raft resource area for teaching
www.raft.net

Curriculum topics:

- Reflection
- Graphing
- Art
- Coordinate Pairs
- Geometry

Subjects: Art, Life Science, Math, Physical Science

Grade range: 3 – 12

ANAMORPHIC ART

Science, math, and art make magic?

In this unique interdisciplinary activity, students use science, math, and art skills to create a drawing on a curved grid. The coordinates used for the drawing on the curved grid are the same as they would be for a square grid. This anamorphic drawing appears distorted from the original and can be difficult to recognize… **until it is viewed with a cylindrical mirror!** A recognizable image "magically" appears when science, math, and art are mixed together.

Who we are:

Resource Area for Teaching (RAFT) helps educators transform the learning experience through affordable "hands-on" activities that engage students and inspire the joy and discovery of learning.

For more ideas and to see RAFT Locations

www.raft.net/visit-raft-locations

Materials required

For each activity station:

- Reflective Mylar® (polyester film) sheet, ~ 12.7 cm (5”) x 10 cm (4”)
- Tape
- Optional: Colored markers
- Copies of grid patterns with a star and a house (page 5), blank square grids (page 6), a blank curved grid (page 7), and/or other simple patterns

How to build it

1. Create a cylindrical mirror by rolling the 12.7 cm (5”) x 10 cm (4”) reflective Mylar® sheet along the 5” length, with the shiny side out. The mirror will stand 10 cm (4”) tall.

2. Overlap the sides of the Mylar® by about 0.3 cm (⅛”). Tape the overlap.

To do and notice

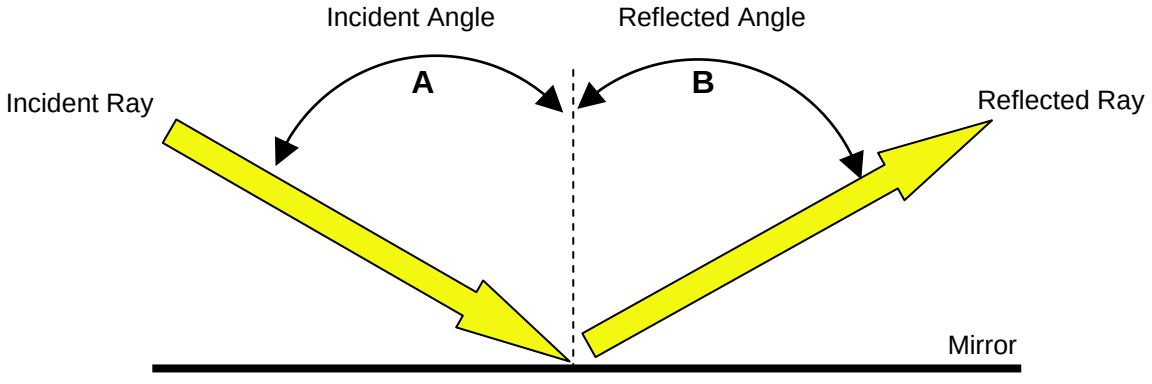
1. Transfer the star or house pattern from the square grid onto the curved grid by mapping the points on the square grid to the equivalent points on the curved grid. Every place the pattern crosses a line, make a point and plot the point. It may help to do the first few points as a group. Use a pencil first. Once the pattern is transferred correctly, retrace the pattern with colored markers.

2. Transferring the pattern requires patience and skill in using coordinate pairs. For younger children, beginning with the star may be the best choice.

3. Place the cylindrical mirror onto the circle as marked. Look at the reflection on the mirrored tube. The image now appears recognizable and looks similar to the drawing on the square grid.

The science behind the activity

The basic scientific rule for mirrors is “angle in, angle out” or “the angle of incidence is equal to the angle of reflection.” When the mirror is curved, as are mirrors in a fun house, the reflections become distorted. Notice that the image of the house, when viewed in the curved mirror, is reversed from the original, and that the grid numbers and letters are backwards. In flat and positively curved (convex) mirrors, such as cylindrical mirrors, images are always reversed left/right. Negatively curved (concave) mirrors, such as the bowl of a reflective spoon, can have un-reversed images. (A parabolic mirror, a special case of a concave mirror, can make a perfect real image.)



