Title: Carnival Craze: What Are Your Chances?

**Brief Overview:**

Through a carnival theme, the students will develop the concept of probability by using mathematical methods to determine possible outcomes of independent events. Activities include: Target Toss to determine a fair game, Clown Races to determine possible outcomes, and Delightful Dessert to determine combinations.

**NCTM Content Standard/National Science Education Standard**:

Data Analysis & Probability

**Grade/Level:**

Grades 4/5

**Duration/Length:**

3 days/ 50-60 minutes

**Student Outcomes:**

Students will:

- Describe the likelihood of an event using probability terms of more likely, less likely and equally likely.
- Determine possible outcomes of independent events.
- Analyze the results of a probability experiment.

**Materials and Resources:**

**Lesson 1**

- Mystery bag – containing 2 different types of items for a total of 10 objects per bag (one bag per group) Object examples: cubes, candy, coins, counters, etc.
- Supply of extra items from mystery bag
- Transparency of Teacher Resource Sheet 1 – Target Toss
- Overhead Projector
- Damp paper towel balls – 3 or 4 balls (or sponges, tape balls, etc.)
- Student Resource Sheet 1 – Super Target Toss – for extension purposes
- Teacher Resource Sheet 2 – Super Target Toss - Answer Key

**Lesson 2**

- Teacher Resource Sheet 3a and 3b – Clowns (Cut into 12 cards)
- Sticky notes - 1 per student

- Six sided number cubes – 2 per group and a teacher set
- Student Resource Sheet 2 – Clown Race – 1 per group
- Student Resource Sheet 3 – Table of Sums – for reteaching purposes

**Lesson 3**

- Student Resource Sheet 4 – Yum! Yum! – 1 per student
- Teacher Resource Sheet 4 – Yum! Yum! – Answer Key
- Student Resource Sheet 5 – Delightful Dessert – 1 per student
- Teacher Resource Sheet 5 – Delightful Dessert – Answer Key
- Student Resource Sheet 6 – Carnival Craze – 1 per student
- Teacher Resource Sheet 6 – Carnival Craze – Answer Key

**Development/Procedures:**

**Lesson 1.....**

## Pre-Assessment –

- Distribute mystery bags to each team of three or four students.
- Tell students that there are ten items in each bag.
- Have students take one turn pulling an item from the bag one at a time returning each item to the bag after each turn.
- Have students work with their groups to make a prediction of the contents of the bag.
- Without giving feedback, observe students as they are making their predictions.
- Have students share the results of the prediction with the rest of the class.

**Launch –**

- As students are trying to make their predictions, give the students some clues about making predictions. For example: *Could you be pulling out the same object more than once? Could there only be one type of object in your bag? Are there equal amounts of each type of object in your bag? How would that effect your prediction if there were different amounts of each object in your bag?*
- Ask students if they have ever been to a carnival where they have played a game of chance. Ask them how they knew if the game was fair. Tell students that the class will be having a carnival and will be playing games to determine probability and a game's fairness.

**Teacher Facilitation –**

- Work with students to develop a definition of probability. (Probability is a measure of the likelihood that an event will occur. Probability arises out of a need to anticipate what might happen in a random event that has not yet occurred.)
- Tell the students that as part of our carnival they will play the Target Toss game.

- Put Teacher Resource Sheet 1 on the overhead projector and project onto the chalkboard or wall. Ask students if they think the game is fair or unfair under the following criteria: *Student 1 will get two damp paper towel balls to throw at the target. After the towels are thrown, Student 1 will find the sum of his/her scores. Student 2 will get three damp paper towel balls to throw at the target. After the towels are thrown, Student 2 will find the sum of his/her scores.*
- Ask the students if they think the game is fair or unfair under the following criteria*: Student 1 will get two damp paper towel balls to throw at the target and will add the sum of his/her scores. Student 2 will get two damp paper towel balls to throw at the target and will add the sum of his/her scores.*
- Discuss the fairness of a game. What makes a game fair? What makes a game unfair?

