Problem Solving

Lindsi Shanahan

2nd Grade

Discrete Math

Executive Summary-

This unit is designed to build problem solving skills and lay the foundation for more complex Discrete Math concepts through a variety of games and activities. This unit is set up to be used in a daily math rotation format with the students completing one rotation each day completing the 4 separate activities in 4 days. "At Your Seat" is designed to be an individual review of the concepts taught. "Hands On" is a small group activity related to the math concept. "Math Facts" is designated as a time to practice basic math facts and/or additional practice on the concept being taught with a partner or small group. "Teacher's Choice" is a small group mini lesson to either introduce a new concept, or reinforce a previous topic.

One activity taken was downloaded for free from:
http://teachmama.com/color-puzzles-fun-math-and-logic-for-kids/

MN State Standards

* 2.1.2.1 Use strategies to generate addition and subtraction facts including making tens, fact families, doubles plus or minus one, couting on, counting back, and commutative and associative properties. Use the relationship between addition and subtraction to generate basic facts.

* 2.1.2.2 Demonstrate fluency with basic addition facts and related subtraction facts.

* 2.1.2.4 Use mental strategies and algorithms based on knowledge of place value and quantity to add and subtract two-digit numbers.

* 2.1.2.5 Solve real-world and mathematical addition and subtraction problems involving whole numbers with up to two-digits.

* 2.1.2.6 Use addition and subtraction to created and obtain information from tables, bar graphs and tally charts.

* 2.2.2.1 Understand how to interpret number sentences involving addition, subtraction and unknowns represented by letters. Use objects and number lines and create real-world situations to represent number sentences.

* 2.2.2.2 Use number sentences involving addition, subtaction, and unkowns to represent given problem situations. Use number sense and properties of addition and subtraction to find values for the unknowns that make the number sentences true.

* 2.3.3.2 Identify pennies, nickels, dimes and quarters. Find the value of a group of coins and determine combinations of coins that equal a given amount.

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Day 1- (Pre-Test) Introduce Euler and Hamilton Paths and Circuits-Whole Group

MN State Standards
2.1.2.1, 2.1.2.2, 2.1.2.4, 2.1.2.5, 2.1.2.6, 2.2.2.1, 2.2.2.2

Launch- Administer the Pre-Test. Today we are going to start some problem solving activities. Does anyone know what problem solving means? For the next couple of weeks during our Math Rotation time we are going to be working on a few different problem solving activities, and trying some logic puzzles to get our brains moving along with some of our general math fact practice.

Explore- For our first "brain activity" we are going to need some string and Play Doh. Your job to start is to see if you can follow the lines on the sheet without going over a line twice. (Euler) You need to use the string for the lines and the Play Doh will be for the "dots". Does anyone know what the lines are called? (Edges) What are the "dots" called? (Vertices) Demonstrate how to use the Play Doh at the vertices to hold the string in place. Give time for the students to explore. Then try the bottom half of the sheet looking at just connecting all the vertices. (Hamilton) Point out that you do not need to follow every edge/line and you can not go to a vertex/dot more than once.

Share/Summarize- Share with your partner if you could solve all of them. Did you start and end in the same place or in different places? Discuss that when you start and end in the same place it is called a circuit and if you start and end in a different place it is called a path.

Assessment- (Pre-Test) As the students are working make note of who is struggling and who has found a solution right away.

Using Play Doh and string can you follow the lines without covering the line twice?

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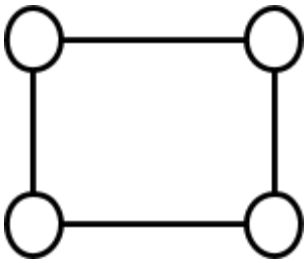

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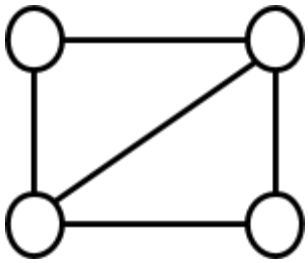

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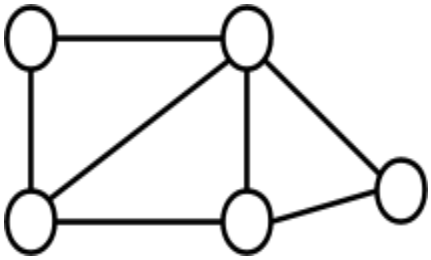

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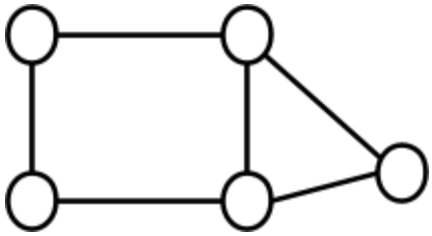

Can you connect all the dots without going to the same dot twice?

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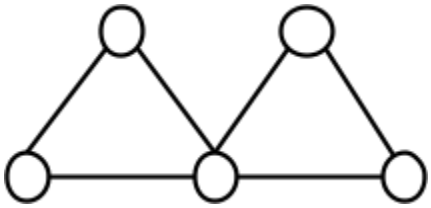

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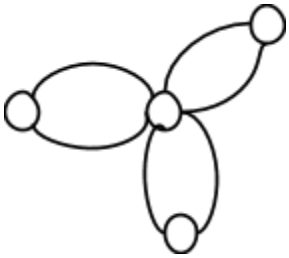

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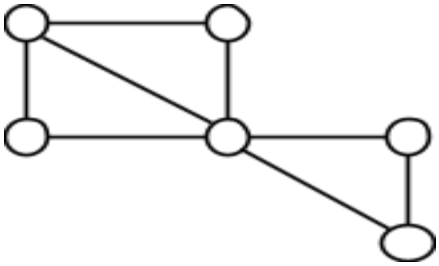

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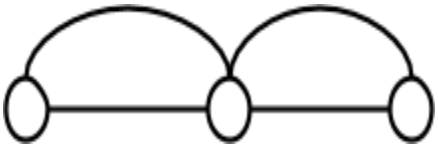


Days 2-5 Rotations

MN State Standards
2.1.2.1, 2.1.2.2, 2.1.2.4, 2.1.2.5

Math Facts- Roll-A-Fact- Using 2 dice make a list of all the fact combinations possible and record the answer. Differentiate using 6, 8, 10 or 20 sided dice.

At Your Seat- Color Puzzle- Color each section using only Red, Yellow, Blue, and Green. You can not color two sections next to each other with the same color. (Activity downloaded for free from http://teachmama.com/color-puzzles-fun-math-and-logic-for-kids/)

Teacher's Choice-
Launch-Read the book, "It's Not Easy Being a Bunny" by Marilyn Sadler. PJ does not want to be a bunny anymore so he tries "becoming" a different animal.

Explore- Using a map of the area PJ lives in. How far did PJ travel in all? Work with your neighbor to figure out an answer.

Share- Discuss what strategies each partnership used to find an answer.

Summarize- Today we figured out the distance PJ walked to get to all the animal's homes. Each group went about it a little different way but still got the same answer.

Hands On- The students will continue to explore edges and vertices on their own using Play Doh and string.

After day 5 share the results of the rotations.

At Your Seat- Did anyone find a way to color in the puzzle so that no 2 pieces touched with the same color?

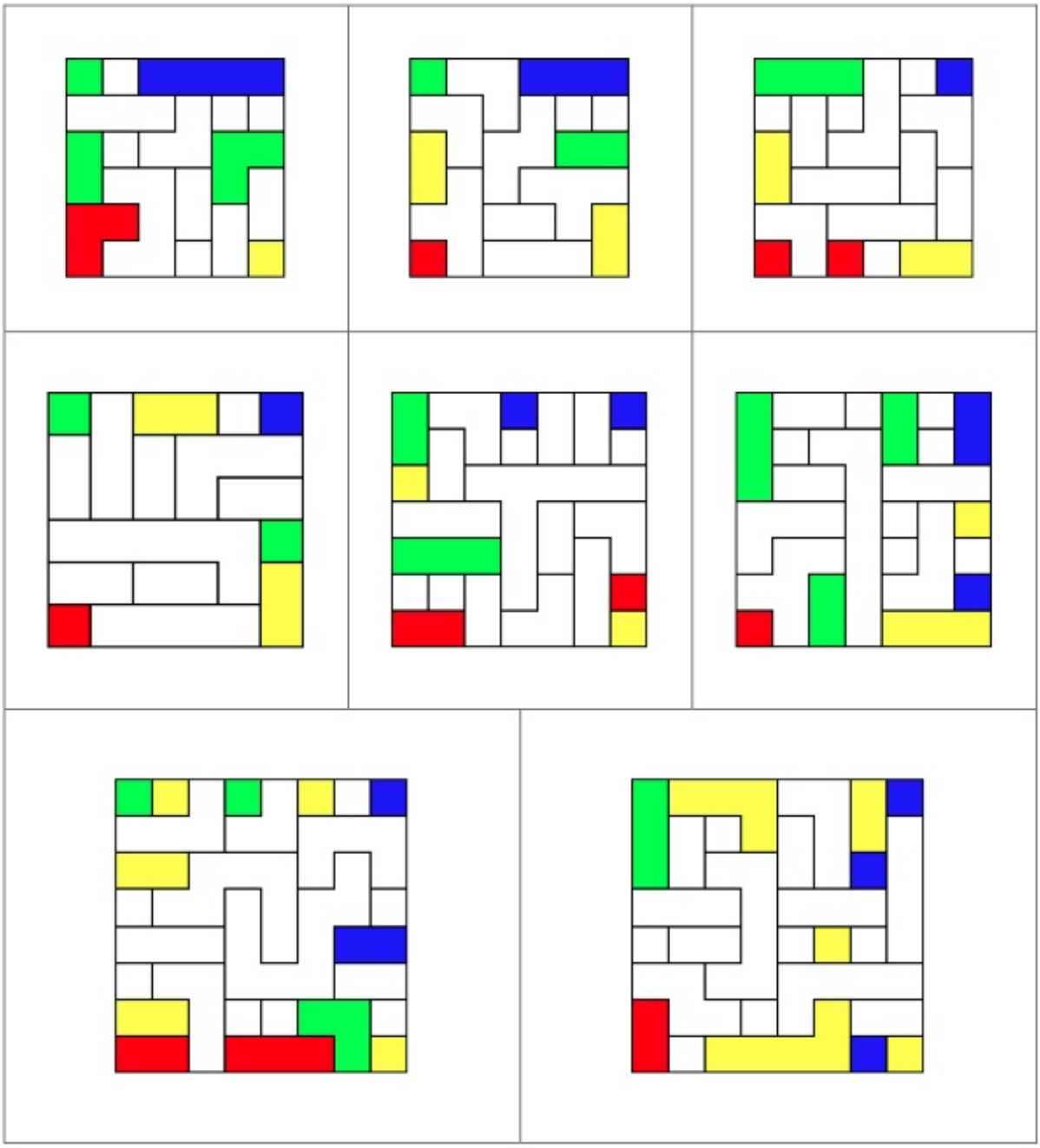
Hands On- Were all of the puzzles possible? Could you do some of them following the line but not get to all the dots? Were there any that you could connect all the dots but not follow all the lines?

Math Facts- How many combinations did you find? Compare the number found for 6-sided dice vs. 8-sided dice. Which had more? Why?

Teacher's Choice- Share any other observations made during the small group time.

color puzzles

Color each of the following maps with 4 colors so that no adjacent countries have the same color. Each puzzle has a unique solution. From http://www2.stetson.edu/~efriedma/4colors/



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Using Play Doh and string can you follow the lines without covering the line twice?

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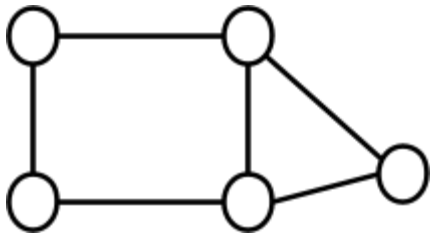

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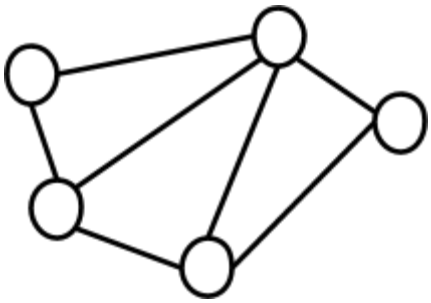

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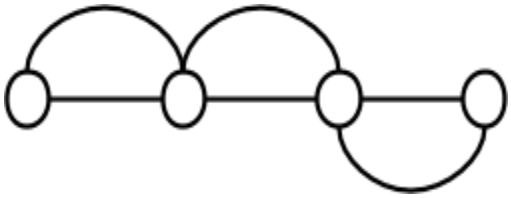

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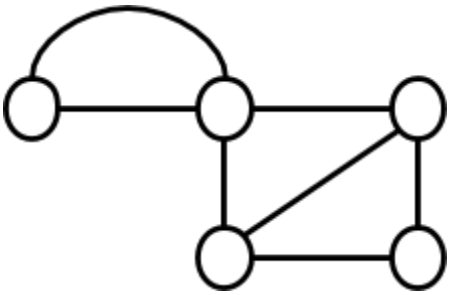

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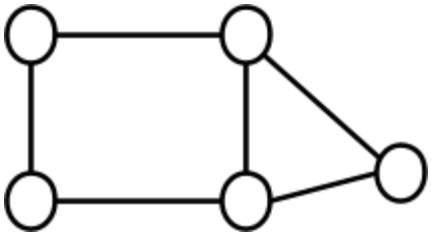

