THE UNIVERSITY OF BRITISH COLUMBIA
Faculty of Education
Department of Curriculum & Pedagogy

For Curious and Inquiring Minds .....


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Virtual Family Math Fair

Saturday Feb 11, 2023, 10:00am - 11:30am PT

Resource Guide

Edited and Compiled by:

Dahlia Benedikt, Shannan Downey, & Shawn Feener

Virtual through Zoom with
BC Faculty of Education Graduate Students and Teacher Candidates

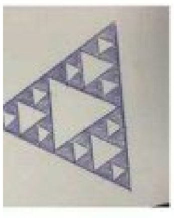





Photo credits above: *Janice Novakowski*

Land Acknowledgment

We would like to acknowledge the traditional and ancestral territories of the Indigenous peoples who have lived and continue to live on this land. We honour their elders, past and present, and express our gratitude for their stewardship of this land. The Virtual Family Math fair was hosted by the University of British Columbia, which occupies the traditional, ancestral, and unceded territory of the Coast Salish Peoples, including the territories of the xʷməθkʷəỷ əm (Musqueam), Skwxwú7mesh (Squamish), and the Stó:lō and Səl̓ ílwətaʔ/Selilwitulh (Tsleil- Waututh) Nations.

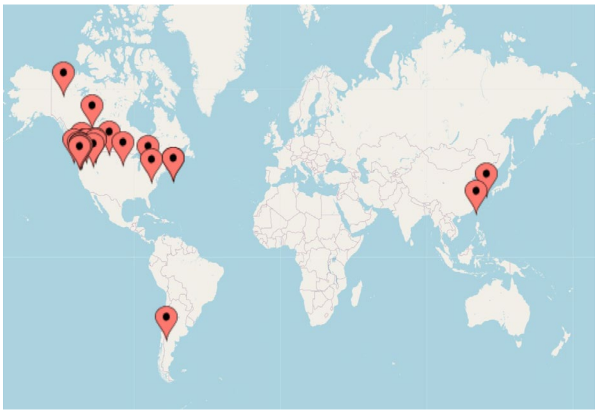
The purpose behind the Virtual Family Math Fair was to share knowledge, build community, and increase familial bonds through the lens of mathematics. In recognizing the contributions of Indigenous peoples to the field of mathematics, we understand that knowledge is not something that can be owned, but instead shared and built upon. Indigenous peoples have long understood the importance of sharing knowledge and building community.

As we continue to learn from Indigenous peoples, we recognize the importance of respecting their knowledge and understanding. We commit to honouring their contributions by building relationships with Indigenous communities, listening to their stories, and learning from their traditions.

Locations and Maps

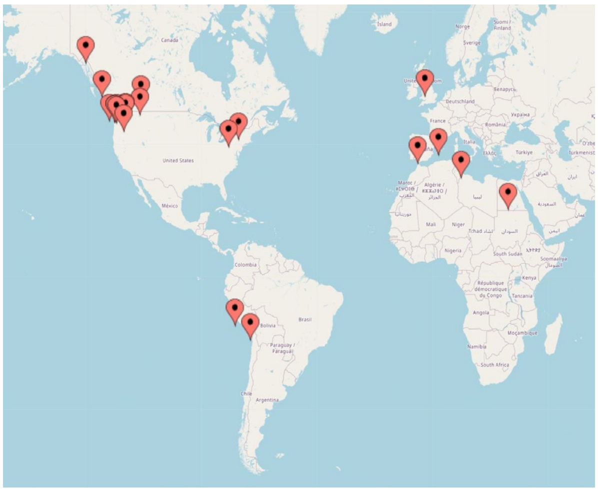
Although the event was hosted by the University of British Columia, our presenters and families came together from all over the globe, bringing with them different cultures, customs, languages, and ways of knowing.

Presenters



Canada: Victoria, North Vancouver, Vancouver, New Westminster, Burnaby, Langley, Burrey, Sooke, Alert Bay, Powell River, Quesnel, Salmon Arm, Fernie, Okotoks, Calgary, Prince Albert, Winnipeg, Toronto, Timmins, Yarmouth, Cedar Lake, Inuvik, Hay River.
International: Hangzhou, China; Incheon South Korea; Santiago, Chile.

Participants



Canada: Victoria, North Vancouver, Vancouver, New Westminster, Burnaby, Langley, Roberts Creek, Sechelt, Squamish, Summerland, Kelowna, Terrace, Calgary, Edmonton, Ottawa, Toronto, Whitehorse.

International: Barcelona, Spain; Egypt; Lima, Perú; Moquegua, Perú; Riadh, Tunisia; Trujillo, La Libertad - Perú; United Kingdom; United States.

Introduction

The University of British Columbia's graduate cohort in mathematics education held our third Virtual Family Math Fair on a Saturday morning in February 2023. This event grew as an opportunity to engage in mathematical play as a community and to show math's potential to bring people together. Graduate students invited families, children and youth to attend sessions they facilitated along with faculty, other graduate students, and teacher education candidates through Zoom.

280 families, with more than 570 family members from across Canada and around the world, registered and participated in the event. Seventeen activities over three concurrent sessions engaged children from early years to teen years and their families to explore the beauty and wonder of mathematics.

Sessions included: origami, paper weaving, making Mobius strips, making animals with shapes, exploring circles, puzzles, logic games, number card games, dice games, Japanese multiplication, number Jeopardy, exploring the Anishinaabe Turtle calendar, the Mi'kmaw game of Waltes, and more!

This document is a collection of the activities offered at this Virtual Family Math Fair. Please browse through these pages to discover enriched mathematics activities for families and educational settings. We hope this document inspires you and your family to explore the possibilities mathematics offers in bringing us together. We hope you have hours of fun learning about math by choosing, using and adapting activities included in this document.

Table of Contents

"And math play builds the ability to change perspectives, to see a problem from many viewpoints, as well as on openness of spirit that contributes to community - when you share in the struggle and the delight of working on a problem with other human beings, you begin to see them differently."

-Francis Su

Hidden Numbers and Counting Objects

Presenters: Sukhwinder kaur and Kelly Davila

Grade Range	Content Area	Materials
Pre K - Kindergarten	• Number Sense	• Counters (e.g., seeds, beads, gems, etc.) • Splat (or something to cover the counters) • Any objects to count • Picture Books (suggested)

Instructions

Hidden Numbers

1. Display a set of counters (e.g., seeds, beads, gems, etc.) and ask the following questions:
    a. What do you see?
    b. How many counters do you see?
2. Cover some of the counters with a splat (see the end of the document) and ask the following questions:
    a. How many counters are under the splat?
    b. How do you know?

    If your child needs some support to answer the previous questions, you can pose some scaffolding questions:
    a. How many counters were in total?
    b. How many counters do you see?
    c. How many counters do you think are under the splat?
3. Look under the splat to see how many counters are there.
4. Ask: What can you learn from this?
5. You can repeat the sequence with a different amount of counters.

Counting Objects

1. You can start this activity by reading a mathematical picture book to inspire your children to count objects. You can find some suggested titles below:
   a. Ten Black Dots by Donald Crews
   b. Two Ways to Count to Ten by Ruby Dee
   c. Pete the Cat and His Four Groovy Buttons by Eric Litwin
   d. The Very Hungry Caterpillar by Eric Carle
   e. Anno's Counting Book by Anno
   f. 1 Cookie, 2 Chairs, 3 Pears by Jane Brocket
2. Prompt your child to count different quantities of objects using the following questions (You can focus on quantities from 1 to 5, or you can extend the questions to count collections up to 10, depending on the age and experience of your child):
   a. What do you see around that comes in a group of 1?
   b. What do you see around that comes in a group of 2? How did you know there were 2?
   c. What do you see around that comes in a group of 3? How did you know there were 3?
   d. What do you see around that comes in a group of 4? How did you know there were 4?
   e. What do you see around that comes in a group of 5? How did you know there were 5?
   f. What do you see around that comes in a group of 10? How did you know there were 10?

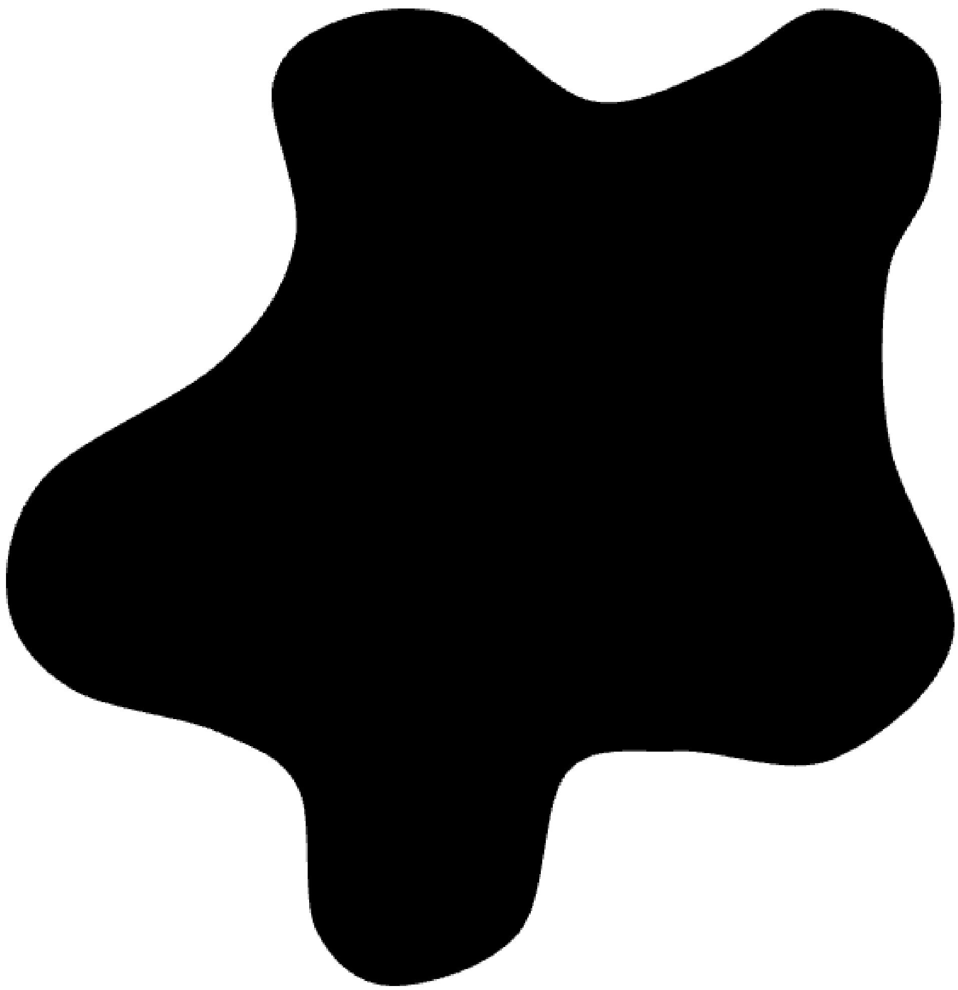
Extensions, Modifications & Additional Resources

The **Hidden Numbers** activity is inspired by Splat by Steve Wyborney.
 	
