Geometry Projects: Escher, Sierpinski and Snowflakes in Your Classroom

Paul Kelley

Anoka High School

Anoka, Minnesota

In the next 75 minutes, we'll look at:

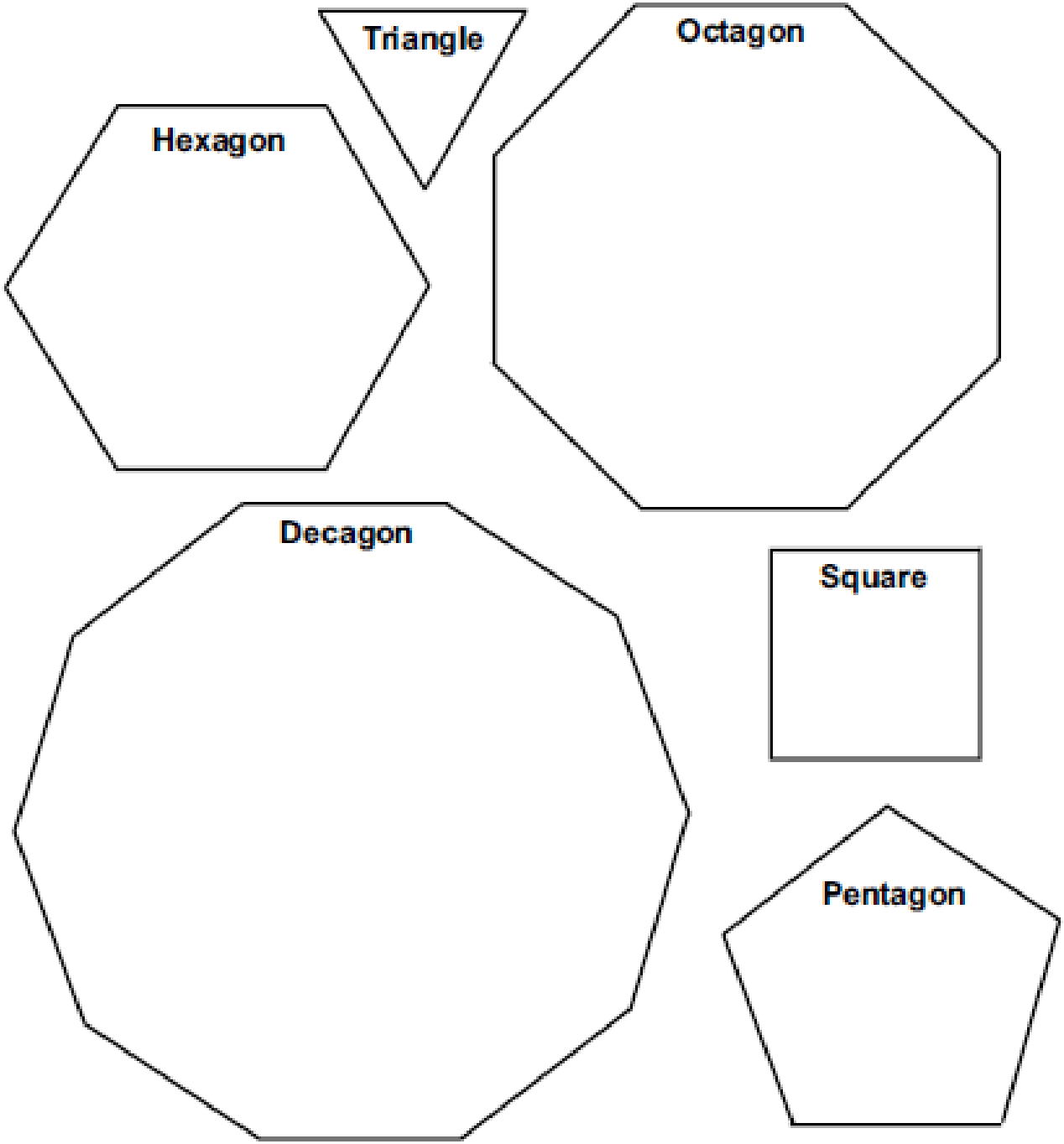
1. Tessellations;
2. "Snowflake" designs;
3. Hand-drawn fractal designs;
4. A big (19-foot-tall) Sierpinski pyramid.

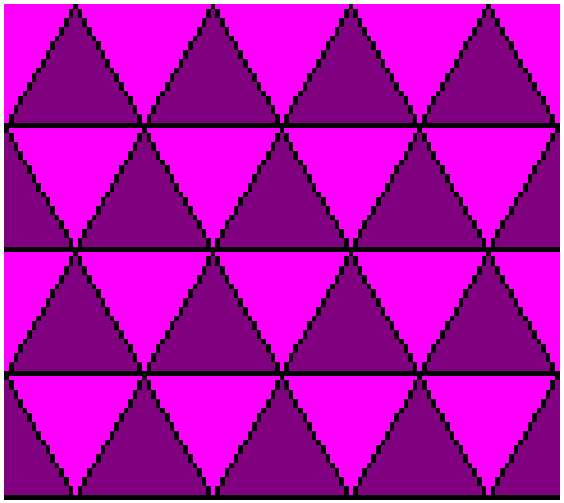
This is usually a “session”
as opposed to a “workshop.”

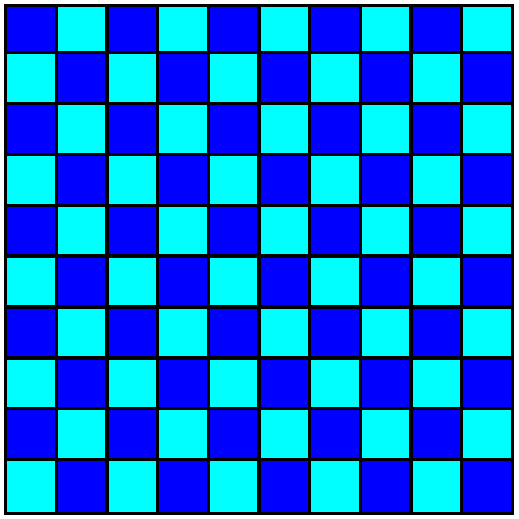
The majority of questions come in regard to constructing the Sierpinski Pyramid.

