Curriculum Integration:
Can you believe that
THIS is Math?

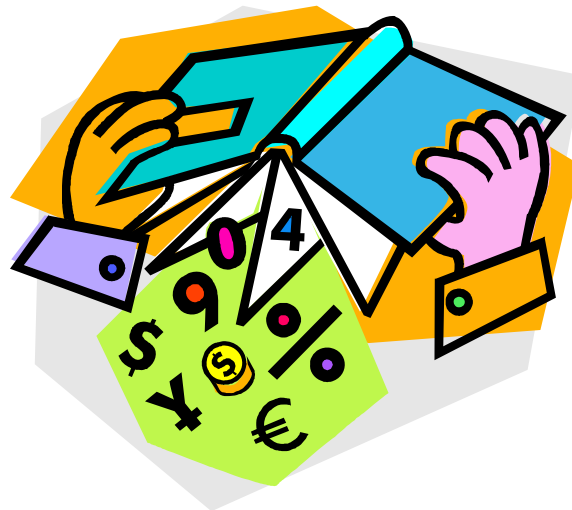Presented by Dr. Lynda Colgan, Queen's University
at the Summer Institute for Elementary Teachers 2012
July 17 to 19, 2012
Canada Science and Technology Museum
Ottawa, ON

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OUR BODY RULES!

Activity 1: Are You a Perfect Square?

Comparing the length of their body's to the length of their arm span, students can determine their body shape.

Materials
Each pair of students will require:

- A piece of string
- A ruler
- A pencil

Procedure
1. Use the piece of string to measure the height of the tallest person in the pair. The tallest person can stand with their back to the wall, and the second persona can but a piece of string to the tallest person's height.
2. Compare the length of the string to the tallest person's arm span.
3. Repeat this process for the other partner, using the string ruler.
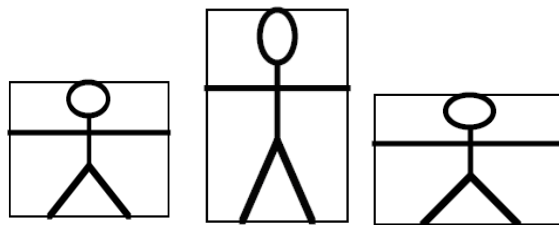
Compare your results to the diagrams above. If you resemble A (your height is equal to your arm span) your body shape is a square. If your arm span is shorter than your height, you are like diagram B, a tall rectangle. Lastly, if your arm span is longer than your height, your body type is a short rectangle as demonstrated by diagram C.

Activity 2: How Tall am I?

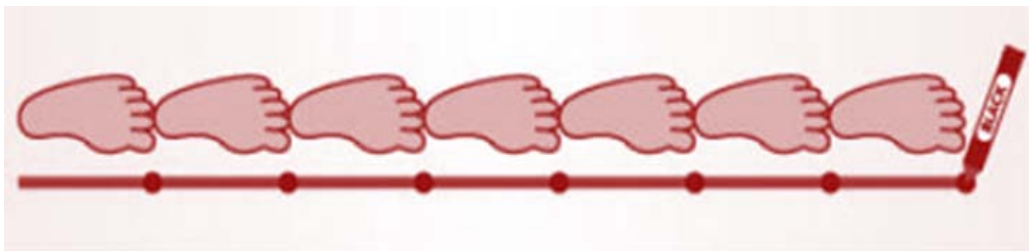Only using your foot, students can measure their height.

Materials
Each student will require:
- A pencil
- A sheet of construction paper

Procedure
1. Remove your right shoe.
2. Trace the shape of your foot onto a piece of construction paper.
3. Use the outline as a template to trace 7 more copies of your foot.
4. Tape the feet together, heal-to-toe, and use this measure your height.

Further Questions
- How does the length of your foot compare to that of your forearm?
- How does the length of your foot length compare to the size of your fist?

Use A Piece of String...

Wrap a string around your wrist to fit. How many times will this string go around the base of your thumb? How does the length of the string compare to your hand span? How many lengths of string do you need to circle your neck? Your head? Your waist?

What did you find?

The circumference of the neck is double the circumference of the wrist, which is in turn double the circumference of the thumb. As well, three times around the wrist is the same distance as once around the head. And, twice around the neck is the same distance as once around the wait.

