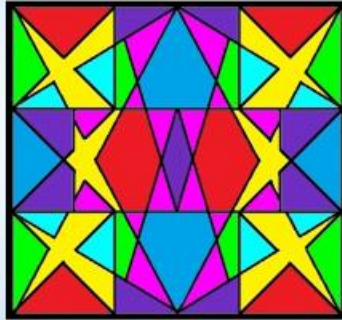


# NCTM ANNUAL MEETING & EXPOSITION 2019

April 3-6

San Diego

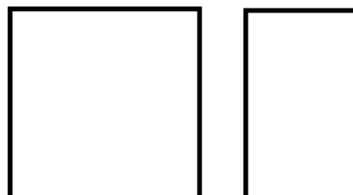
*The Beauty of Harmonic Divisions of  
Golden Rectangle Designs*

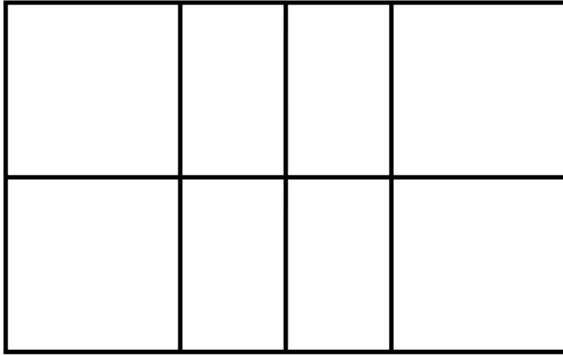


Presented By  
Stephanie H. Cooperman  
Shc.amtnj@gmail.com  
April 5, 2019

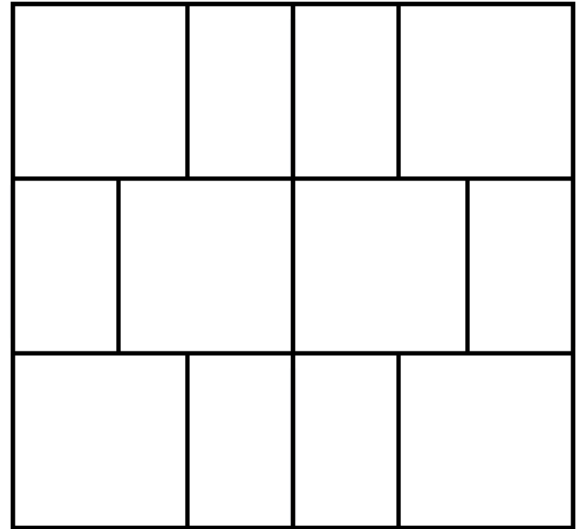
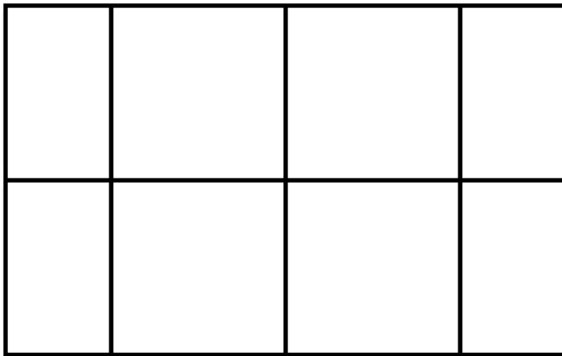
## GRID SELECTIONS – Google Classroom

