

CRANE CRAZY WITH TRANSFORMATIONS

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Don't say, "Remember all these rules!"

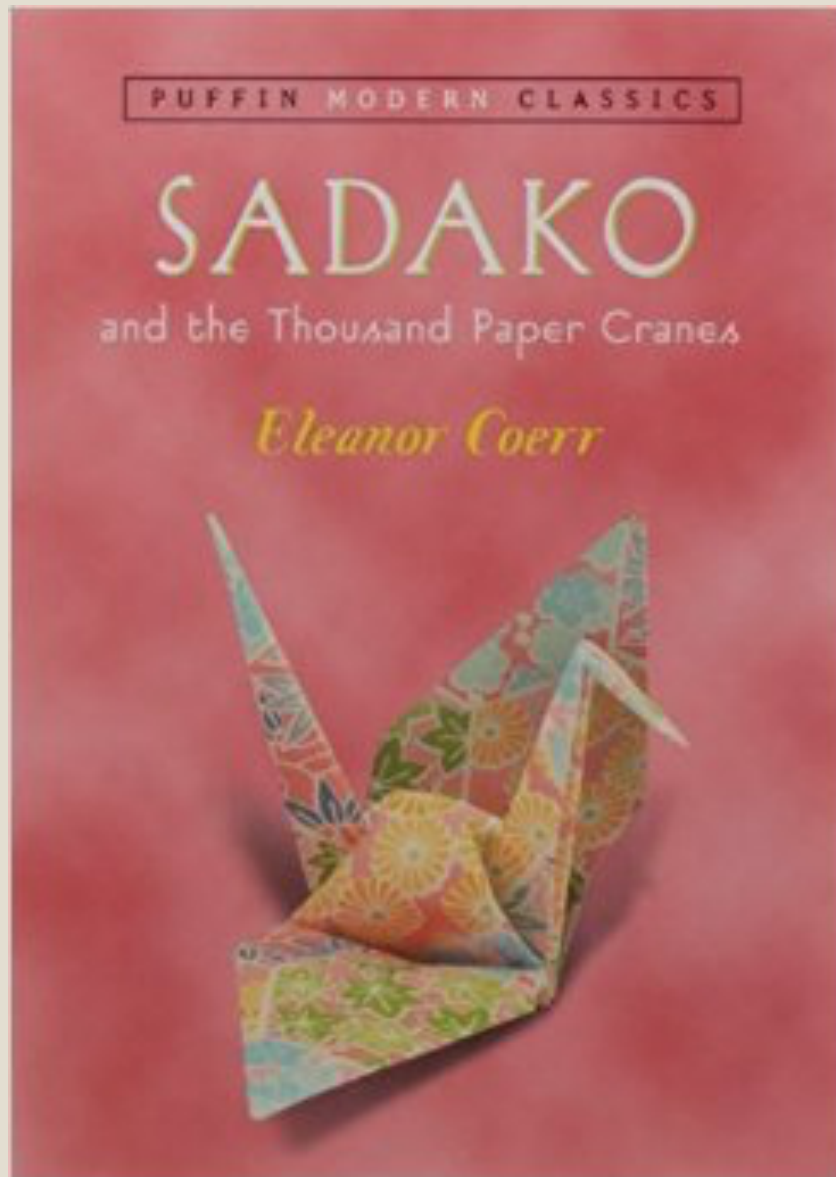
Table 2 Transformation geometry rules

Transformation	Rule
Reflection	
About the x axis	(x, y) becomes $(x, -y)$
About the y axis	(x, y) becomes $(-x, y)$
About $y = x$	(x, y) becomes (y, x)
About $y = -x$	(x, y) becomes $(-y, -x)$
Rotation	
90° about the origin	(x, y) becomes $(-y, x)$
180° about the origin	(x, y) becomes $(-x, -y)$
270° about the origin	(x, y) becomes $(y, -x)$
-90° about the origin	(x, y) becomes $(y, -x)$
Translation	
$T_{ab}(x, y)$	$(x + a, y + b)$



Instead,
give them
ownership
of the rules!





Integrate other subjects...

- **English** - Read *Sadako and the Thousand Paper Cranes*. Our English teachers use this book for their Heroic unit.
- **Science** - Our science teachers discuss atomic bombs when they are teaching Chemistry. They also use the book when studying genetic mutation.
- **Social Studies** - Our social studies teachers discuss World War II and the dropping of nuclear weapons on the Japanese city of Hiroshima.
- **Art** - Our art teacher has students make other origami shapes & Japanese decorations.
- During this study as an 8th grade hall, students all together **make 1,000 origami cranes**. We hang the cranes throughout the hall along with other Japanese decorations.



What Does Research Say?

- Tubis & Mills (2006) states that origami can deepen students' geometric understanding through multiple learning opportunities.
- Today, we will not just make origami simply to make it, but we will tie into standards that you already teach (8.G.A.1, 8.G.A.2, & 8.G.A.3) as well as incorporate Mathematical Practices (3, 4, & 5).