**Student Application –**

- Have students form a line behind the starting point. Give the first student a damp paper towel ball to throw at the target projected on the wall or chalkboard. After the student has thrown one, provide a second damp paper towel ball to throw. Ask the students to record the sum of their scores on the chalkboard or chart paper. Do this for every child. (Alternate ways to play game: put a copy of the target on the floor for each group. Students may drop a marker, counter or a small paper ball onto the target. Other objects can be thrown at the projected target such as a sticky tape ball, or damp sponge.
- Ask the students to predict how many possible outcomes are possible with the different combination of points. Go around the room and ask for all of the student outcomes. Compare the class results. On the board have students come up and write different combinations of their student outcomes until all outcomes have been reached.
- Discuss if the outcomes are more likely, equally likely, or less likely. The scores are not equally likely to be hit because it takes more skill to hit the center of the target because it is smaller. There is also more area in the rings going around the target.

**Embedded Assessment –**

- Refer back to the pre-assessment activity. Discuss the results using vocabulary such as more likely, less likely and equally likely. Have groups examine the contents of their mystery bags. Ask students to determine what they would need to do to the number of objects to produce equally likely results. (Add or remove items from the mystery bags to create an equal number of each item.)

**Reteaching/Extension –**

- For those who need reteaching, have students draw pieces out of the mystery bags. Record the results to see the probability of how they are equally likely.
- For extension, use Student Resource Sheet 1 – Super Target Toss. Answers can be found on Teacher resource Sheet 2.

## Lesson 2

**Pre-Assessment –**

- Share the following scenario: *For fun and entertainment, we will be having clown races at our carnival! Each clown has been assigned a number. Two number cubes will be rolled. The clown who has the sum of the number cubes will move forward one space. Predict which clown will win the race. Write your prediction on a sticky note.*
- Have students create a line plot on the chalkboard using the sticky notes.

**Launch –**

- Create a number line on the chalkboard or floor large enough for the 12 clown cards. Use clowns from Teacher Resource Sheets # 3a and 3b.
- Have students take turns rolling the number cubes as the clowns move forward one space on the chalkboard or floor. All students may take at least one turn.

**Teacher Facilitation –**

- Discuss the results of the race. Did all clowns seem to have an equally likely chance of moving forward? Why or why not?
- Ask students what combinations make up each sum using six sided number cubes. Display data on chalk board, transparency or chart paper as shown below:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3+4 | | | | | |
| | | | | | 3+3 | 4+3 | 4+4 | | | | |
| | | | | 3+2 | 2+4 | 2+5 | 3+5 | 4+5 | | | |
| | | | 2+2 | 2+3 | 4+2 | 5+2 | 5+3 | 5+4 | 5+5 | | |
| | | 1+2 | 1+3 | 1+4 | 1+5 | 1+6 | 2+6 | 3+6 | 4+6 | 5+6 | |
| | 1+1 | 2+1 | 3+1 | 4+1 | 5+1 | 6+1 | 6+2 | 6+3 | 6+4 | 6+5 | 6+6 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

**Student Application –**

- Give the groups Student Resource Sheet 2 and two number cubes.
- Have each team member select the sum they predict will occur most frequently. (More than one group member may have the same number.)
- Working in teams, students roll the number cubes at least 20 times. Record data on Student Resource Sheet 2.

- Circulate among the students as they work, providing assistance as necessary.
- Discuss team results recording the data using mathematical vocabulary such as: mode, line plot, frequency and probability.

**Embedded Assessment –**

- Have students individually write three sentences describing the data their group collected. Encourage the use of mathematical vocabulary such as: mode, line plot, frequency and probability.

**Reteaching/Extension –**

- For students who need reteaching, use Student Resource Sheet 3 - Table of Sums.
- For extension, challenge the students to write an explanation describing which 3 numbers they would choose if they were trying to win a prize at the carnival. Encourage them to use the mathematical vocabulary of probability.

## Lesson 3

**Preassessment –**

- Tell the students: *Another great thing about a carnival is the food! At our carnival we will offer both hotdogs and hamburgers. You may choose one, as well as one topping of mustard or ketchup. Predict how many different combinations you could create. Write your prediction on Student Resource Sheet 4.*
- Have the students create the combinations with Student Resource Sheet 4. Answers can be found on Teacher Resource Sheet 4.

**Launch –**

- Share student responses from pre-assessment.
- Tell the students: *Now that we have had our food, it is time for dessert! Our carnival will offer ice cream.*
- *Customers may select a sugar cone, a waffle cone, or a cup.*
- *They may choose one scoop of ice cream from the following flavors: mint chip, bubble gum, or chocolate.*
- *All ice cream needs a topping! Customers may choose 1 topping from: sprinkles, nuts, or gummy worms.*
- Ask students how they could organize the information to show all the possible combinations.