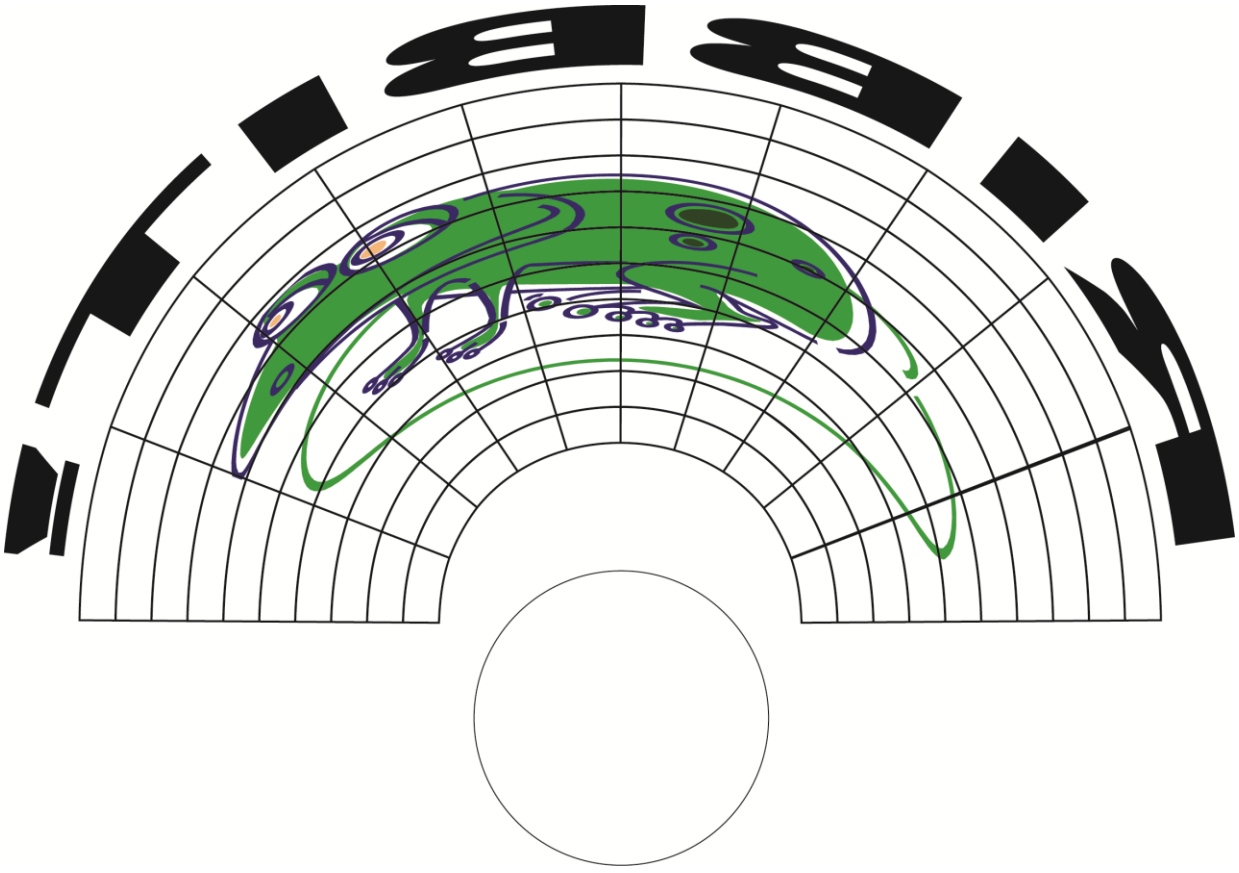
Angle **A** = Angle **B**

The science behind the activity (continued)

It is always a good idea to begin with a simple design. When the students distort an image onto a curved (non-linear) grid, the starting and ending coordinates for each line segment are the same as they were for the square grid. Using the curved grid can be challenging at first; but students of all ages will soon enjoy curved graphing.

History

Anamorphic art has a long history, having roots in cultures from around the world, including China, England, France, and the Netherlands. Distorted images were used for everything from amusing royalty to carrying secret messages and concealing political allegiances (such as in England during the 17th and 18th centuries). During the Victorian era, anamorphic art and viewers were popular parlor items, and eventually they became inexpensive toys for children.