Leonardo Da Vinci's Vetruvian Man

- A palm is the width of four fingers.
- A foot is the width of four palms (i.e., 12 inches).
- A man's height is four cubits (and thus 24 palms).
- The length of a man's outspread arms (his arm span) is equal to his height.
- The distance from the hairline to the bottom of the chin is one-tenth of a man's height.
- The distance from the top of the head to the bottom of the chin is one-eighth of a man's height.
- The distance from the bottom of the neck to the hairline is one-sixth of a man's height.
- The maximum width of the shoulders is a quarter of a man's height.
- The distance from the middle of the chest to the top of the head is a quarter of a man's height.
- The distance from the elbow to the tip of the hand is a quarter of a man's height.
- The distance from the elbow to the armpit is one-eighth of a man's height.
- The length of the hand is one-tenth of a man's height.
- The distance from the bottom of the chin to the nose is one-third of the length of the head.
- The distance from the hairline to the eyebrows is one-third of the length of the face.
- The length of the ear is one-third of the length of the face.
- The length of a man's foot is one-seventh of his height.

THE PHI FACTOR

The Golden Ratio

The golden ratio is also known as the golden mean, the golden section, or the golden proportion.

AC:AB=AB:BC

Pick you favorite:

Which on is the most visually appealing to you?

What does φ mean to me?

- light switch plate
- file card
- television screen
- paperback novel
- door frame

You're golden

1. Measure and record your height.
2. Stretch out your arm, and measure the distance from the top of your head to the tip of your middle finger of your outstretched arm. Record this result.
3. Compare the ratio of your height to the measure of the length from the top of the head to the end of your outstretched arm. When calculated, what does the ratio approximate?
4. Next, measure your height and your navel height. Compute the ratio of height: navel height. What did you learn?
5. Measure your entire arm length and the length of your arm from fingertip to elbow. Write the result as a ratio.

Want to know if your face is golden?

1. Have someone take a digital 'headshot' photo of you. Draw rectangles on the print as shown.
2. Measure the length and width of the rectangle formed from the top of the head to the chin and from one side of the face to the other. To calculate the ratio, divide length by width.
3. Measure the length and width of the rectangle formed from one side of the face at eye level to the other side at eye level and from eye level to chin. To calculate the ratio divide length by width.

> The head forms a golden rectangle with the eyes at its midpoint. The mouth and nose are each placed at golden sections of the distance between the eyes and the bottom of the chin.

Architecture

During the 5th century B.C., ancient Greek architects of the 5th century B.C. were aware of the golden rectangle. The golden rectangle is found throughout the Parthenon and Acropolis. The space between the columns is one example. The *Porch of Maidens* is another. The Pyramids of Giza also have dimensions based on the golden ratio, and they were constructed before the Parthenon.
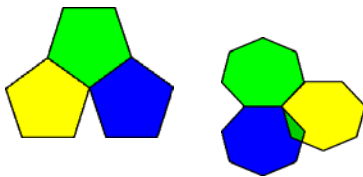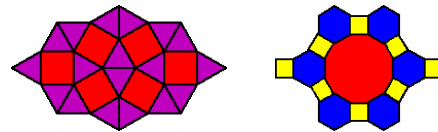
TESSELLATIONS

Which shapes will tessellate the plane?

- Diamond
- Trapezoid
- Oval
- Octagon
- Parallelogram/rhombus
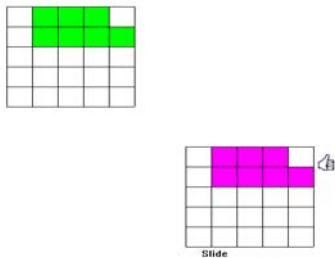- Pentagon

- Hexagon
- Circle
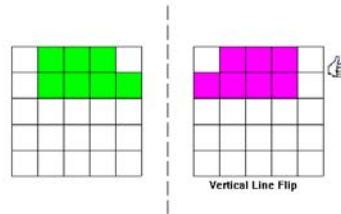- Rectangle
- Semi-circle

Non-tessellating Shapes

Pattern Block Tessellations
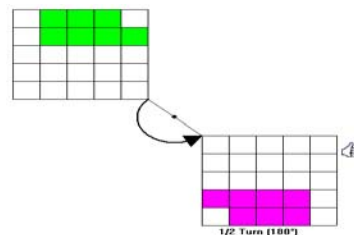
Slides (Translations)

Flips (Reflections)

Glide Reflections

Turns (Rotations)