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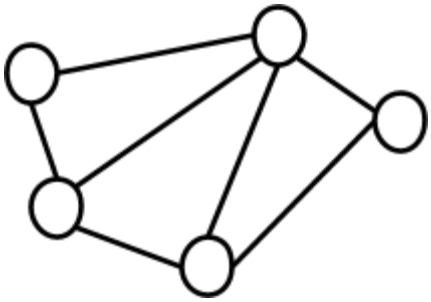

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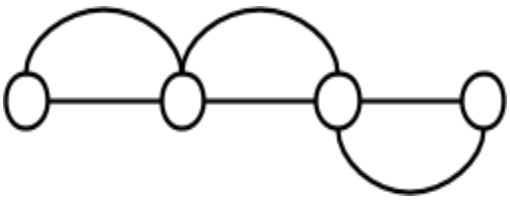

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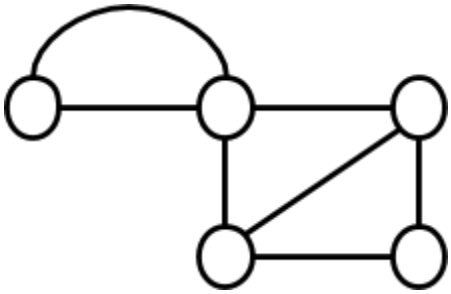
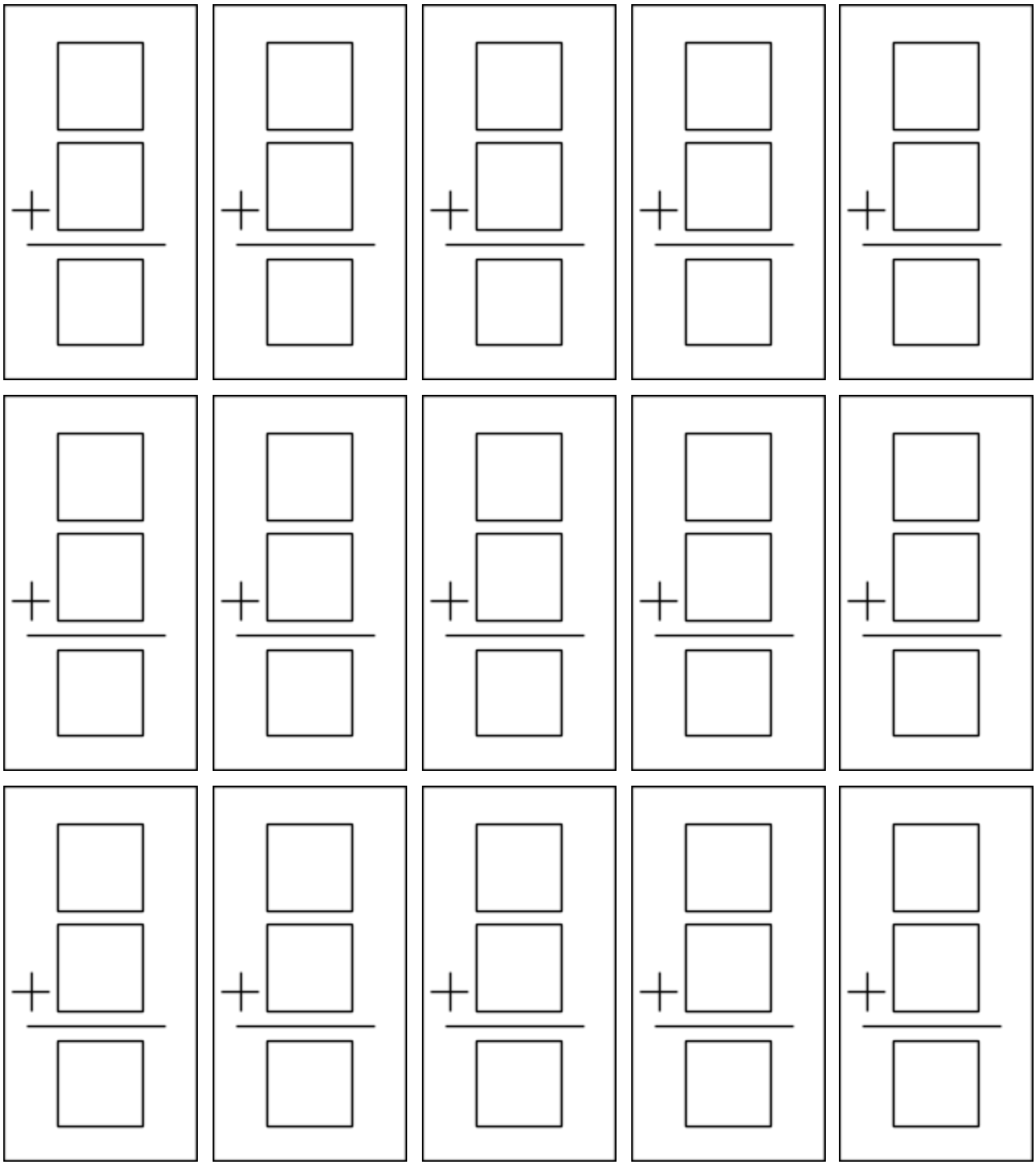


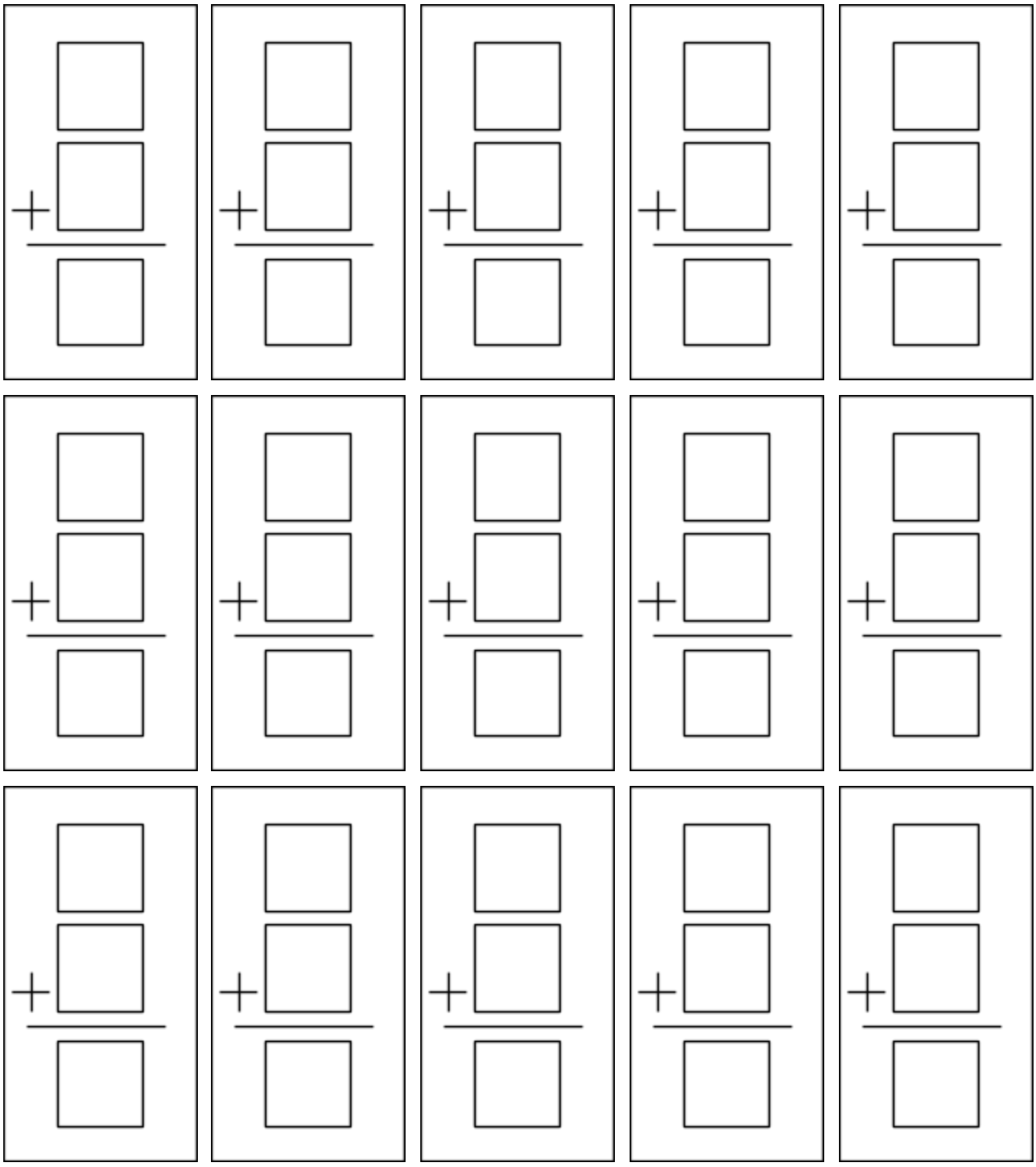
Roll-A-Fact (Addition)

Name _____

Roll the 2 dice and record the 2 numbers. Find the answer. How many <u>different</u> combinations can you find?



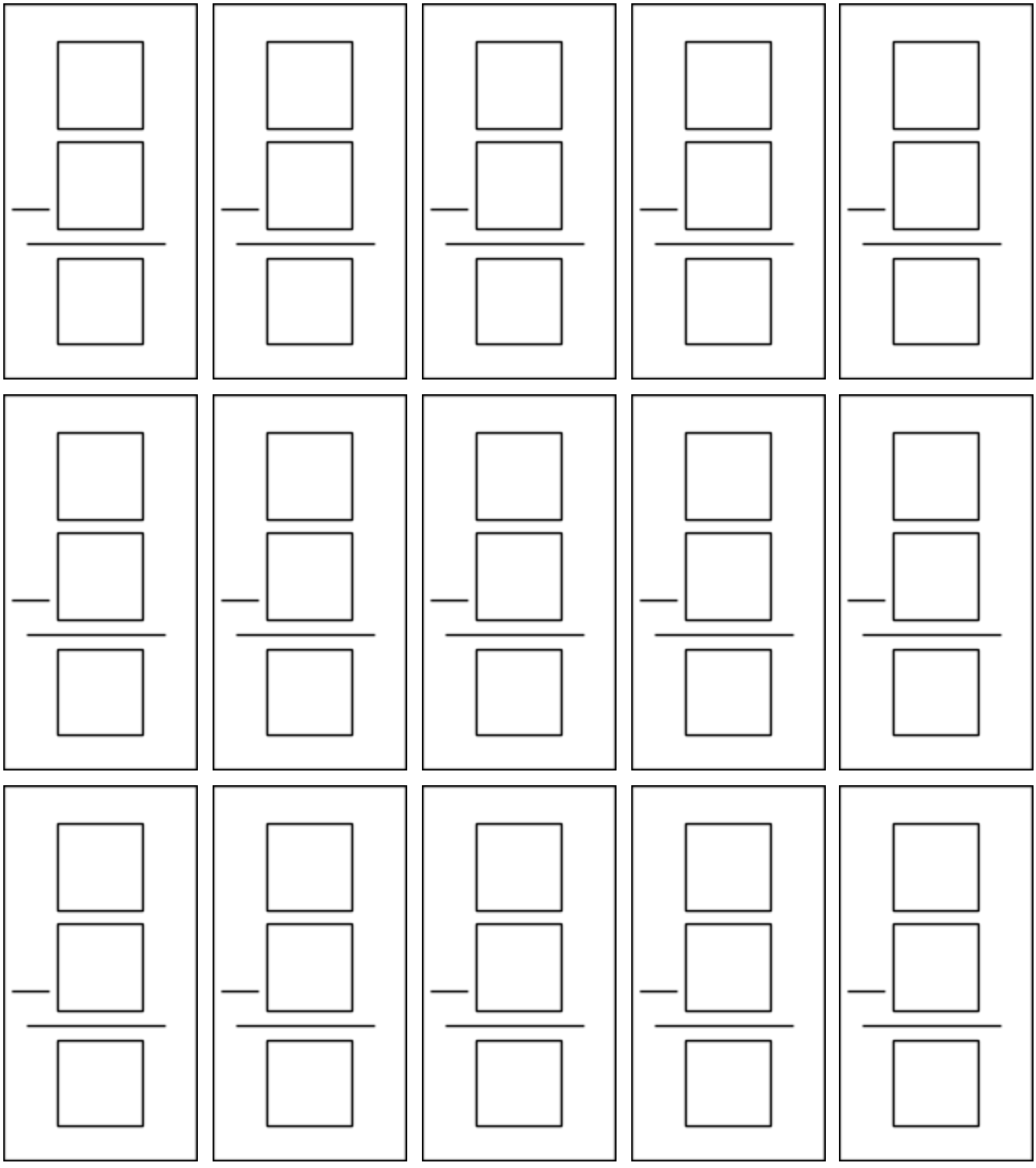
Roll-A-Fact (Addition)



