Weaving Math

Aboriginal Mathematics Inquiry Team

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BOARD OF EDUCATION BURNABY SCHOOL DISTRICT 41

Rationale

The formation of the Mathematics Inquiry Team in Burnaby came about as a desire to explore the connection between Mathematics and place-based First Peoples knowledge. The collaboration between the Burnaby Aboriginal Education Department and Secondary Mathematic teachers allows for the development of strategies to support and enhance the practice of teachers in our district in incorporating cultural knowledge in the new BC Mathematics Curriculum. The creation of project based lessons can be shared as a way of incorporating First Peoples Principles of Mathematical Teaching Respecting Indigenous Knowledge and how First Peoples use, and continue to use, mathematical knowledge.

First Peoples Principles of Mathematical Teaching

Respecting Indigenous Knowledge

1. Build on indigenous knowledge systems.
2. Relate story teachings to mathematical processes (e.g., how characters solve problems).
3. Make connections to a wide range of differing contexts (daily activities, traditional practices, activities in the workplace) and integrate learning related to mathematics and other subject areas in project assignments.
4. Find ways to build learning relationships with the local Aboriginal/cultural community (Elders, artists, people in various walks of life, including emergent business and industry).

Respecting the learner

5. Build on what students are already familiar with (both abstract "knowledge" and concrete knowledge).
6. Explore and build on students' interests (asking learners about what is important to them is a good way to identify what context will prove meaningful to them as a basis for learning mathematics).
7. Present mathematics problems of various sorts in various sorts in varied ways (visual, oral, role-play, and experiential problems as well as word and symbol problems).
8. Stimulate students' innate curiosity and desire to explore.

Fostering the development of positive attitudes

9. Communicate a positive and enthusiastic attitude toward mathematics (be willing to take risks and make mistakes and encourage students to do the same).
10. Promote and reward perseverance (give necessary time for difficult problems and revisit them on multiple occasions).
11. Use humour and celebrate successes.

Fostering transformation for both teacher and student (transformative pedagogy)

12. Reflect on and revise your own practice with respect to teaching mathematics (including mistakes).
13. Find ways to build learning relationships with various professional communities where mathematics plays an important role.
14. Share what your are doing as a teacher with other colleagues, and use colleagues to support self-reflection.
15. Encourage students to reflect on and be explicit about their own thinking processes and the transformations in their own understanding.

from www.fnesc.ca *Teaching Mathematics in a First Peoples Context*

The team was looking for an activity that would be incorporated into a unit rather than be a stand alone unit in order for the information to be integrated in a meaningful way. We were also thinking of something that would not take too much time to include in a unit, would be hands on, and would be cost effective. We wanted to integrate the principles of the redesigned Mathematics curriculum by applying real-life situations, enable students to interpret the world around them mathematically, and be actively engaged. We thought it was important that we incorporate the knowledge of the traditional Aboriginal groups whose territory our district is located (Coast Salish).

Foundations of Mathematics and Pre-Calculus, Grade 10

Big Idea

Rate of change is an essential attribute of **linear relations**, and has meaning in the different representations, including equations.

Content

Linear relations, including slope and equations of lines.

Curricular Competencies

Reasoning and Analyzing

- Use **reasoning** and **logic** to analyze and apply mathematical ideas.
- Use tools or technology to analyze relationships and test conjectures.
- **Model** mathematics in contextualized experiences.

Understanding and Solving

- Develop, demonstrate, and apply **conceptual understanding** of mathematical ideas.
- Engage in problem-solving **experiences** that are connected to place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures.

Communicating and Representing

- Communicate mathematical thinking in **many ways.**
- Use mathematical vocabulary and language to contribute to mathematical **discussions.**
- **Represent** mathematical ideas in a variety of ways.

Connecting and Reflecting

- **Reflect** on mathematical thinking.
- **Incorporate** First Peoples worldviews and perspectives to **make connections** to mathematical concepts

First Peoples Principles of Learning

Learning is holistic, reflexive, reflective, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).

Learning involves patience and time.

Possible Mathematics Curriculum Connections

Kindergarten

Repeating **patterns** with multiple elements and attributes.

Grade 1

Repeating patterns with multiple elements and attributes.

Grade 2

Repeating and increasing **patterns**.

Grade 3

- Increasing and decreasing **patterns**.
- **Pattern rules** using words and numbers based on concrete

Grade 4

Increasing and decreasing patterns, using tables and charts.

Grade 5

- Rules for increasing and decreasing patterns with words, numbers, symbols, and variables.
- Single transformations.

Grade 6

- Increasing and decreasing **patterns**, using expressions, tables, and graphs as functional relationships.
- **Line graphs.**

Grade 7

Discrete linear relations, using expressions, tables, and graphs.

Grade 8

Discrete linear relations.