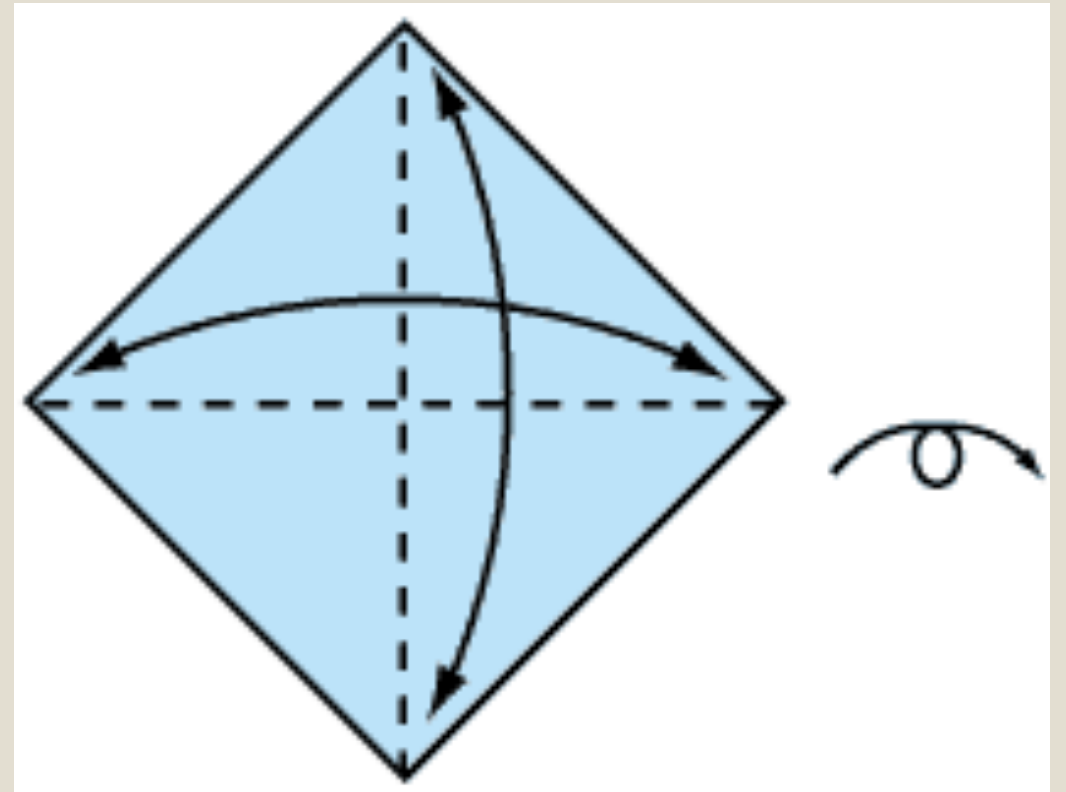
Lets Make Origami Cranes!

- We recommend purchasing 6x6 squares of origami paper.
- We purchased a pack of 500 for less than \$12 on Amazon.

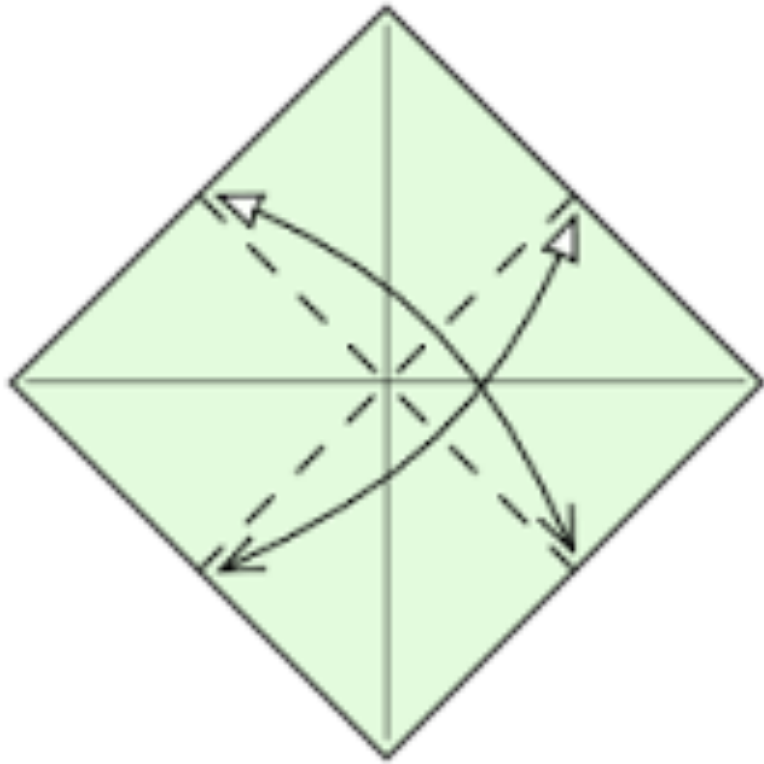


Step 1

- Start with a square piece of paper, colored side up.
- Fold in half and open. Then fold in half the other way.

