# **Unit 14 Probability**

Target 1 - Calculate the probability of an event

*Target 2 – Calculate a sample space 14.2a – Tree Diagrams, Factorials, and Permutations 14.2b– Combinations* 

Target 3 – Calculate the probability of independent and dependent events (compound) AND/THEN statements

# *Target 4 – Calculate the probability of overlapping and disjoint events (mutually exclusive events 14.4a – Addition Rule 14.4b – Subtraction Rule*

#### Target 5 – Calculate and apply conditional probability

Date	Target	Assignment	Done!
W 5-3	14.1	14.1 Worksheet	
R 5-4	14.2a	14.2a Worksheet	
F 5-5	14.2b	14.2b Worksheet	
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T 5-9	Quiz	Quiz 14.1-14.3	
W 5-10	14.4a	14.4a Worksheet	
R 5-11	14.4b	14.4b Worksheet	
F 5-12	14.5	14.5 Worksheet	
M 5-15	Quiz	Quiz 14.4-14.5	
T 5-16	Review	Unit 14 Test Review	
W 5-17	Test	Unit 14 Test Part 1 (Targets 1-3)	
R 5-18	Test	Unit 14 Test Part 2 (Targets 4-5, FRQ)	

## *Name:\_\_\_\_\_*

## *14.1—Experimental Probability &. Theoretical Probability Target 1: Calculate the probability of an event*

### <u>Vocabulary:</u>

**Probability:** The study of how likely it is that some event will occur.

*Experimental Probability:* The number of times an event occurring divided by the total number of observations

*Theoretical Probability:* determined using reasoning and analysis assuming the outcomes are equally likely

Sample Space: set of all possible outcomes of some action.

## Example 1: Find the experimental probability

P(A) = <u>Number of times event A occurs</u> <u>Number of observations</u> \*\*P(A) = is read: "The probability of event A occurring is"

Surveyors counted the number of trees in a popular city park. There were 62 spruce trees, 44 firs, 12 oaks, and 2 maples. What is the experimental probability that a randomly selected tree is an oak?



## Example 2: Find the theoretical probability using sample space



If a coin is flipped twice, it comes up heads twice. Use the sample space to determine the theoretical probability of having two heads in a set?

Sample Space





## Geometry Unit 14 Probability *Example 3: Find the theoretical probability using sample space*

If you roll a pair of dice, what is the probability that the *total* on the two dice will be 7?



## ANNOTATE HERE



1. A jar contains jellybeans, 5 of which are white, 14 blue, 18 yellow, and 7 red. What is the theoretical probability of grabbing a blue jellybean?



2. In a standard deck of cards there are 52 total cards. Four aces standard deck. Johnny had 10 chances to select an ace from the deck. After each draw, Johnny put the card back into the deck. The results are below:

| Draw |
|------|------|------|------|------|------|------|------|------|------|
| 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| 5    | J    | Q    | 8    | Α    | 3    | 6    | Α    | K    | 7    |

What is the experimental probability of drawing an ace from a deck of cards?

## 14.2a – Tree Diagrams, Factorials, and Permutations Target 2: Calculate a sample space

**ANNOTATE HERE** 



## Example 1: Find the number of outcomes

The Select Ice Creamer sells 8 flavors of ice cream and 3 types of cones. How many single-scoop combinations can you buy?



## <u>Vocabulary:</u>

**Permutation:** an <u>ordered</u> arrangement of a set of objects (order matters)



## Geometry Unit 14 Probability Example 2: Find the number of permutations

How many permutations are there of the ten digits 0 through 9?

# Example 3: Find the number of permutations when a certain number of objects are taken at a time

100 people enter a contest where there is a first, second, and third prize. How many different ways are there for the prizes to be awarded assuming a person cannot be allowed to win more than once.





**ANNOTATE HERE** 

"n objects chosen r at a time"



1. A local restaurant offers a lunch buffet with 5 meats, 8 vegetables, 3 breads, and 12 desserts. If a complete meal consists of one of each, how many possible complete meals does the restaurant offer?

2. How many different ways are there to choose jerseys for five athletes out of 30 possible numbers?

3. Jan's book club is choosing a one book to read in each of the months December, January, and February. If there are 14 books to choose from, how many permutations are there?

Answers:

1,440 meals

2. 17,100, 720 ways

3. 2184 permutations

## *14.2b— Combinations Target 2: Calculate a sample space*

### <u>Vocabulary:</u>

**Combination:** a selection of elements of a set where the order doesn't matter.

#### Example 1: Find the number of combinations

How many combinations of 2 cards can be formed from 4 cards in a deck?



## Example 2: Find the number of combinations

You have 3 extra tickets to a concert by your favorite musician. You have 10 friends who would like to go. How many different groups can you choose?



 $_{n}C_{r}=\frac{n!}{r!(n-r)!}$ 

**ANNOTATE HERE** 

r = number objects chosen at a time.