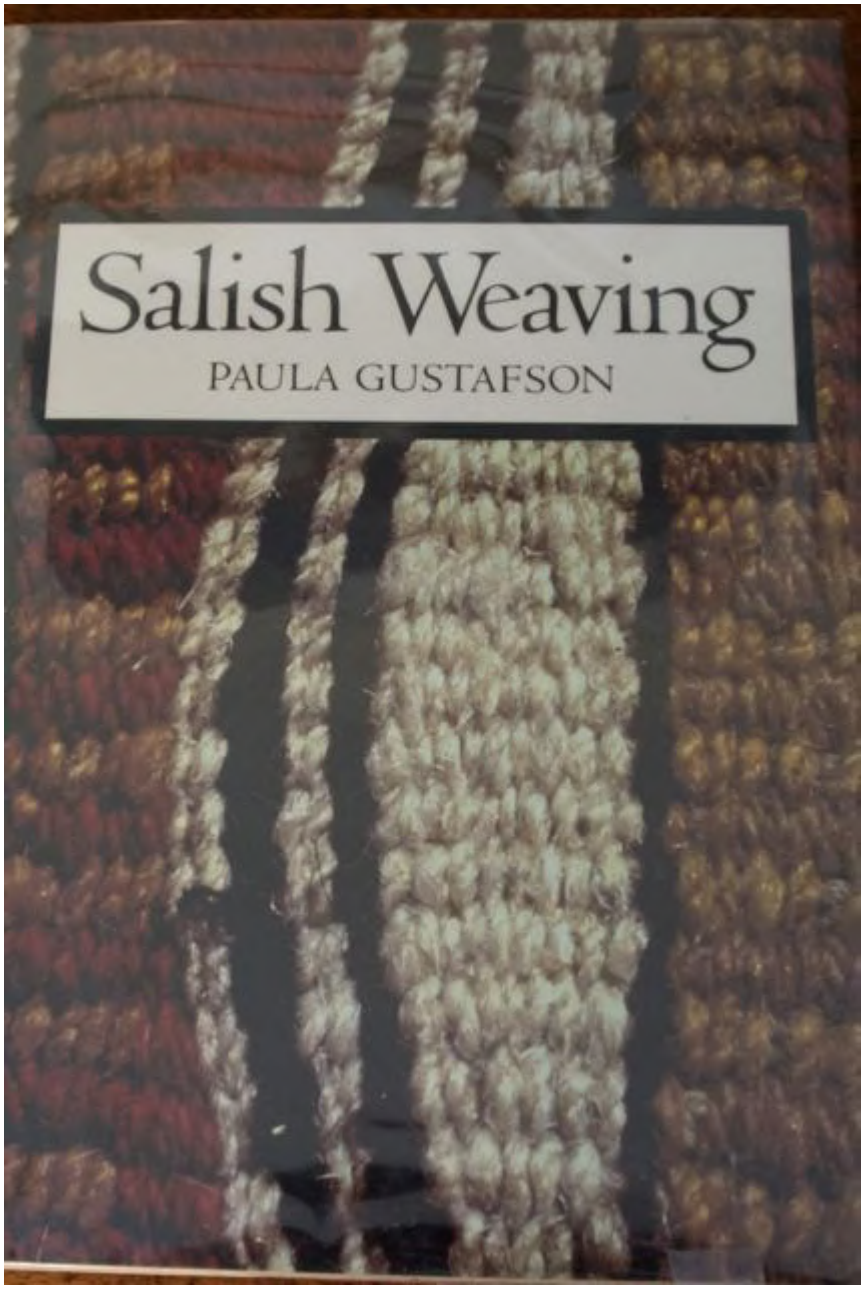
Grade 9

Two-variable linear relations, using graphing, interpolation, and extrapolation.

Grade 11—Workplace Mathematics

- Linear relationships.
- Slope as a rate of change.

Coast Salish peoples have developed weaving techniques for over 20,000 years or more. Coast Salish blankets have been made by women spanning from the mouth of the Columbia River in Oregon north to Bute Inlet in British Columbia. The blankets are used for ceremonial purposes and is a status symbol of wealth and prosperity. Wearers of the blankets are often leaders in the Coast Salish communities. Traditionally, the blankets were also used as currency and bartered for goods. This lesson was developed as a way of integrating Indigenous Knowledge of the weaving of blankets with an understanding of slope and equations in the Grade 10 Mathematics Curriculum.



Web Resources:

Chief Joe Capilano Blanket—https://www.youtube.com/watch?v=WLnBZgdbSyc

Coast Salish Spinning and Weaving—UBC Blogs (pdf)

Coast Salish Weaving Lesson Plan (pdf)

Lesson Plan on Coast Salish Weaving—Glenbow (pdf)

Musqueam Weavers Final—Museum of Anthropology (pdf)

Weaving a Quarter Bag—http://blogs.ubc.ca/aboriginalmathnetwork/files/2014/03/WeavingBagInstructions.pdf

Books/CDs/DVDs

Coast Salish Weaving (cd-rom) - https://www.historymuseum.ca/boutique/product/coast-salish-weaving/