Counting Objects - Modification
 	
1. Provide your child with different collections of objects (the range of the collection can go from 1 object to 20 objects, depending on the age and experience of your child).
2. After your child counts, you can ask the following questions:
   a. How many?
   b. How did you count?

Notes:

- If at the end of the count, your child needs to recount to answer “How many?”, remember that it is part of the process of learning how to count. Please encourage them to keep counting.
- If your child does not attach one number word to each object, you can make a plan for counting: arrange objects in a row, count objects from left to right, touch one object and say each number word out loud, move each object as it is counted or place it into a bag.

SPLAT

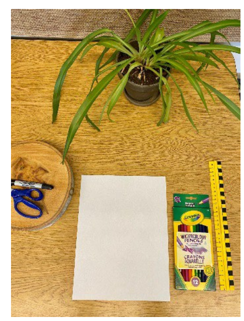


Shapes, they are all around us!

Presenters: Amanda Pasternak and Pat Morris

Grade Range	Content Area	Materials
Pre K – 1	• Geometry and Measurement	• Ruler • Paper • Glue • Colouring supplies • Scissors

Activity

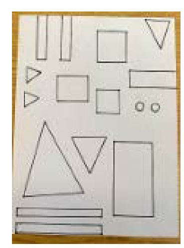


Essential Questions

- Where do we see shapes in daily life?
- How might we use shapes to build an animal?

Exploration 1 - Shape Hunt!

- What shapes can you find around your house or community?
- Can you find an example of a circle, square, triangle, and rectangle?
- I wonder if there are any 3D shapes?



Exploration 2 - Build an Animal!

- Which animal should I choose?
- Which shapes do I need?
- How can I use these shapes to build the animal of my choice? Now, create those shapes, cut them out, and build your animal!

Extensions, Modifications & Additional Resources

Possible Extensions and Wonder Questions:

- What animal can you make with the fewest shapes?
- What animal can you make with the most shapes?

Puppy Paper Folding

Presenters: Qiaochu Xu, Jingya Huang and Balpreet Kaur

Grade Range	Content Area	Materials
Kindergarten to Elementary	• Patterning • Geometry and Measurement	• Color Paper • Markers

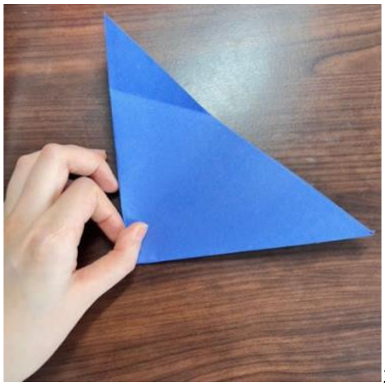
Puppy Paper Folding 1 (a Cute Puppy Face)

The Idea:

Paper folding activities, also known as origami, can provide many benefits for children. Paper folding requires precision, attention to detail, and control, which can help improve a child's hand-eye coordination and patience. In addition, Origami is a form of art that allows children to express their creativity and imagination through paper folding. Moreover, Origami involves following step-by-step instructions, which can help children develop their problem-solving skills and improve their ability to follow instructions.

Procedure:

1. Fold from top to bottom and making a triangle.


2. Then fold over from right to left and make another triangle.


3. Start at the very top of the crease and create the right ear right at the tip. Do the same with the left ear.


4. Turn it over to the back. Fold down the top to make his head flatter. fold the chin up so it's also flatter.


5. Now get a pen of your favorite color. Let's draw the face!

Questions to wonder:

1. What shapes can we make by folding a piece of square paper into half?
2. What shapes can we see from the paper folding in each step?
3. Do you notice any shape that you are familiar or unfamiliar with?
4. How many times have you fold to get a triangle or more triangles?
5. What other creative ways can we use paper folding to make a shape of puppy face?

Puppy Paper Folding 2 (a cute puppy with tongue)

Procedure:

Repeat the steps in Puppy Paper Folding 1 until step 3.

4. Flip it over…

5. Flip up one side of the chip.

6. Now get a pen of your favorite color. Let's draw the face!

Questions to wonder:

1. What difference do you notice in this activity than the previous one?
2. What other creative ways that you can think of to create a puppy with tongue?
3. What are some mathematical concepts we can explore through paper folding, like symmetry or angles?
4. Can we use paper folding to create 3D objects?
5. Can we use paper folding to create a pop-up tongue?

Extensions, Modifications & Additional Resources
Video Tutorial: How to Make an Easy Origami Puppy Video Tutorial: How to make a Paper Dog Tutorial (with togue) Video Tutorial: How to Make Paper Origami Dog (with body)

Fun With Number Cards!

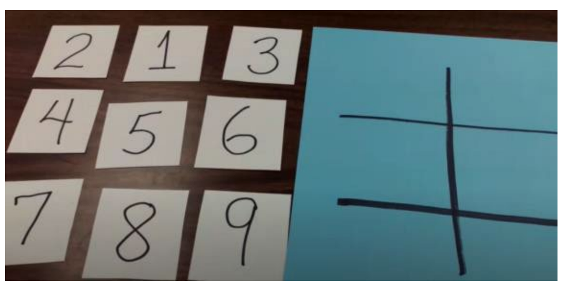
Hannah Nicholson

Grade Range	Content Areas	Materials
Grades 1 – 4	• Number • Addition • Problem-solving	• Paper • Pencil • Scissors

Activities

Before beginning either activity, create number cards with numbers 0-9. You can write these numbers with anything (pencil, pen, marker, crayons). These numbers should be a consistent size. Cut out the numbers into squares/rectangles.

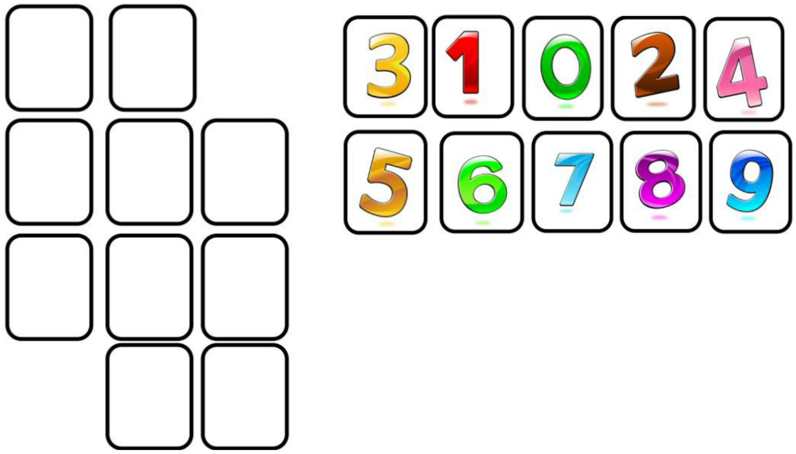
Activity 1: Addition Tic-Tac-Toe
Sourced from: Tic-Tac-Toe Mathematics
Object of the game: To place the third number to get a column, row, or diagonal that adds up to **15**.



How to play:

1. You will need numbers 1-9 for this game.
2. Draw a Tic-Tac-Toe board on a piece of paper.
3. Find a partner to play against or play left hand against right hand.
4. This game is played like traditional tic-tac-toe but with addition where players take turns placing numbers on the board.
5. The player who goes first **cannot** place the number 5 in the middle.
6. Take turns placing numbers on the board trying to be the last to add up to 15 in a column, row, or diagonal.

Activity 2: Next Door Neighbour Numbers
Sourced from: Problems Worth Solving in a Thinking Classroom (Grade 2 Resources - Activity #13)
Object of the game: arrange the cards so that no two consecutive numbers are next to each other, horizontally, vertically, or diagonally.



How to play:

1. You will need number cards with 0-9 for this problem.
2. Arrange the cards as shown in the picture above (one row of two, two rows of three, and a row of two) without having two consecutive numbers touching (horizontally, vertically, or diagonally).
3. This means 1 cannot be touching 2, 2 cannot be touching 1 or 3, 3 cannot be touching 2 or 4, and so on.

Extensions, Modifications & Additional Resources
<u>Questions for Extension/Reflection</u> **Activity 1: Addition Tic-Tac-Toe** (Tic-Tac-Toe Mathematics) • Does this addition game work if you try to add up to a different number? • Is there a best number to play first? In what spot on the board? Why or why not? **Activity 2: Next Door Neighbour Numbers** (Problems Worth Solving in a Thinking Classroom) • There are multiple solutions to this problem. How many can you find? • What is the most challenging part of this problem?

Mobius Strip Magic

Adapted by Megan Schollenberg and Mike Wong

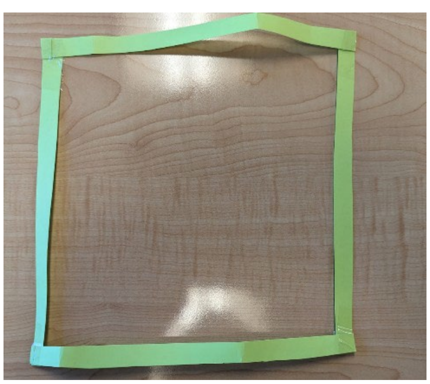
Grade Range	Content Area	Materials
Grades 1-5	• Geometry • Shape and Space	• Strips of paper (about 30cm in length and 2-3cm wide) • Scissors • Tape

Activity

Activity 1 - (Is it Possible to Turn Two Circles into One Square?)

1. **Procedure**

- Form one strip into a circle. Tape.
- Loop the second strip through the circle in the manner of a paper chain. Tape.
- Securely tape the two circles together. Important: tape loops together on *both* sides.



- Carefully cut one circle in half lengthwise. Now you have two loops connected by one long strip.
- Cut the remaining strip down the middle.

2. **Questions to wonder**
- Is it possible to transform something round into something straight?
- What shape did you get when you cut this out?
- How do you know it is a square?
- Do you think it is possible to make a rectangle?
- What sides came from what loops? How could we show this?

Activity 2 - (Mobius Strips)

1. **Procedure**
- Mark an X on both ends of the same side of the paper strip.
- Half-twist the paper so the Xs touch.
- Tape together.
- Now you have a Möbius strip.
- Feel free to make another one!

2. **Questions to wonder**

- What is a mobius strip?
- How many "sides" or surfaces does it have?
- How can a 3-D shape only have 1 surface?
- How could we show this?

What happens if I cut it in "½"

3. **Procedure**

- With your pencil, draw a line down the middle of the strip, making a continuous line until you reach the starting point.
- Take your scissors and cut down this line.
- When you reach the end, do not let go immediately!
- Instead, think: What is going to happen when I pull these apart?

4. **Questions to wonder**

- What do you notice about the loop? (How many twists does it have now?)
- Why didn't we get two pieces?
- What do you think would happen if we cut the loop in half again?

What happens if I cut it in "1/3"

5. **Procedure**

- This time, instead of drawing a line down the middle, make your starting point one third of the way from the edge of the Möbius strip.
- Continue the line until you reach the starting point. You will see (*what looks like*) two parallel lines on the surface. Cut the strip.
- Once again, before making the final snip, predict what will happen.

6. **Questions to wonder**

- Is there a way to cut it into two pieces by cutting along the length?
- If we started with a thicker(wider) paper, what would happen if we kept cutting the loops?