**Teacher Facilitation –**

- Demonstrate how to create a tree diagram by modeling the first component using the sugar cone, three flavors of ice cream and three toppings. (See Teacher Resource Sheet 5 for examples).

- Discuss how many combinations could be created from this part of the tree diagram.

**Student Application –**

- Have students create a complete tree diagram using Student Resource Sheet 5, Delightful Dessert.
  Answer Key may be found on Teacher Resource Sheet 5

**Embedded Assessment –**

- Ask students to identify the total number of combinations of desserts.
- Record the total on Student Resource Sheet 5.

**Reteaching/Extension –**

- For extension, challenge students to write a number sentence to represent the data on the tree diagram. Encourage students to represent the information in an alternate way such as an illustration, organized list, etc.
- For those requiring reteaching, provide additional practice with manipulatives or drawings to represent the cones, flavors, and toppings.

**Summative Assessment**:

Students will complete the assessment activity, Student Resource Sheet 6 – Carnival Craze, by finding different combinations of two games and three rides. They will use what they know about probability to explain how they found these combinations.
Answer Key may be found on Teacher Resource Sheet 6.

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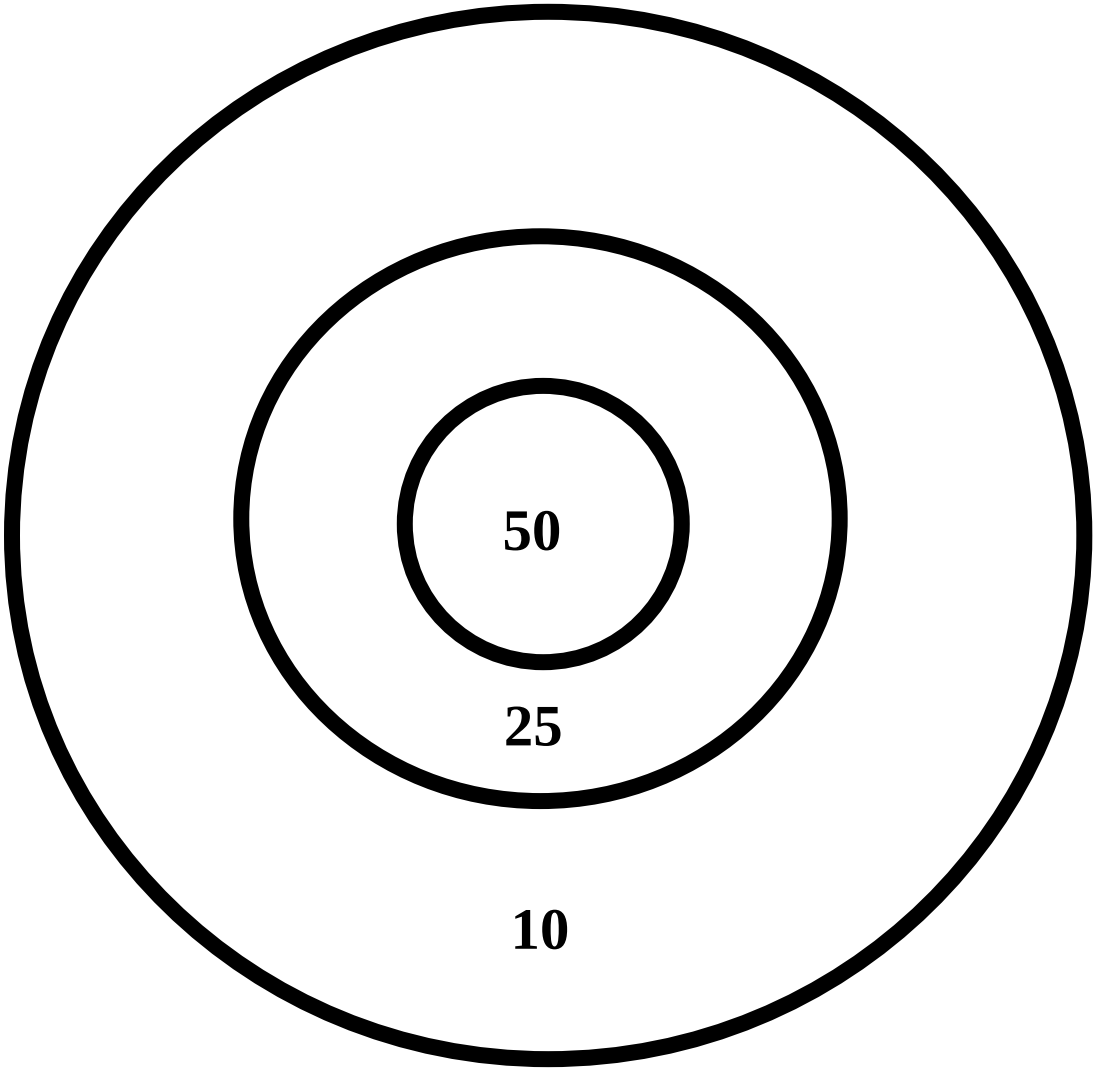
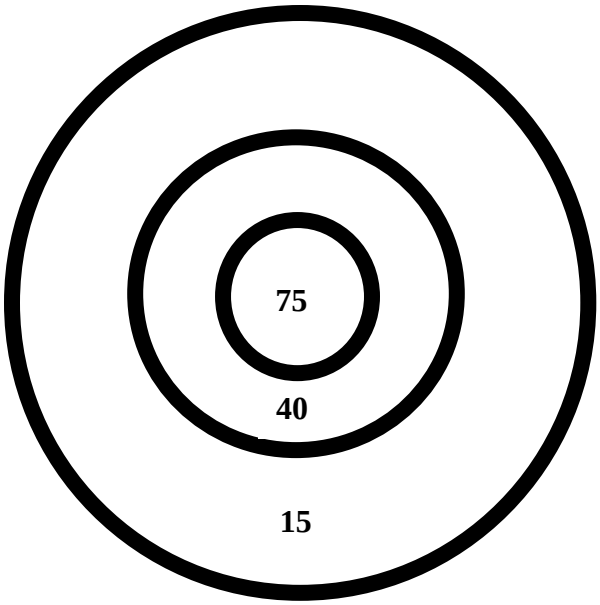
# Target Toss