Hands of Our Ancestors by Elizabeth Lominska & Kathryn Berrick Johnson

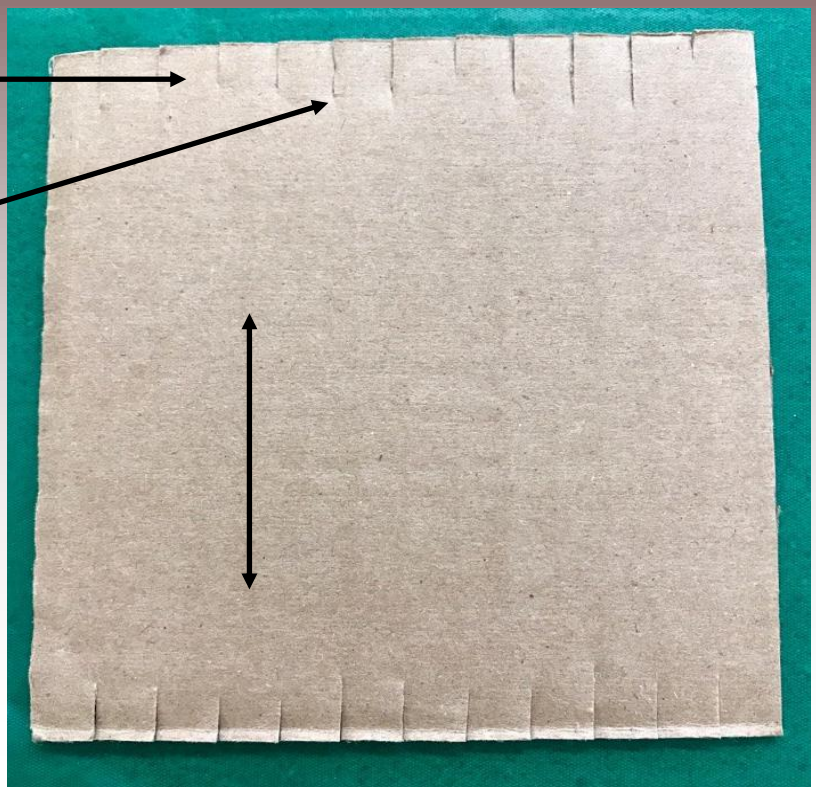
Salish Blankets by Leslie Tepper, Janice George & Willard Joseph

Salish Weaving by Paula Gustafson

MATERIALS

1 cm apart widthwise

1 cm cut down lengthwise



Please note that it is important to have the ribs of the cardboard be vertical.

The yarn should be thick so that students are not weaving forever.

The yarn should also be a wool blend as wool catches and holds together better than synthetic yarns.

For two classes of 30 students we only needed two balls of yarn.

Choose two colours that sharply contrast in order for them to show up well in photos.

Yarn needles are a good option for students who have difficulty using their fingers to weave.

They are also good for weaving in the ends.

Lesson 1 Weaving

The unit on slope was introduced using a PowerPoint on the cultural significance of Coast Salish weaving and it's connection to the Musqueam, Tsleil-Waututh, and Squamish Nations who have traditional territory in Burnaby. The students were then taught how to weave a slant design using the methods taught by Anjeanette Dawson from the Squamish Nation. The instructions were modified from Weaving a Quarter Bag at: http://blogs.ubc.ca/aboriginalmathnetwork/ideas-lessons/. The cardboard used as the loom and the yarn were prepared ahead of time. A PowerPoint on how to weave was shown as we walked the students through the steps.

Lesson 2 Weaving

Students finish weaving the panel of the slant design they started in the previous class. Each session is one hour and ten minutes. They were taught how to weave in the ends and complete their weaving. Please note that the students will be using mathematics vocabulary throughout the weaving process (Slope, parallel lines, and perpendicular lines).

Lesson 3 Slope (Equation of Line)

Lesson 4 Computer Lab (DESMOS Program)

Students were asked to take pictures of their weaving and send it to their email in order to access it to use with the DESMOS computer program. They can choose to log into the program using a Google account. The following questions can be answered using their weaving.

What's My Equation?

Is the woven pattern straight?

Are the line patterns parallel?

How do you know?

What's My Equation With a 90° Rotation?

Find the equation of at least three lines of weaving.

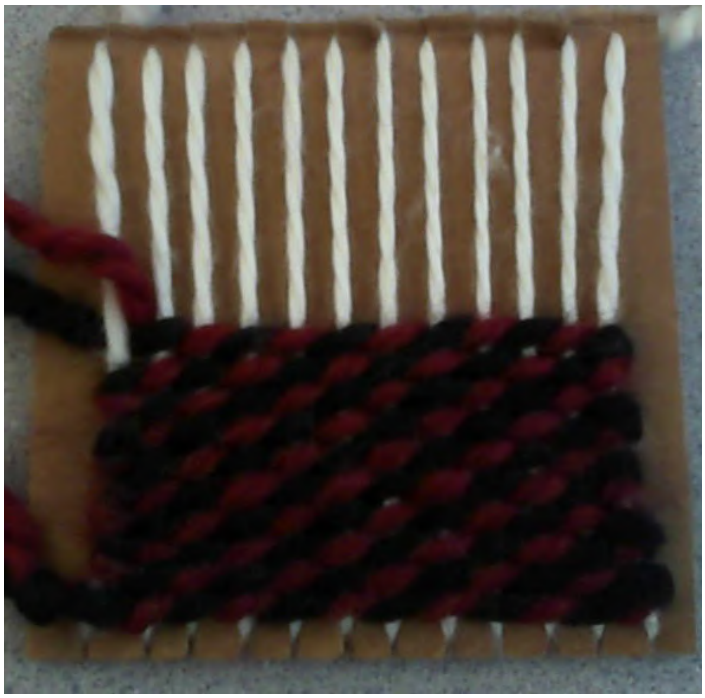
Are any lines perpendicular to the previous equations?

How do you know?

Is the woven pattern straight?

Are the line patterns parallel?

Are any lines perpendicular to the previous equations?