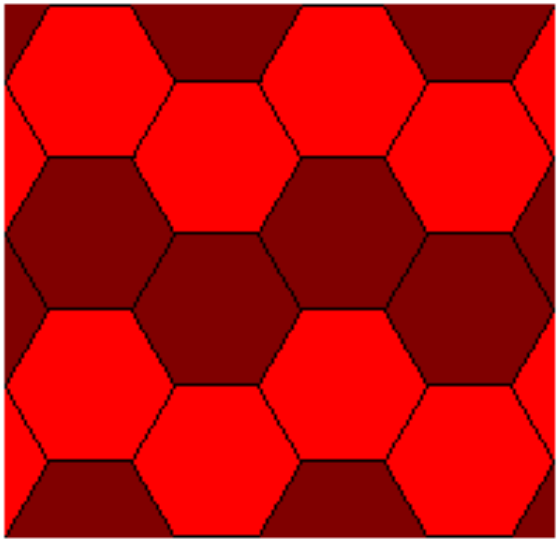
So, we’ll pretend it’s a session until the last 15 minutes, and then have you create mini-pyramids.

Tessellation –
A repeating pattern
that completely covers
a surface, leaving no gaps
or overlaps.

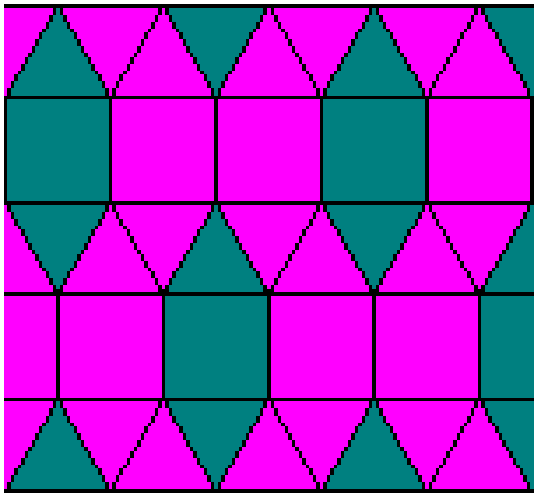

Triangle
Octagon
Hexagon
Decagon
Square
Pentagon

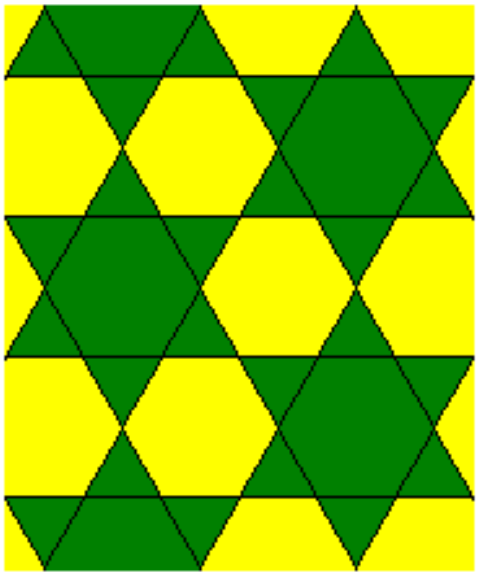


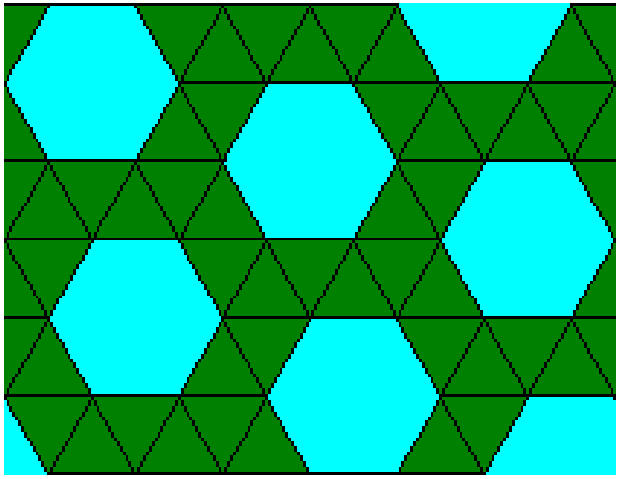


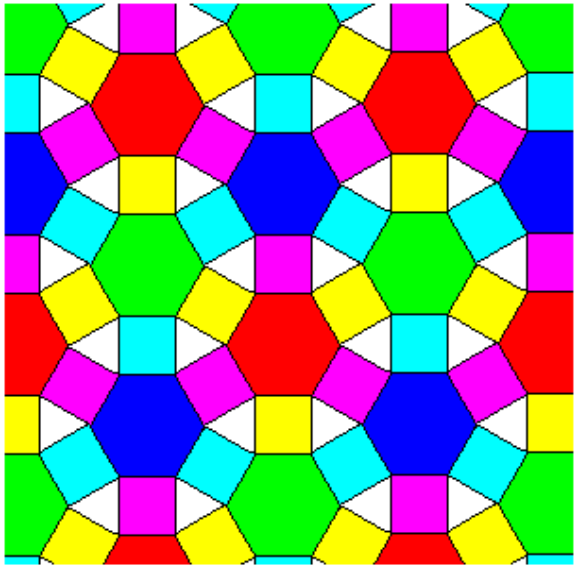


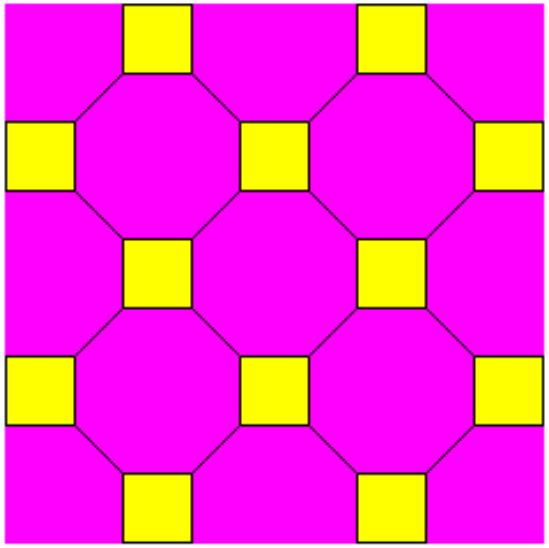
http://gwydir.demon.co.uk/jo/tess/grids.htm