Resources
Alagappan, S. (n.d.). *The Timeless Journey of the Möbius Strip*. Scientific American. Retrieved February 13, 2023, from https://www.scientificamerican.com/article/the-timeless-journey-of-the-moebius-strip/ Erica. (2015, June 16). Geometry Magic: Turn 2 Circles into 1 Square. *What Do We Do All Day*. https://www.whatdowedoallday.com/geometry-magic/ Erica. (2014, July 8). Math Art with a Möbius Strip. *What Do We Do All Day*. https://www.whatdowedoallday.com/math-art-mobius-strip/ Gunderman, David and Gunderman, Richard. (September 25, 2018). *The Mathematical Madness of Möbius Strips and Other One-Sided Objects | Science| Smithsonian Magazine*. (n.d.). Retrieved February 13, 2023, from https://www.smithsonianmag.com/science-nature/mathematical-madness-mobius-strips-and-other-one-sided-objects-180970394/

Origami Challenge!

Presenters: Sue Park & Axel Soos

Grade Range	Content Area	Materials
Grade 1-5	• Patterning • Geometry	• Origami Paper / A4 paper • Scissors • Pen (optional)

Activities

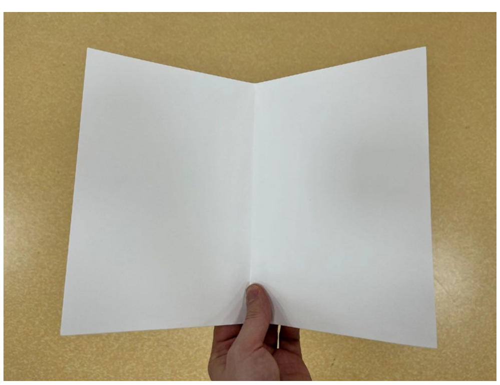
Activity 1. Minds-On Activity

Instructions:

- Fold a sheet of paper, and make at least two shapes that are the same.
- Discuss what shapes were made. Who made the most shapes?

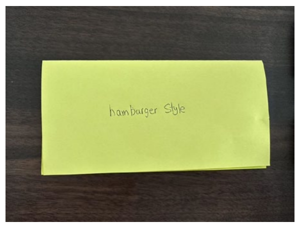
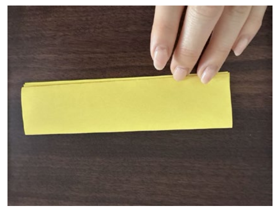
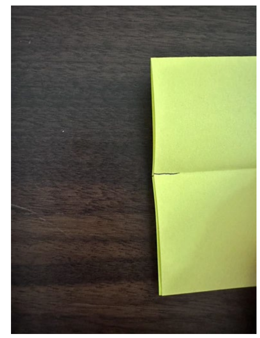
Questions to Consider:

- What shapes do you see?
- How many shapes can you make?
- How do you know that the shapes are equally sized?



Activity 2. One-Cut Origami Challenge!

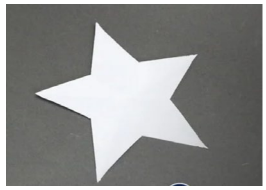
<u>Instructions:</u>

Step 1	Step 2	Step 3	Step 4
You need one piece of origami paper and scissors.	Fold origami paper in half (hamburger style) 	Fold in half one more time. 	Open it again and use a pen to mark the middle 

Step 5	Step 6	Step 7	Step 8	Step 9
Fold diagonally. 	Fold over a large triangle. 	Fold the arrowhead in half. 	Mark the cutline 	Cut the line. Please do not open it yet! 

<u>Questions to Consider:</u>

- What shapes did you find while doing the activity?
- What shape do you think you will see?

Step 10
Open the paper and find out what shape you will see! 

Extending Activities

1. Try to fold the paper however you want, and cut only once. What shapes did you get?

2. You can draw any lines on the folded paper and cut them. Do you see any patterns?

Resources
Small, Marian. Open Questions for the 3-Part Lesson, Grades K - 3 (2016) Autodesk Instructable, One Cut Origami Star. https://www.instructables.com/One-Cut-Origami-Star/

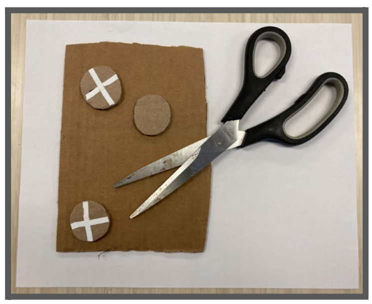
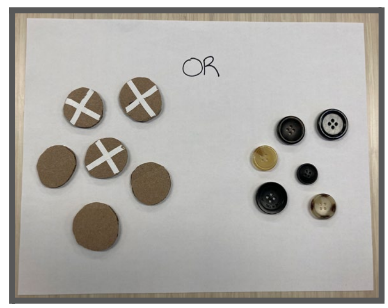
“Doing math for fun is beneficial for keeping our minds sharp and active. While doing so, we are also experiencing flow, the psychological explanation of happiness. However, when we take a look at it, there are some hidden real-life applications to be found. Lighthearted excursions in math give us happy moments in life; the stern examinations in math give us power and control. Grab your cape- it’s time to fly!”

-Sunil Singh

Waltes: a Mi’kmaw Game of Chance and Luck

Adapted by Kelly Legere and Cailen Langille

Grade Range	Content Area	Materials
Grades 3 to 5	• Number • Data and Probability	• Paper • Pencil • Flattish non-breakable dish (paper plate, box top, etc.) • Scissors and cardboard OR • 6 buttons • Dish cloth or towel

Activity

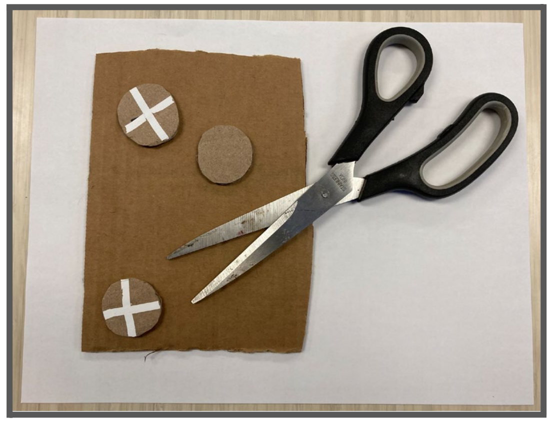
Waltes (WALT’-iss): Background and History

- Traditional Mi’kmaw game
- Played by 2 people
- Game of chance
- Pieces made of caribou or moose bone
- Sticks used as scoring system
- Sometimes played with 8 pieces
- Winter evening game
- 4th day of wedding celebration
- Rules passed down by elders

Photo by: Terri Pennell

If you are Making your own Game Pieces:

- Use corrugated cardboard rather than thin cardboard
- Make 6, they do not have to be perfectly round or the same size
- Mark one side with an 'X'



Abbreviated Rules of Waltes:

1. Start with all pieces face down
2. Raise dish 1 to 2 inches above the cloth/towel and slam the dish to toss pieces
3. If pieces come out of the dish, you lose your turn
4. Your turn continues as long as you have scored at least one point

How to Keep Score:
If ALL pieces are the same - Score 5 points

If 5 pieces are the same - Score 1 point

All other arrangements - Score zero and play moves to the next player
Winner will be the first to reach 8 points!

Questions to Think About While Playing Waltes:

- Since our game pieces only have two sides, how likely is it to get the 'X' side up?
- What could happen to make a game go very quickly? How likely is that to happen?
- How could we change the rules so scoring points would be easier?
- How would using six-sided dice change the game?

Extensions, Modifications & Additional Resources
1. If you'd like more background on the game and the rules for scoring. https://www.cbu.ca/indigenous-affairs/mikmaq-resource-centre/miscellany/the-game-of-waltes/ 2. A CBC article about Nova Scotia students learning to play the game. https://www.cbc.ca/news/canada/nova-scotia/waltes-mi-kmaw-children-elementary-1.4977810 3. A Mi'kmaw story about the game with pictures and Mi'kmaw language with audible pronunciations. https://firstnationhelp.com/ali/waltesey_atukwaqn/page1.html

Show Us Your Magic Cut!

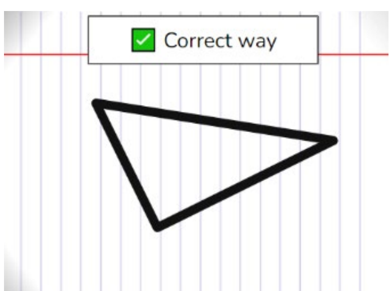
Felipe Merino & Shawn Feener

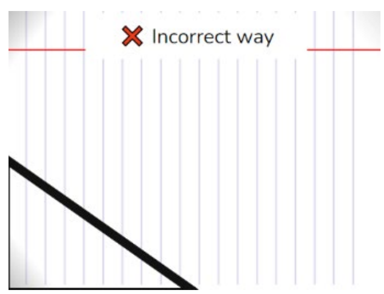
Grade Range	Content Area	Materials
3 to 6	• Geometry and Measurement	• Ruler • Paper • Pen • Scissors

Activity

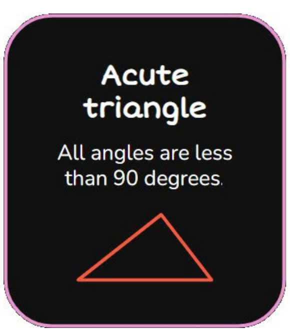
The Task: We will cut out a triangle with just one straight line cut.

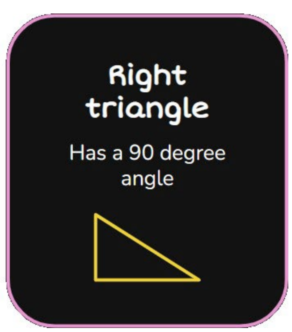
Step 1: Draw your triangle near the center of your paper.

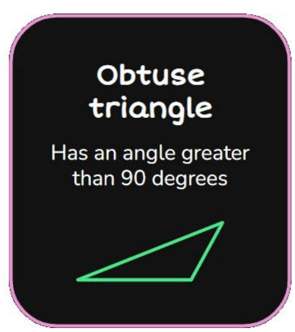




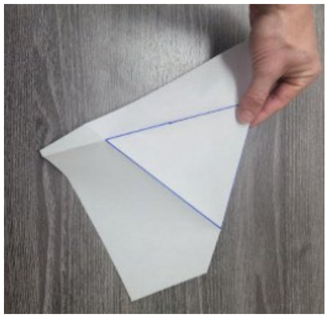
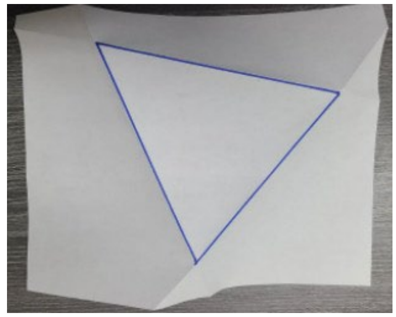
Any triangle is fine.