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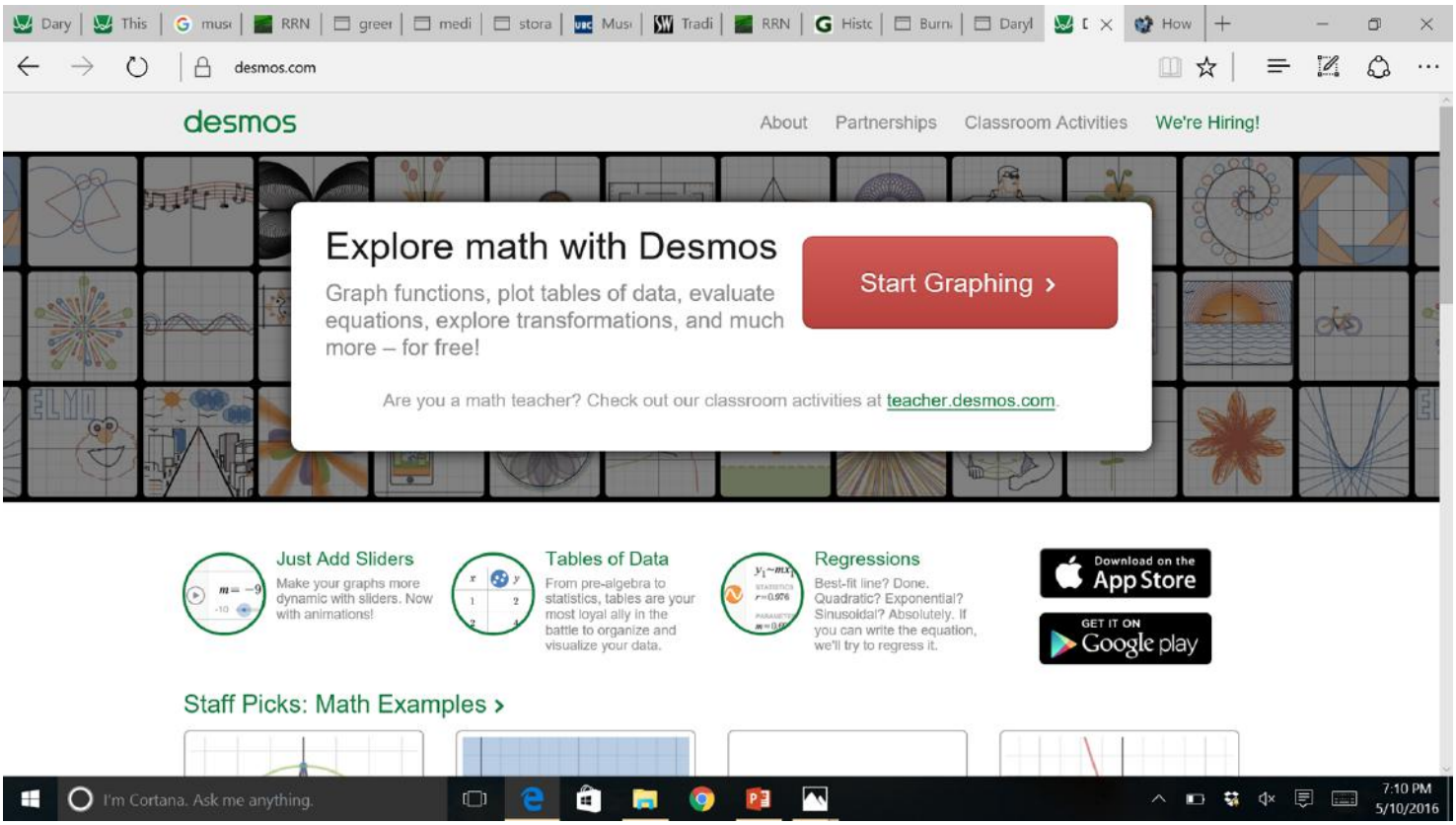
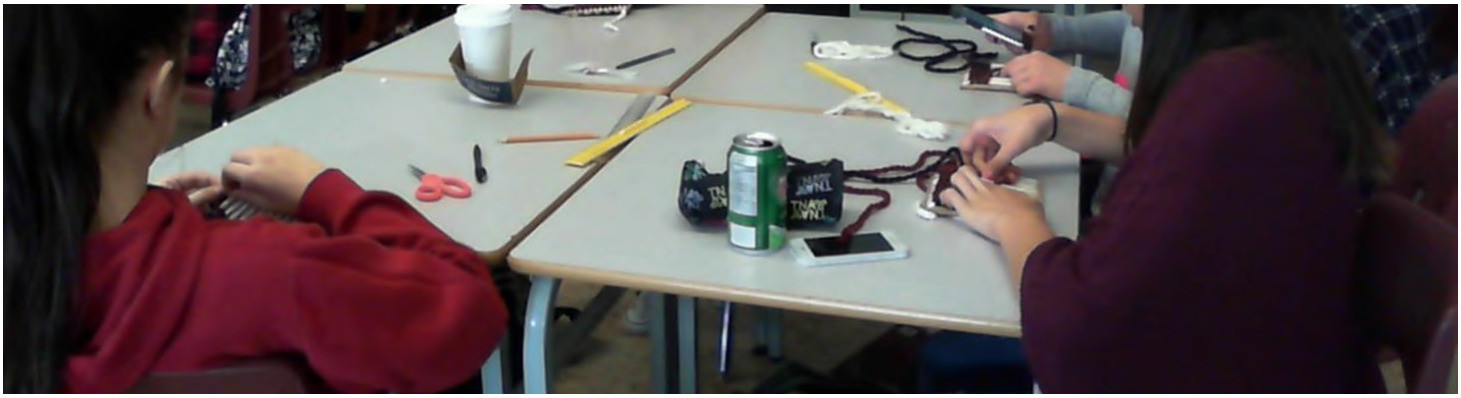