Curriculum Standards:

Reflection (Next Generation Science Standards: Grade 4, Physical Science 4-2; Middle School, Physical Science 4-2)

Senses (Next Generation Science Standards: Grade 4, Life Science 1-2)

Coordinate Graphing (Common Core Math Standards: Grade 5, Geometry, 1 & 2)

Additional standards at: http://www.raft.net/raft-idea?isid=278

Learn more

- Extend this activity by adding color and details to the house such as curtains and shrubs.
- Create more detailed pictures using the blank grids provided.
- Experiment to see how the images distort as they move the mirror to a different location.
- Use the curved grid to discover how to write letters or words so that they appear as legible writing in the curved mirror. It might help to break this down into two parts: first, write the word so that it can be read with a flat mirror; and then transfer the writing to the curved grid.
- Have an anamorphic art show.

Related activities: See RAFT Idea Sheets:

Reflection:

Color Wheel Kaleidoscope-
http://www.raft.net/ideas/Color Wheel Kaleidoscope.pdf

Hinged-Mirror Kaleidoscope -
http://www.raft.net/ideas/Hinged-Mirror Kaleidoscope.pdf

Infinity Mirror -
http://www.raft.net/ideas/Infinity Mirror.pdf

Coordinate Graphing:

Graphing Race to the Edge!-
http://www.raft.net/ideas/Graphing Race to the Edge.pdf

Resources

Visit www.raft.net/raft-idea?isid=278 for "how-to" video demos & more ideas!

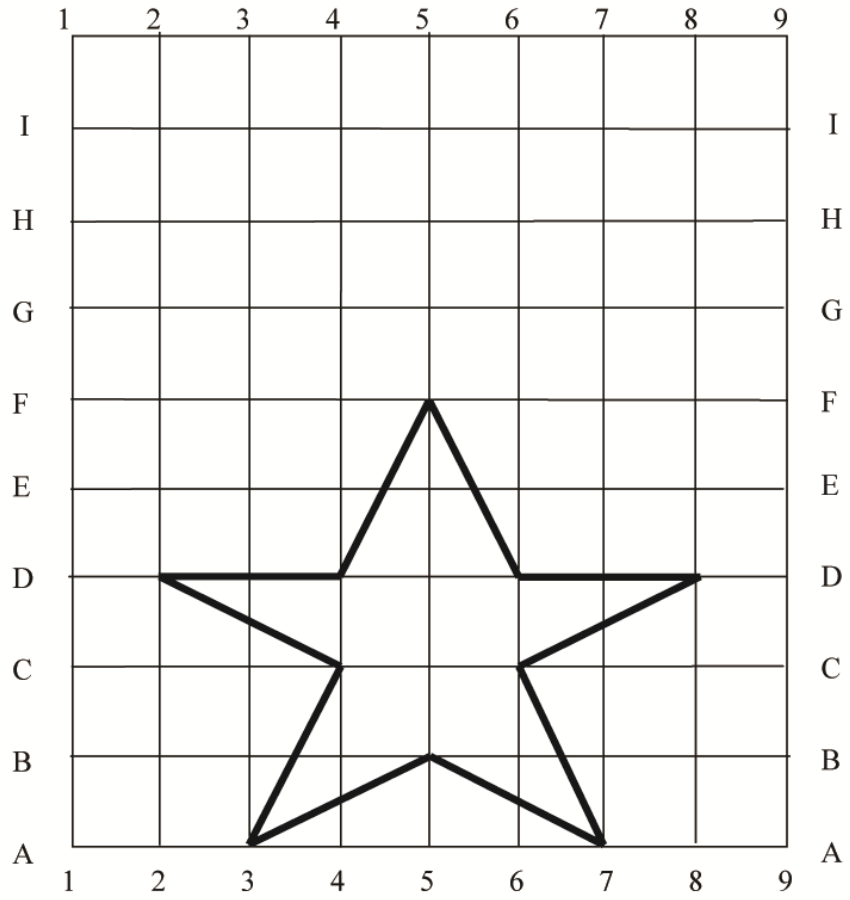
See this website for more information on the following topics:

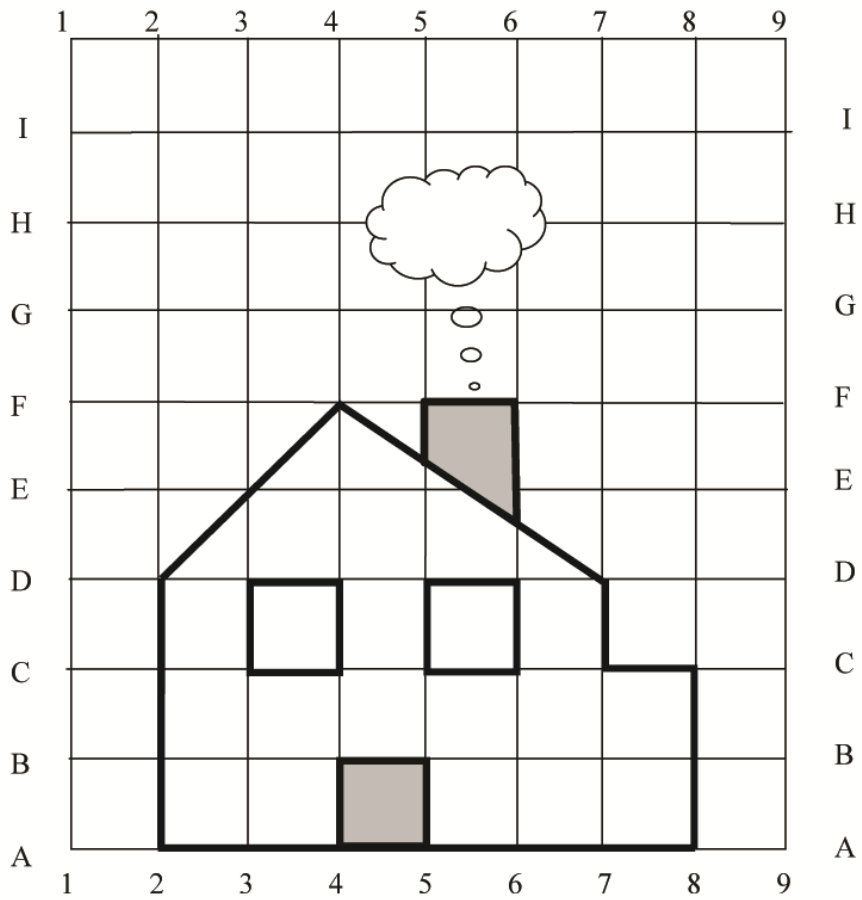
- **Descriptions, with anamorphic images, that explain the anamorphosis process.** There is also a link for a free software download, for Windows, which will carry out several different anamorphic transformations on digital images http://www.anamorphosis.com/ .

- **Videos and exercises on the coordinate plane from the Khan Academy** – https://www.khanacademy.org/math/algebra/linear-equations-and-inequalitie/coordinate-plane

