Imaginative Quilted Geometric Assemblages

Elaine Krajenke Ellison
6712 Forrest Commons Boulevard
Indianapolis, Indiana 46227
eellisonelaine@yahoo.com
www.mathematicalquilts.com

Abstract

Quilts serve as a visual introduction to mathematical objects that allow students to explore mathematical art as they gain geometric insights. From Plato's dissection in the fourth century and Leonardo da Vinci's curvilinear shapes in the fifteenth century to Mascheroni constructions of the eighteenth century, these quilt designs and hands-on constructions will engage the viewer in mathematical visualization and problem solving. With each compass construction a corresponding completed quilt will be shown. No sewing is necessary.

1. Introduction

Adding hands-on activities to the high school mathematics classroom helps to engage students at a variety of levels. My introduction will include a synopsis as to the changing concepts of what constitutes mathematics and a mathematical activity. From the study of number in roughly 500 B.C, to the contemporary ideas on mathematics including the study of number, shape, motion, change, mathematical tools, and patterns, we will expand our thinking about mathematics. Mathematics can even be included in quilting.

2. Ordering

A puzzle will be presented to the teachers in this workshop. The teachers will be told that the puzzle is made up of squares. The teachers will have to figure out what order the squares would be assembled in to achieve the given pattern. The idea of this activity is to communicate the theory of order in designing and executing a quilt. What piece is attached first, second, third, etc. is very important in forming the quilt correctly. Further, how this problem is solved can be done in a variety of ways. This reinforces the fact that we all learn mathematics differently!

3. Plato's Dissection

Probably the earliest of dissections, Plato (427-347 B.C.) posed the following problem: given a square, cut the square and form two new squares so that the sum of the two new areas are equal to the given squares' area. Each teacher will be given a square and scissors to accomplish this dissection.

4. Leonardo's Curved Shape

Leonardo da Vinci (1452-1519) was interested in writing a book about fun with geometry: De Ludo Geometrico was never written. However, Leonardo did leave us with a wealth of dissections to learn from. Some historians think that Leonardo was trying to square the circle—something we know is impossible today. The curved shape we will be investigating in this exercise was found in the *Codex Atlanticas*, a collection of Leonardo da Vinci's notes and figures. Each teacher will be given the curved shape and asked to cut the shape to form a rectangle. More than one solution exists to this problem and Leonardo's method will be shared. It is quite surprising how he thought about this figure. If time, the Clamshell will also be investigated. This pattern is found in Leonardo's notes over and over again. Both shapes are "hinged dissections".

5. Leonardo's Claw

Leonardo's Claw resembles the foot of a bald eagle. We will construct the Claw by first constructing a "net" that relates to the proof of the area relationships that exist in the Claw. After the "net" is constructed, we will complete the Claw. Then, we will look at two proofs of the fact that the area of the claw is equal to the area of the square sitting inside the Claw.

Figure 1: *Leonardo's Claw*

6. Mascheroni's Cardioid

Lorenzo Mascheroni (1750-1800) studied compass construction. In 1797, Lorenzo Mascheroni, an Italian mathematician, published *Geometria del Compasso*. Just as Georg Mohr had done 125 years earlier, Mascheroni proved that all compass-and-straightedge constructions could be done using a moveable compass alone. Because Mohr's work had gone virtually unnoticed at the time it was published, it was Mascheroni who was given credit for this result. Today, compass only constructions, like the cardioid that we will be doing in this workshop, are called *Mascheroni Constructions*. On a side note, Mascheroni was employed by Napoleon to teach his military the use of constructions in warfare.

7. Golden Rectangle and Golden Triangle

We will construct the Golden Rectangle and examine its' properties that can be used in the high school classroom. The Golden Triangle will also be investigated.

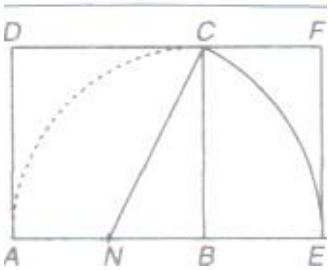

Figure 2: *The Golden Rectangle*

References

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