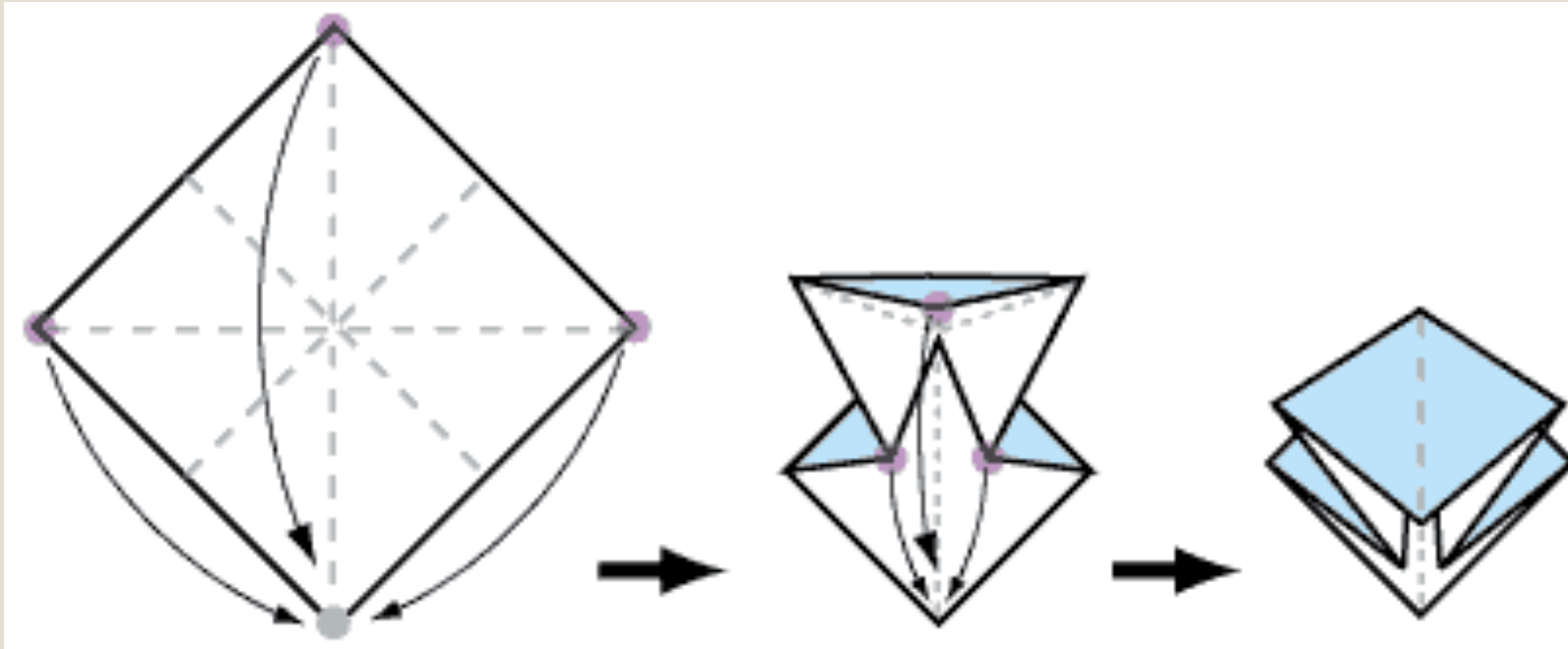


Step 2



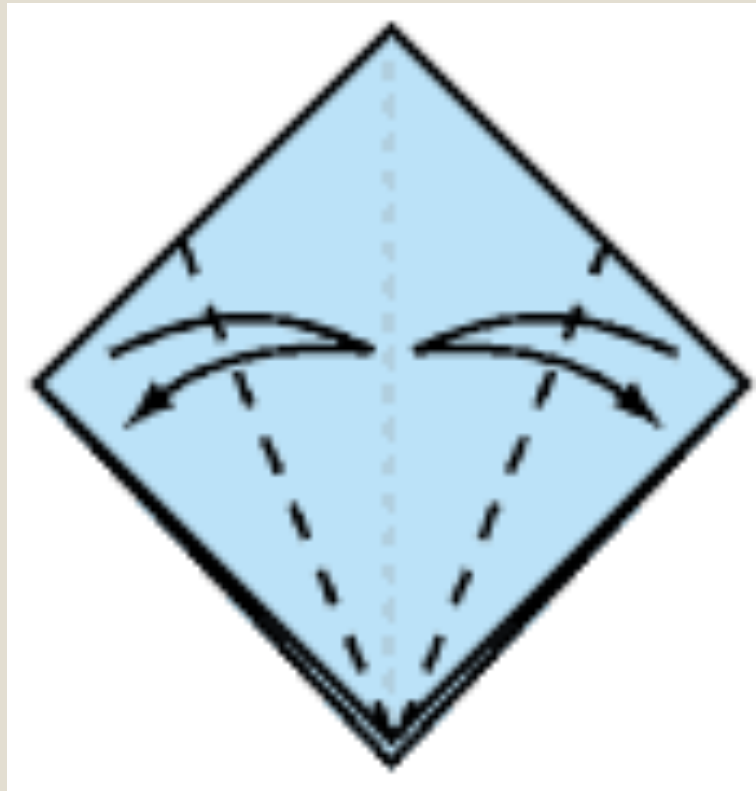
- Turn the paper over to the white side.
- Fold the paper in half, crease well and open, and then fold again in the other direction.