Using DESMOS

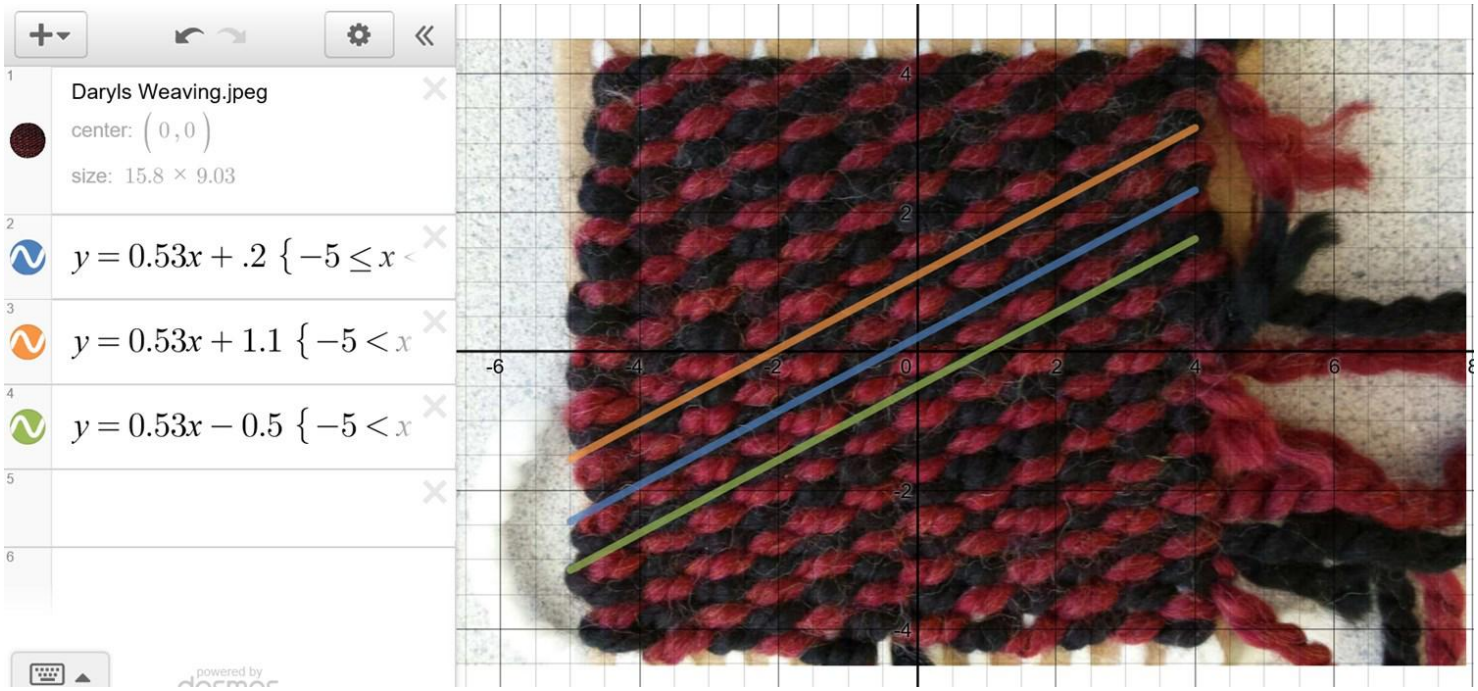
Students will need a google account—most will have one.

It is a good idea for students to take a photo of their weaving prior to going to the computer lab. They can then email the pictures using Wi-Fi at home and upload them to the program at school.