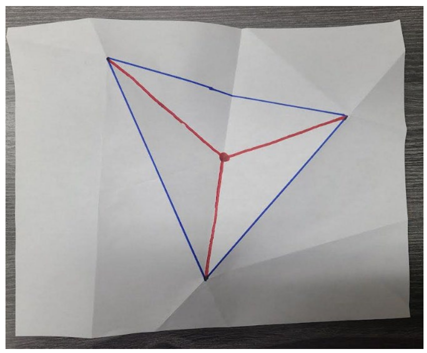




Step 2: Fold the paper backwards along all 3 sides of your triangle.

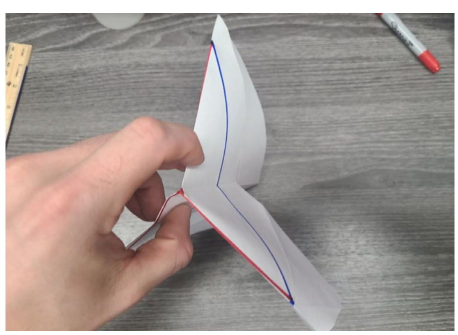
 

Step 3: Next fold each angle in half. These lines are called angle bisectors.
Then draw the angle bisectors. Notice they meet at a single point!

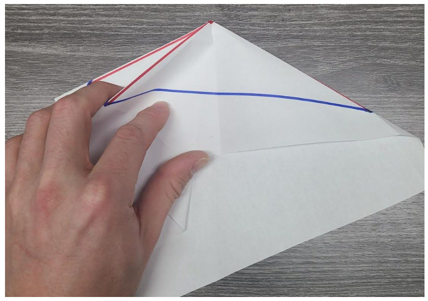


Step 4: To help foster imagination, creativity and perseverance it is recommended to play around with the current folds and some additional folding. While playing around with the folding, observe and predict what object might be created if you were to make a magic cut. Take as much time as you like based on your comfortability with this task.

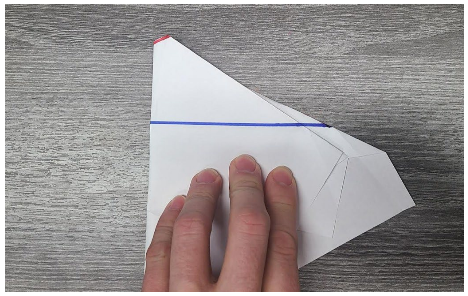
Step 5: The big reveal.
Push in the sides of the triangle so that the angle bisectors look like below.



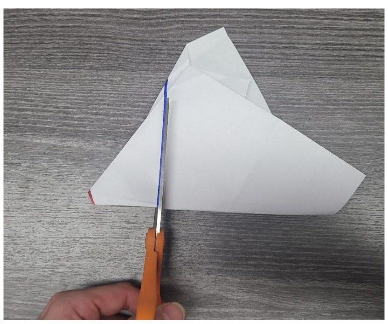
Lay the paper down. Fold one tab on top of the other so two sides of the triangle line up.

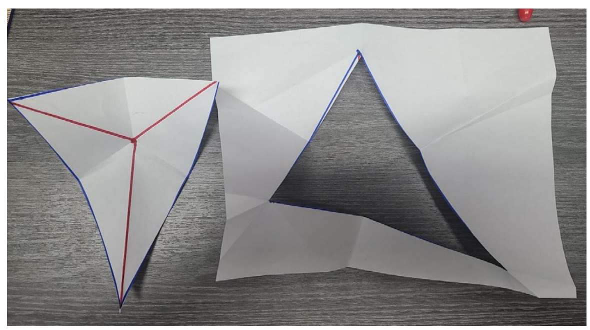


Then fold the last tab so the third side of the triangle lines up.



Now you are ready for your magic cut.





Extensions & Additional Resources
Extensions: 1. In step 3, is it always true that the angle bisectors of any triangle will meet at a single point? Think, play, explore and see. 2. Will this magic cut work for a square, a rectangle, or other polygons? Think, play, explore and see. Additional Resources: 1. A good video that overviews the "fold - one cut theorem". 2. The activity was made to demo in a virtual environment with a camera. So here is a video showing the steps.

“In math we don’t just follow rules. We Invent them. We tweak them. We propose a possible constraint, play out its logical consequences, and then, if that way leads to oblivion- or worse, to boredom- we seek a new and more fruitful path.”

-Ben Orlin

Come to the Math Side... We have Pi!

Presenters: Cassidy Cooper and Joshua Essery

Grade Range	Content Area	Materials
Intermediate (Grades 6 & 7)	• Number Sense	• 4 objects with a circular face (e.g. soup can, plate) • String • Marker • Scissors • tape

Activity

Procedure

1. Measure the diameter of one of the circular faced objects with a piece of string. Mark the string with the edge of your marker, then cut the string at your mark.

2. Ask your child to predict how many lengths of string they think it will take to measure around the circle? Then, have your child measure using their string to determine how many lengths of the string it takes to measure around the circle?
3. Repeat steps 1 and 2 for each of your 4 circular faced objects.
4. Ask your child,
    a. What did you notice?
    b. What did you wonder?
    c. What is the relationship between the diameter and circumference of a circle?

Discussion Questions:

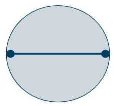
Do you think you will get the same result for all circles? Why or why not?

How could we use our knowledge of pi to determine the circumference of the circle?

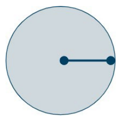
How would your investigation differ if you were determining the distance around your object using the radius rather than the diameter?

Useful Math Concepts to review

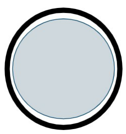
Diameter is a straight line passing from side to side through the center point of a circle.



Radius is a straight line extending from the center of a circle to the surface.



Circumference is the distance around a circle.



Extensions, Modifications & Additional Resources

Extension:

Have each child measure the length of the diameter and the length of the circumference. Use the sample data recording form below to record their answers. Ask students to divide the Circumference/Diameter. What is the result? How does this relate to the results found when using the length of the diameter to determine the length of the circumference?

Sample Data Recording Form:

Object	**Circumference**	**Diameter**	$\frac{\textbf{Circumference}}{\textbf{Diameter}}$
Paper plate	78 centimeters	25 centimeters	$25\overline{)78}$

Get to 1000!

Diane Wiens

Grade Range	Content Area	Materials
4 to 8	• Addition • Multiplication • Probability	• One die • Pencil • “Get to 1000” game board or paper

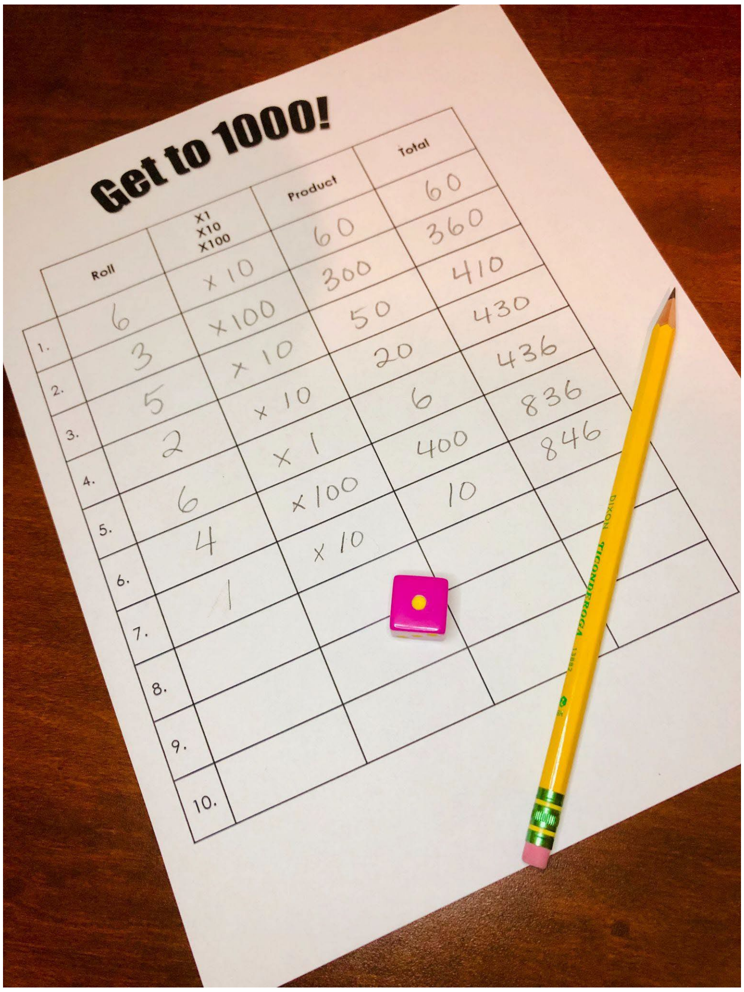
Activity

Object of the Game: Be the closest to 1000 without going over after 10 rolls.

Number of players: 2+

How to Play:

1. Roll a die.
2. Decide whether you will multiply the value of the roll by 1, 10, or 100 then complete the multiplication.
3. Add your product to your running total.
4. Continue for 10 rounds.
5. The person who comes closest to 1000 (without going over) at the end of 10 rolls is the winner.



Extensions, Modifications & Additional Resources

Resources:

- Use this link to make a copy of the game board.

Variations:

- Every player can roll their own dice, or every player could use the same roll in every turn. How does the strategy change if you use the same roll? How does the strategy change if you roll your own dice?
- Use a different sized die. Will you have the same strategy with a 6-sided die as you would for a 10-sided die? What if you used a die that had a 0 as one of its values?
- Allow the closest to 100 (over or under) to win at the end of the game.
- Practice subtraction skills and start from 1000 and subtract to "Get to 0!"

Questions to Spark Mathematical Thinking:

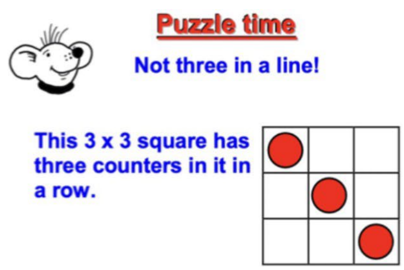
- What strategies did you use? Why?
- How does probability factor into your decisions as you play the game?
- How would your strategy change if you used 15 rounds to Get to 1000? What about 7 rounds? Why?
- Do you notice any patterns in the product column? What do you notice? What do you wonder?