# Super Target Toss




List all of the possible outcomes: _____

List all of the possible combinations of two throws:

_____

List all of the possible sums of two throws: _____

Why is it more likely to get a lower score than a higher score? _____

_____

At the carnival, prizes will be given.
Use what you know about probability to explain why the highest score should win the largest prize. Use words, and/or numbers in your explanation.

_____

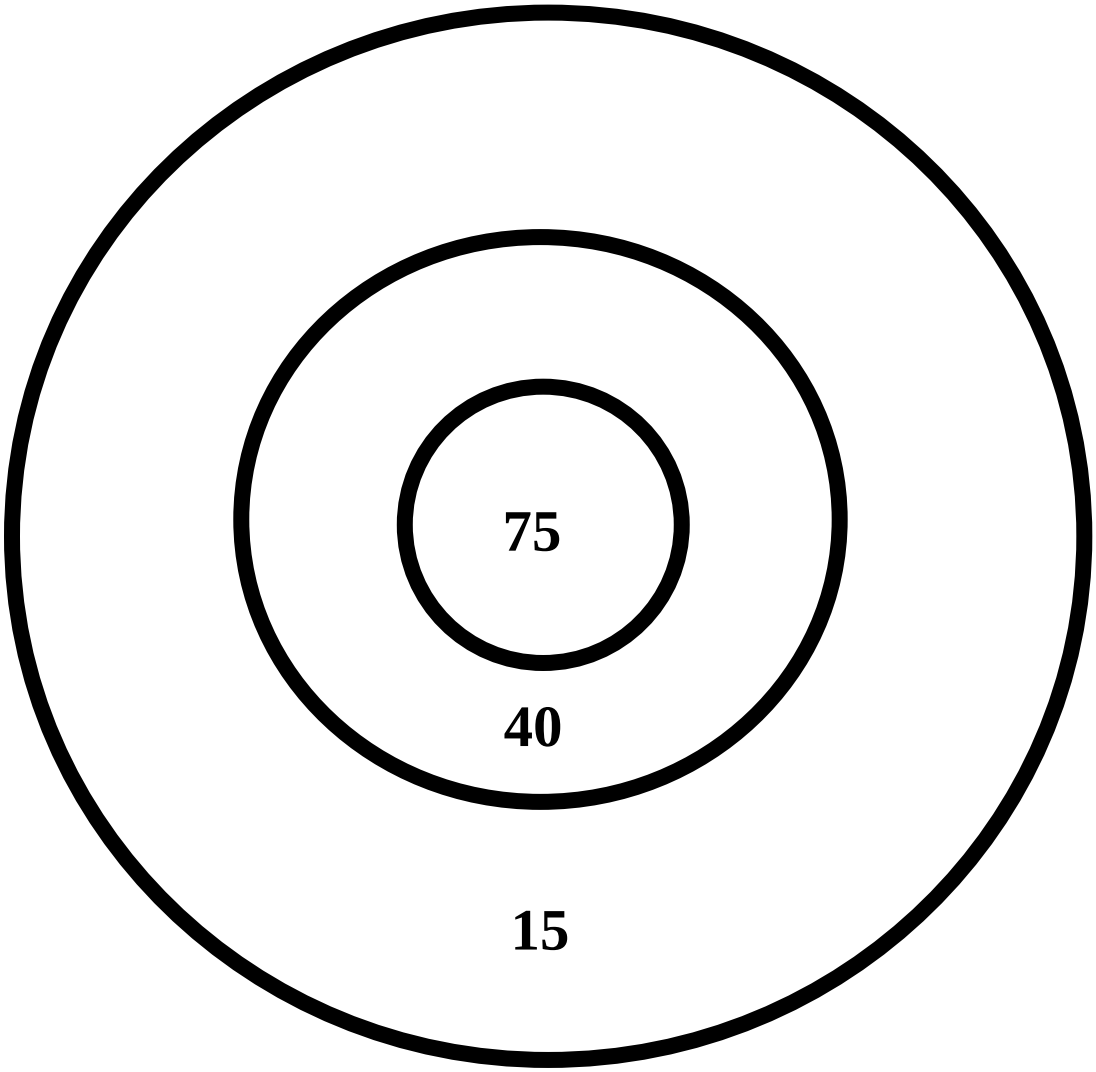
_____

_____

_____

_____

# Super Target Toss




List all of the possible outcomes: 75, 40, 15

List all of the possible combinations of two throws: 75 +75 = 150, 75 + 40 = 115, 75 + 15 = 90, 40 + 40 = 80, 40 + 15 = 55, 15 + 15 = 30

List all of the possible sums of two throws: 150, 115, 90, 80, 55, 30

Why is it more likely to get a lower score than a higher score?

At the carnival prizes will be given. Use what you know about probability to explain why the highest score should win the largest prize.

2

3

4

5

6

7

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12

1

# Clown Race

Roll two number cubes.
Find the sum.
Record the sum on the line plot.

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| | | | | | | | | | | |
| | | | | | | | | | | |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

Sums of Number Cubes