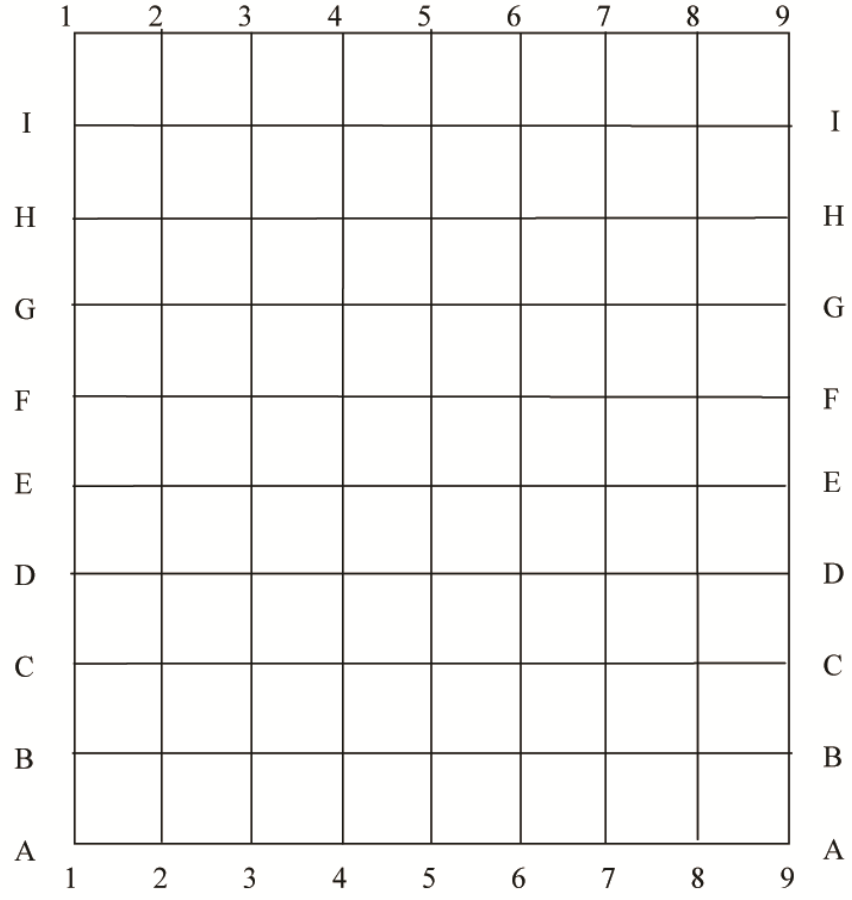
Acknowledgements:

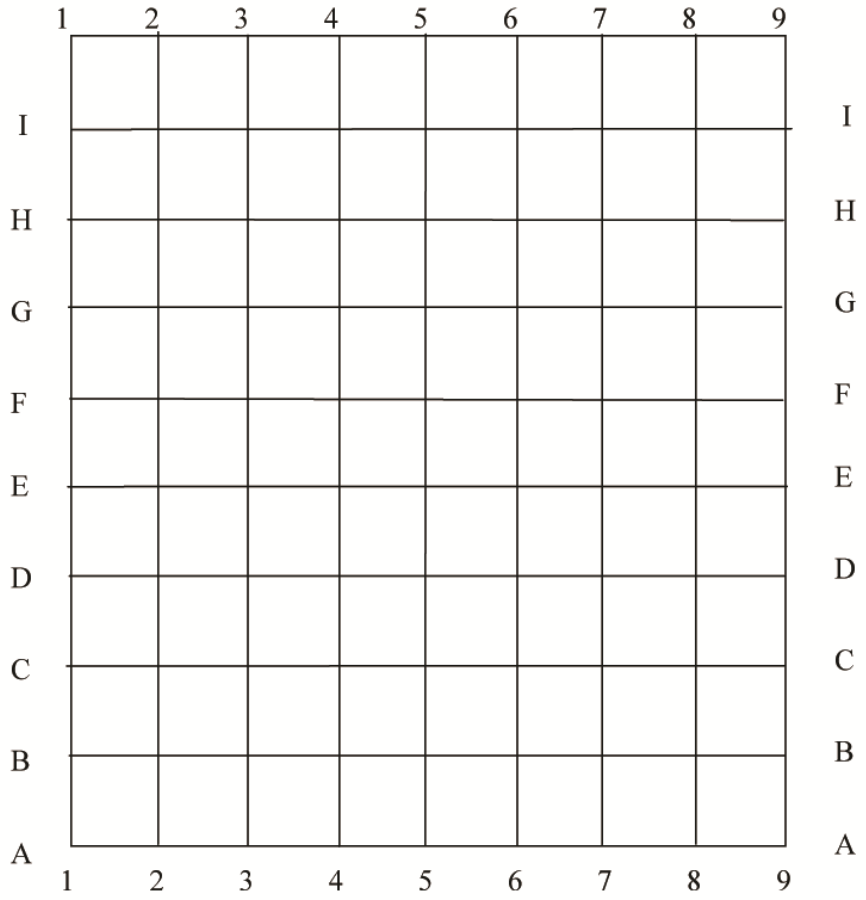
Activity Idea by Don Rathjen of the Exploratorium.
Written by RAFT Education Department.