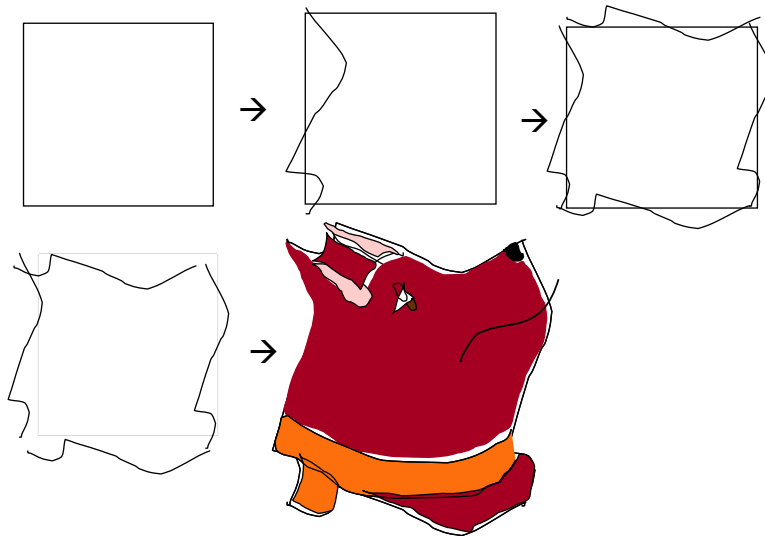# Activity 3: Draw a Tessellation Pattern

Students will learn to easily draw a tessellation pattern by following these simple steps.

Materials

- A pencil
- An eraser
- A piece of paper
- Coloring pencils

Procedure

1. Begin with drawing a square.
2. Change the shape of one side.
3. Copy this same line change on the opposite side.
4. Rotate the square and repeat the line on the remaining edges.
5. Erase the square.
6. Add lines to the inside of the shapes to turn them into a picture.
7. Add colour to enhance your picture.

Activity 4: Draw a Tessellation Pattern 2

Students will learn to easily draw a tessellation pattern
by following these simple steps.

Materials

- A pencil
- An eraser
- A piece of paper
- Coloring pencils

Procedure

1. Begin with drawing a square.
2. Change the shape of one side.
3. Repeat the line on the opposite side.
4. Rotate the square and repeat the line on the remaining edges.
5. Erase the square.
6. Turn the shape, looking for two hidden animals, flowers, fish, insects, or birds.
7. Draw a line that separates the two hidden shapes you have found.
8. Add a few lines to emphasize your hidden shapes.
9. Separate the two shapes so you can use them one at a time.
10. Make four versions of each shape, each with more detail.
11. Color all of one type of shape using the same basic color scheme.
12. Line up the simplest version of one shape with the most complex of the other along the bottom.
13. Line up the next most complex with the next simplest over the bottom row.
14. Add the next row in the same way.

QUILTING

The Underground Railroad

Monkey Wrench

The monkey wrench quilt was the first to be displayed. It was the signal for the slaves to get ready for their escape. It was a symbol that told them to gather their 'tools.' Tools could be anything that they needed to take with them to survive, such as compasses, weapons, food, and possibly a few coins. A monkey wrench is used by blacksmiths to change metal. This symbol meant that it was time for the slaves to make a change. Getting their tools ready was also a reminder that they needed to have strong 'mental' tools, such as being alert.
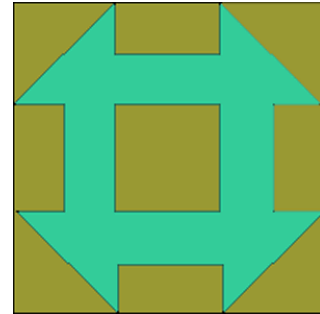
The Wagonwheel

The wagon wheel pattern was the second quilt to be displayed on the fence. It was a signal which alerted slaves to pack up the supplies that they would need on their journey (as if they were packing up a wagon).
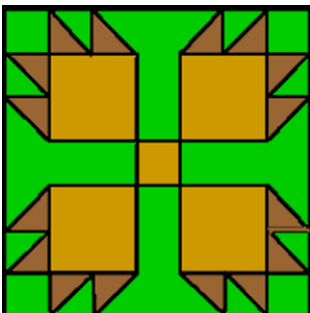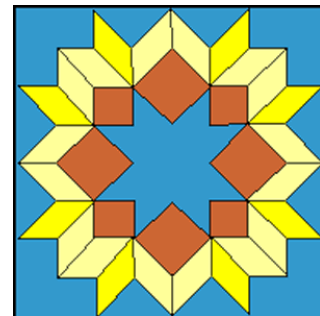
Bear's Paw

Slaves on their journey to freedom were told to follow the bear's trails over the Appalachian mountain range. Bears knew many routes through the mountains, and could find water and fish.