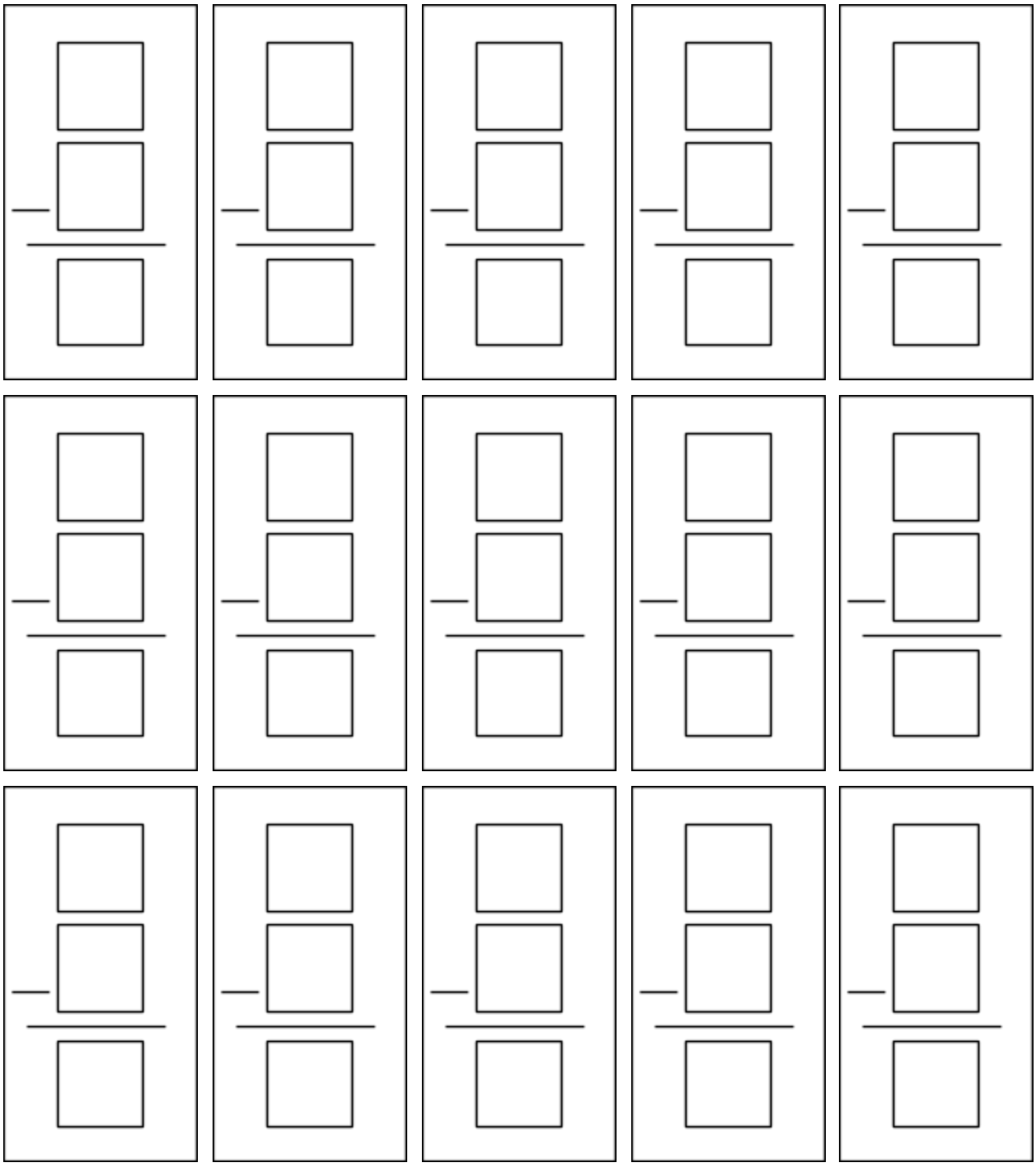
Roll-A-Fact (Subtraction)

Name _____

Roll the 2 dice and record the 2 numbers. Make sure the bigger number is on top! Find the answer. How many <u>different</u> combinations can you find?



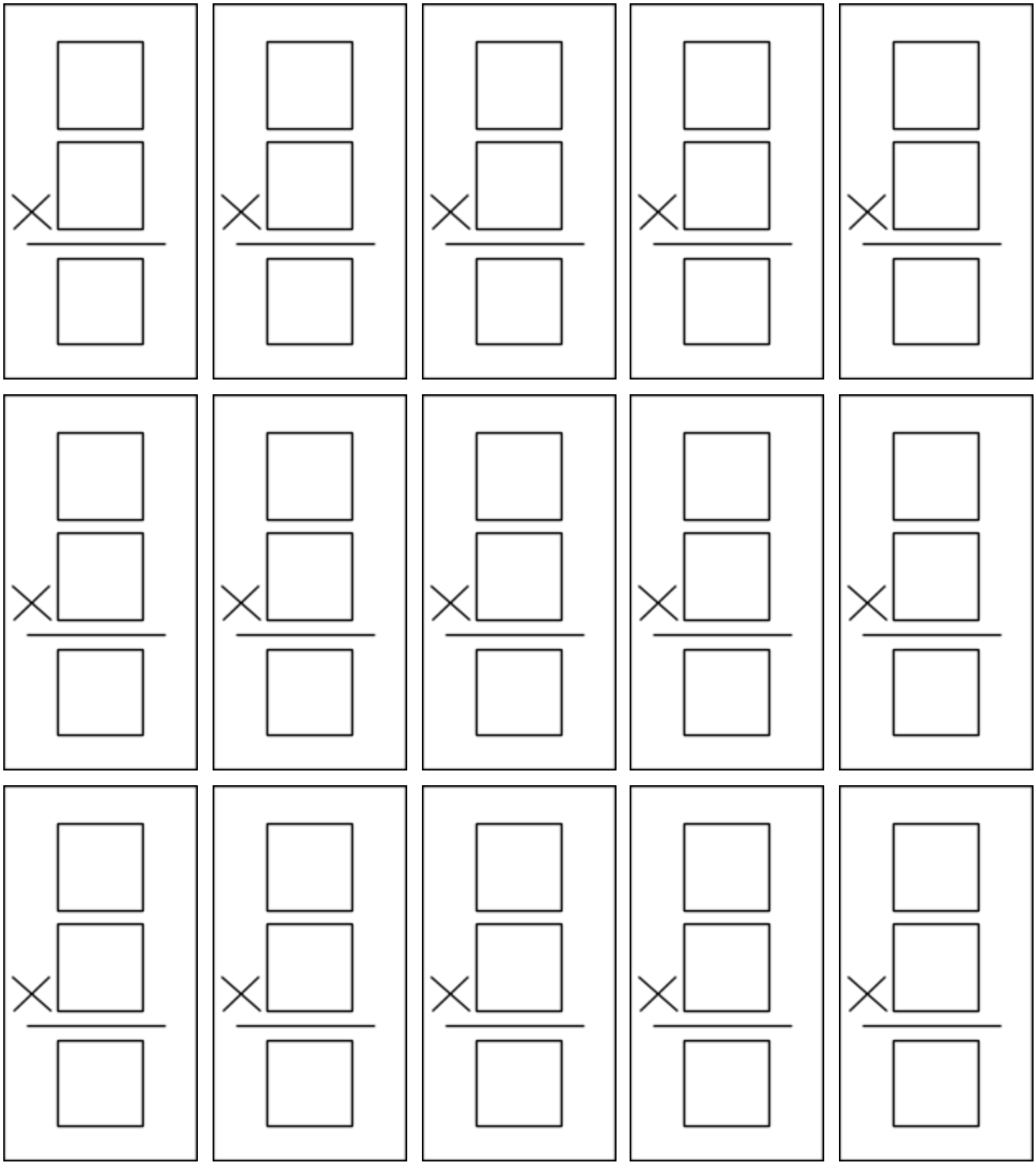
Roll-A-Fact (Subtraction)



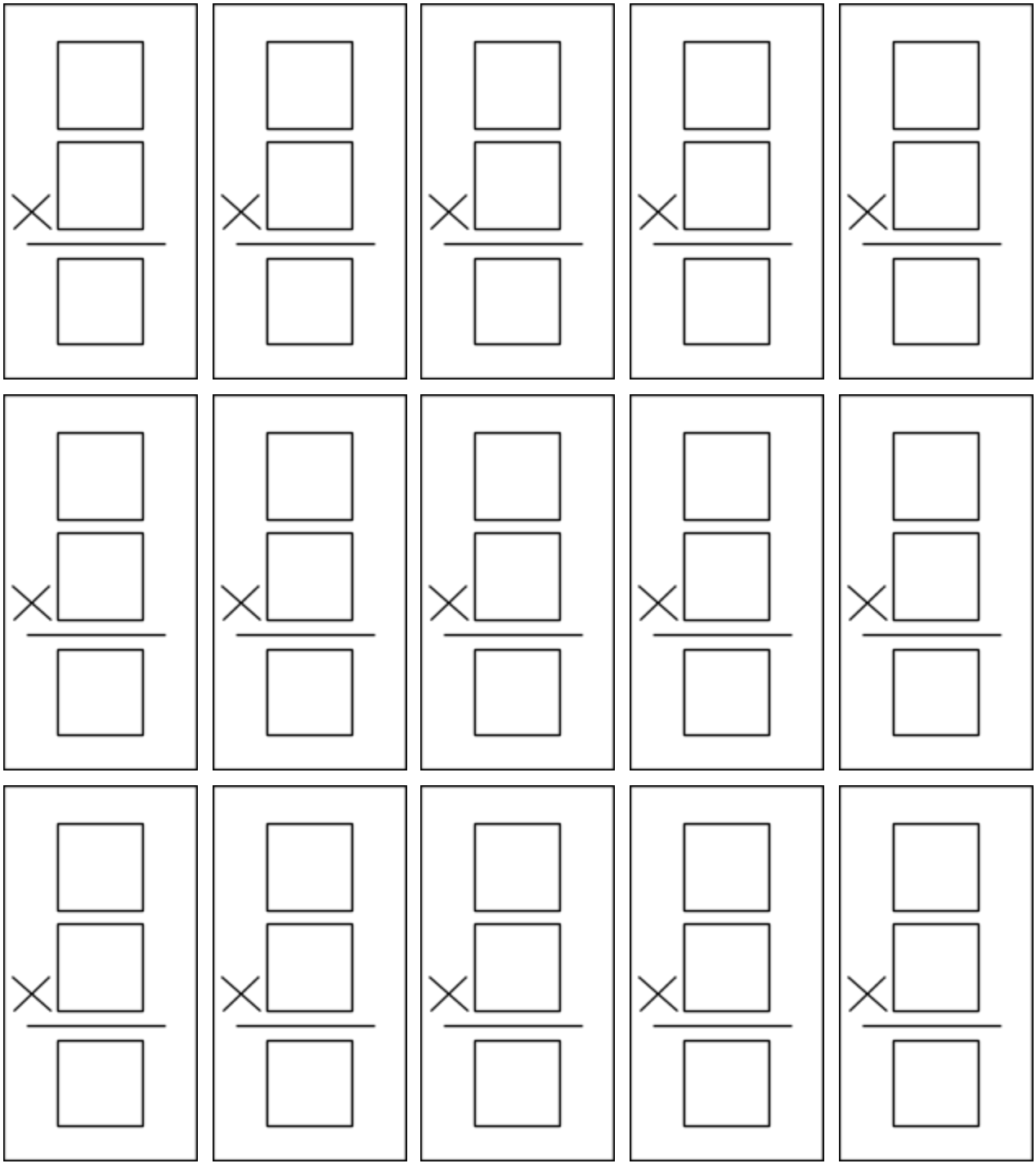
Roll-A-Fact (Multiplication)

Name _____

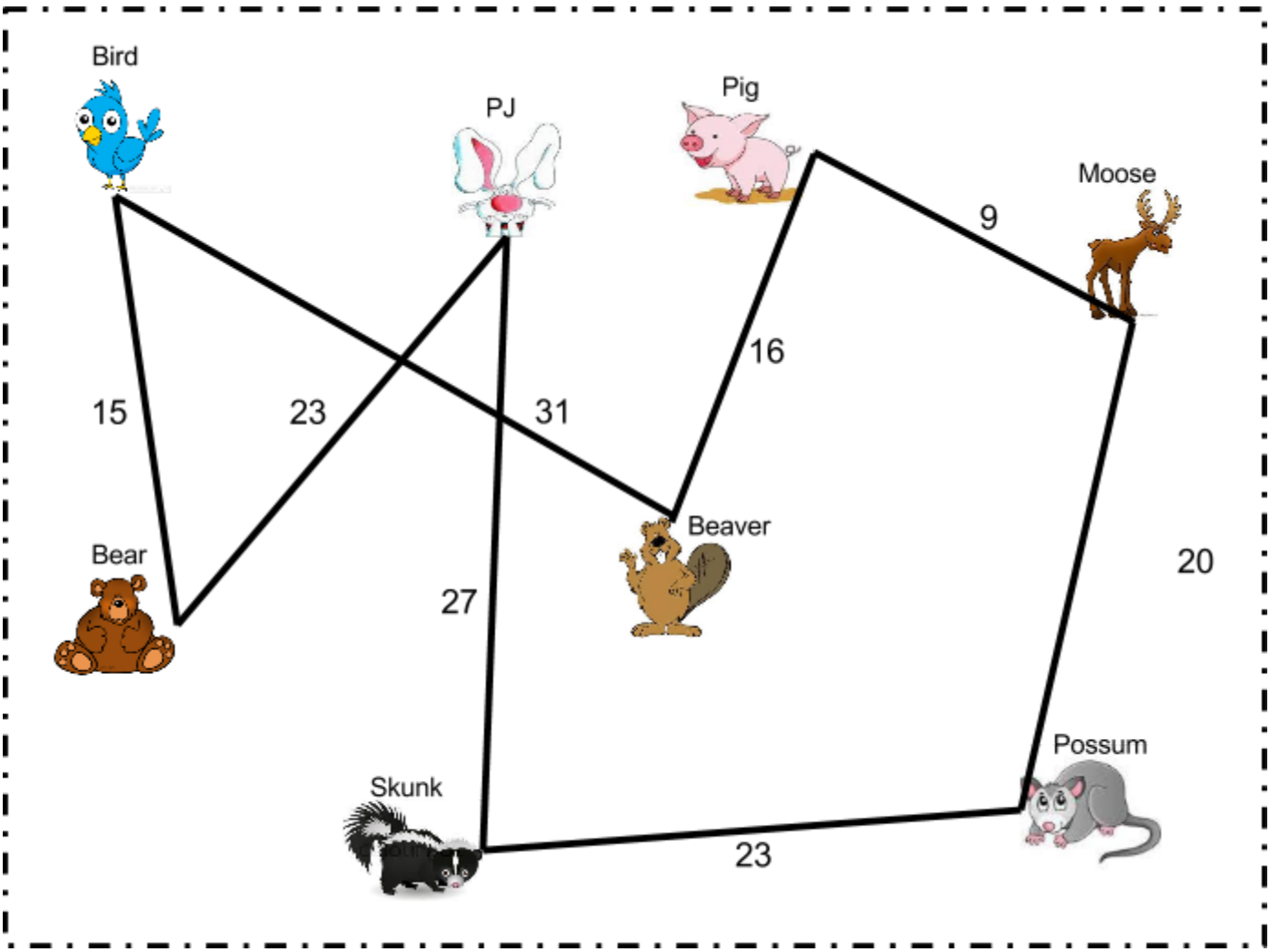
Roll the 2 dice and record the 2 numbers. Find the answer. How many <u>different</u> combinations can you find?