# Table of Sums

| + | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |

Shade the sums of 2, 3, 4 and 5.
How many combinations will result in a 2, 3, 4 or 5? _____

Circle the sums of 6, 7 and 8.
How many combinations will result in 6,7or 8? _____

Mark an X on the sums of 9, 10, 11 and 12.
How many combinations will result in 9, 10, 11 or 12? _____

# Yum! Yum!

The carnival offers <u>either</u> **hotdogs** or **hamburgers**.

Customers may have <u>either</u> **ketchup** or **mustard**.

1. Predict how many combinations of one food item and one topping may be purchased.

_____

2. Show possible combinations of hotdogs, hamburgers, ketchup and mustard.
Remember only one food item and one topping can be combined.

3. How many combinations can be purchased? _____

# Yum! Yum!

Answer Key

The carnival offers <u>either</u> **hotdogs** or **hamburgers**.

Customers may have <u>either</u> **ketchup** or **mustard**.

1. Predict how many combinations of one food item and one topping may be purchased.

_____

2. Show possible combinations of hotdogs, hamburgers, ketchup and mustard.
Remember only one food item and one topping can be combined.

Students should show:

Hotdog with ketchup
Hotdog with mustard
Hamburger with ketchup
Hamburger with mustard

3. How many combinations can be purchased? _____4_____

# Delightful Dessert

Our carnival will offer ice cream.