Step 3



Using the crease you have made, bring the top 3 corners of the model down to the bottom corner. Flatten model.

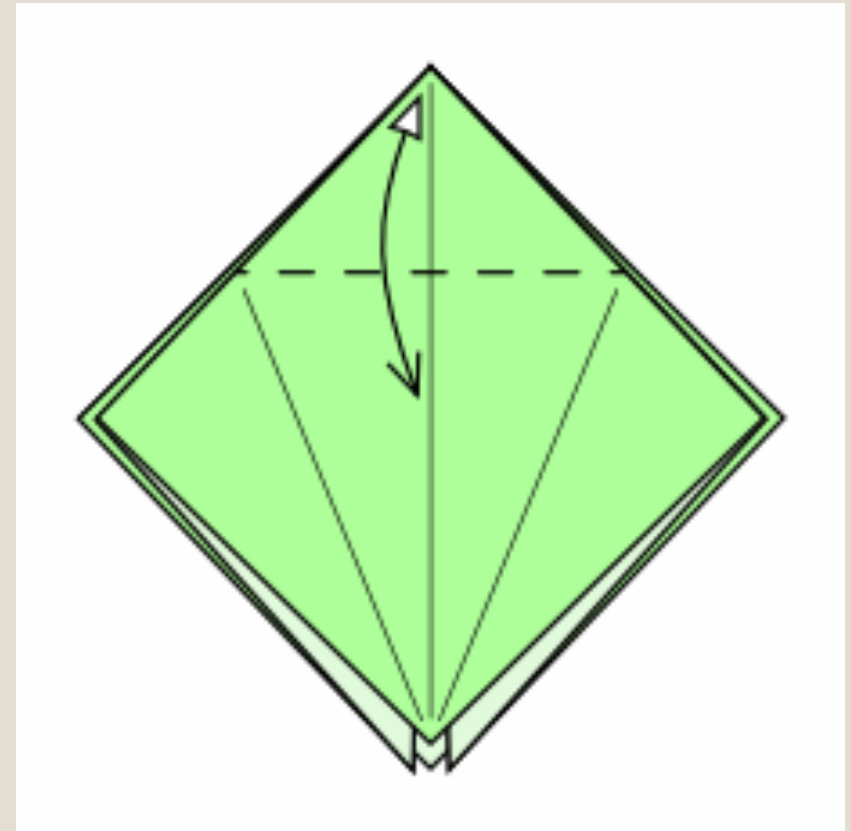
Step 4



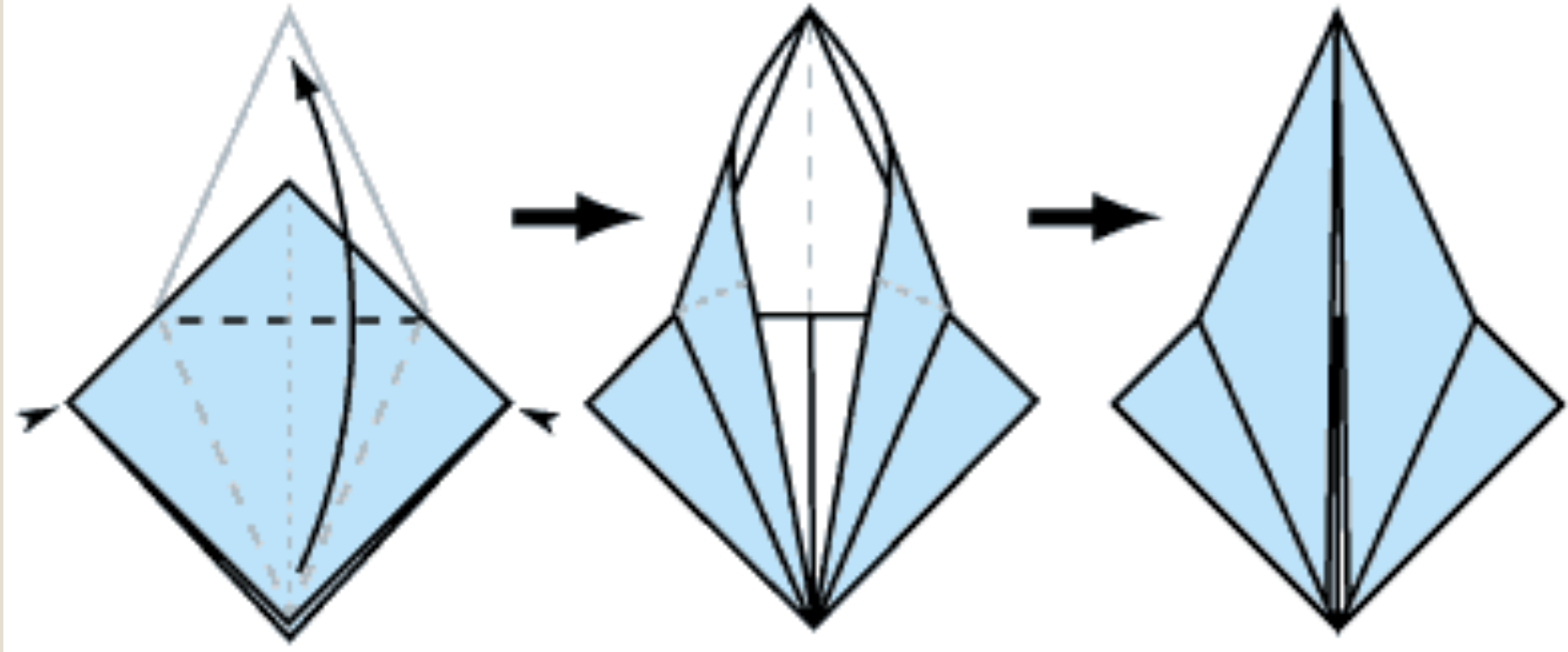
- Fold top triangle flaps into the center and unfold.