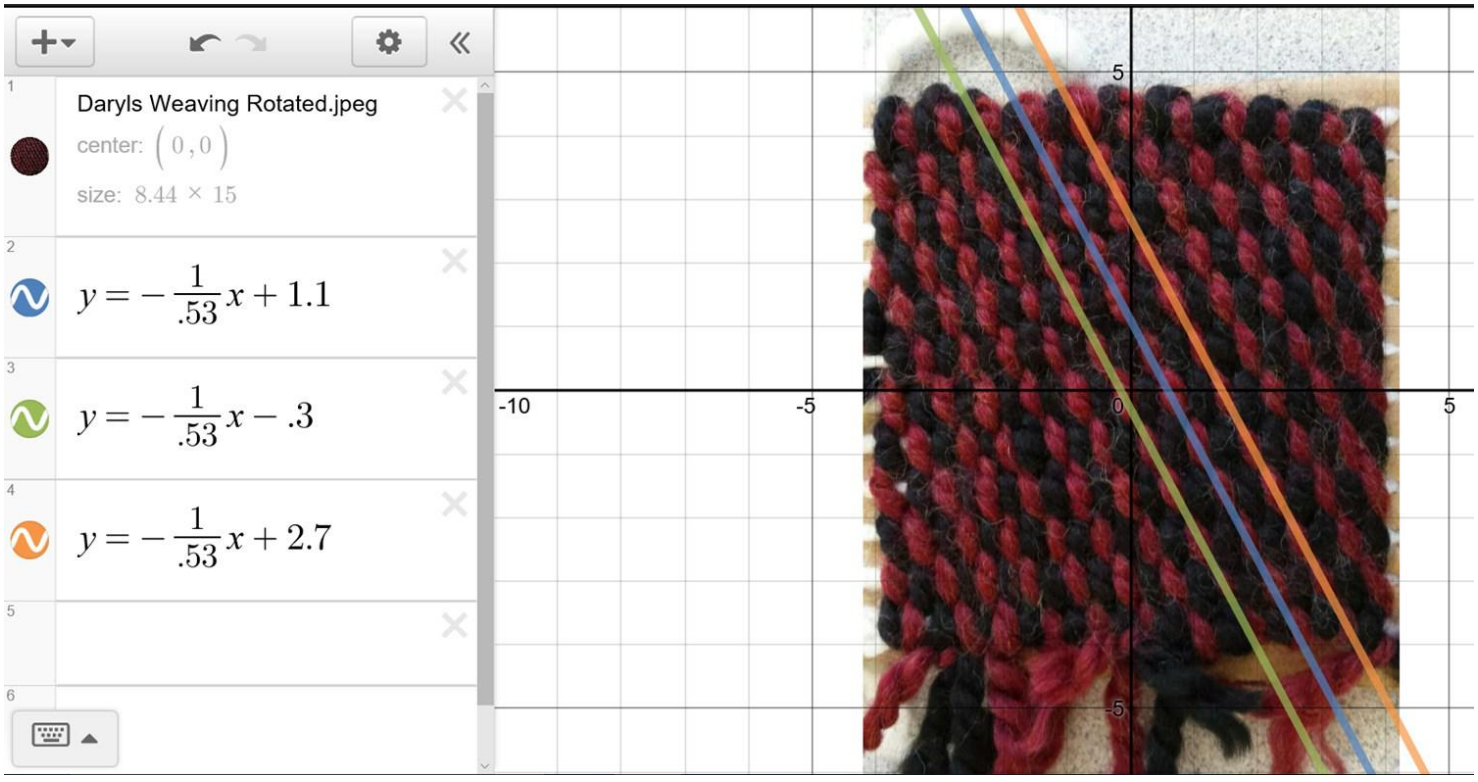
It is also advisable to bring a device to the lab in order to take pictures if students have not already done so. You may also choose to use a picture of your weaving, or another students' weaving for the students who have not completed the project.



Weaving and DESMOS



Rotate 90°



Questions Worth Asking

What do you **notice** about the slopes of each set of lines? **Explain** why this is so.

How are the slopes of the first set of lines **connected** to the slopes of the second set of lines? **Explain** why this is so.

Student Reflection

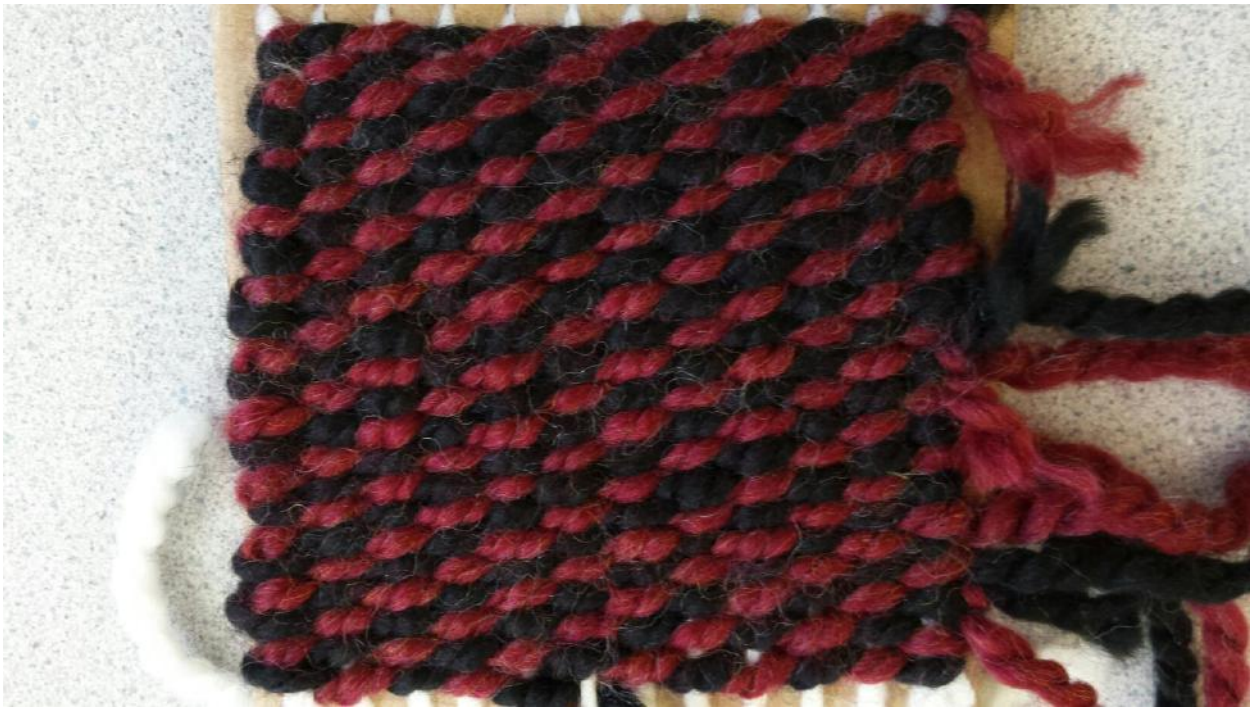
How has your understanding of slope, parallel lines, and perpendicular lines deepened?