Roll-A-Fact (Multiplication)



PJ Funnybunny's Forest



PJ's Route

1. PJ's Home
2. Bear's Home
3. Bird's Home
4. Pig's Home
5. Moose's Home
6. Possum's Home
7. Skunk's Home
8. Back to his home

How far did PJ travel to visit all the other animal's homes?

Days 6-9 Rotations

MN State Standards
2.1.2.1, 2.1.2.2, 2.1.2.4, 2.1.2.5, 2.2.2.1, 2.2.2.2

Math Facts- Roll-A-Fact- This time try it with a different number sided dice or if you did addition last time, do subtraction this time.

At Your Seat- Have the students complete the number of heads and legs problem solving sheet. If there is time, complete the "Challenge" problem on the back of the sheet.

Teacher's Choice-
Launch- How many of you like dogs? How many of you like cats? What about both? We have used Venn diagrams in the past to compare and contrast characters in a story but today we are going to use it in math. As a small group fill in the dogs and cats Venn Diagram on the whiteboard. Discuss where those who only like dogs go, where those who only like cats go and where those who like both go. Discuss where those would go if they did not like either dogs or cats.

Explore- On small whiteboards have the students fill in the Venn Diagrams for the following scenarios. 1st address labeling the circles, then filling in the numbers.

1. 7 people only like chocolate ice cream, 10 people only like strawberry ice cream and 4 people like both. Check for understanding and address any mistakes.

2. 5 people like pepperoni pizza, 6 people like sausage pizza, 8 people like both and 2 people only like cheese. How many total people answered which was their favorite pizza? Check for understanding and address any mistakes.

3. 12 people told me what kind of cereal they liked. 3 said Lucky Charms, 5 said Fruit Loops and the rest said they liked both. How many liked both? Fill in the Venn Diagram and write a missing addend equation. Check for understanding and address any mistakes.

4. 20 people were asked what they wanted for lunch, pizza or hamburgers. 5 said they were ok with either one, 6 said hamburgers, 1 said they did not want either one and the rest said pizza. How many chose pizza? What is the equation?

Share- Tell your neighbor what number you got and how you figured it out. Are your answers the same? Did you both figure it out the same way?

Summarize- Venn Diagrams can be very helpful in reading when comparing characters in a story but they can also help us organize our information in math too.

Hands On- The last round of rotations you read about PJ Funnybunny and calculated how far he went on his journey. Today I want you to see if you can come up with a shorter path for him to follow and still go to all the animal's homes.

After day 9 share the results of the rotations.

Math Facts- How many combinations did you find? Compare the number found for 6-sided dice vs. 8-sided dice. Which had more? Why?

At Your Seat- Discuss the answers to the legs and heads problems. How did you figure them out?

Teacher's Choice- Discuss any additional observations made during small group time.

Hand's On- What did you find for PJ Funnybunny's new route? What was the shortest route? How did you figure it out?

Name _____

Some deer and ducks were near a pond. There were 14 legs and 5 heads. How many were deer and how many were ducks?

_____

_____

A family took their dogs for a walk. There were 6 heads and 18 legs. How many were dogs and how many were people?

_____

_____

My neighbors went to the park for a picnic. When they sat down they saw some spiders. There were 30 legs and 6 heads. How many spiders and people were there?

_____

_____

Challenge

5 Yahtzee dice were rolled. 19 dots were showing. Which numbers were rolled?

_____

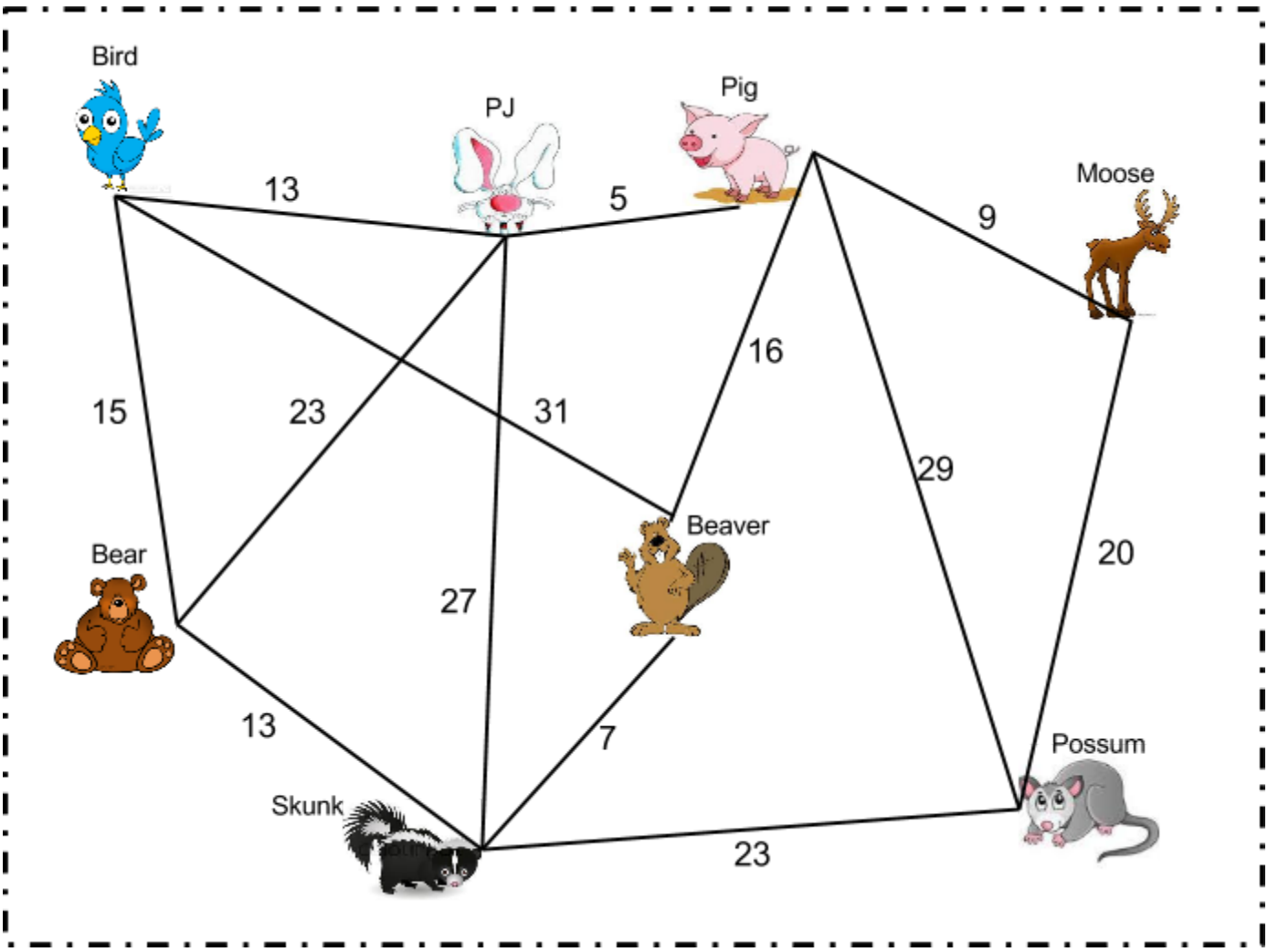
_____

Is there more than 1 combination of dice that will show 19 dots?

_____

If there are, what are they?

PJ Funnybunny's Forest



1. PJ's Home
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. Back to his house

How far did PJ go with this new route? _____

Day 10 Combinations of Beads- Whole Group

MN State Standards
2.1.2.4, 2.1.2.5, 2.3.3.2

Launch- Grace loves to make necklaces. Since she is so little I only give her 4 beads at a time. She likes lots of colors so I give her 1 red, 1 yellow, 1 blue, and 1 orange bead. How many different ways can she arrange these beads? Have students make an estimation and record for later.

Explore- Hand out the stacking rods, the 4 colored beads, and the recording sheet to each student. Have the students see how many DIFFERENT ways they can arrange the beads and color it in on the recording sheet. If the red beads cost 25¢, yellows cost 32¢, blues cost 19¢, and oranges cost 18¢ how much will the bracelets cost? Do they all cost the same amount? Why/why not? How much would it cost to make all the bracelets?

Share- Have you found them all? How did you go about doing this? Record on a class record sheet the combinations the students found. Emphasize trying to organize the list, all red first, all yellow first, etc. Compare the estimations from the beginning to the actual number found.

Summarize- Today we made some color combinations using beads. How do you feel about doing this? Show me a 5 if you totally get it and could do it again with different colors, a 3 if you are still working on it, and a 1 if you are needing some more help. Make note of who still needs help.

Bead Color Combinations

Name _____

1. Using red, yellow, blue and orange, color in the different bead color combinations you created. Make sure they are all different!

2. If 1 red bead costs 25¢, 1 yellow is 32¢, 1 blue is 19¢ and 1 orange is 18¢ how much would each necklace cost? _____

3. Which coins would you use to buy the 4 beads at the store? _____

4. What is another combination of coins you could use? _____

_____

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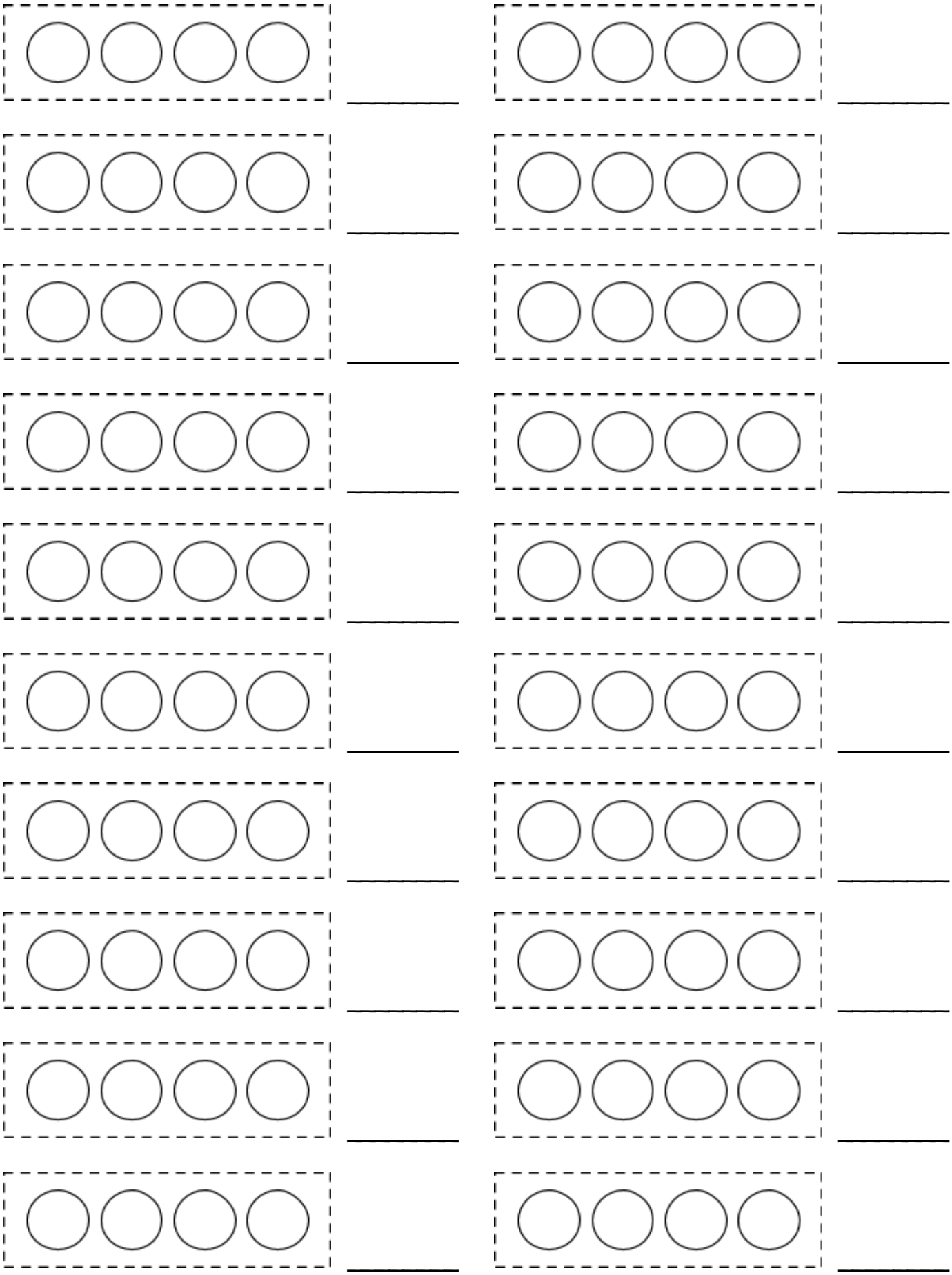


Days 11-14 Rotations

MN State Standards
2.1.2.1, 2.1.2.2, 2.1.2.4, 2.1.2.5, 2.2.2.1, 2.2.2.2

Math Facts- After reading the book "Rosie's Walk" by Pat Hutchins, find the distance Rosie took around the farmyard. Is that the shortest route? Try and find a route that is shorter.