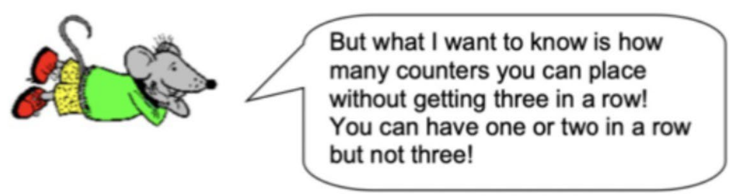
Not Three in a Line

Presenters: Malcolm Knoll, Diane Wiens

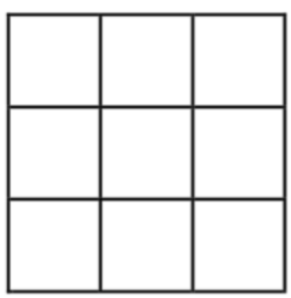
Grade Range	Content Area	Materials
K to 8	• Geometry and Measurement • Patterning	• Paper • Pen

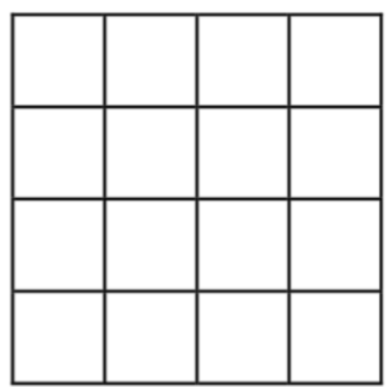
Activity





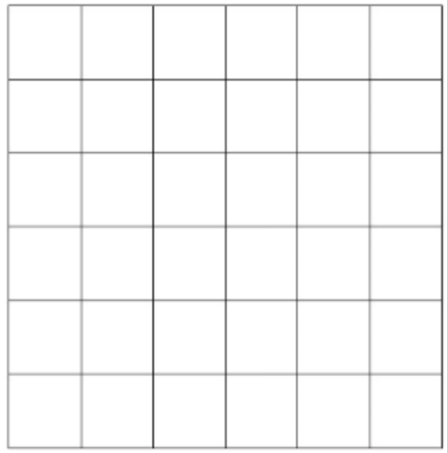
Try it out with a 3 x 3 and a 4 x 4 grid.





How many counters did you put in a 4 x 4 grid without getting three in row!

What about a 6x6 square? Are you starting to see a pattern? How many counters do you think you could put in a 10 x 10 grid without having three in a line?



Extensions, Modifications & Additional Resources

Questions to Provoke Students' Thinking:

1. Do you see a pattern in how many counters can be placed as the grid gets larger in size?
2. How can you use what you know about patterns to try and solve this puzzle?
3. How can you use what you know about symmetry to try and solve this puzzle?
4. What happens when you place the counters on vertices instead of inside the grid squares? Can you fit more or fewer counters in that case?
5. Can you find multiple ways to place the same number of counters in the grid?
6. How can you use what you've learned from this puzzle to solve other mathematical problems or challenges?

Activate Prior Knowledge:
Consider what prior knowledge is necessary for students to successfully complete the task. Ensure that all students understand the concept of 3 in a row and how to arrange objects so there are not 3 in a row.

Communicate Learning Objectives:
Clearly communicate the objectives to students so they understand what they are expected to do and learn.

Differentiation:
Consider the diverse range of learners in your class and plan to make the taks more accessible for struggling learners and more challenging for advanced learners. One one to modify the difficulty is changing the size of the grid and giving students the number of counters they need to be able to fit into the grid ahead of time.

Provide Context:
Consider how this task is relevant to students' lives and how it connects to other areas of study. Perhaps the task could be modified to represent a real world example (i.e. The teacher needs to arrange desks a certain way but has 8 students they need to keep out of the same row.)

Encourage Collaboration:
Structure the task to encourage students to work together, discuss their ideas and share their thinking with their peers.

Reflection:
Consider how students will be encouraged to reflect on their learning. Plan for opportunities for students to reflect on progress and think about what they have learned. Encourage them to set goals and think about how they can continue to improve.

Acknowledgments:
Task modified from No three in a line puzzle
Images from Math Sphere

“Children need to leave their thumbprints all over their journey of mathematics. Only then will there be a possibility of nurturing that most treasured goal - a lifetime interest in learning mathematics. Here too we both see a call for human flourishing. A call we are not alone in making either.”

-Sunil Singh

Japanese Multiplication

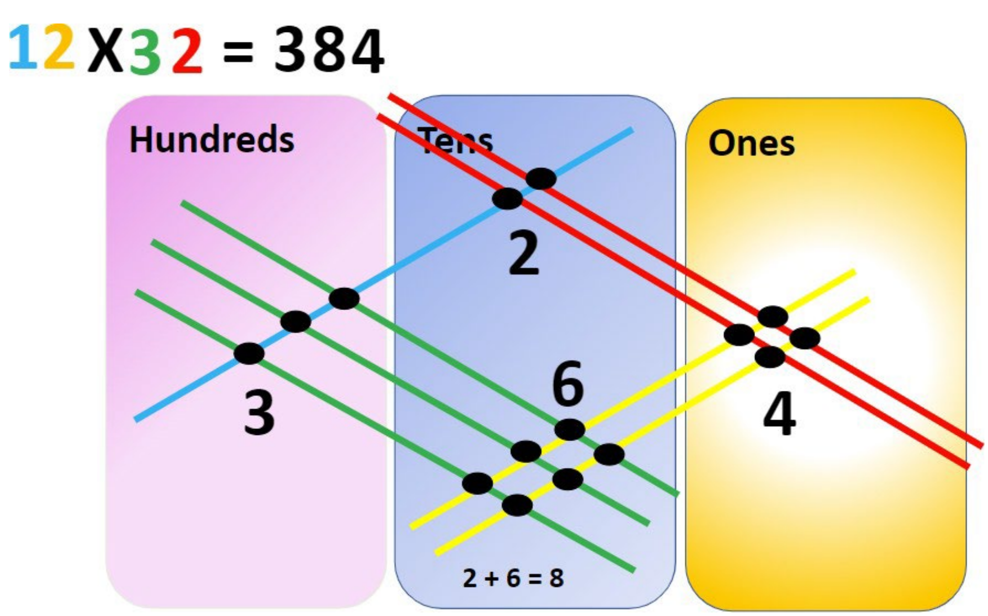
Ariane Faria and Elisa

Grade Range	Content Area	Materials
1 to 8	• Number • Addition • Multiplication • Problem-solving	• Paper • Pens with different colors

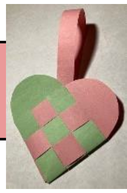
Activity

Learn to multiply by merely drawing a few lines and improve our understanding of math through visual representations.

1) Draw diagonal lines corresponding to the tens.
2) Leave a space and draw additional lines parallel to the first ones to represent the ones place.
3) Next, draw the number 32 in reverse direction with the lines intersecting at the corners.
4) Calculate the product by counting the number of intersections between the lines and writing down each digit.
5) If there are multiple intersections, add the corresponding numbers.
6) See the example below:



Extensions, Modifications & Additional Resources
• Presentation with the step by step



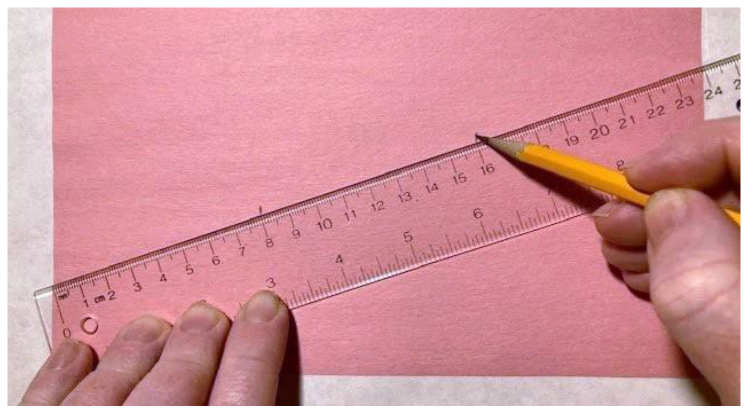
Paper Weaving with Math Magic!

Presenters: Reed Moore and Dahlia Benedikt

Grade Range	Content Area	Materials
3 and up	• Patterning • Geometry and Measurement	• 2 sheets of colored paper • 30cm ruler • pencil • scissors

Activity

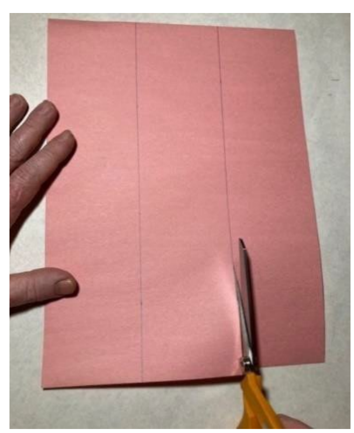
1. Cut two different colors of paper into strips. Construction paper (or a similar size) is recommended. Strips must be at least 3x longer than they are wide. To make optimal use of your paper, cut it into equal thirds lengthwise using the measuring "trick" described below.



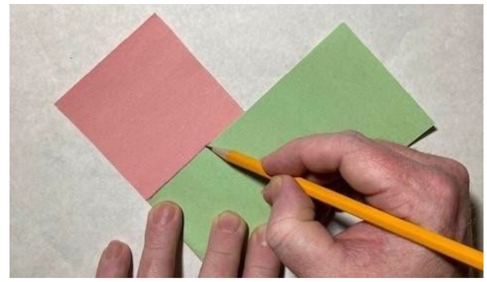
Measure the width of your paper. It is most likely a number not easily divisible by 3, for example mine was 22.9cm. To avoid using a calculator and bothersome decimal numbers, find the multiple of 3 just past your width, in my case 24cm. Angle your ruler up the page slightly until 24 lines up with the edge. Since 24 ÷ 3 = 8, make a mark at 8 and another mark at 16. Ta-da! Perfect thirds!

2. Repeat this trick further up or down the page to create a second set of marks. Connect the pairs of marks and cut along the lines to create 3 equal pieces!

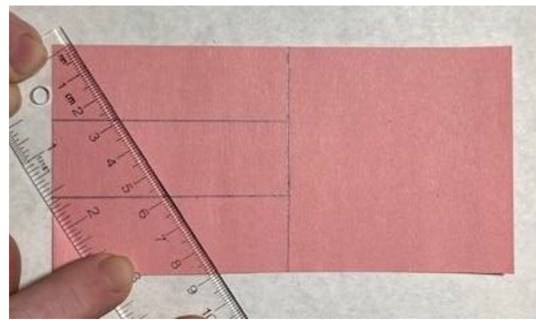
Note: This trick works in many other situations too – if dividing something into 5 equal parts, angle the ruler to the nearest multiple of 5 (say 25cm) and then make marks at 5, 10, 15, and 20. It's even more effective when using imperial measurements to avoid fraction math: Need to find the center of something 11 7/16" wide? Tilt the ruler to 12" and make a mark at 6"!



3. Fold your two colored strips in half and line them up as shown below. The folds should be towards your body. Mark with a pencil where the top one overlaps the bottom one.

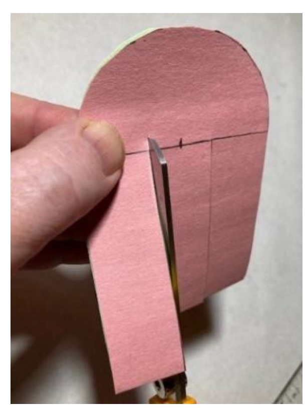


4. The overlapping parts will eventually become the woven part, so next you'll need to mark out the "fingers" that will be woven together on one of the two pieces. You can use the measuring trick above to divide the width evenly – I recommend dividing into thirds, although halves, quarters, fifths, etc. will all work. (In this example I angled the ruler to 9cm and marked at 3cm and 6cm.)