### Original Golden Rectangle and Parts

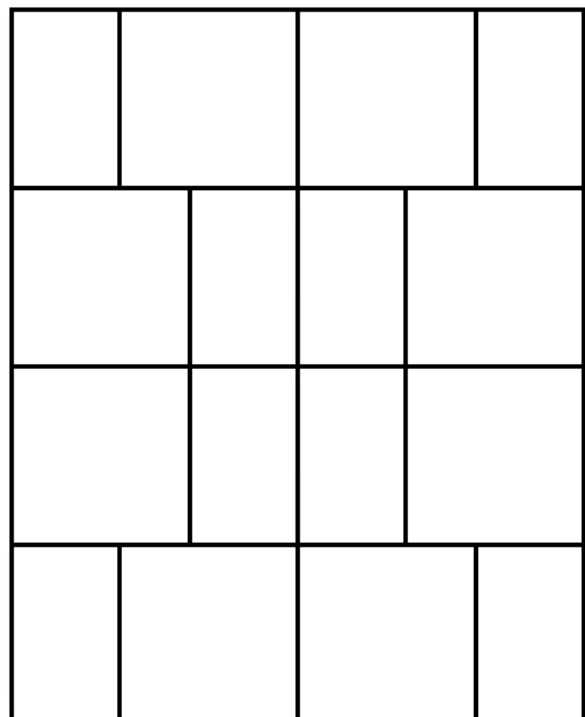
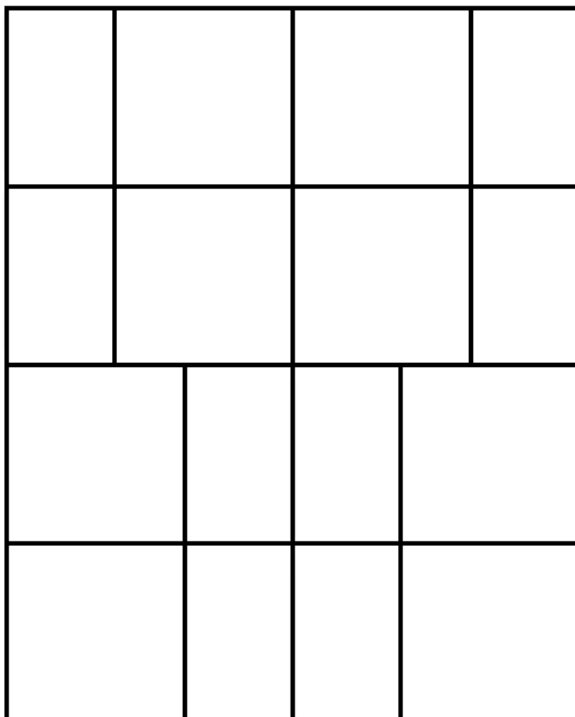




Using a Paint Document, put together combinations of Golden Rectangles in a balanced format. Start with simple ones and then experiment with more complex underlying grids.



### More Complex Grids Formed With Golden Rectangles



## REQUIREMENTS FOR THIS PROJECT:

### *The Beauty of Harmonic Divisions of Golden Rectangle Designs*

- Familiarity with the Desmos Graphing Calculator: graph settings; tools
- Familiarity with GeoGebra: Geometry
- PC computer, mouse, and Paint Application
- MS Paint Videos: <https://tinyurl.com/y6e2uqob>
- PowerPoint Presentation and relevant files: please send a request to [shc.amtnj@gmail.com](mailto:shc.amtnj@gmail.com)

## INTERNET RESOURCES:

- Websites for GeoGebra:

<https://www.geogebra.org/>

<https://www.geogebra.org/geometry>

<https://www.geogebra.org/graph>

<https://www.geogebra.org/search/golden%20rectangle>

[https://wiki.geogebra.org/en/Manual#User\\_interface](https://wiki.geogebra.org/en/Manual#User_interface)

[https://wiki.geogebra.org/en/File\\_Menu](https://wiki.geogebra.org/en/File_Menu)

<https://www.geogebra.org/materials>

[https://wiki.geogebra.org/en/Selecting\\_objects](https://wiki.geogebra.org/en/Selecting_objects)

<https://help.geogebra.org/topic/how-do-i-fill-a-closed-polygon-with-color->

- Websites for the Desmos Graphing Calculator:

<https://www.desmos.com/>

<https://www.desmos.com/calculator>

<https://learn.desmos.com/graphing>

<https://learn.desmos.com/graph-settings>

<https://learn.desmos.com/points>

<https://learn.desmos.com/tables>

<https://learn.desmos.com/functions>

<https://learn.desmos.com/inequalities>

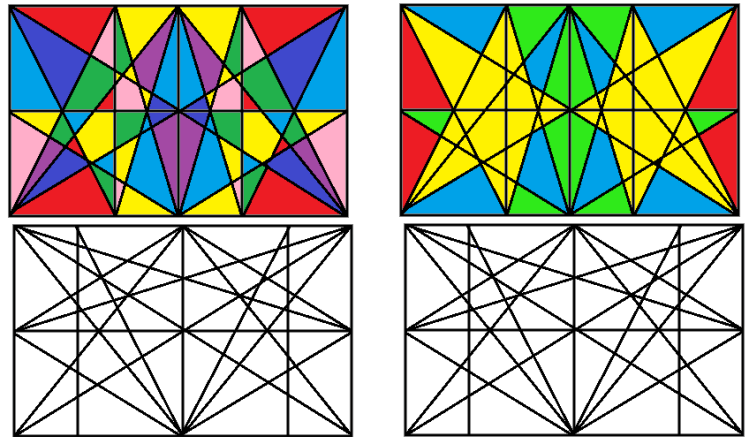
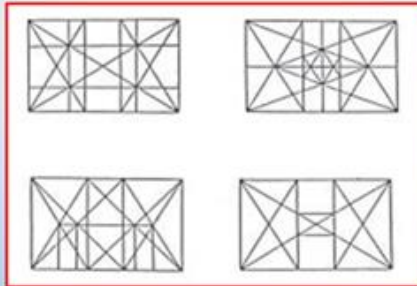
<https://learn.desmos.com/restrictions>

<https://www.desmos.com/calculator/mvcuf0mirs>

<https://support.desmos.com/hc/en-us/articles/203665195-Shading-Your-Graph>

#### HARMONIC DIVISIONS OF GOLDEN RECTANGLES

- ❖ Arrange golden rectangles in a symmetric pattern.
- ❖ The square can be drawn on either side.
- ❖ Vertices can be connected in many variations to create harmonic divisions.
- ❖ Use a Paint document for drawing your lines symmetrically with the Line tool.
- ❖ Color the sections symmetrically; choose hues so the composition is pleasing to the eye.



#### Cross-Curricular Connections:

- ❖ Ancient Civilizations – Artistic Expression
- ❖ Historical Significance of Architecture – Buildings & Statues
- ❖ History of Painting – Renaissance to Modern Times
- ❖ Attributes of Diverse Cultures – Customs and Values
- ❖ Mathematics and Art – Connections to the Real World

#### The Importance of Interdisciplinary/Cross-Curricular Teaching:

- ❖ Increase in student motivation, engagement and new friendships
- ❖ Appeals to individual strengths and interests with opportunities to excel
- ❖ Encourages pair/group interaction in a supportive and constructive setting
- ❖ Increase in problem-solving skills emphasizing creativity and imagination
- ❖ Amplifies and enhances the synthesis of knowledge outside the classroom

#### Directives For Success:

- ❖ Communication: email, letter or other type of announcement so that families are aware of the activity; optional or a required marking period project
- ❖ Level of proficiency: access to Golden Rectangle grids to meet varying skill levels; Google Classroom or other suitable resource
- ❖ Modeling: several class time opportunities for demonstrations and launches of project phases
- ❖ Time management: periodic checks to determine that students are meeting target dates for initial constructions, harmonic divisions, composition/coloring and final project
- ❖ Individualization: additional assistance/time available for students needing help with construction and design considerations; parent communications

### **Suggestions For Grading Rubric**

- ❖ Underlying Harmonic Division grid: minimal to complex
- ❖ Symmetry of design: maintained throughout composition
- ❖ Strategic pattern of polygonal shapes: diverse and engaging
- ❖ Eye-catching application of color: perspective and depth
- ❖ Presence of “hidden stars”: variation in size and direction
- ❖ Overall design: attractive and appealing presentation

**Thank you for coming to this presentation!**

**If you would like a copy of the slide show,  
please send an email to:**

**Stephanie Cooperman: [Shc.amtnj@gmail.com](mailto:Shc.amtnj@gmail.com)**