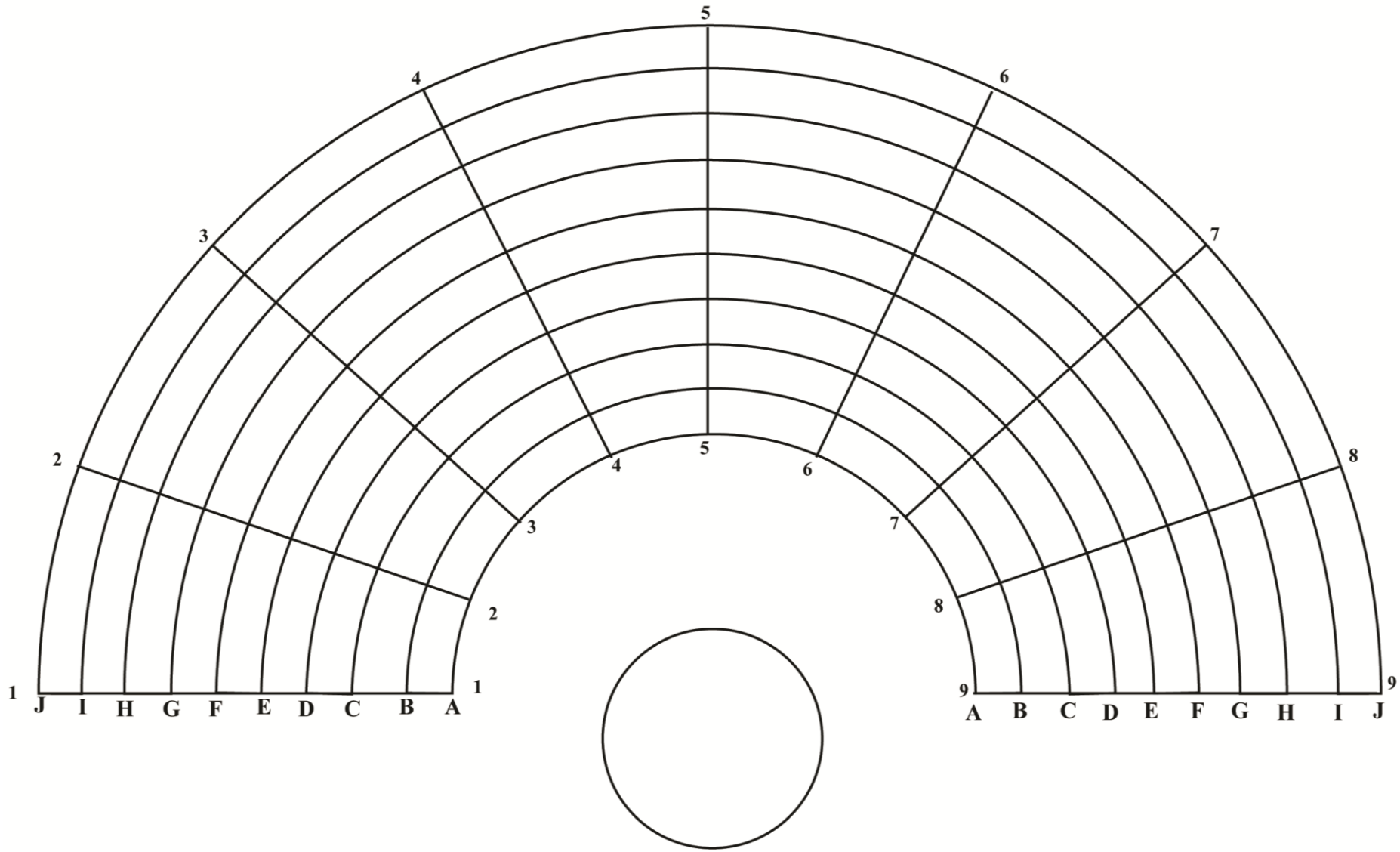




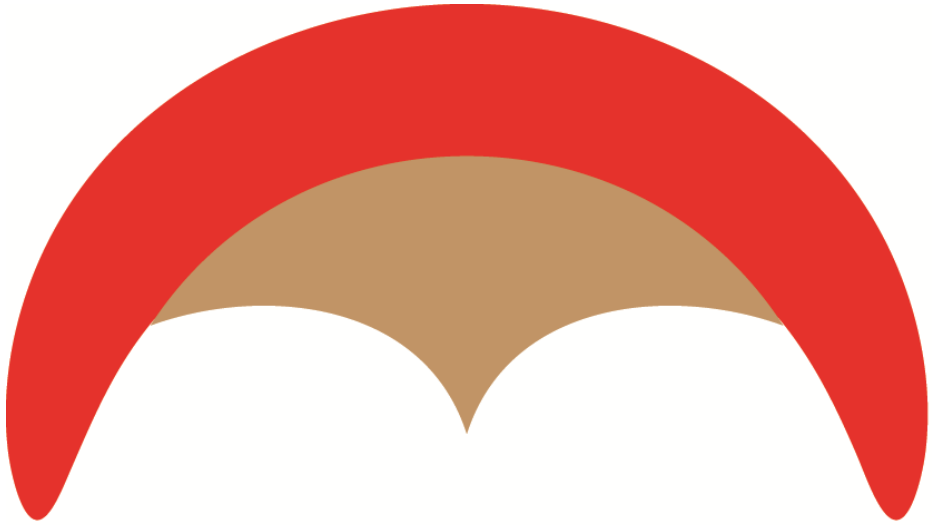
raft
resource area for teaching

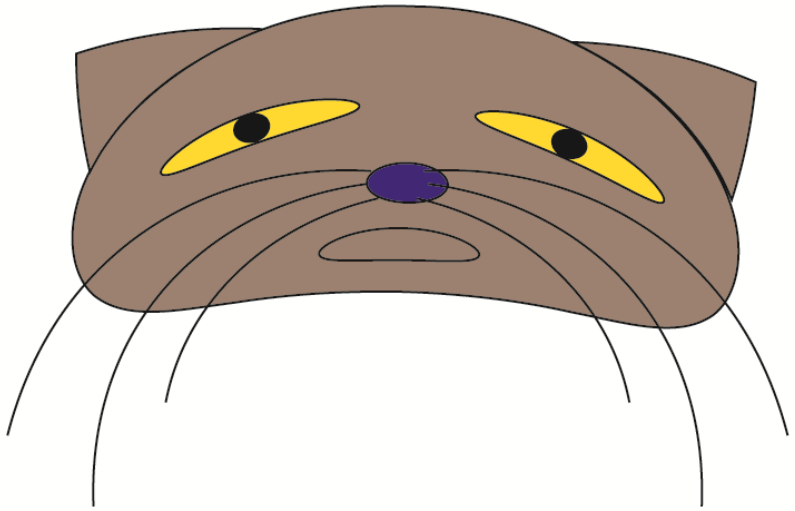

1 2 3 4 5 6 7 8 9
I
H
G
F
E
D