- Customers may select a **sugar cone, a waffle cone, or a cup**.
- They may choose one scoop of ice cream from the following flavors: **mint chip, bubble gum and chocolate.**
- Customers may choose 1 topping from: **sprinkles, nuts, or gummy worms.**

Create a tree diagram to determine the possible combinations.

# Delightful Dessert

(Answer Key)

Our carnival will offer ice cream.

- Customers may select a **sugar cone, a waffle cone, or a cup**.
- They may choose one scoop of ice cream from the following flavors: **mint chip, bubble gum and chocolate.**
- Customers may choose 1 topping from: **sprinkles, nuts, or gummy worms.**

Create a tree diagram to determine the possible combinations. Outcomes may be labeled with words, abbreviations or pictures.

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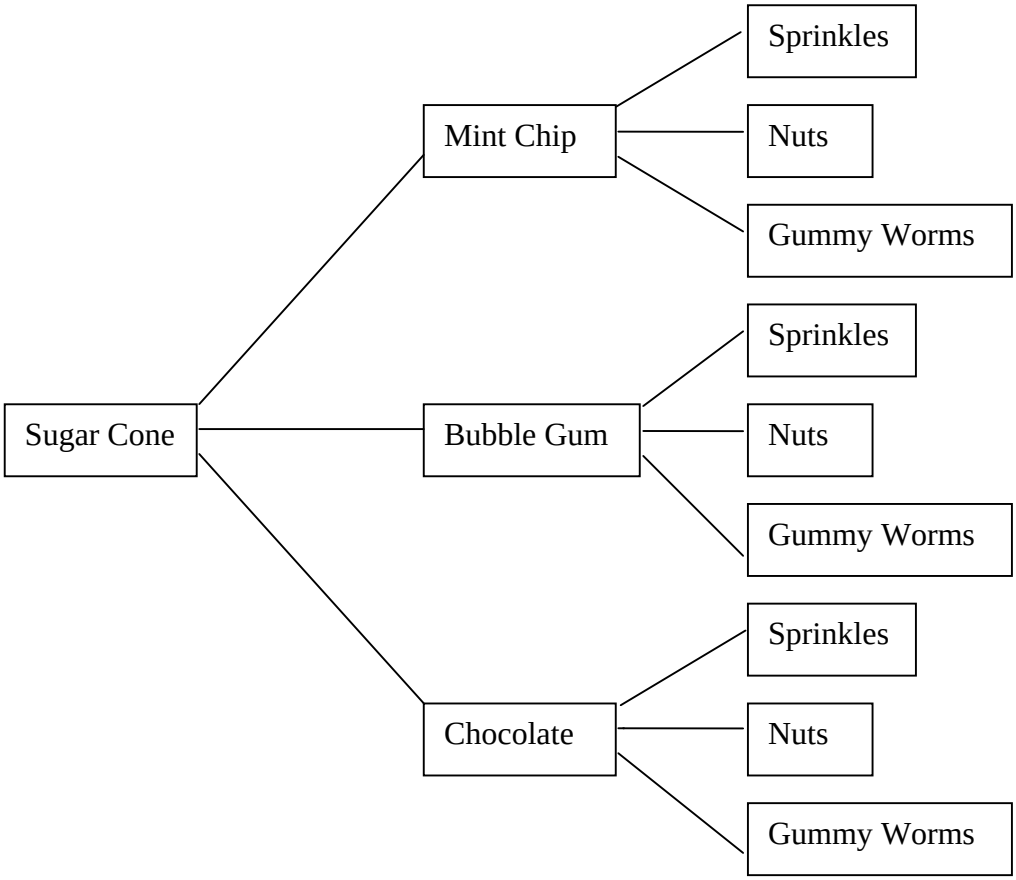
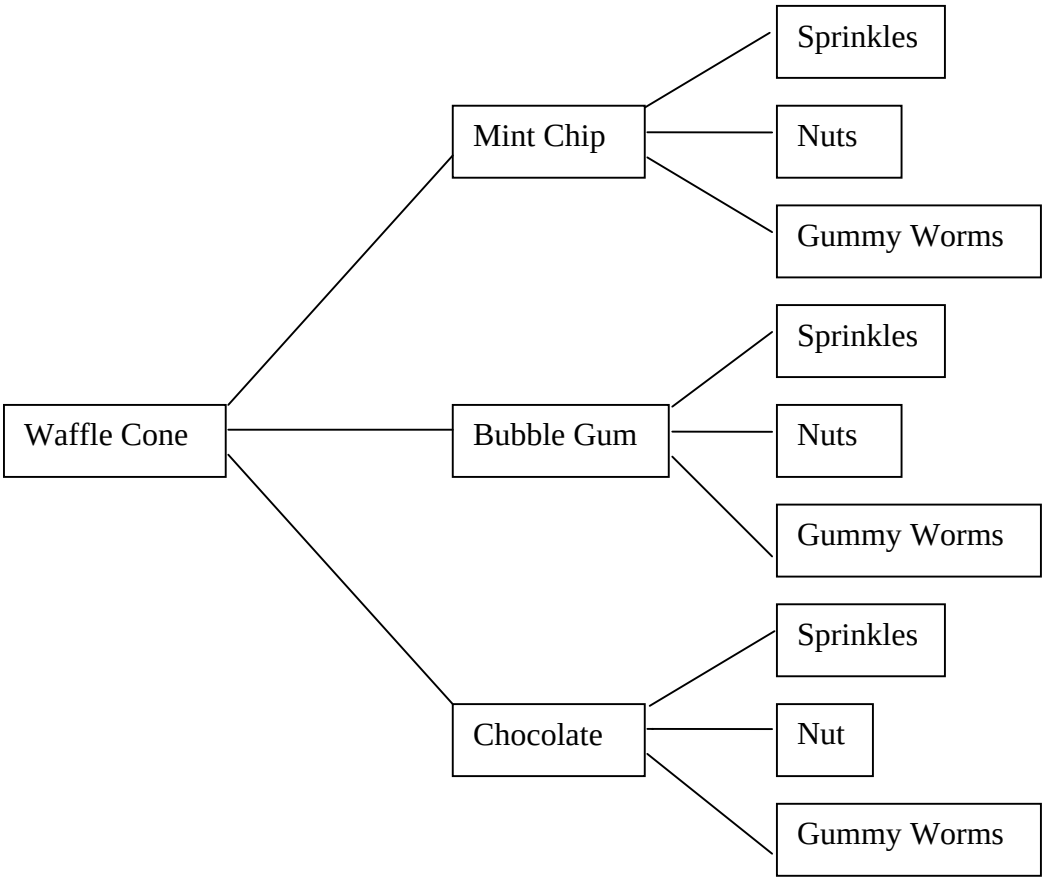
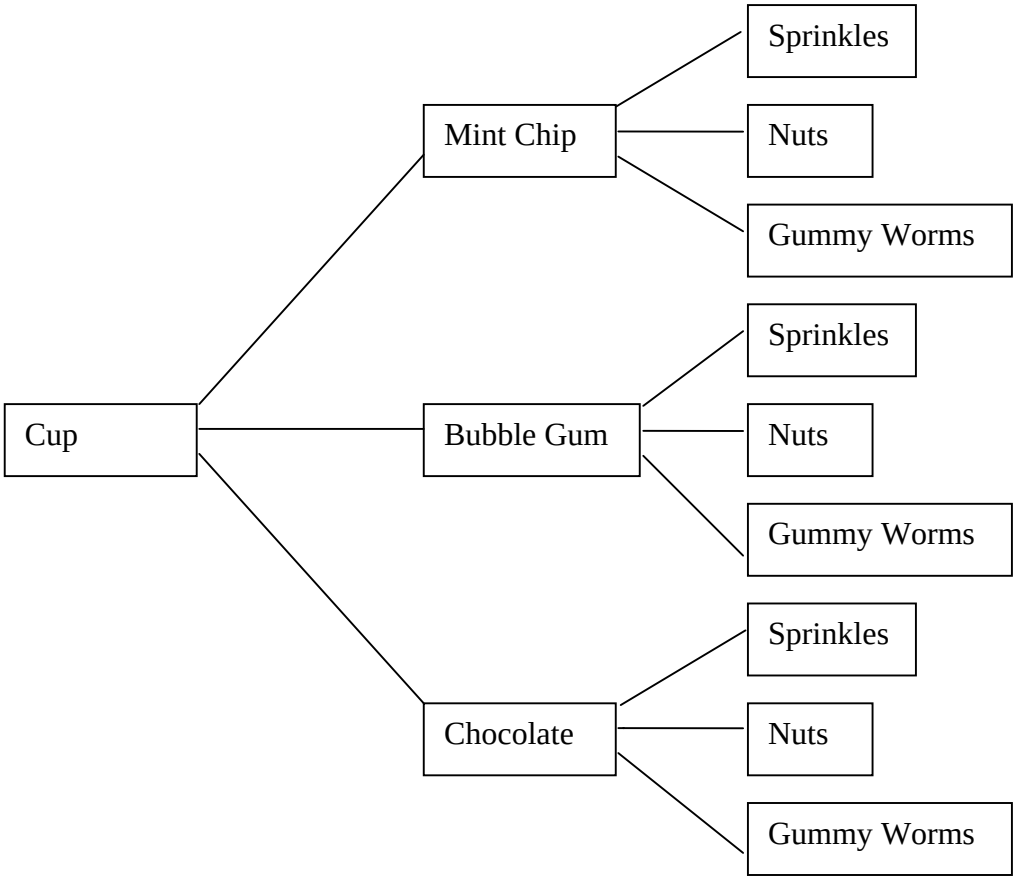