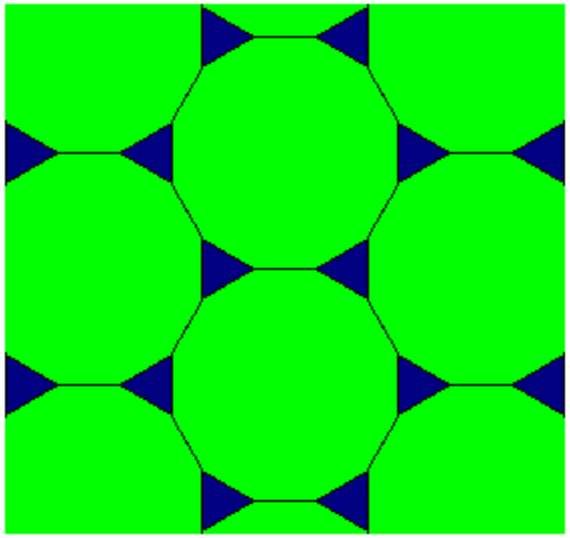


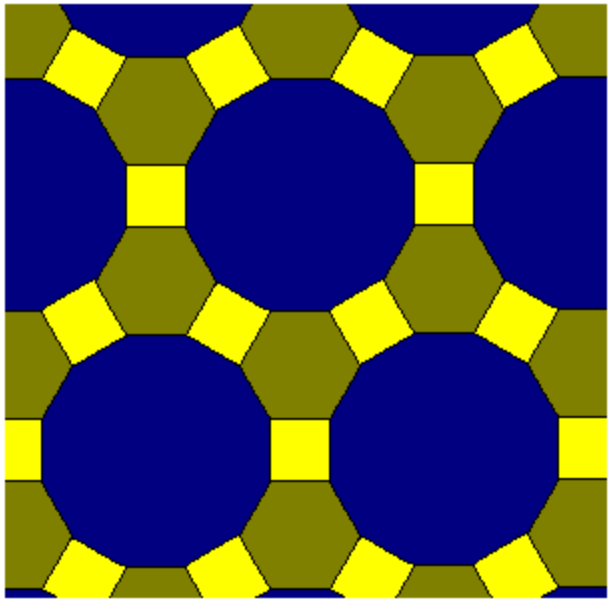


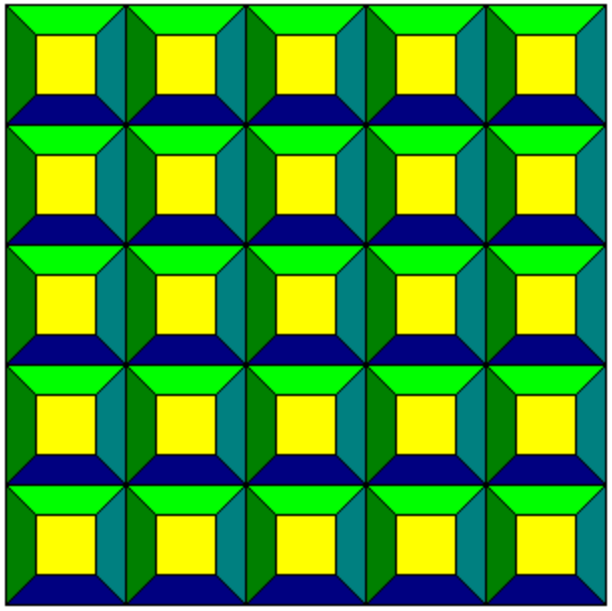


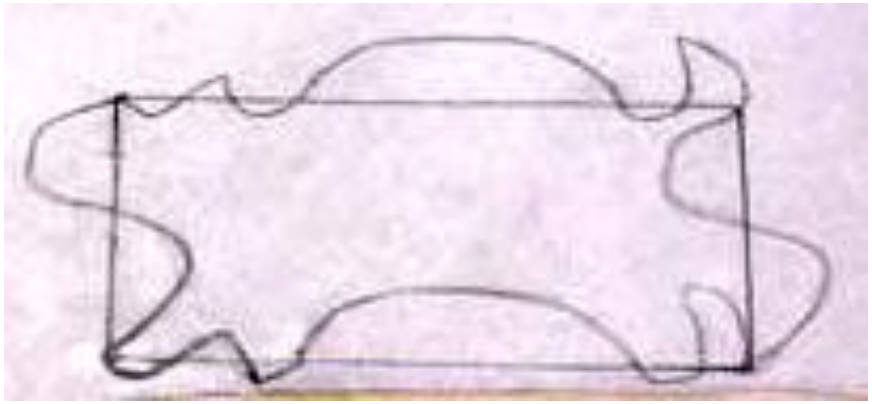


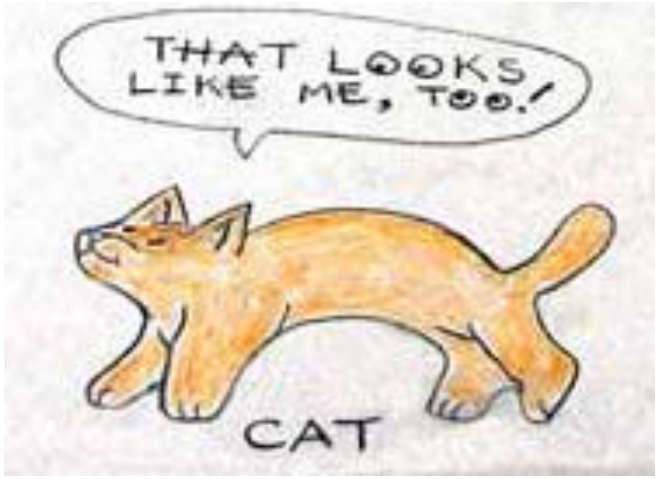




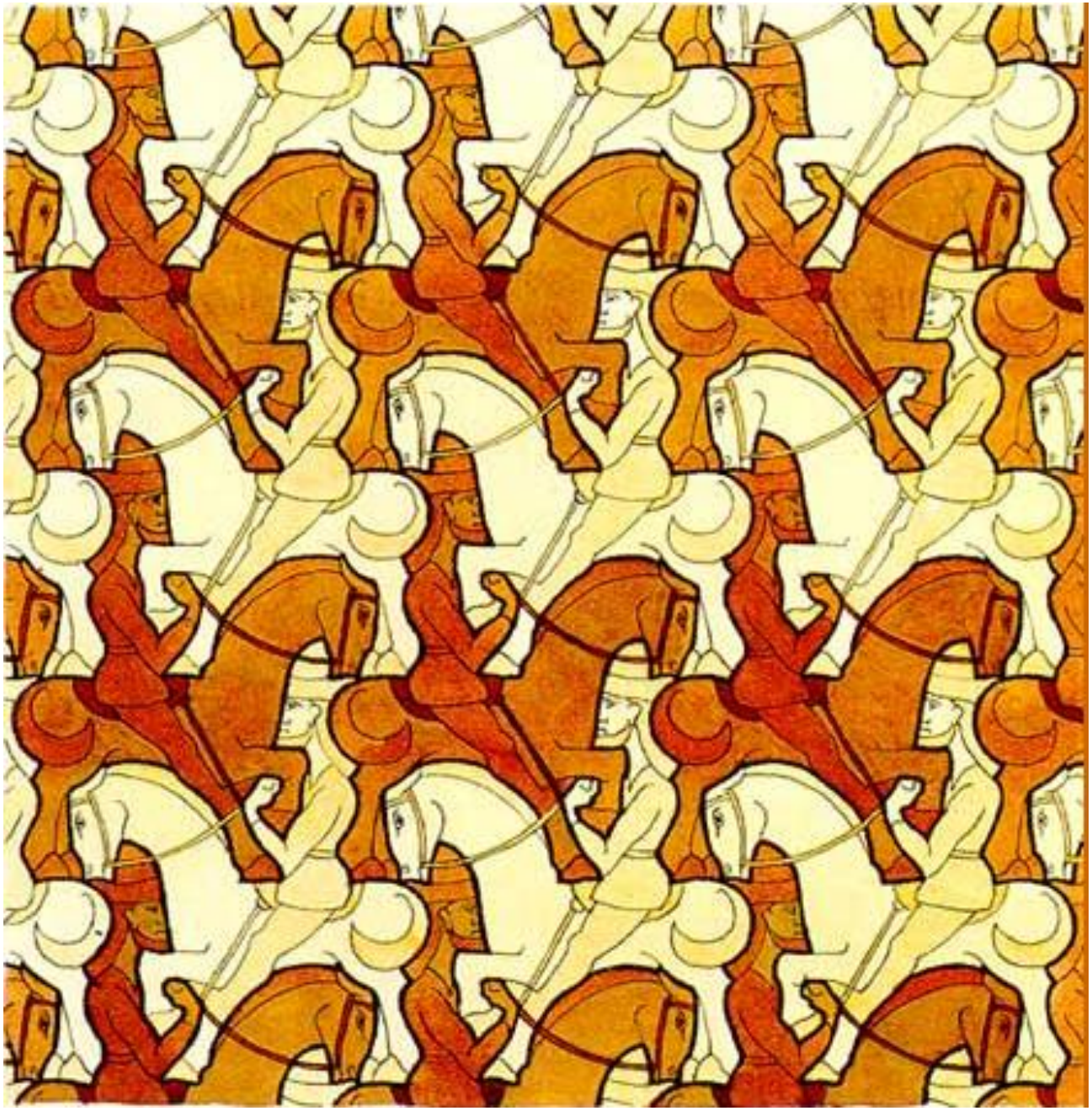