Step 5

- Fold top of model downwards, crease well and unfold.



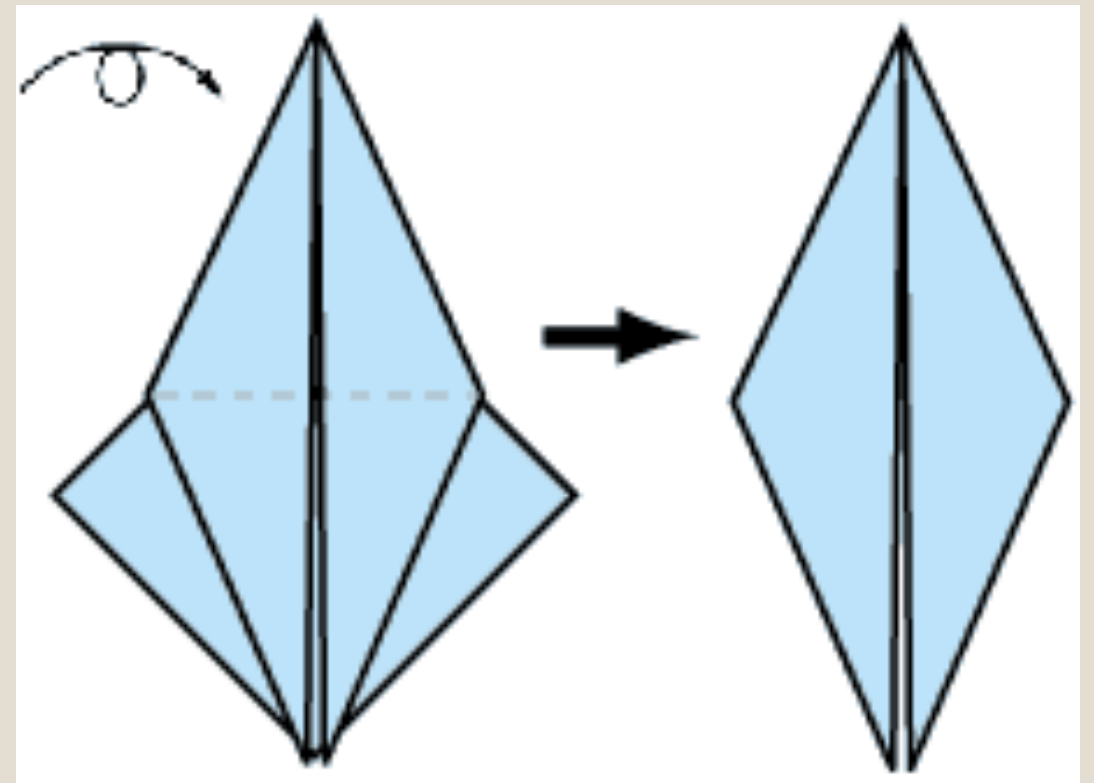
Step 6



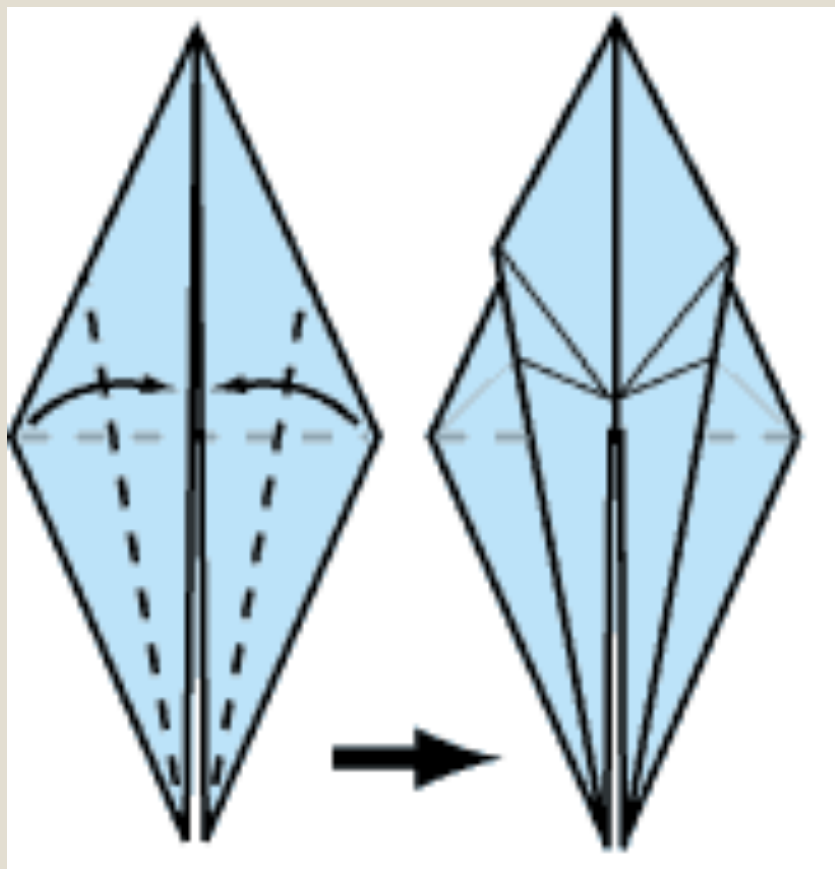
Open the uppermost flap of the model, bringing it upwards and pressing the sides of the model inwards at