Waffle Cone
Mint Chip
Bubble Gum
Chocolate
Sprinkles
Nuts
Gummy Worms
Sprinkles
Nuts
Gummy Worms
Sprinkles
Nut
Gummy Worms

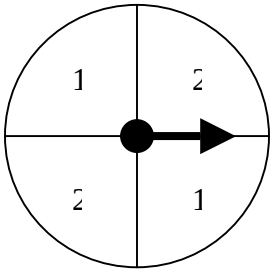

Cup
Mint Chip
Bubble Gum
Chocolate
Sprinkles
Nuts
Gummy Worms
Sprinkles
Nuts
Gummy Worms
Sprinkles
Nuts
Gummy Worms

# Carnival Craze

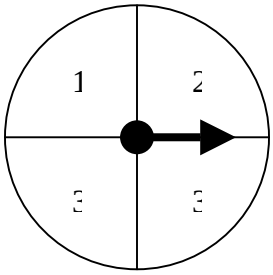
Summative Assessment

1. Which spinner does not show an equally likely chance to win a prize? _____

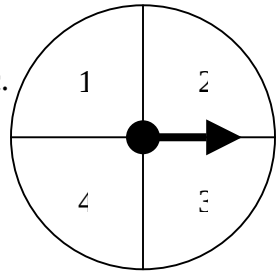
a.



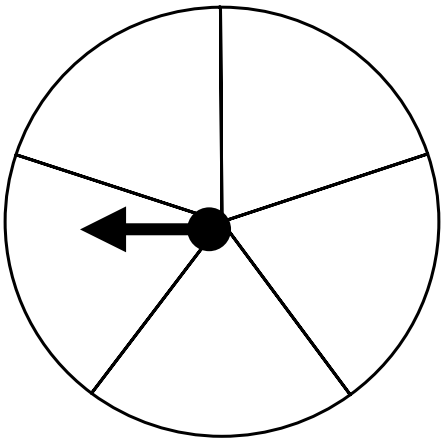

b.




c.




2. Create a spinner with an equally likely chance of winning.



3. At the carnival all tickets for games and rides are sold as combination tickets. Each ticket allows a choice of one game and one ride.

- Game choices: **Target Toss, Clown Race**
- Ride choices: **Roller Coaster, Bumper Cars, Merry-Go-Round**

Step A:
How many possible combinations of games and rides can you choose? _____

Step B:
Explain how you determined the number of combinations. Use what you know about probability in your explanation. Use words, numbers and/or symbols in your explanation.

_____

_____

_____

_____

_____

3. Step A:
How many possible combinations of games and rides can you choose? _____6_____

Target Toss, Roller Coaster
Target Toss, Bumper Cars
Target Toss, Merry-Go-Round

Clown Race, Roller Coaster
Clown Race, Bumper Cars
Clown Race, Merry-Go-Round

Step B:
Explain how you determined the number of combinations. Use what you know about probability in your explanation. Use words, numbers and/or symbols in your explanation.

Student responses should include six possible combinations containing one game and one ride. Students may make a list, tree diagram, table, or illustration, etc.