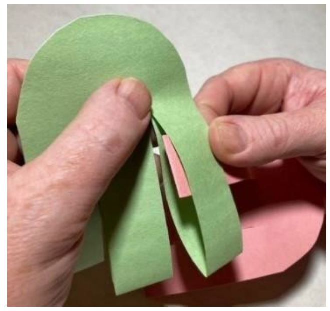


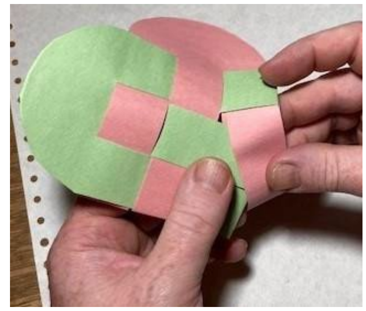
5. Create a semi-circle above the woven area. This will form the two upper "lobes" of the heart. This can be done freehand, or use a small cutoff from the top of one of your strips to help sketch out the radius. Fold the cutoff in half and use it to first find the center of the semi-circle and then use the folded piece to make a series of dots around that center – these can then be connected to make an eye-pleasing circular shape.

6. Lay your two pieces of paper together and cut them both at the same time (I find it works best if one is nested inside the other one). Tip: cut the fingers a little bit past the boundary line to give yourself a bit of wiggle room when weaving.

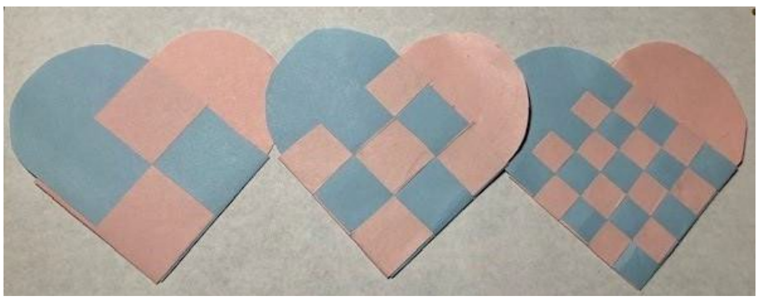


7. Weave the fingers together. So it can open as a basket, weave together by passing a finger THROUGH the other finger (not over or under). Complete slipping the fingers through each other in an alternating pattern until the weave is complete!





Extensions, Modifications & Additional Resources



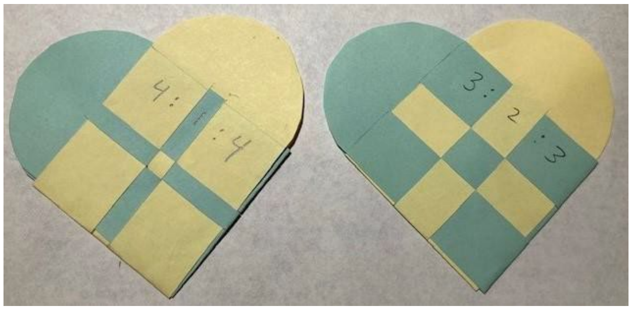
Simplifications:

- Create a 2x2 woven pattern before attempting the 3x3 pattern described above.
- The measuring techniques and lay out of lines can be done by a teacher or adult beforehand so children can focus on cutting and weaving.
- Simple over-under weaving instead of passing fingers through each other (requires less manual dexterity but will not make a basket).

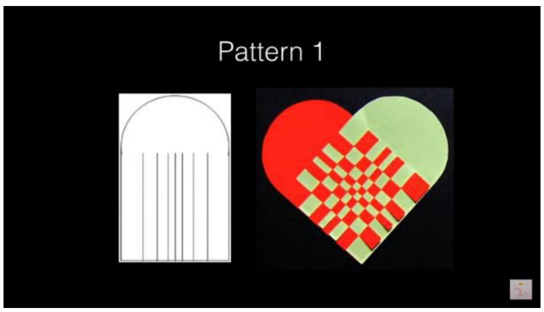
Intermediate/Advanced Techniques:

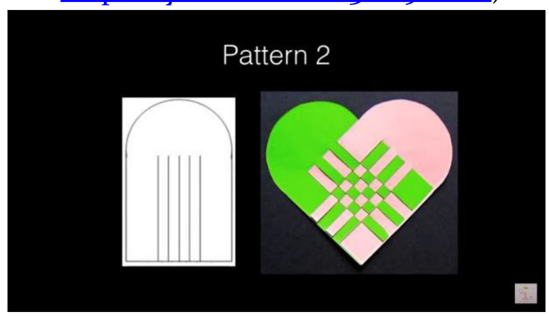
- Create fingers of different widths using a variation on the measurement trick. In step 4, when the ruler is tilted to 9cm to divide into thirds, instead think of numbers that ADD to 9, for example 4+1+4=9. Make marks at 4cm and 5cm (instead of 3 and 6) to create a thin center finger. Or tilt the ruler to 8cm and use 3+2+3=8. See picture examples on next page.
- This is a good opportunity to discuss questions such as:
  - ✓ What other 3-finger width combos can you make using 9? Or 8? Or 10?
  - ✓ How many unique 3-finger patterns can you make using 9 or 8 or 10?
  - ✓ Are there more patterns with a wide or a narrow middle finger?
  - ✓ Does this change if the number is even or odd?
  - ✓ Why must the starting strips be at minimum 3x longer than they are wide?

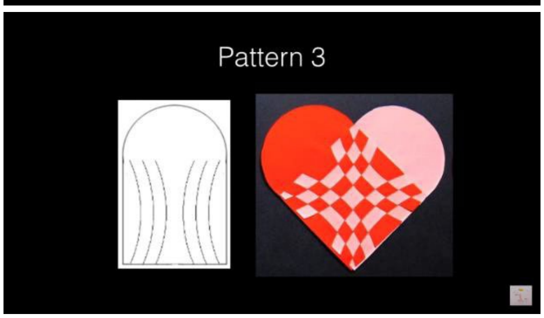
- Try some of the advanced patterns below, and even attempt to create your own patterns, like my Super Bowl-themed attempt below.

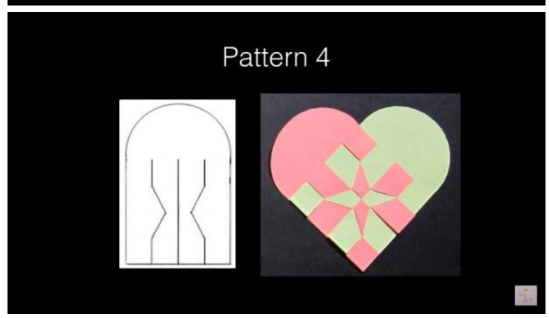


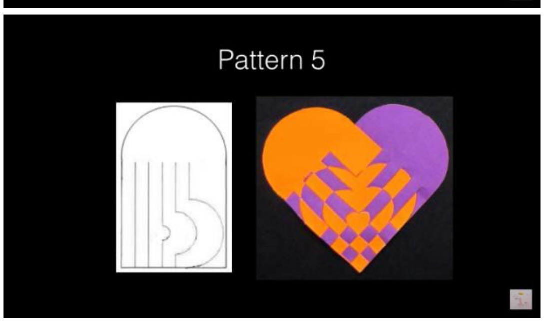
Advanced Patterns (screenshots from: https://youtu.be/Oni3nX9sYkw)

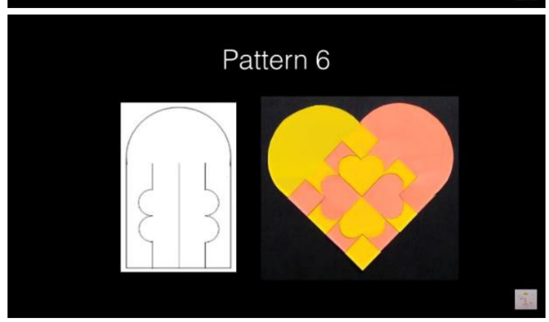


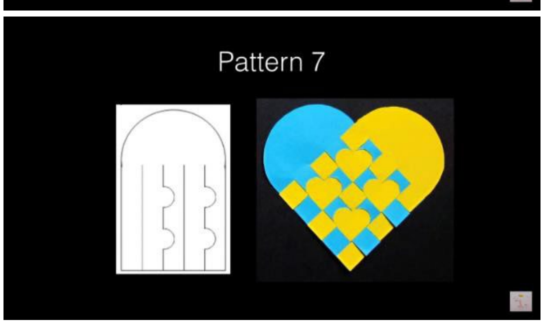


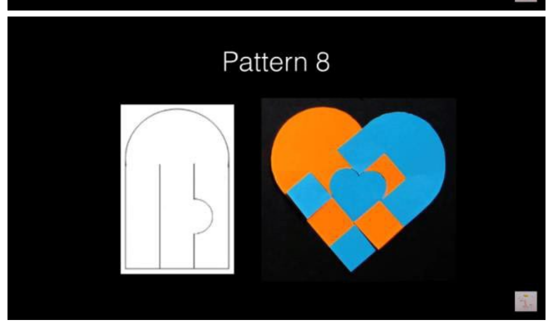












The 1-10 Card Investigation

Presenters: Kaitlin Burns and Jodi Thompson

Grade Range	Content Area	Materials
Grade 3 and up	• Number • Problem Solving • Strategy	• Playing cards A-10 OR • Individual pieces of paper labeled 1-10

Activity

Problem: Arrange a set of ten cards, numbered A to 10, facedown so that the following occurs:

1. When you turn the top card over, it should be an A. Place it faceup on the table.
2. Move the next card to the bottom of the deck, keeping it face down.
3. When you turn over the third card, it should be a 2. Place it faceup on the table.
4. Move the next card to the bottom of the deck, keeping it face down.
5. Continue this way, turning over a card, placing it faceup on the table, and moving the next card to the bottom of the deck.
6. When you're done, all of the cards on the table should be faceup in order from A-10.

Retrieved from: https://marilynburnsmath.com/

See this video for a visual explanation:
https://www.youtube.com/watch?v=037H94j5Znc

As participants work through the problem, some questions to ask are:

- How did you get started?
- What have you noticed so far?
- What have you tried so far?
- Can you share any strategies you have tried?
- How are you keeping track of what you've tried?

Extensions, Modifications & Additional Resources

Modifications:

- Try the problem with 4 cards only (numbered 1-4 or A-4)
- Try the problem with 5 cards only (numbered 1-5 or A-5)

Extensions:

- Can you repeated the pattern with a full deck of cards (A-K)
- What happens when you move 2 cards to the bottom of the deck each time? How does that change your pattern?

The Solution:

Additional Questions:

- What strategy did you use to find the pattern? Did your strategy change?
- Did you feel stuck at any point? What did you do?

Bump and Freeze

Presenter: Karen Kehl

Grade Range	Content Area	Materials
Everyone	• Subitizing numbers 1-6 • Making doubles from 2-12 • Addition and subtraction with numbers to 10, 12 and 20	• Two 6-sided dice • Paper and pencil • 12 tokens (6 each of one colour)

How to Play

1. With a pencil, draw the numbers 9-8-7-6-5-4 at the top of a piece of paper. This will be your playing board.

9	8	7	6	5	4

2. First player rolls one 6-sided die. What number added to their roll equals 10?
   Example:

    + ______= 10

   Answer: 6

   First player places their coloured token on the number “6” they calculated.

3. Second player rolls and places their coloured token on the number added to their roll to make 10.

4. If a player places a token on a number that their opponent has a marker on already, the player can "bump" it off and return the token to their opponent. The opponent will have a chance to place the token back onto the board on their next turn.