the same time. Flatten well, creasing well.

Step 7

- Turn model over and repeat step 6.



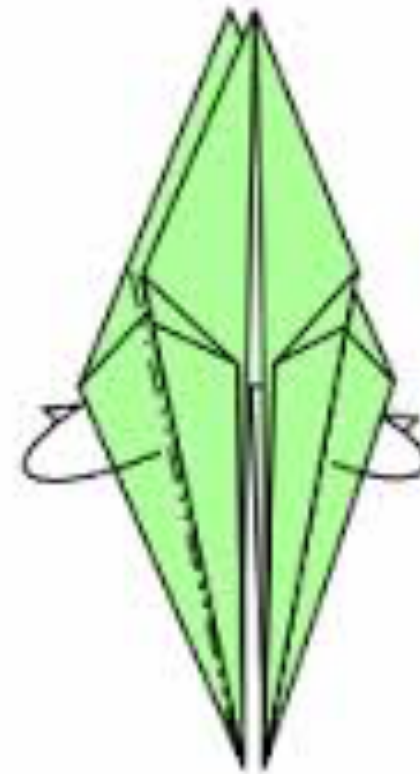
Step 8



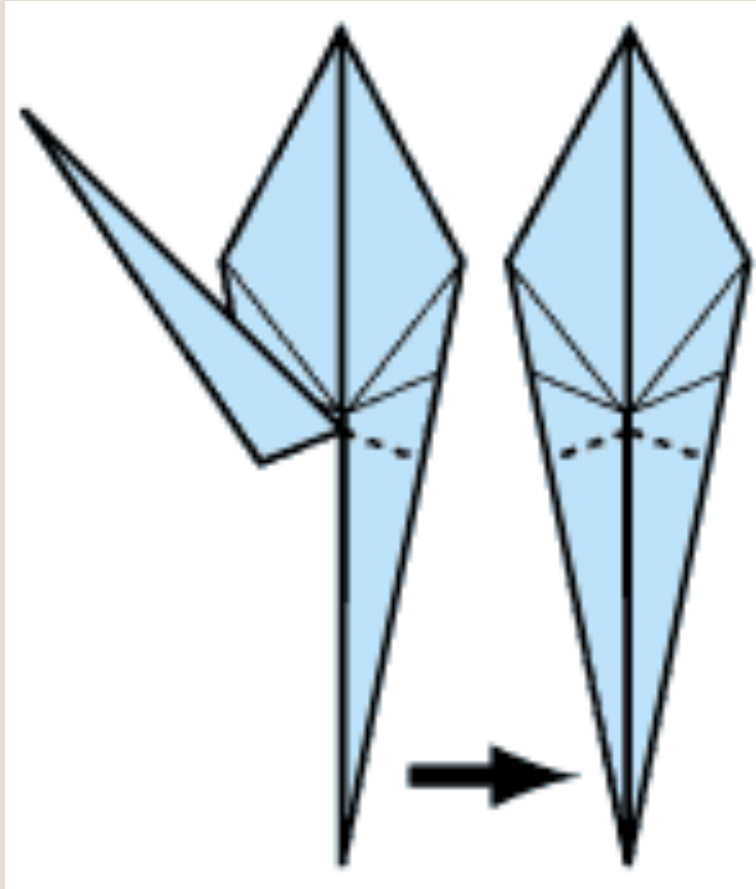
- Fold top flaps into the center.

Step 9

- Repeat step 8 on the other side.