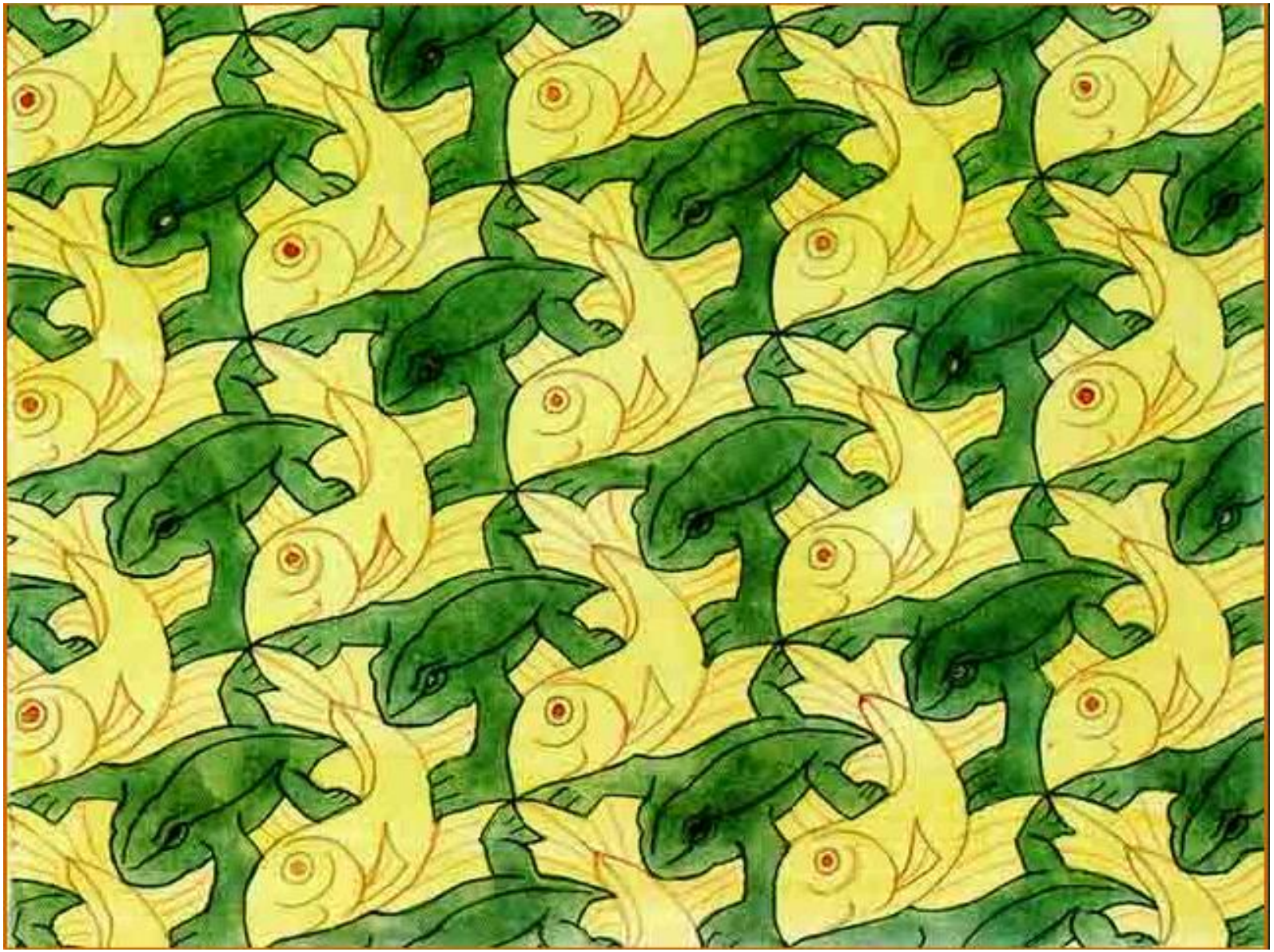




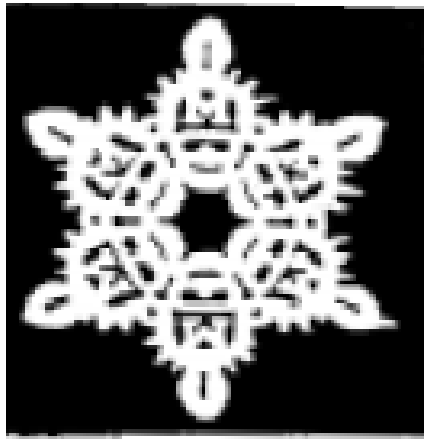


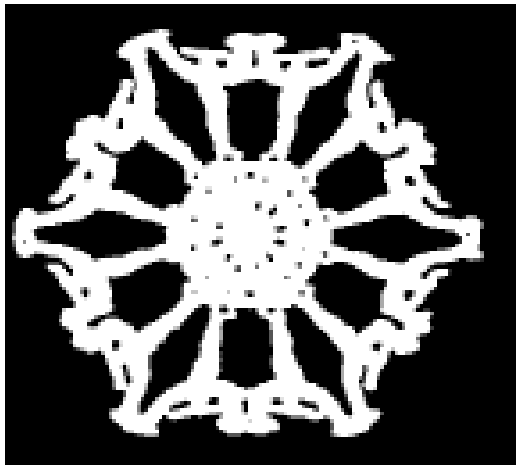
http://www.tessellations.org

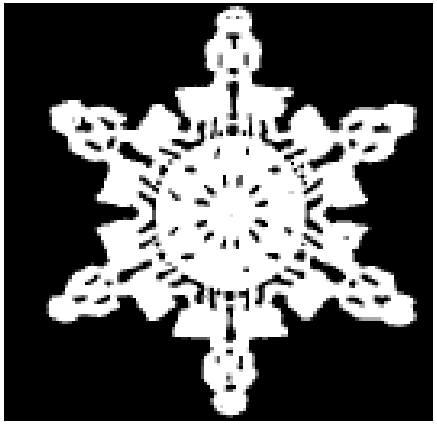


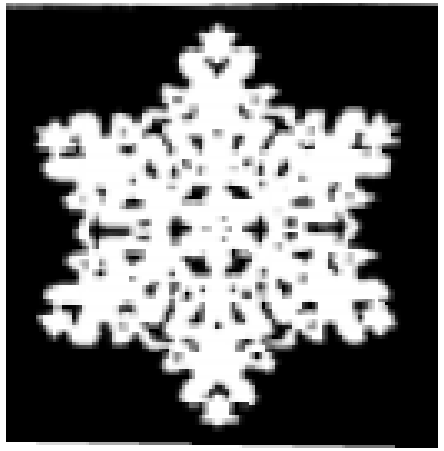


“Snowflake” Designs







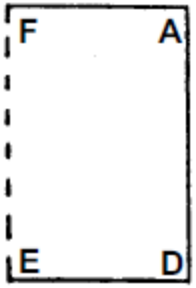


Equilateral Triangle 2

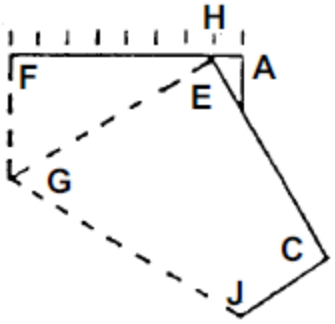
Use 8 1/2 x 11 or any other paper that is close to 3:4 ratio.

1. Start with paper crosswise. (facedown)

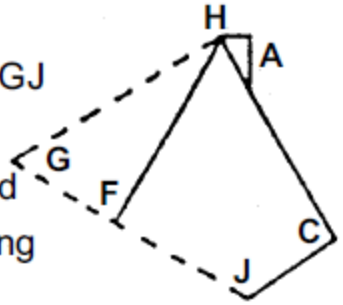
2. Fold in half, left over right.