5. If there are two of the same-coloured tokens on a number, then that number is "frozen". Players cannot place more than two tokens on a number. If a number is already frozen, you cannot place another token down on this turn and the play passes to the next player.

6. The winner is the first person to place all 6 of their coloured tokens on the board.

Extensions

1. Change the operation to subtraction:

   Example: 10 -  = ____

2. Use two 6-sided dice and subtract one from the other? What would the numbers on your playing board be?

3. Use 1 dice and double it. What is the double subtracted from 12? What would the numbers on the playing board be?

4. Roll 2 dice and add together. What is the number subtracted from 20? What would the numbers on the playing board be? Instead of a linear board of numbers, could you place your numbers in a grid? How many times could you repeat the numbers to make the grid? The first player to get three tokens in a row wins.

Face Off

Presenters: Shannan Downey and Courtney Fox

Grade Range	Content Area	Materials
Everyone	• Number Sense • Computational Fluency • Comparing and Ordering Whole Numbers, Fractions, and Decimals • Operations with Integers	• Deck of Cards • Paper and pencil (optional)

Activity

Introducing Face-Off: The Math Battle Card Game!

To play, simply remove the Jacks, Queens, and Kings from a standard deck of cards, shuffle, and get ready to duel. Each player starts by placing a facedown pile of cards in front of them. On the count of three, both players flip over their top card.

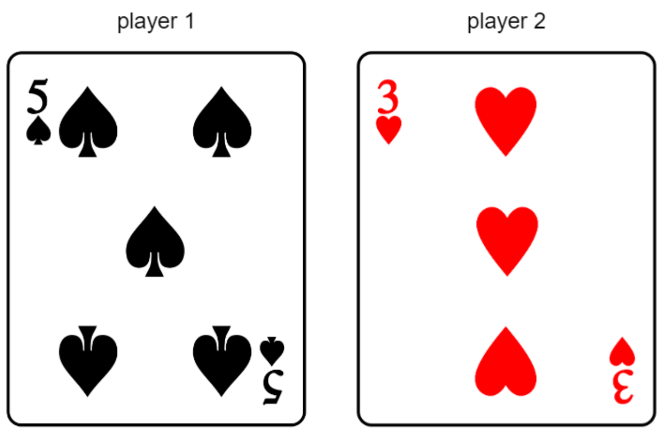
<u>Version 1: Pre-k - Lower Elementary</u>

The player who flips over the highest card wins both cards.

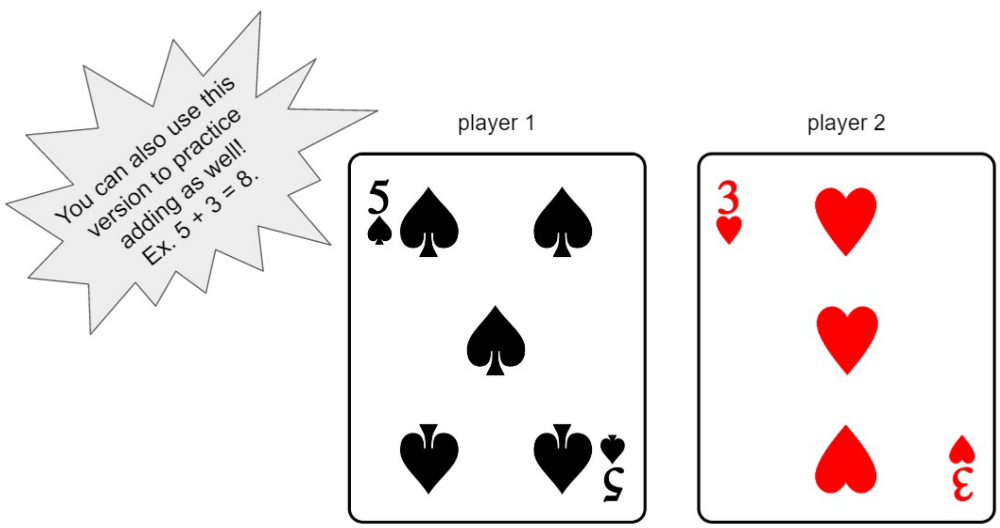
<u>Version 2: Lower Elementary +</u>

The first player to correctly state the product of the two cards wins the round and takes both cards, adding them to their personal pile.

But beware! If it is a tie, the cards go into the center of the table and become a prize for the next winner. The goal is to collect the most cards by the end of the game, so put your math skills to the test and show your opponent who's boss!



5 > 3



5 x 3 = 15

Questions to Consider

1. Were some answers easier to find? Why do you think so?
2. What other skills do you think you can use in this game? Can you create your own version to target that skill?
3. How might you adjust this game so that you can play alone? With a third person?

Extensions, Modifications & Additional Resources

1. Fraction Face-Off puts a new spin on the game. Players flip over two cards, with the first card serving as the denominator and the second as the numerator. The player with the largest fraction wins!

2. Decimal Duel transforms the game into a decimal-based competition. Remove all face cards, and Aces become 1. Players flip over three cards, with the first serving as the whole number, the second as the tenths, and the third as the hundredths. The person who creates the highest number wins.

3. Integer Battle turns the game into a mathematical showdown. Red cards are positive, and black cards are negative. Players choose to add, subtract, or multiply the cards, with the first player to perform the correct operation winning both cards.

Nim
A Game of Logic and Strategy

Presented by: Tamara Shand and Courtney Lepetich

Grade Range	Content Area	Materials
• K - everyone	• Patterning • Logic • Problem Solving	• 10 - 15 blocks/coins/small items

Activity

How to Play:

1) Place 10 items in a pile between the two players.
2) Decide who will go first and switch who plays first every game.
3) Players take turns removing objects until no more remain. A player must remove at least 1 object but no more than 2 on their turn.
4) The player who removes the last block wins!

Extensions, Modifications & Additional Resources

- Play with 2 piles of 10 items each. A player may only draw 1-2 items during a turn but it must come from ONE pile.
- Play with 3 piles of 5 items each. In this version, each player can take 1-3 items during a turn, but the items must all come from the same pile.
- Create piles of different sizes. Ex. 1, 3, 5 and 6
- Change the total number of items to an even number. Ex. 14 instead of 15
- Change the winner to be the player that does NOT take the last item.

Math for Love - Game of Nim

Numbers are Fun - Jeopardy

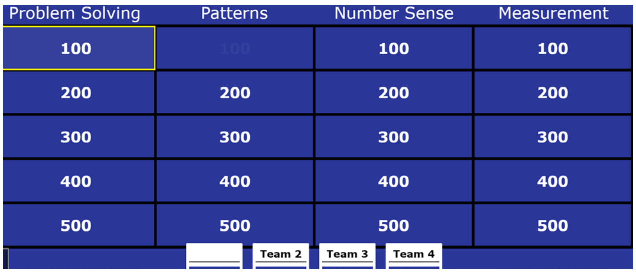
Presenters: Kanwaljit Gill & Tony Domina

Grade Range	Content Area	Materials
All age levels	• Number Sense • Problem Solving • Measurements • Patterns	• Paper and pencil

Activity

<u>Introduction</u>

This Jeopardy game consists of a variety of problems in the area of general problem solving, patterning, measurements,and number sense. The purpose is to have fun while reviewing, solving, recalling and applying the knowledge of previously learned Mathematical concepts.



The Jeopardy game can be accessed at the following link: [Click Here]

<u>Playing Instructions:</u>

1. You can play by yourself, or in teams of 2,3,4.
2. To get started, open the powerpoint, play slideshow.
3. Click on the square of the problem you would like to solve (e.g. you could choose Number sense for 400 or Patterns for 300 etc.)
4. When you click on the desired square, the question will show up.
5. Solve the problem. Use pencil/paper if required.
6. Click on Answer to reveal the solution.
7. You may or may not choose to keep a track of score.

8. Click “Back to the Game board” to go back and choose the next square.
9. If you are playing in teams, take turns to choose the game questions.
10. Have fun and get your Math Brains thinking.

While you work through the problem, some questions to consider:

1. Which Mathematical concept did you use to solve the problem?
2. How will you explain your answer to your classmates?
3. Be prepared to explain your thinking behind how you got the answer?
4. Was a particular question too easy for you? How might you modify the question to make it more challenging?
5. Challenge yourself and create your own game board. With the help of your peers or guardians, create a list of questions and create your own Jeopardy game.

Extensions & Modifications
The game of Jeopardy can be modified and adapted for any grade level, content and subject area.

Track Time on a Turtle's Back!

Presenters: Dahlia Benedikt and Reed Moore

Grade Range	Content Area	Materials
Grades 4 - 7 and Everyone	• Number sense • Computational Fluency • Pattern recognition • Problem-solving • Temporal orientation • Geometry	• Online handout (create a copy) • 5 dice or virtual dice • Online day counter

Activity

Activity 1: Let's Play Turtles and Moons! *(Handout page 2)*

1. Find a partner. Each player chooses a colour and places one coloured token on month 1 and the other on day 1.

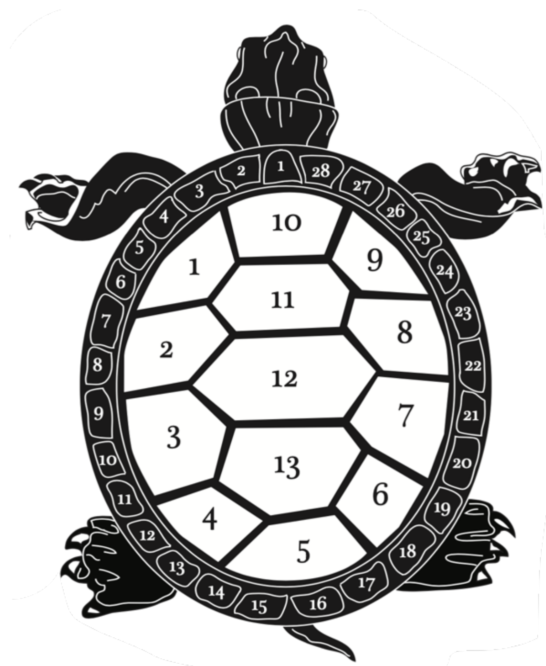
2. Taking turns, each player rolls 5 dice and moves their **day** token the number of spaces shown. When a token passes 28, advance to the next **moon** plate and continue the **day** count.

3. The trick: If you land on a day that is a **multiple** of your **moon number**, divide the **day number** by the **moon number** and move back that number of spaces. (For example, if you are on the 3rd moon and land on 18, move your token back 6 spaces, to day 12.)

Activity 2: Locating ourselves in the Anishinaabe Calendar *(Handout page 3)*

As you go... What do you notice about the calendar on Turtle's back?
Jot down what you notice on page 4 of your handout.

Task: Find TODAY on the lunar calendar



1. *Think first*: How can we figure this out? What information do we have?

   Hint: The Lunar New Year was on January 21st, 2023.

2. Use the day counter to calculate the number of days between 2 dates. Check the box for "include end day." When you have your answer, drag the tokens on the Turtle to show today's moon and day.

3. *Pause and reflect*:
   a. How did you did you figure this out?
   b. Can you think of a 'rule' for calculating any given date on the Turtle calendar?
   c. How far are we from the next new moon? When was the last full moon?