At Your Seat- Last week in my group we worked with Venn diagrams. I have a few more practice problems for you to see what you remember. Make sure you write the equation along with the Venn Diagram.

Teacher's Choice- Pizza Toppings
Launch-I want to start a pizza restaurant and I need to make a menu. My topping choices are pepperoni, canadian bacon, pineapple, mushrooms and black olives. What are the options for 3-topping pizzas that I have? (assume cheese is always a topping)

Explore- Hand out the pizza topping manipulatives for the students to begin creating pizzas, recording what they have found as they go.

Share- After a few minutes of recording on their own have them share and compile a group list of the pizza toppings created emphasizing trying to organize them into an order (all pepperoni listed first, etc).

Summarize- Do you think these are all the 3-topping combinations possible? Why/Why not? I will keep your list and we will compare it to the other teams lists during this round of rotations.

Hands On- The creators of Angry Birds is working on a new level. They need your help figuring out the order to launch the birds. The level needs to have 4 birds launched. You need to use Red, Yellow, and Bomb. They all need to be used at least 1 time, (1 you will use twice). You must start with either Red or Yellow. Your job is to find the different order combinations they can use.

After day 14 share the results of the rotations.

Math Facts- What route did you find that was better? Why did you say that route was better? Does anyone else find a different route that was better? Why?

At Your Seat- Discuss the answers to the Venn Diagrams problems. How did you find an answer? Did anyone do it differently?

Teacher's Choice- Discuss any additional observations made during small group time.

Hand's On- How many different combinations for the Angry Bird launcher did you find? What were they?

Rosie's Farm

Rosie always follows the same path around the farm. She starts at the henhouse, goes across the yard, around the pond, over a haystack, past the mill, through the fence, under the beehives, and back to the henhouse. Is that the best route for her to take? Is there a better route?

Best Route- **henhouse**, _____, _____,

_____, _____, _____,

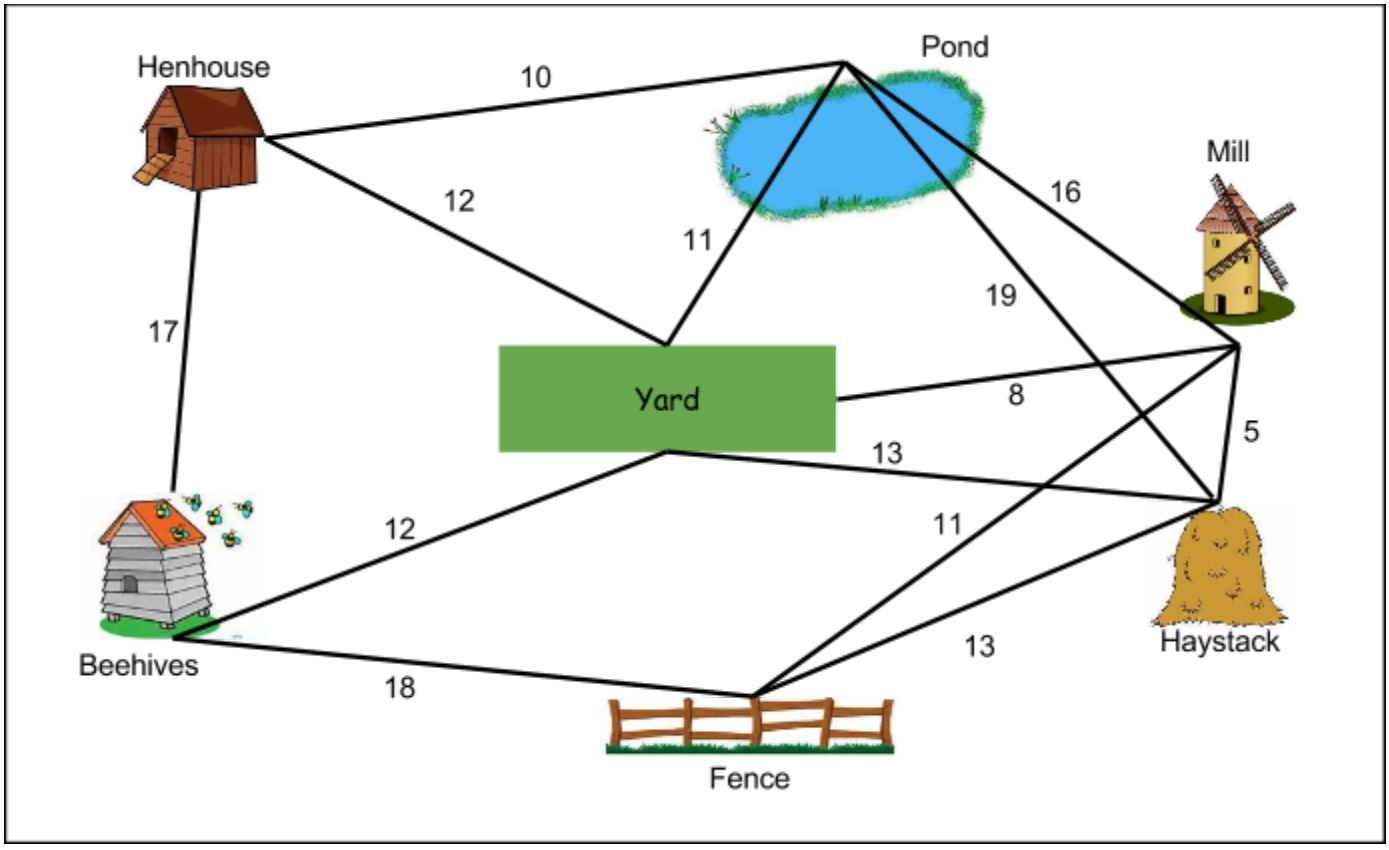
_____, **henhouse**

Why? _____

_____

_____

_____

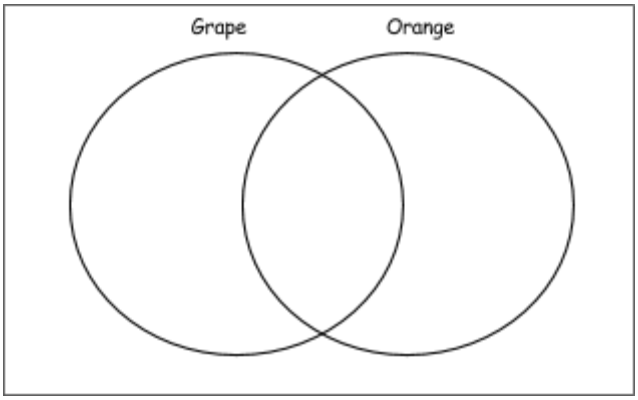


Venn Diagrams

Name _____

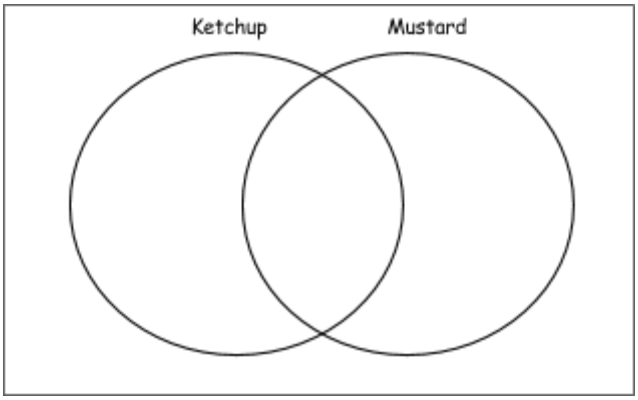
1. Aaron asked 15 people what kind of pop they like. 8 people like grape, 4 people like both. How many like orange?

What is the equation?



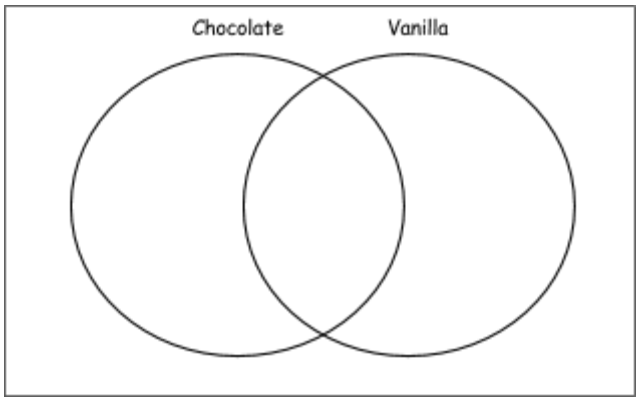
2. Sarah found 12 people who like just ketchup on their hot dogs, 9 who like just mustard, and 25 who like both. How many people did she talk to?

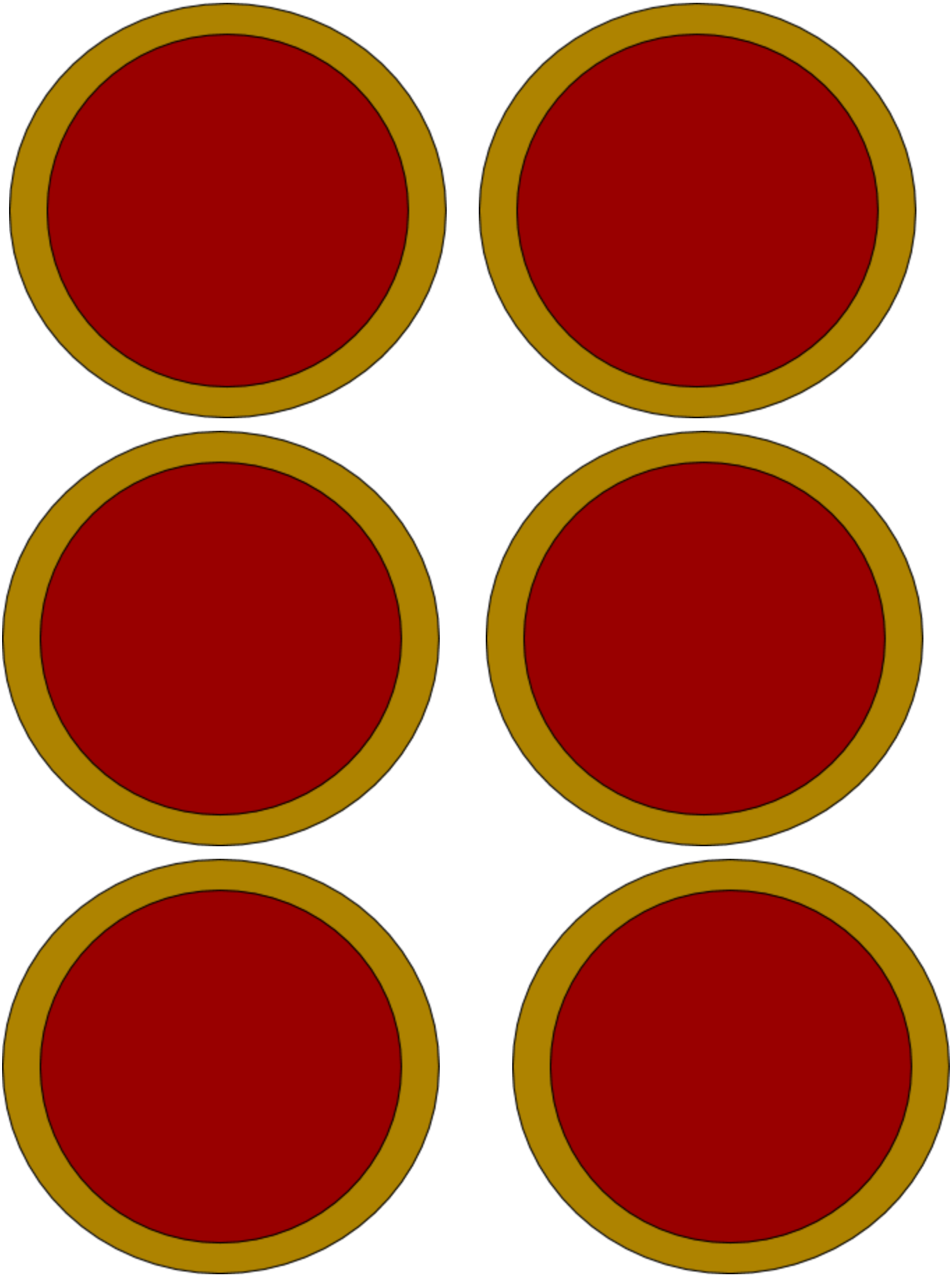
What is the equation?