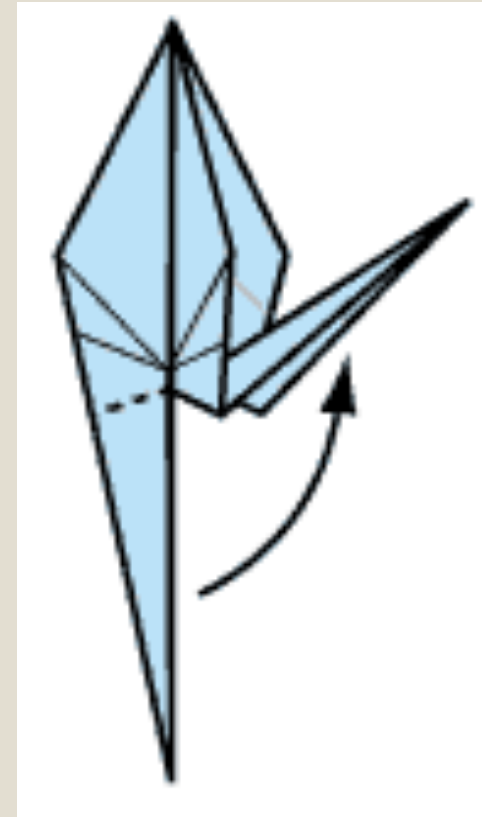
Step 10



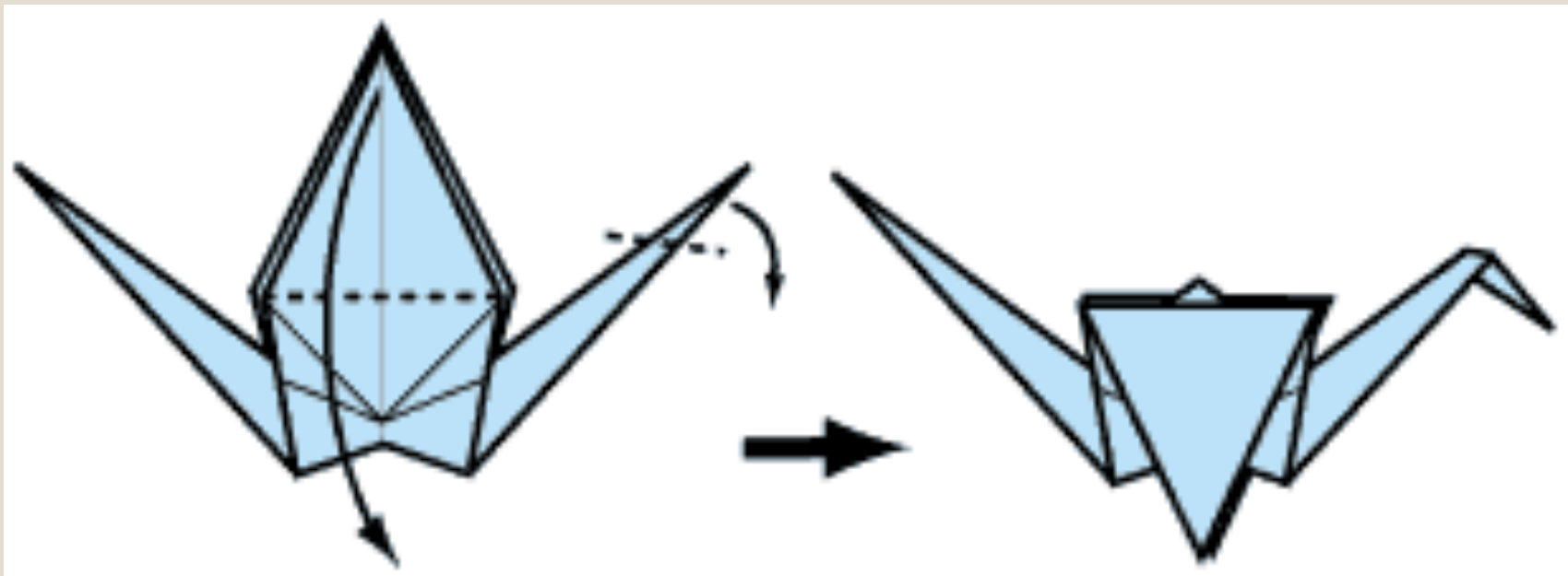
- Fold both legs of the model up, crease very well, and unfold.

Step 11

- Inside reverse fold the legs along the creases you just made.