The Crossroads

According to the code, the crossroads was Cleveland in the free state of Ohio. Cleveland was the place where many overland trails began. From here, travelers could choose between 4 or 5 different paths to Canada. Special preparations may have been needed before the next part of the journey to Canada began.
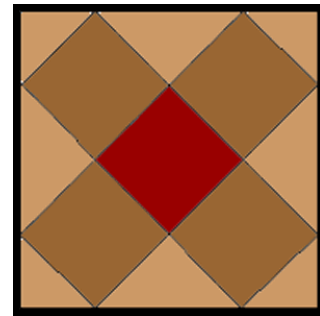
The Log Cabin

This part of the code may have told the slaves to draw a picture in the dirt for a 'Conductor' to see, or to look for a cabin displaying a quilt with this pattern.
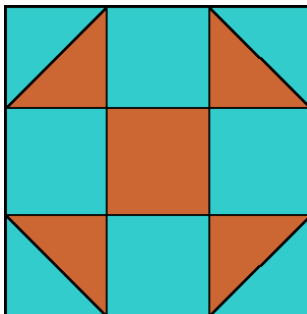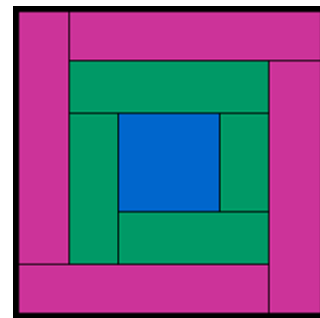
Shoofly

This part of the code was telling people to look for free blacks who knew about the Underground Railroad. A Shoofly may have been a special person who would help the travelers to get rid of their dirty, torn, and tattered clothes.

The Bow Ties

Runaway slaves needed to wear new clothes so they would look like the free blacks who lived in the north. They may have been hidden in a church until it was time for the next part of their journey.
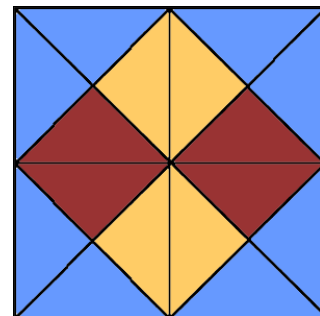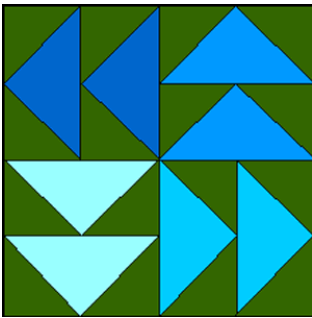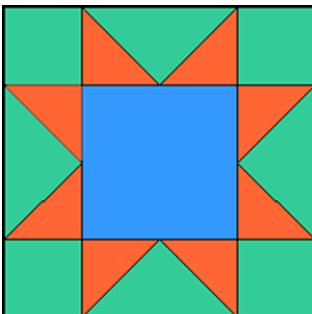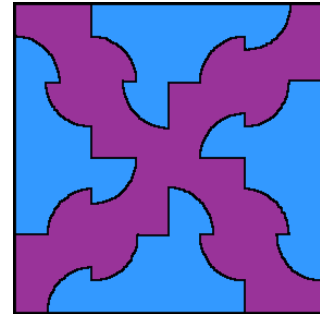
Flying Geese

Geese fly north in the springtime, and their flight path could guide the travelers.

The Drunkard's Path

Slave catchers from the south hunted for runaways with tracking dogs. This pattern told the slaves to walk in a crooked path like a drunkard, to avoid capture.

The Star

The North Star quilt was used as a navigation tool, and sung about in the song "Follow the Drinking Gourd." This pattern like "Flying Geese," is a directional pattern. The runway slaves looked to the sky for guidance.

Activity 5:
Making the Drunkard's Path Quilt Block

Students will construct their own Drunkard's Path Quilt Block. This was one of the quilt patterns that served as a symbol for the African Americans who escaped slavery by following the Underground Railroad.

Materials
- 2 colors of construction paper
- A pair of scissors
- A pencil
- A glue stick

Procedure
1. Cut 2 squares and 2 circles out of each color. The diameter should be 2/3 the length of the sides of the square.
2. Fold the squares and circles in quarters.
3. Mark the fold lines with a pencil.
4. Glue each circle onto the centre of a square of the opposite color. Use the lines to position the circles.
5. Cut each square into quarters along the marked fold lines. You will now have 16 small squares.
6. Each quilt block is made up of 4 smaller identical blocks. Assemble the first block as shown below.
7. Assemble 3 more identical small blocks. To form the quilt block, the small blocks are rotated 90 degrees starting in the upper left corner. See the diagram.