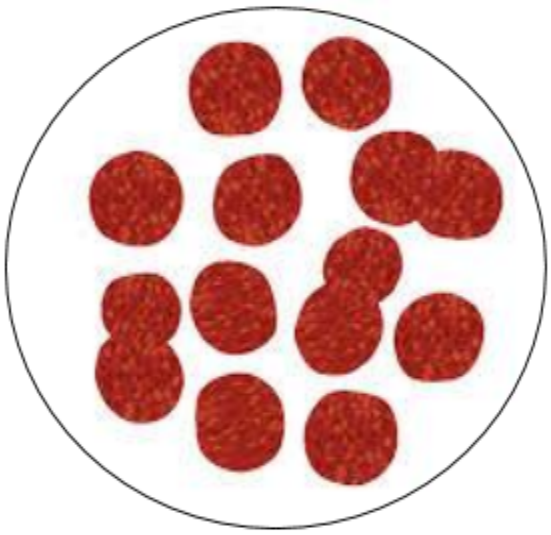


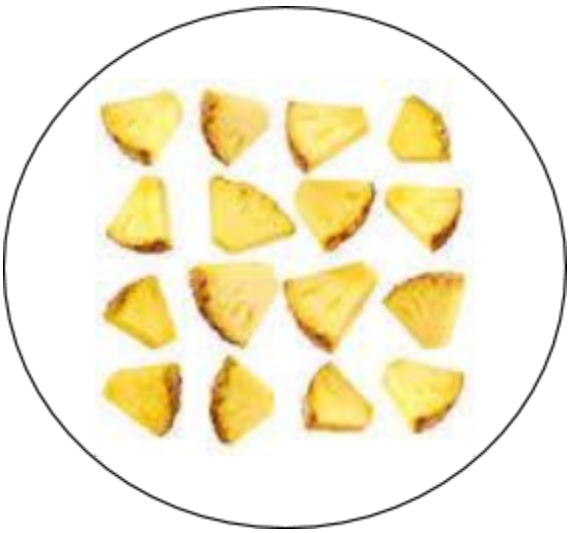
3. The owner of the Cool Cone's Ice Cream Shop kept track of the ice cream sold for one hour. She found that 15 people bought chocolate ice cream, 23 people bought vanilla, and 29 people bought mint chocolate chip. How many people bought ice ice cream?

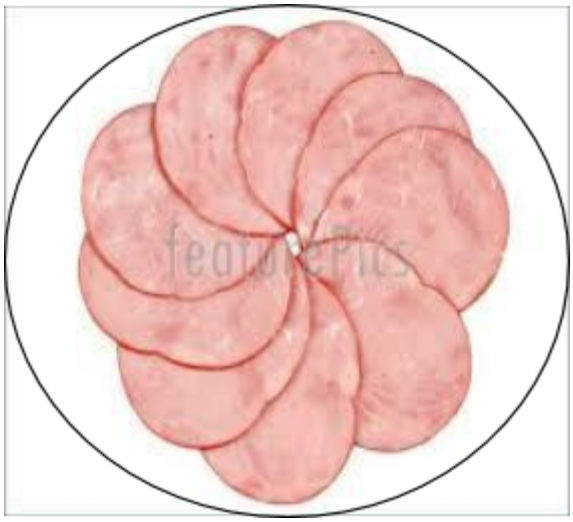
What is the equation?











Name _____

The creators of Angry Birds is working on a new level. They need your help figuring out the order to launch the birds! The new level needs to have 4 birds launched. You can only use Red, Yellow, and Bomb. They all need to be used at least 1 time, (1 you will use twice). You must start with either Red or Yellow. Your job is to find the different order combinations they can use.

1. _____, _____, _____, _____
2. _____, _____, _____, _____
3. _____, _____, _____, _____
4. _____, _____, _____, _____
5. _____, _____, _____, _____
6. _____, _____, _____, _____
7. _____, _____, _____, _____
8. _____, _____, _____, _____
9. _____, _____, _____, _____
10. _____, _____, _____, _____
11. _____, _____, _____, _____
12. _____, _____, _____, _____
13. _____, _____, _____, _____
14. _____, _____, _____, _____
15. _____, _____, _____, _____
16. _____, _____, _____, _____
17. _____, _____, _____, _____
18. _____, _____, _____, _____

Day 15 Snack Mix Combinations (Post Test)

MN State Standards
2.1.2.1, 2.1.2.2, 2.1.2.4, 2.1.2.5, 2.1.2.6, 2.2.2.1, 2.2.2.2

Launch- We are going to a party next weekend and I am in charge of bringing a snack mix to share. I would like to include; Cheerios, M&M's, raisins, sunflower seeds, and marshmallows but I was told I can only have 3 items in my mix. What should I do?

Explore-What combinations CAN I make? Record as a class. After several activities actually moving around manipulatives assess whether or not the students can do it without a picture in front of them if they are still struggling give out the snack mix pieces.

Share- Have the class vote on which combination I should make for the party. Then create a class graph with the combinations and vote totals. Discuss which combination had the most and how much more that combination had than others. (If it is too many choices say… "My mom just called and she said NO MARSHMALLOWS!" to eliminate a few choices.)

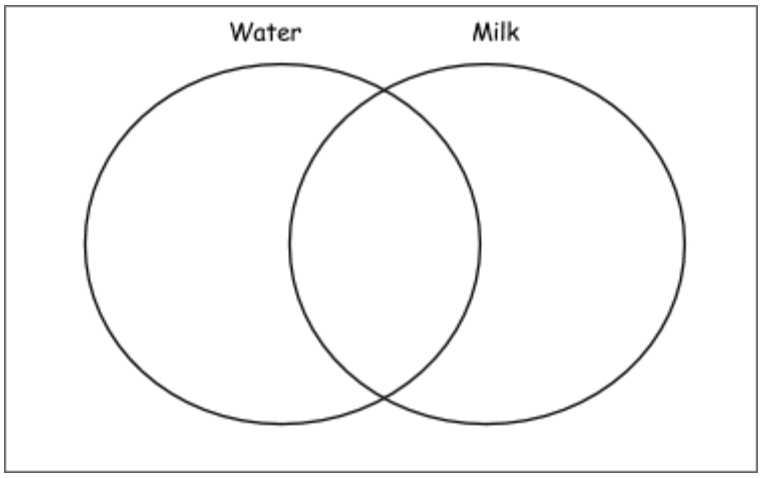
Summarize- Over the past couple of weeks we have been looking at some problems to get our brains moving. We have made some Venn Diagrams, found all the different combinations of different things, and looked at what the best path for PJ and Rosie to take. Now I want to see how much your brain is moving with these problems. Administer the post-test. Then make the snack mix and enjoy!

Problem Solving Pretest

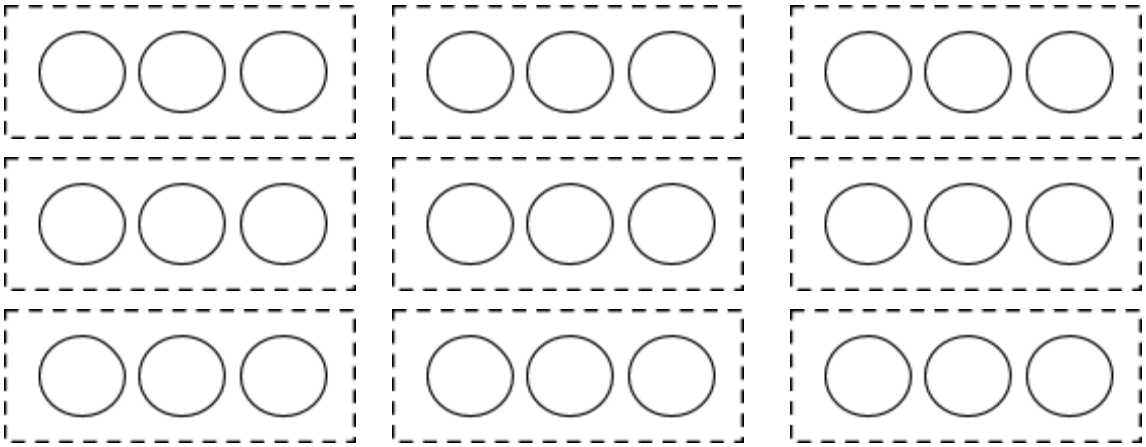
Name _____

1. Jan talked to 20 people. 8 people drank a glass of water at lunch, 6 people drank milk and the rest had both. How many had both? _____

Fill in the Venn Diagram and solve the equation.

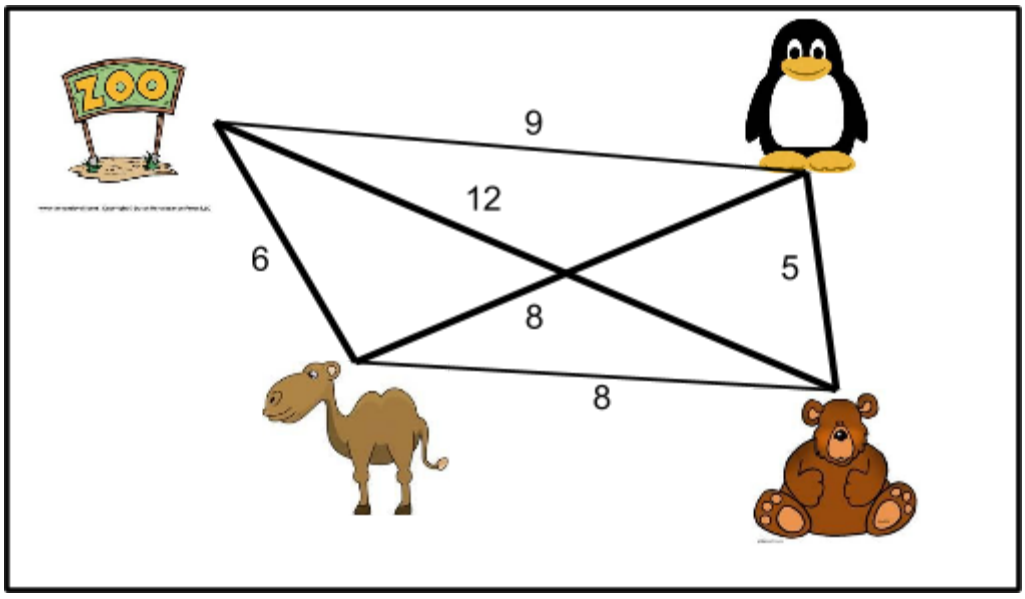


2. I gave Mike 3 beads; 1 red, 1 blue, and 1 yellow. He wants to make a necklace for his sister. What are all the color combinations he can make with his 3 beads?



3. There are some dogs and some kids at a park. There are 14 legs and 5 heads. How many dogs are there? _____ How many kids are there? _____

4. Sam took his sister to the zoo. They saw the bears 1st, the penguins 2nd, the camels 3rd and then they left the zoo. How far did they travel?



Is there a shorter route? _____

What is the distance traveled with the new route? _____

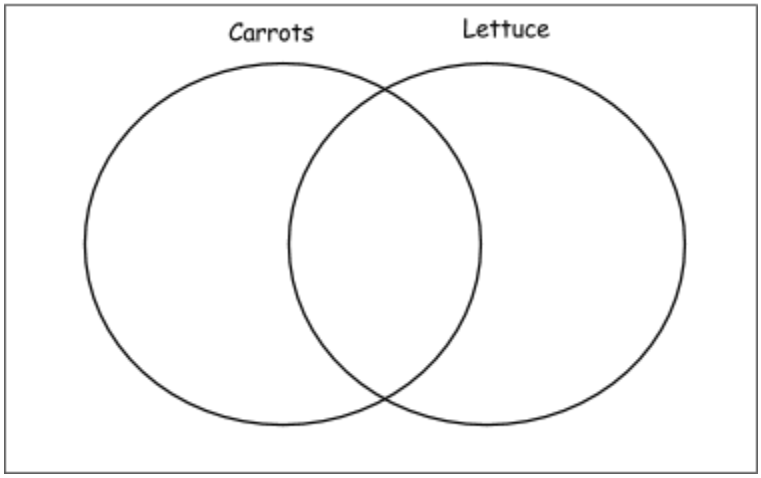
Show your work.

Problem Solving Posttest

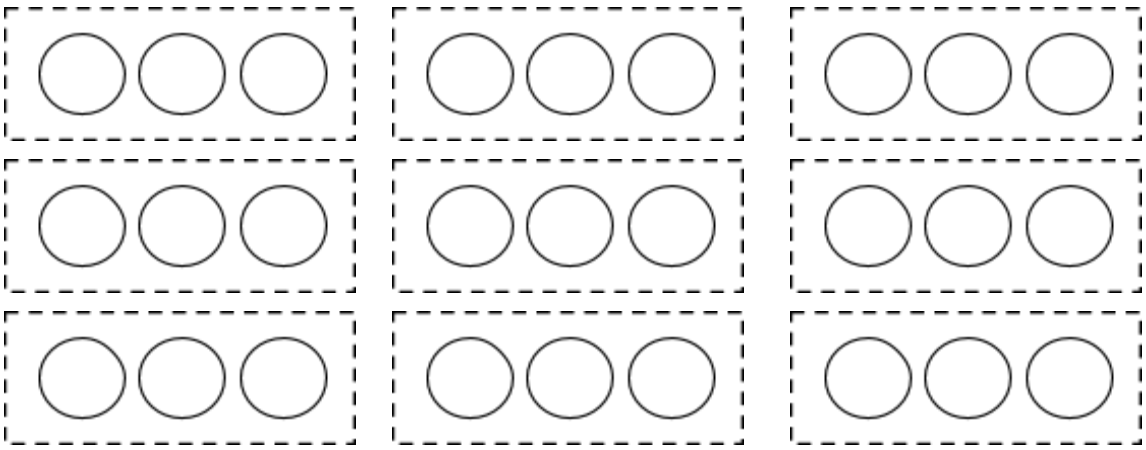
Name _____

1. Jan talked to 16 people. 4 people ate only carrots at lunch, 6 people ate only lettuce and the rest had both. How many had both? _____

Fill in the Venn Diagram and solve the equation.