C
B
A
1 2 3 4 5 6 7 8 9

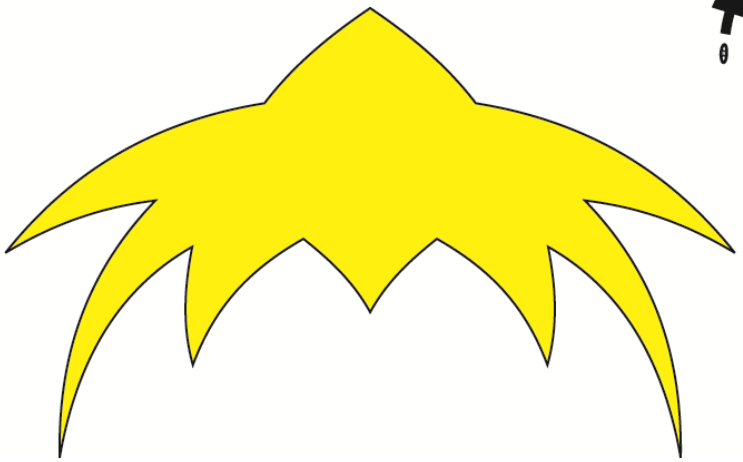

1 2 3 4 5 6 7 8 9
I
H
G
F
E
D
C
B
A
1 2 3 4 5 6 7 8 9



Sample Anamorphic Art Images







raft resource area for teaching