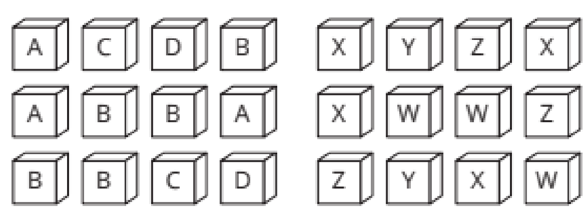


2. There are 24 students in a math class. Each day, the teacher randomly chooses 1 student to show a homework problem solution on the board. What is the probability that the same student will be chosen 5 days in a row?

3. You spin each spinner in the diagram one time. What is the probability that the first two spinners land on 1?



4. You randomly choose a block from each set below. What is the probability of choosing a block labeled W from the second set?



Skills Practice

Name ______________________________ Date ______________

I. Calculating Probabilities from Relative Frequencies

A. The two-way frequency table shows the current inventory of hardwood that a lumberyard carries. Suppose a board is selected at random from the lumberyard's inventory. Use the table to calculate each probability. Round to the nearest tenth of a percent if necessary.

Type of Hardwood	Size: 1×2	1×3	1×4	1×6	Total
Oak	20	13	17	12	62
Maple	14	28	9	19	70
Cherry	8	17	28	25	78
Total	42	58	54	56	210

1. P(oak)

2. P(maple)

3. P(cherry)

4. $P(1 \times 2)$

5. $P(1 \times 3)$

6. $P(1 \times 4)$

7. $P(1 \times 6)$

8. P(maple and 1×3)

9. P(oak and 1×2)

10. P(maple or cherry)

11. P(cherry or 1×4)

12. P(maple or 1×6)

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B. The two-way relative frequency table shows the results of a survey on the mayor's job approval. Suppose a member of the sample population is selected at random. Use the table of relative frequencies to calculate each probability. Express each probability as a decimal.

Do you Approve of the Mayor's Job Performance	Party Affiliation: Republican	Democrat	Independent	Total
Approve	0.14	0.25	0.03	0.42
Disapprove	0.22	0.1	0.12	0.44
No Opinion	0.03	0.07	0.04	0.14
Total	0.39	0.42	0.19	1

1. *P*(approve)

2. *P*(disapprove)

3. *P*(no opinion)

4. *P*(republican)

5. *P*(democrat)

6. *P*(independent)

7. *P*(republican and disapprove)

8. *P*(democrat and no opinion)

9. *P*(independent and approve)

10. *P*(disapprove or no opinion)

11. *P*(democrat or independent)

12. *P*(democrat or disapprove)

13. *P*(republican or approve)

14. *P*(independent or disapprove)

C. The two-way frequency table shows the results of a study in which a new topical medicine cream was tested for its effectiveness in treating poison ivy. Half of the study participants applied the cream to their affected skin for 3 days and noted any changes in their symptoms. The other half applied a placebo and noted any changes.

		Results			
		Significant Improvement	**Moderate Improvement**	**No Improvement**	**Total**
Treatment	**Medicine Cream**	21	10	4	35
	Placebo	9	14	12	35
	Total	30	24	16	70

1. Use the table to determine each probability. Round each answer to the nearest tenth of a percent if necessary.

a. $P(\text{significant improvement}|\text{medicine cream})$

b. Are significant improvement and medicine cream treatment independent or dependent events? Explain your reasoning.

2. Use the table to determine each probability. Round each answer to the nearest tenth of a percent if necessary.

a. $P(\text{placebo}|\text{no improvement})$

b. Are no improvement and placebo treatment independent or dependent events? Explain your reasoning.

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3. Use the table to determine each probability. Round each answer to the nearest tenth of a percent if necessary.

a. *P*(medicine cream|moderate improvement)

b. Are medicine cream treatment and moderate improvement independent or dependent events? Explain your reasoning.

4. Use the table to determine each probability. Round each answer to the nearest tenth of a percent if necessary.

a. *P*(placebo|significant improvement)

b. Are placebo treatment and significant improvement independent or dependent events? Explain your reasoning.