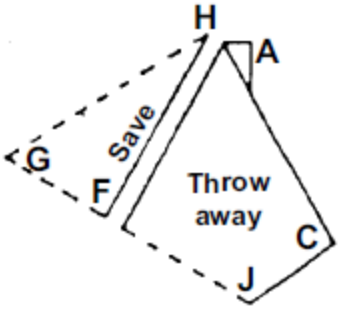
3. Match E to point H which is 7/8 the distance of F to A. Crease along $\overline{GJ}$.



4. Bisect ∠FGJ by matching $\overline{GF}$ to $\overline{GJ}$ and creasing along $\overline{GH}$.

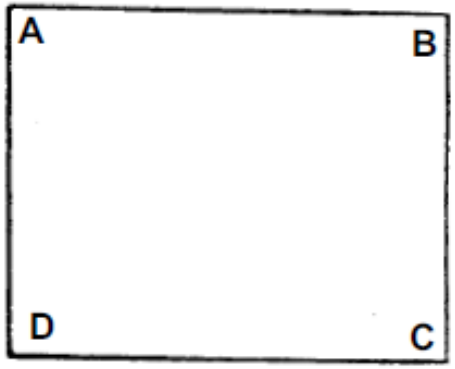


5. Cut along $\overline{FH}$ and unfold ΔGFH.

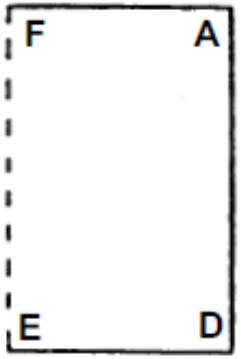


Square 2

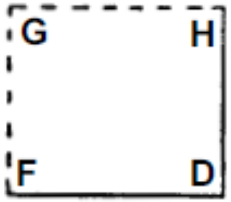
1. Start with paper crosswise. (facedown)



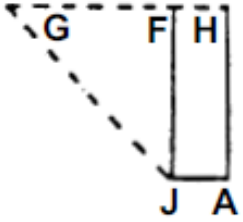
2. Fold in half, left over right.



3. Fold in half again, folding the top down.

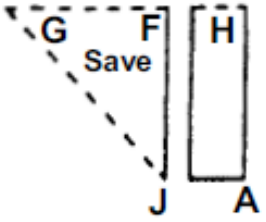


4. Match $\overline{GF}$ to $\overline{GH}$ and crease along $\overline{GJ}$.



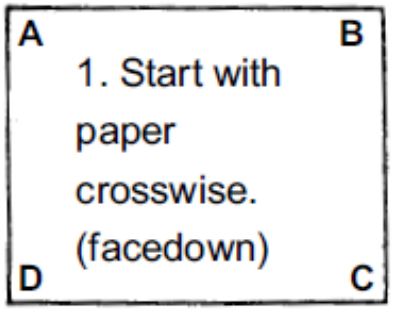
5. Cut along $\overline{JF}$.

6. Unfold ΔGJF.



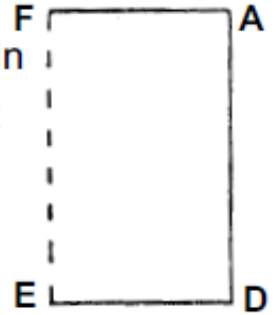
Pentagon

Use 8 1/2 x 11 or any other paper that is close to 3:4 ratio.

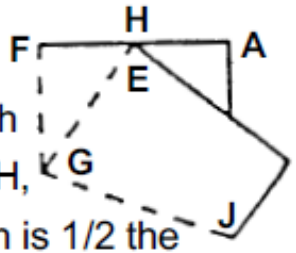


1. Start with paper crosswise. (facedown)

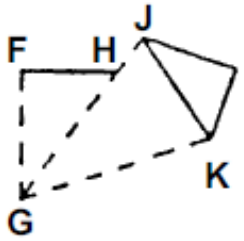
2. Fold in half, left over right.



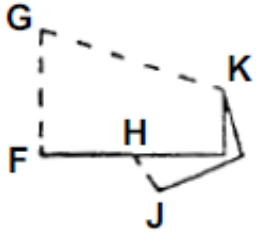
3. Match E to H, which is 1/2 the distance of F to A. Crease $\overline{GJ}$.



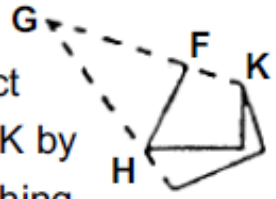
4. Bisect ∠EGJ by matching $\overline{GJ}$ to $\overline{GE}$. Crease on $\overline{GK}$.



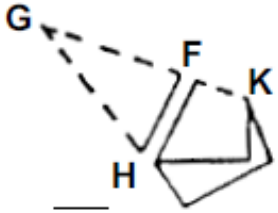
5. Turn over, flipping the bottom to the top.



6. Bisect ∠FGK by matching $\overline{GF}$ to $\overline{GK}$. Crease on $\overline{GH}$.

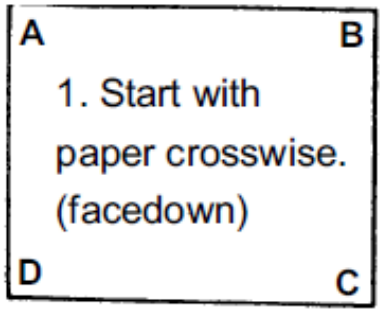


7. Cut on $\overline{HF}$.

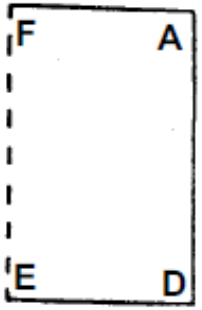


8. Save and unfold ΔGFH.

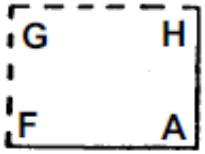
Hexagon



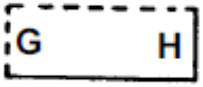
2. Fold in half, left over right.