How has this activity helped you perceive the world with a mathematical lens?

Linear Equations Weaving Assignment

Name:

Take a picture of your weaving. Insert it here…



Choose one colour to focus on. Use desmos.com to come up with the equations of the lines created by that colour. I choose black to focus on.

The Equations of the Lines:

Orange Line:

Blue Line:

Green Line:

What do you **notice** about the slopes of each line?

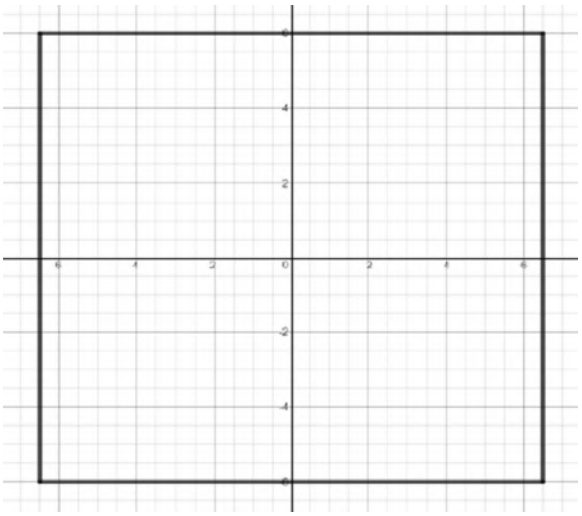
Explain why this is so:

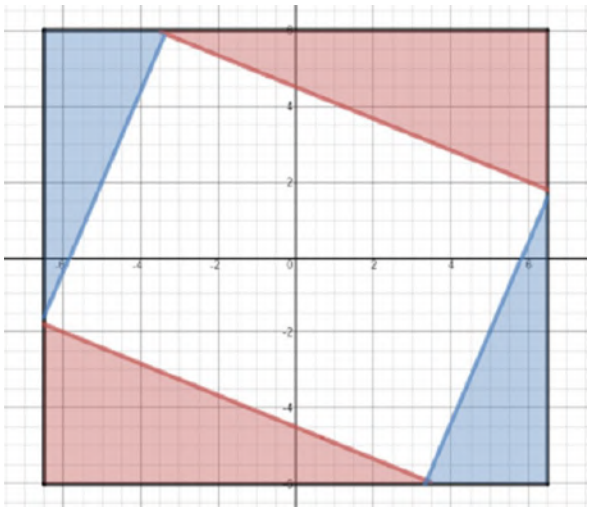
Now rotate your weaving by 90^{o} and try to find the new equations of the lines (of the colour that you have chosen.) Insert it here.

EXTENSIONS

Create a new weaving with Oblique Lines

Disclaimer: This is very difficult!