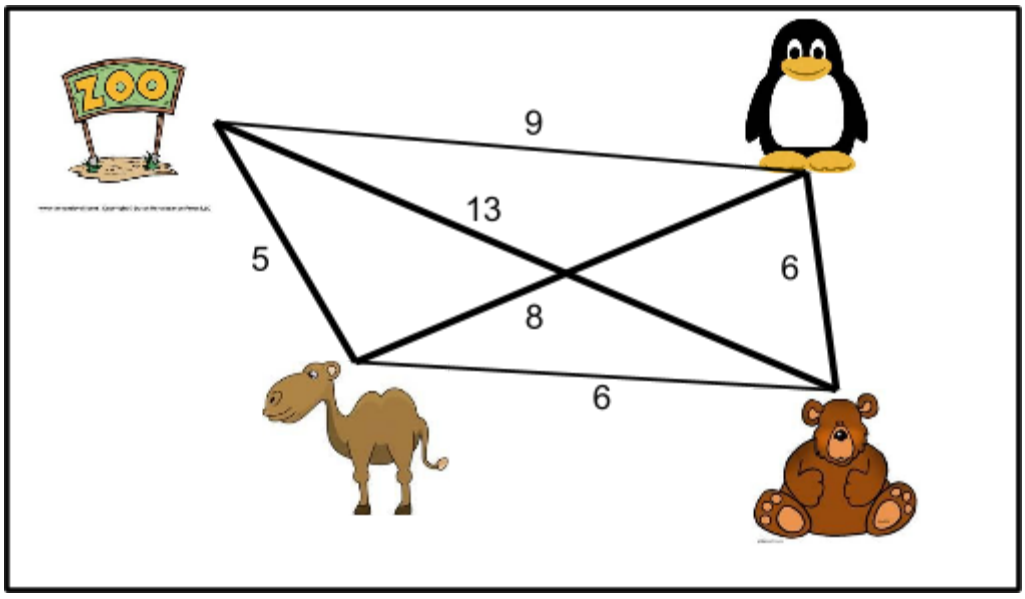


2. I gave Sarah 3 beads; 1 orange, 1 blue, and 1 green. She wants to make a bracelet for her friend. What are all the color combinations she can make with her 3 beads?



3. There are some cats and some people at a park. There are 16 legs and 5 heads. How many dogs are there? _____ How many people are there? _____

4. John went to the zoo. He saw the camels 1st, the penguins 2nd, the bears 3rd and then he left the zoo. How far did he travel?



Is there a shorter route? _____

What is the distance traveled with the new route? _____

Show your work.

Name _____

Some deer and ducks were near a pond. There were 6 legs and 2 heads. How many were deer and how many were ducks?

_____

_____

A family took their dogs for a walk. There were 4 heads and 12 legs. How many were dogs and how many were people?

_____

_____

My neighbors went to the park for a picnic. When they sat down they saw some spiders. There were 22 legs and 5 heads. How many spiders and people were there?

_____

_____

Challenge

5 Yahtzee dice were rolled. 19 dots were showing. Which numbers were rolled?

_____

_____

Is there more than 1 combination of dice that will show 19 dots?

_____

If there are, what are they?

Name _____

Some deer and ducks were near a pond. There were 26 legs and 9 heads. How many were deer and how many were ducks?

_____

_____

A family took their dogs for a walk. There were 10 heads and 30 legs. How many were dogs and how many were people?

_____

_____

My neighbors went to the park for a picnic. When they sat down they saw some spiders. There were 52 legs and 11 heads. How many spiders and people were there?

_____

_____

5 Yahtzee dice were rolled. 19 dots were showing. Which numbers were rolled?

_____

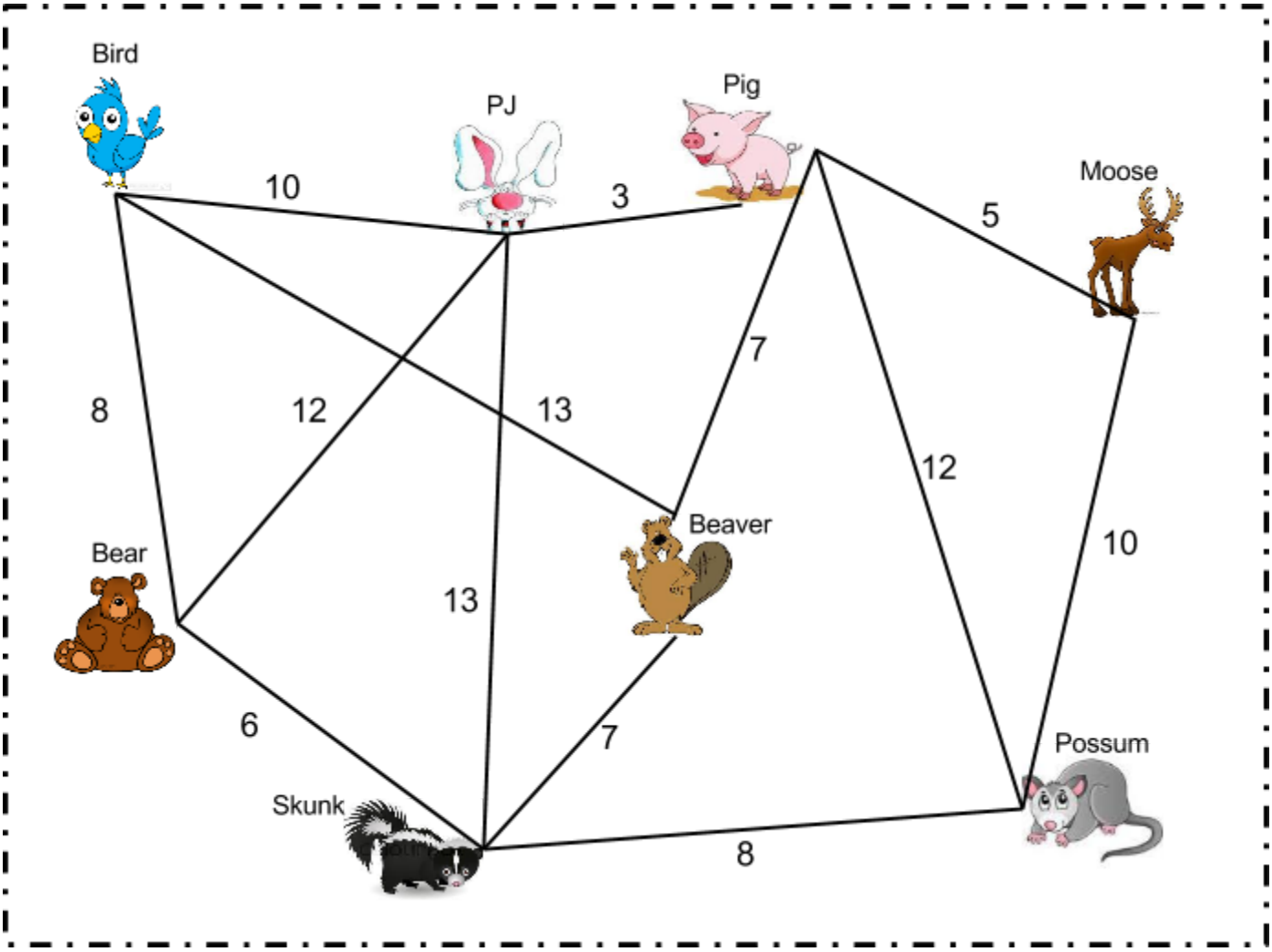
_____

Is there more than 1 combination of dice that will show 19 dots?

_____

If there are, what are they?

PJ Funnybunny's Forest



9. PJ's Home

10. _____

11. _____

12. _____

13. _____

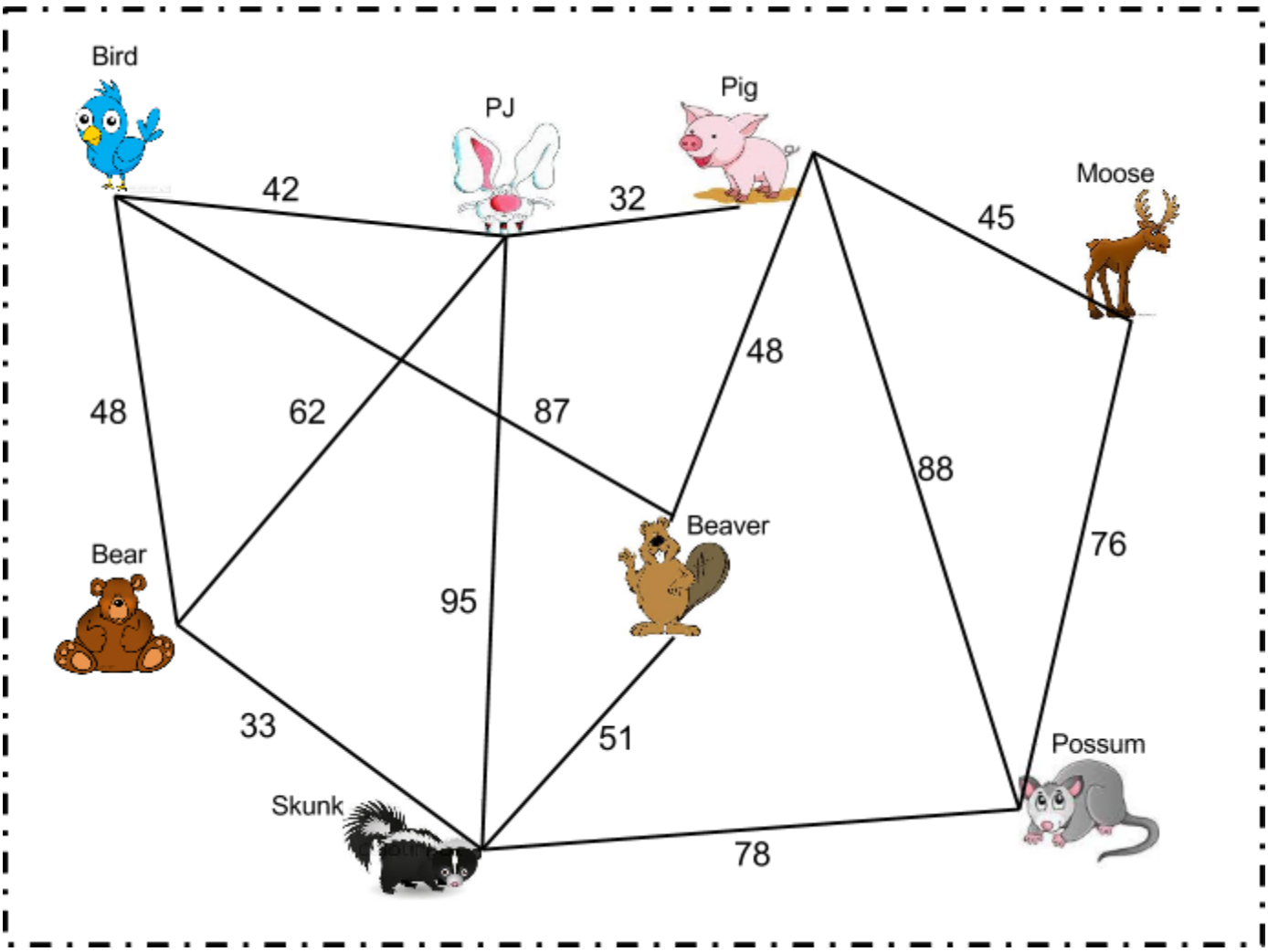
14. _____

15. _____

16. Back to his house

How far did PJ go with this new route? _____

PJ Funnybunny's Forest



17. PJ's Home

18. _____

19. _____

20. _____

21. _____

22. _____

23. _____

24. Back to his house

How far did PJ go with this new route? _____

Bead Color Combinations

Name _____

1. Using red, yellow, blue and orange, color in the different bead color combinations you created. Make sure they are all different!

2. If 1 red bead costs 5¢, 1 yellow 8¢, 1 blue 12¢ and 1 orange 8¢ how much would each necklace cost? _____

3. Which coins would you use to buy the 4 beads at the store? _____

4. What is another combination of coins you could use? _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Bead Color Combinations

Name _____

1. Using red, yellow, blue and orange, color in the different bead color combinations you created. Make sure they are all different!

2. A pack of red beads costs $2.76, yellow costs $1.92, blue costs $2.99 and orange costs $2.07. Each pack has 10 beads.

How many packs would I need to buy to make all the different bracelets possible? _____

How much would it cost to buy all the packs needed? _____

If I paid with a $50 bill how much change would I get back? _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Rosie's Farm

Rosie always follows the same path around the farm. She starts at the henhouse, goes across the yard, around the pond, over a haystack, past the mill, through the fence, under the beehives, and back to the henhouse. Is that the best route for her to take? Is there a better route?