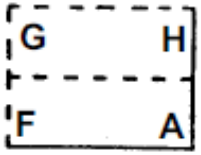
3. Fold in half again, folding the top down.



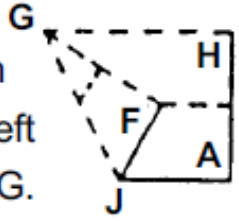
4. Fold in half once more, folding the top down again.



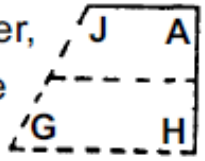
5. Unfold once.



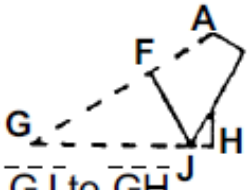
6. Place lower left corner F on center fold and crease through upper left corner G.



7. Turn over, flipping the bottom to the top.



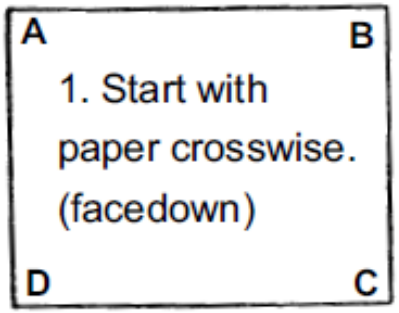
8. Bisect ∠JGH by matching $\overline{GJ}$ to $\overline{GH}$. Crease on $\overline{GF}$.



9. Cut on $\overline{JF}$. Save and unfold ΔGJF.

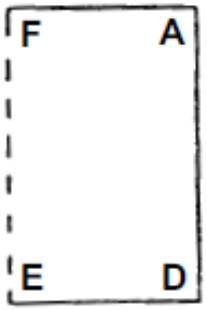
Heptagon

Use 8 1/2 x 11 or any other paper that is close to 3:4 ratio.

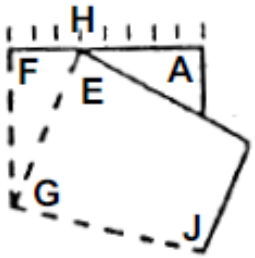


1. Start with paper crosswise. (facedown)

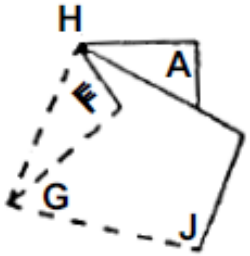
2. Fold in half, left over right.



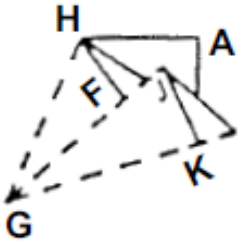
3. Match E to H, which is 3/8 the distance from F to A. Crease $\overline{GJ}$



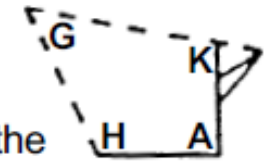
4. Fold ΔFGH down by creasing along $\overline{GH}$.



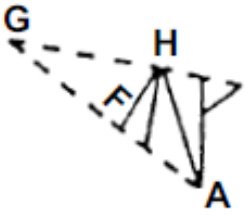
5. Bisect ∠FGJ by matching $\overline{GJ}$ to $\overline{GF}$. Crease on $\overline{GK}$.

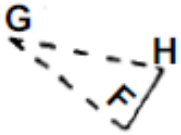


6. Turn over, flipping the bottom to the top.



7. Bisect ∠KGH by matching $\overline{GH}$ to $\overline{GK}$. Crease on $\overline{GF}$.





8. Cut on $\overline{FH}$. Save and unfold ΔGFH.

You will hand in, on construction paper, ten items:

1. Five folded and cut “regular polygons,” each on a separate piece of construction paper;

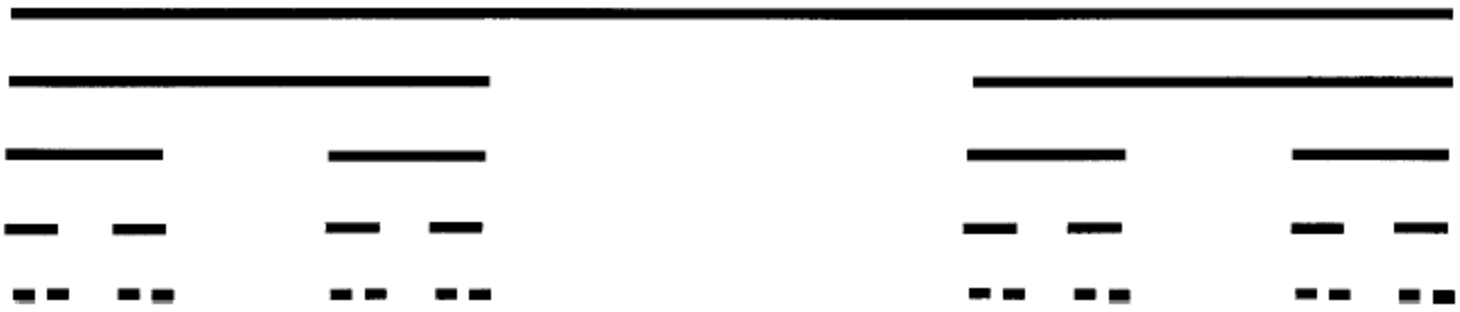
2. On the back of these sheets, you will attach a “snowflake” design, based on the regular polygon that is on the other side.