# **NOU TRY NOW!**

1. How many two-letter groups can you form from the word MOUSE if you don't care about the order?

# 2. You need to choose three of your five friends for a trip. How many combinations can you choose from?

3. How many different plates containing two pizza slices can be formed from a platter of pepperoni, sausage, mushroom, and cheese pizza if you can't have two of the same slices on one plate?



Answers:

- 1. 10 two letter groups
- 2. 10 different friend groups of 3
- 3. 6 different plates

## ANNOTATE HERE

## 14.3 – Independent Events and the Multiplication Rule Target 3: Calculate the probability of independent and dependent events (compound) AND/THEN statements

#### <u>Vocabulary</u>:

**Independent Events:** events in which the outcome of one has no effect on the probability of another occurring.

Multiplication Rule

When two independent events A and B,  $P(A \text{ and } B) = P(A) \cdot P(B)$ 

**Example 1: Find the probability of independent events occurring** What is the probability of a coin coming up heads twice?

#### Example 2: Find the probability of independent events occurring

A bag contains 11 marbles where 3 are red, 2 green, and 6 blue. You choose a marble from the bag, replace it, then draw again. What is the probability of drawing a red marble followed by a green one?



1. What is the probability of rolling a 2 or greater on a die, three times in a row?

2. What is the probability that you draw two queens in a row from a deck of cards? You do not replace the card that you draw.

Answers: a)  $\frac{125}{210} \approx .5787$ b)  $\frac{125}{221} \approx .0045$ 

**ANNOTATE HERE** 

"AND"

rule

## 14.4a - Addition Rule Target 4: Calculate the probability of overlapping and disjoint events (mutually exclusive events



## Magazina <u>You try now!</u>

1. The dogs at this shelter are all solid colors The probability that a dog at this animal shelter is black is 0.4. The probability that it is yellow is 0.2.

- a) Is the event mutually exclusive?
- b) What is the probability that a dog at the shelter is black or yellow?



- 2. A pair of dice is rolled.
  - a) Is the event mutually exclusive?
  - b) What is the probability that the sum of the numbers rolled is 7 or 11?

3. A box contains three red playing cards numbered one to three. The box also contains five black playing cards numbered one to five. You randomly pick a playing card.

- a) Is the event mutually exclusive?
- b) What is the probability that you chose a black or has an odd number?

#### Answers:

- 1. a) Mutually Exclusive b) **0.6**
- a) Mutually Exclusive
  b) <sup>2</sup>/<sub>2</sub> ≈ .22
- a) Not mutually exclusiveb) 0.875

## ANNOTATE HERE

## 14.4b – Subtraction Rule Target 4: Calculate the probability of overlapping and disjoint events (mutually exclusive events \_\_\_\_\_

Subtraction Rule

The probability of an event not occurring is 1 minus the probability that it does occur

P(not A) = 1 - P(A)

## Example 1: Find the probability of an event not occurring

The probability that Charlie catches a fish tomorrow is 0.3. What is the probability that Charlie doesn't catch a fish?



#### Example 2: Find the probability of an event not occurring

The probability the toast lands butter side down is 0.85. What is the probability it lands butter side up?





- 1. If you roll two dice, there is a 1/6 probability that the sum will be 7. What is the probability the two dice do not add to 7?
- **ANNOTATE HERE** This also called finding the complement. "NC

## 14.5— Conditional Probability Target 5: Calculate and apply conditional probability

#### <u>Vocabulary</u>:

**Conditional Probability:** the probability of a second event occurring, given that the first event already occurred.

## **Conditional Probability**

The probability of A occurring, given that B occurred equals the probability of both A and B occurring, divided by the probability that B occurred.

#### Example 1: Find the conditional probability given the probabilities

The probability that Sue will go to Mexico in the winter and to France in the summer is 0.40. The probability that she will go to Mexico in the winter is 0.60. Find the probability that she will go to France this summer, given that she just returned from her winter vacation in Mexico.

## Example 2 Find the conditional probability using a Venn Diagram or Frequency chart

In a monthly report, the local animal shelter states that it currently has 24 dogs and 18 cats available for adoption. Eight of the dogs and 6 of the cats are male. Find the conditional probability if the pet selected is a male, given that it is a cat.



# **NOU TRY NOW!**

1. Andrea is a very good student. The probability that she studies and passes her mathematics test is 17/20. If the probability that Andrea studies is 15/16, find the probability that Andrea passes her mathematics test, given that she has studied. **ANNOTATE HERE** 

2. Out of 100 cars on a used car lot, 20 cars have manual transmissions, 50 cars have air conditioning, and 8 cars have both.

a) What is the percentage of cars that have air conditioning given they have manual transmissions?

b) What is the percentage of cars that have manual transmissions given they have air conditioning?

Answers: 1.  $\frac{45}{75} \approx .9066$ 2. a.  $\frac{2}{5} \approx .4$ b.  $\frac{4}{25} \approx .16$