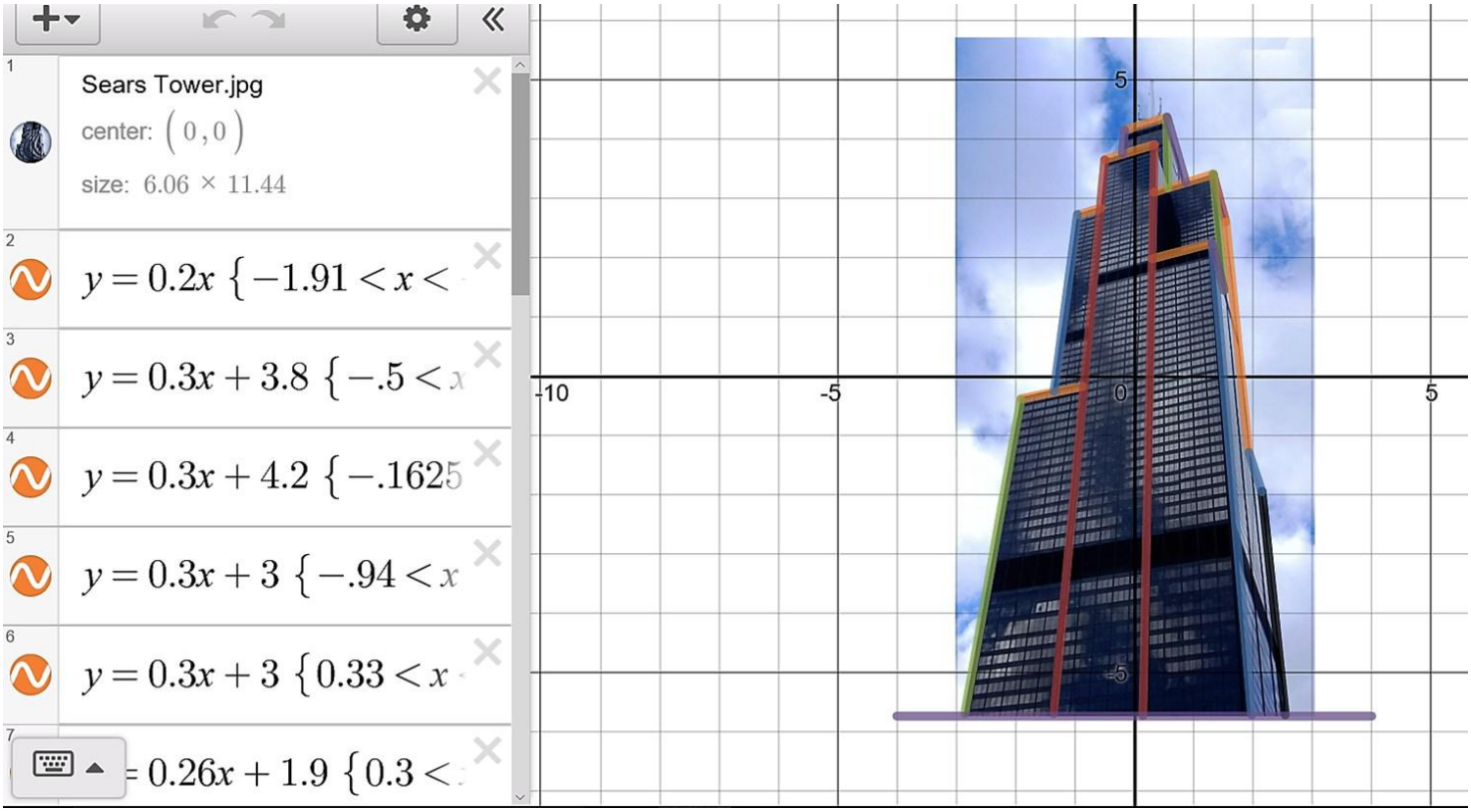


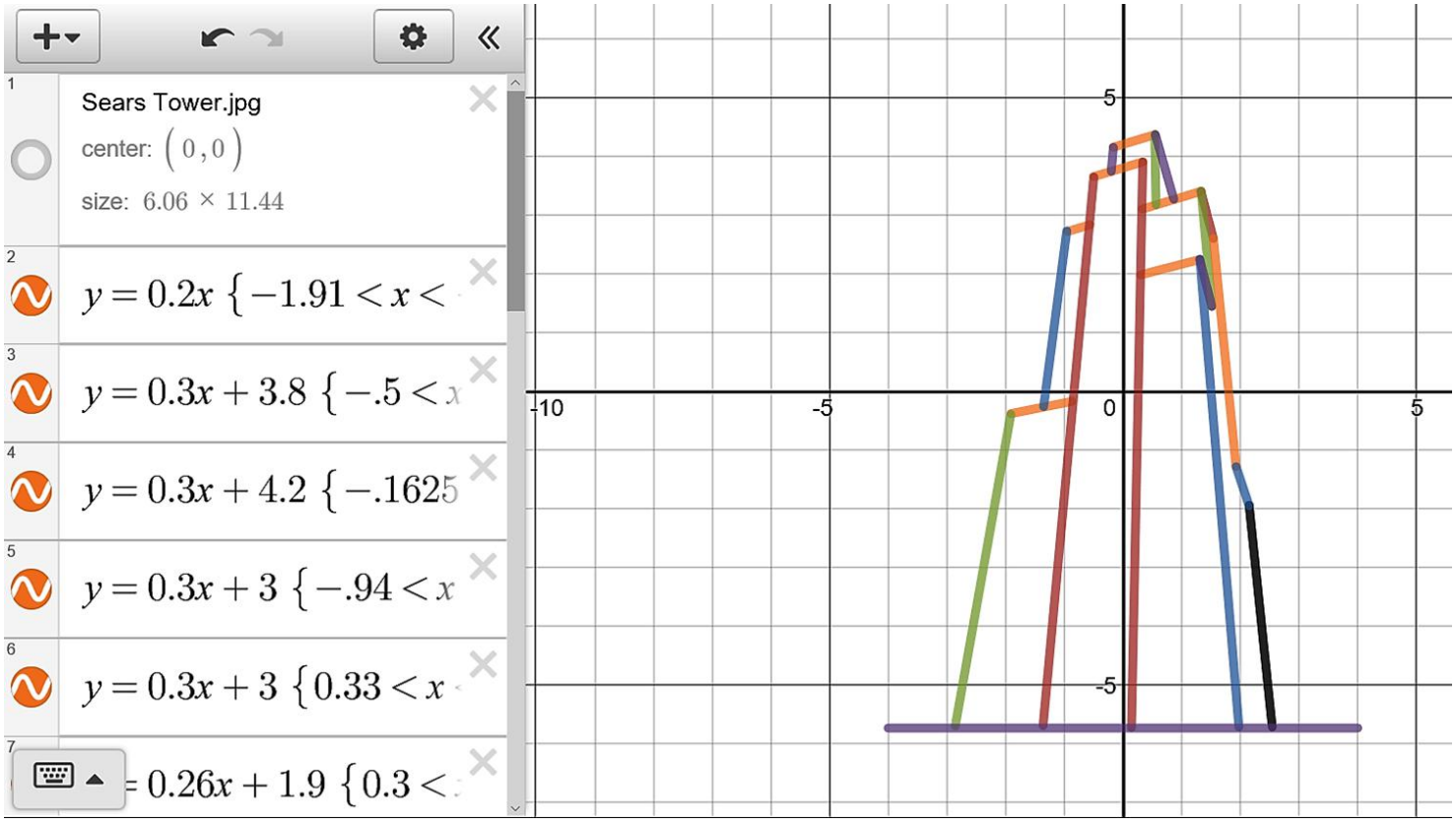
Use DESMOS to create a weaving design.

Start with a square grid.

Try to weave your design.

Use DESMOS with a picture that you like.





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