Hand-Drawn Fractal Designs

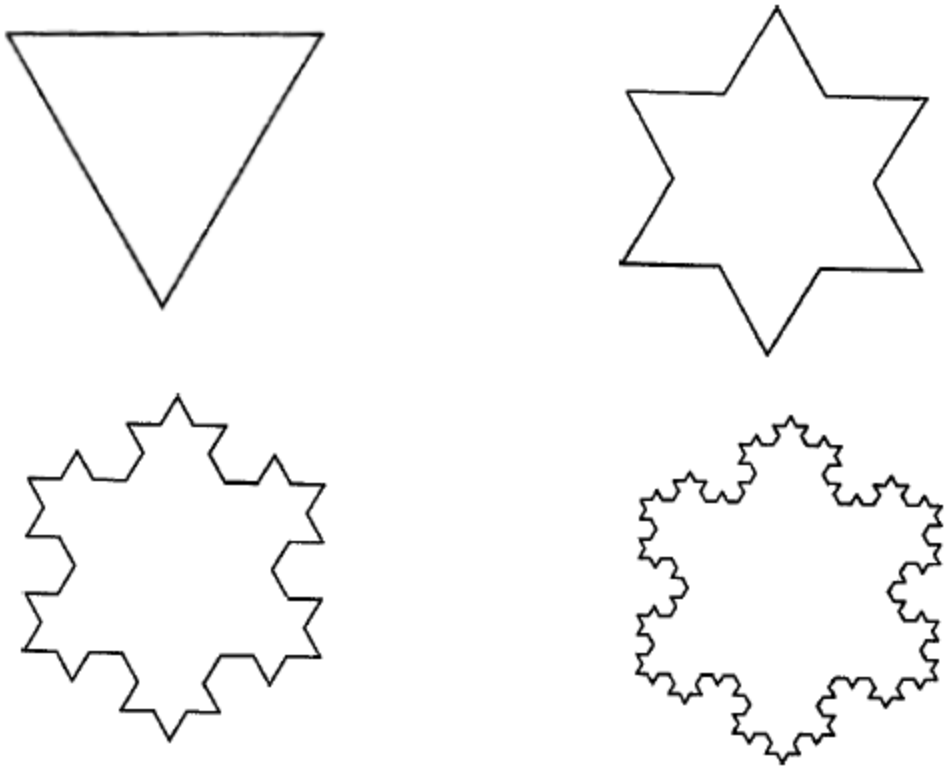
An iterative process – repetition from one stage to another, where the output from one stage becomes the input for the next.

Self-Similarity – a piece looks like the whole, a piece of the piece looks like the piece, etc.

Cantor Dust

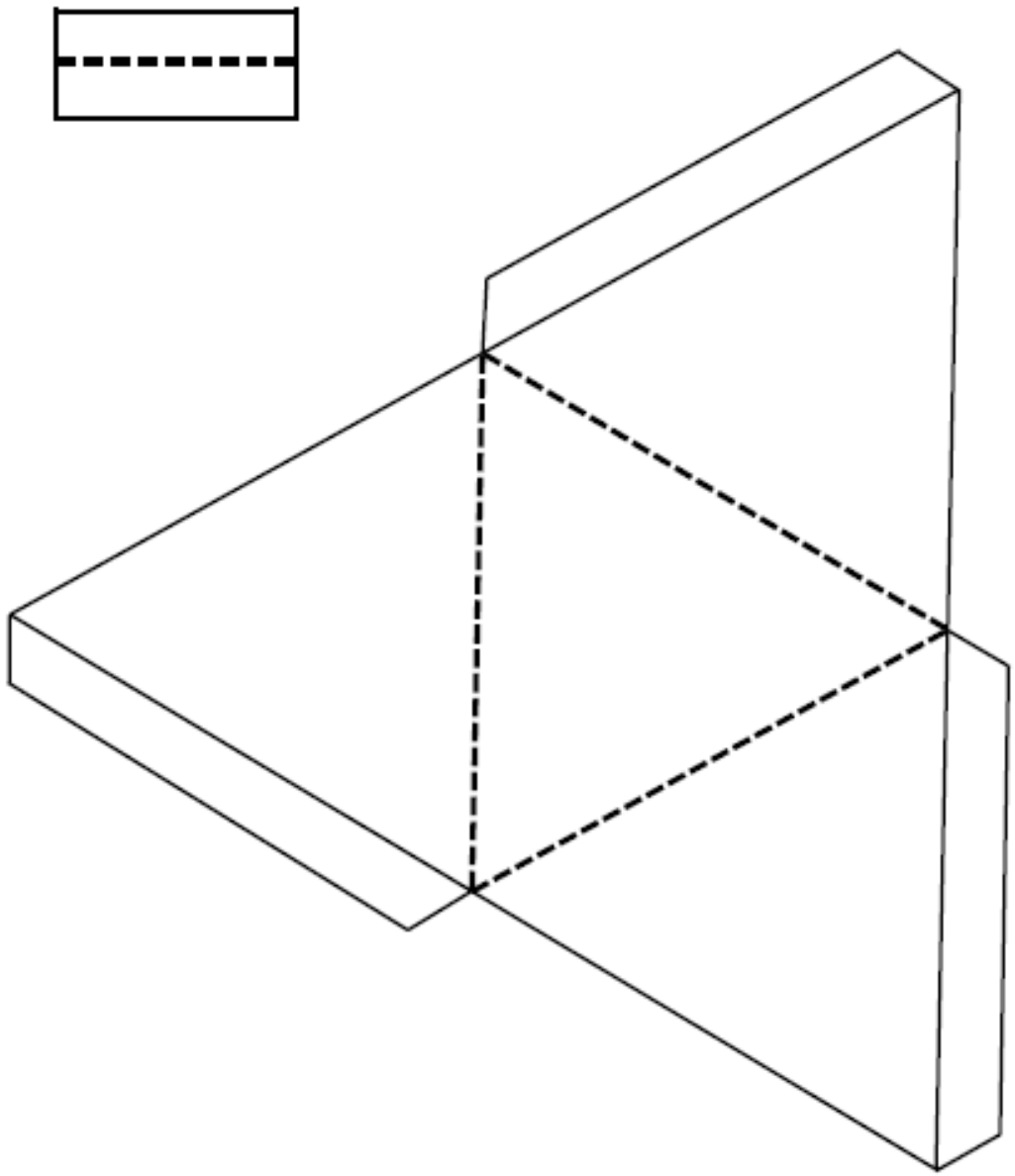


Koch Snowflake



Sierpinski Gasket

“Purina Dog Chow”



Anoka.k12.mn.us/ahskelley

Conference Handouts & Resources

“My Files” for this PowerPoint or the various “pictures” folders for the pictures.