Task: Find YOUR BIRTHDAY on the lunar calendar

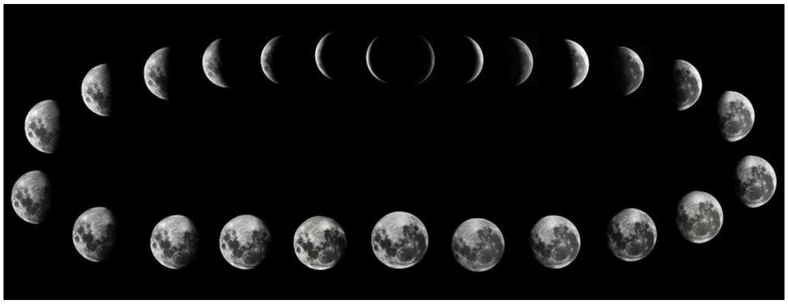
4. *Think first*: Before you calculate, make a guess about which **Anishinaabe moon** your birthday will fall on.
   a. What made you make this guess? What *else* could you base your guess on?

5. Use the method you used before to calculate the Anishinaabe moon/day that your birthday falls on. Drag the tokens on the Turtle to show your birthday's moon and day.

Reflection: Notice and Wonder

A. Do you think your birthday falls in the same place on the lunar cycle each year, or does it change? Why?

B. What are some things you notice about the Anishinaabe calendar on Turtle's back?
C. How does this calendar differ from the one we typically use (the Gregorian calendar)? What does each calendar have us pay attention to?
D. What do you notice about then names of the moons? Why do you think they are named the way they are?
E. What does the Turtle calendar teach us about Anishinaabe relationships to the seasonal cycle and what they view as important?



Extensions & Additional Resources

Moons and months: Why do you think there are 13 moons in a year rather than 12? What is one *year* measured by? If there are 13 moons in a year, why are there 12 months in the Gregorian calendar year?

The sun and the moon: We define one *year* as the time it takes for Earth to travel one full orbit around the sun. Over that time, the amount of sunlight we get each day changes. What moon/day will have the MOST sunlight this year? What moon/day will have the LEAST sunlight? (Hint: when is the summer solstice and winter solstice?)

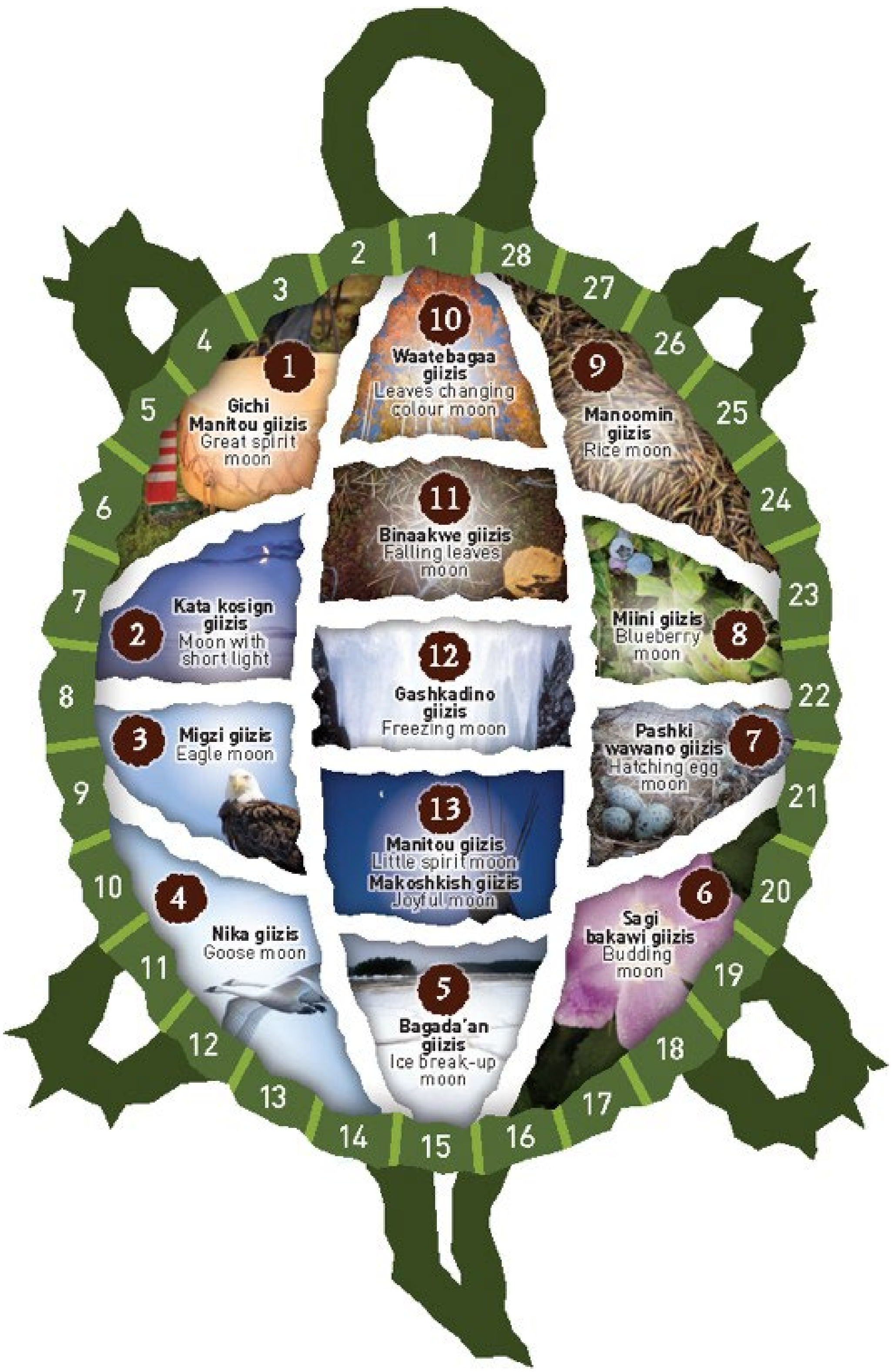
Calendar corrections: Since seasonal cycles don't happen in perfectly whole numbers of days, different calendars have ways to correct this (e.g., leap years). What 'problems' do you think could arise in this calendar, and what ways could they be corrected?

Indigenous calendars: Explore and learn about other Indigenous or lunar calendars used in your culture or local area. What similarities and differences do you see?

Additional resources:

1. Free cut-out book: 13 Moons on Turtle's Back (2022) by Ojibwe Saulteaux educator Sandra Samatte
2. Ojibwe.net activity: Giizisoo-Mazina'igan: The Thirteen Moons and Turtle's Back (2022)
3. Find and download more Anishinaabe seasonal calendars tracing traditional land use activities throughout the year: Pimachiowin Aki (2023)

Giizisoo-Mazina'igan



(Image from Pimachiowin Aki, 2023)

"When numbers are poked and prodded, much like when kids poke their fingers into dirt, mud, or slime to engage with texture and feel of these inviting substances, the details and personalities of numbers emerge."

-Sunil Singh

Websites to Promote Math Interest, Play, Explorations and Wonder

Scale of the Universe - “Explore the sizes of about 300 different objects, from the smallest subatomic particles to the largest galaxies and beyond.”

Animated Factorization Diagrams – Data Pointed - “Factor fans can play with the program interactively, or sit back and enjoy the promenade of dots as they do their thing.”

Mathigon & Polypad - “Unleash your creativity with the world’s best manipulatives! Engage in problem-solving, explore patterns and collaborate with others.”

Geometry - GeoGebra - “GeoGebra is a dynamic mathematics software for all levels of education.”

Dollar Street - photos as data to kill country stereotypes - “A team of photographers have documented over 264 homes in 50 countries, taking photos of up to 135 objects.”

KenKen - “It’s not a crossword. Simply put, it’s a grid-based numerical puzzle that uses the basic math operations, while also challenging your logic and problem-solving skills.”

Mathematics | TED-Ed - “TED-Ed Animations are our signature content: short, award-winning animated videos about ideas that spark the curiosity of learners.”

Symmetry – M.C. Escher – The Official Website - “Maurits Cornelis Escher (1898-1972) is one of the world’s most famous graphic artists. He plays with architecture, perspective and impossible spaces.”

David Robitaille International STEM Education Network - “is committed to research and community engagement for innovative, connected, holistic, and responsive ways of teaching and learning mathematics, science, and technology in education.”

Julia Robinson Mathematics Festival - “hosts fun classroom events and math festivals, creates math puzzles, and trains educators how to inspire kids with joyful math.”

YouCubed - “Inspire ALL Students with Open, Creative, Mindset Mathematics.”

NRICH - “aims to enrich the mathematical experiences of all learners.”

MathPickle - “a resource of original mathematical puzzles, games and unsolved problems for K-12”

Thank you and Acknowledgements

We would like to express our appreciation to all those who made the Virtual Family Math Fair a resounding success. Your generous contributions of time, expertise, and energy were essential in creating an unforgettable event that brought together families, educators, and presenters from all over the world.

Volunteers

Andria Coulbourn

Kelly Davila Vargas

Natalia Dumcke Dalle

Angela Essak

Ariane Faria dos Santos

Nicole Gordon

Jane Howard

Jingya Huang

Balpreet Kaur

Sukhwinder Kaur

Chelsie Koberwitz

Malihe Manzouri

Elisa Nasimi

Presenters

Dahlia Benedikt

Kaitlin Burns

Cassidy Cooper

Tony Domina

Shannan Downey

Joshua Essery

Shawn Feener

Courtney Fox

Kanwaljit Gill

Karen Kehl

Malcolm Knoll

Cailen Langille

Kelly Legere

Courtney Lepetich

Felipe Merino

Reed Moore

Pat Morris

Hannah Nicholson

Sue Park

Amanda Pasternak

Megan Schollenberg

Tamara Shand

Axel Soos

Jodi Thompson

Diane Wiens

Michael Wong

Comments from Families

“Thank you for a morning of Math Fun! Please invite us again.”

“Thanks so much for coordinating this opportunity. My six year old son, Sebastian, had a lot of fun. We especially enjoyed the math multiplication card game and the jeopardy game. The Japanese multiplication was very interesting, but applying it to higher numbers was a little over our heads; we will explore it further using YouTube videos.”

“That was so fun! Thank you ☺”

“I wanted to thank you for putting together the virtual math fair, and kudos to all the grad student facilitators. I am an educator and I learned new games and ideas that I could bring to my classroom to offer my students, AND I had fun.”

“We all had fun learning and practicing our math problem solving skills, Instructors were all friendly and well prepared and it was nice to for the children to be able to work as a team over Zoom while collectively problem solving.”

“All were very engaging for my kids. The activities were fun and educational. Hosts were very enthusiastic about the subject matter!”

“Impressed by how expressive some of the students were when asked open-ended questions about their experience and strategies”

“Discovery of the interconnectedness of numbers”

“All the sessions were very good and teachers were very friendly. We would love to participate again!”

“Our favourite was figuring how to create animals with shapes”

Quote References

Orlin, Ben. *Math with Bad Drawings: Illuminating the Ideas that Shape Our Reality*. Black Dog & Leventhal Publishers. 2018.

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