Best Route- **henhouse**, _____, _____,

_____, _____, _____,

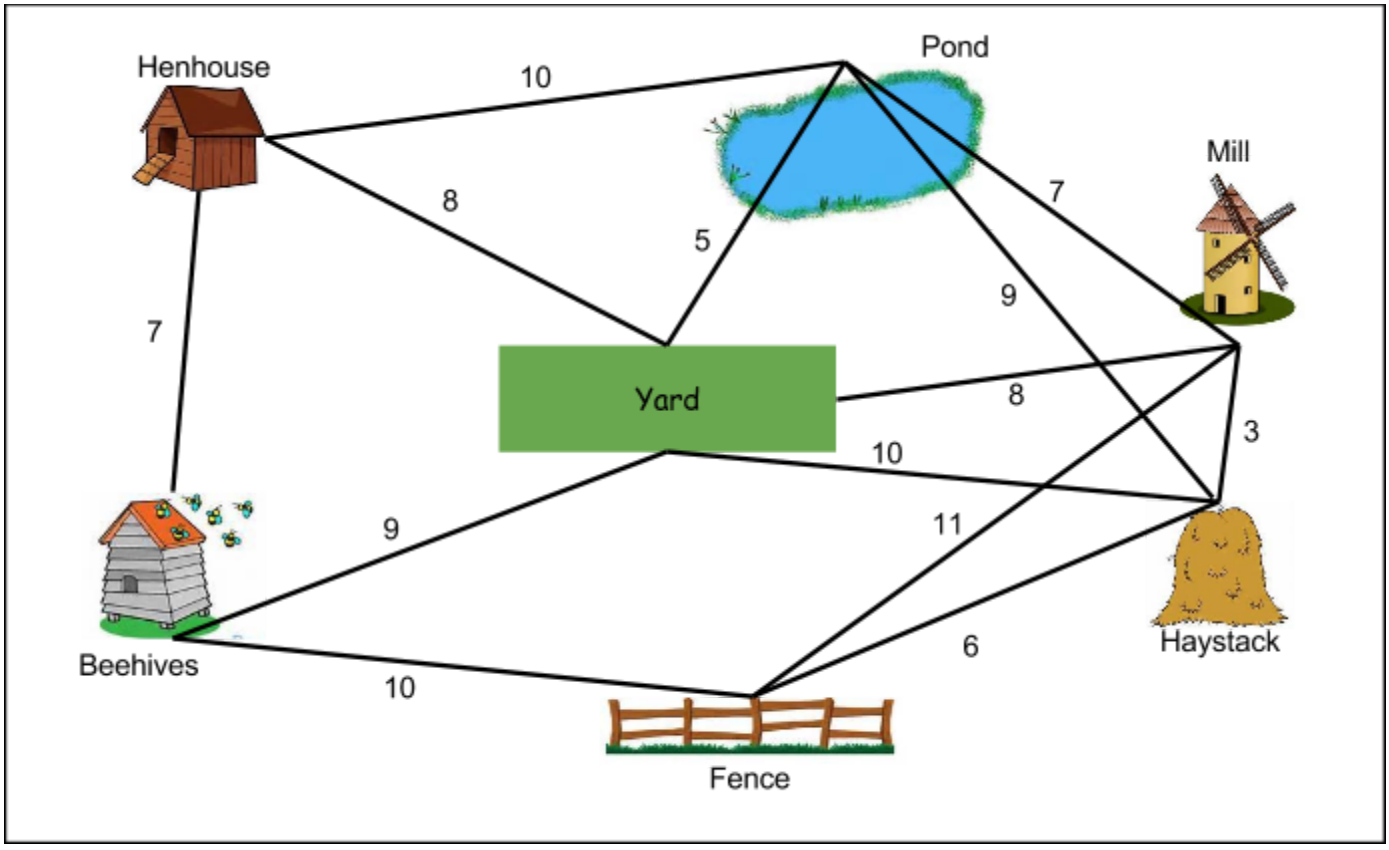
_____, **henhouse**

Why? _____

_____

_____

_____



Rosie's Farm

Rosie always follows the same path around the farm. She starts at the henhouse, goes across the yard, around the pond, over a haystack, past the mill, through the fence, under the beehives, and back to the henhouse. Is that the best route for her to take? Is there a better route?

Best Route- **henhouse**, _____, _____,

_____, _____, _____,

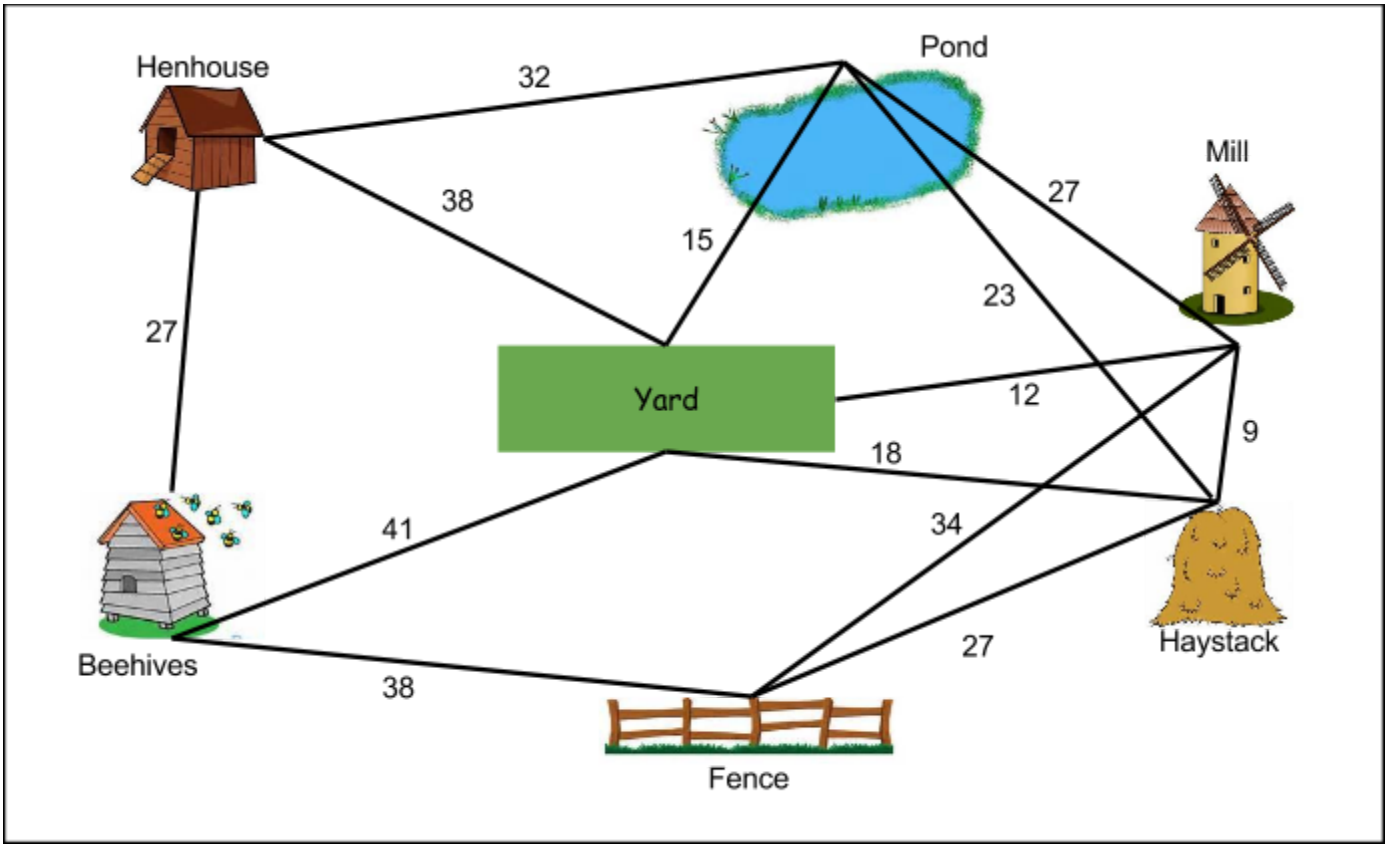
_____, **henhouse**

Why? _____

_____

_____

_____

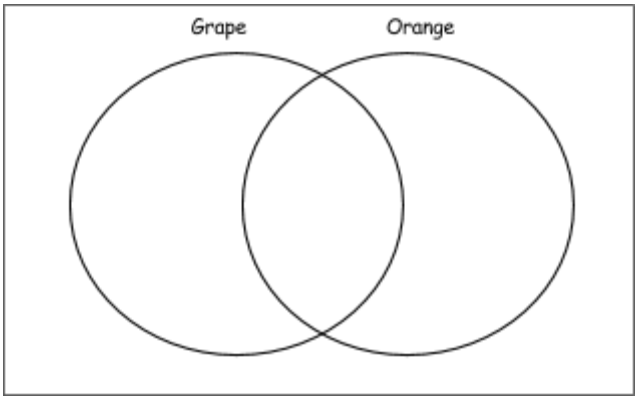


Venn Diagrams

Name _____

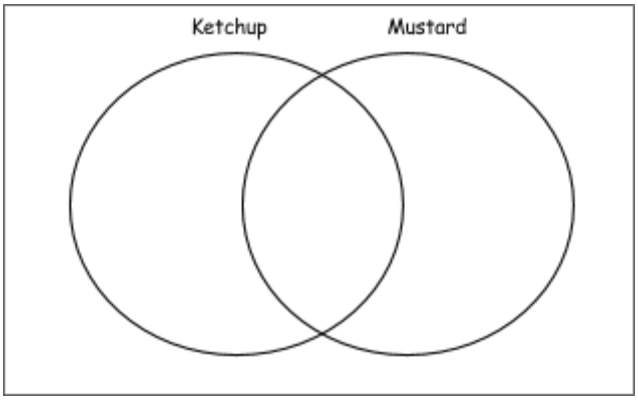
2. Aaron asked 8 people what kind of pop they like. 3 people like grape, 2 people like both. How many like orange?

What is the equation?



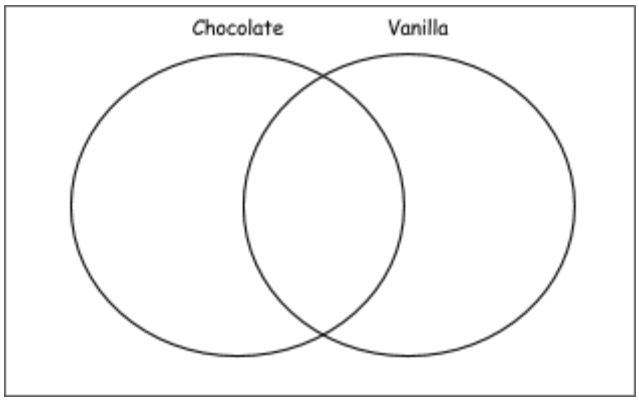
2. Sarah found 10 people who like just ketchup on their hot dogs, 9 who like just Mustard, and 8 who like both. How many people did she talk to?

What is the equation?



3. The owner of the Cool Cone's Ice Cream Shop kept track of the ice cream sold for one hour. She found that 12 people bought chocolate ice cream, 8 people bought Vanilla, and 9 people bought mint chocolate chip. How many people bought ice ice cream?

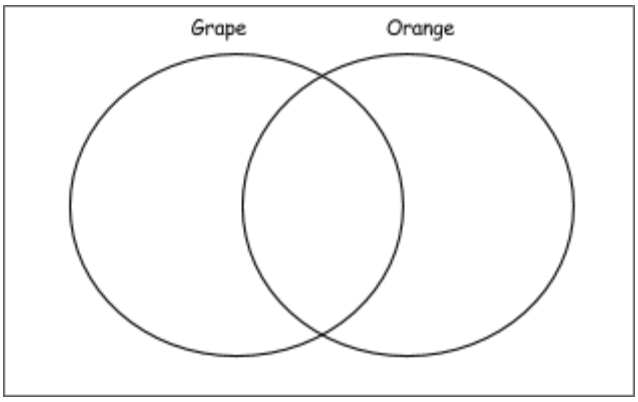
What is the equation?



Venn Diagrams

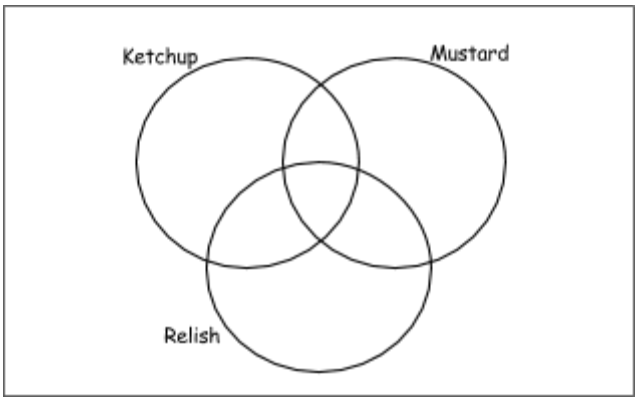
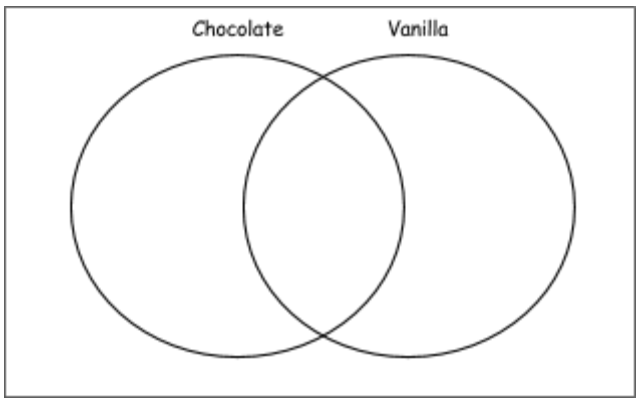
Name _____

3. Aaron asked 47 people what kind of pop they like. 15 people like grape, 22 people like both. How many like orange?
   What is the equation?



2. Sarah found 12 people who like just ketchup on their hot dogs, 9 who like just mustard, 4 who like just relish, 20 who like all three and 7 who like just ketchup and mustard. How many people did she talk to?

What is the equation?



3. The owner of the Cool Cone's Ice Cream Shop kept track of the ice cream sold for one hour. She found that 15 people bought chocolate ice cream, 23 people bought Vanilla, and 29 people bought mint chocolate chip. How many people bought ice ice cream?
   What is the equation?