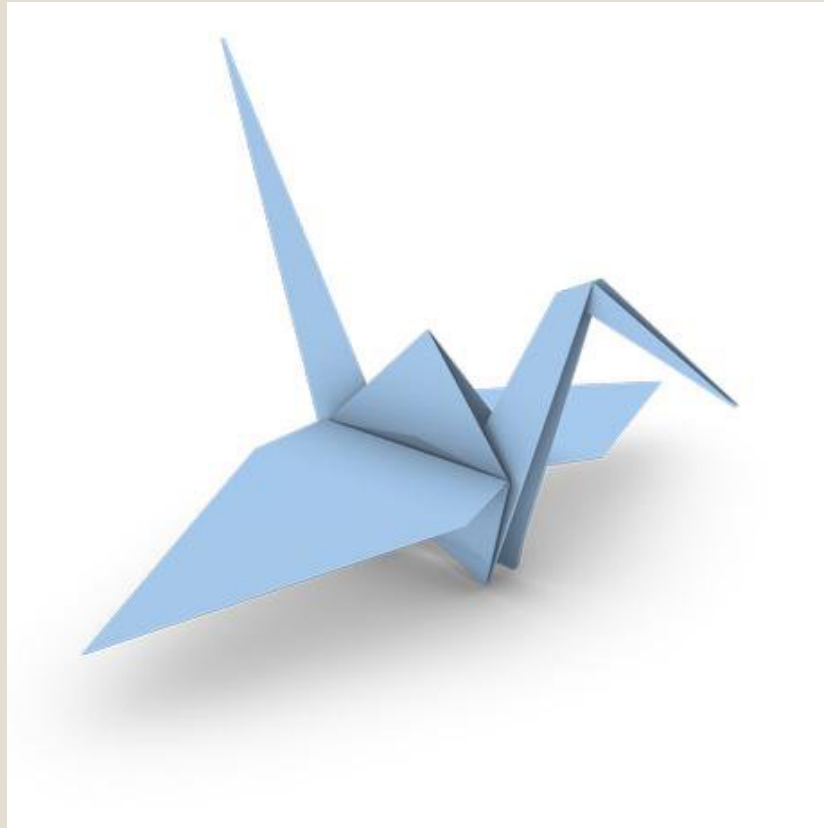


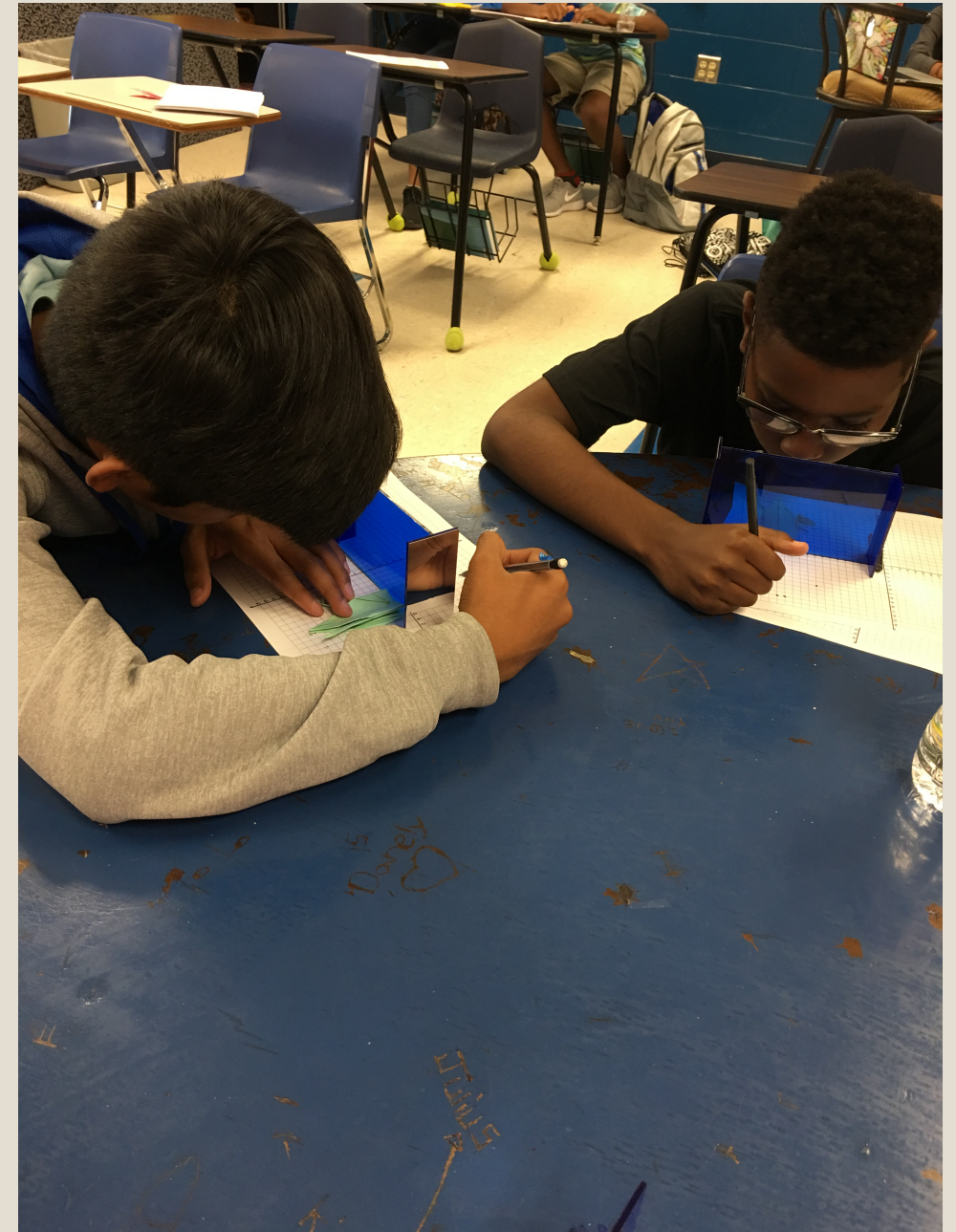
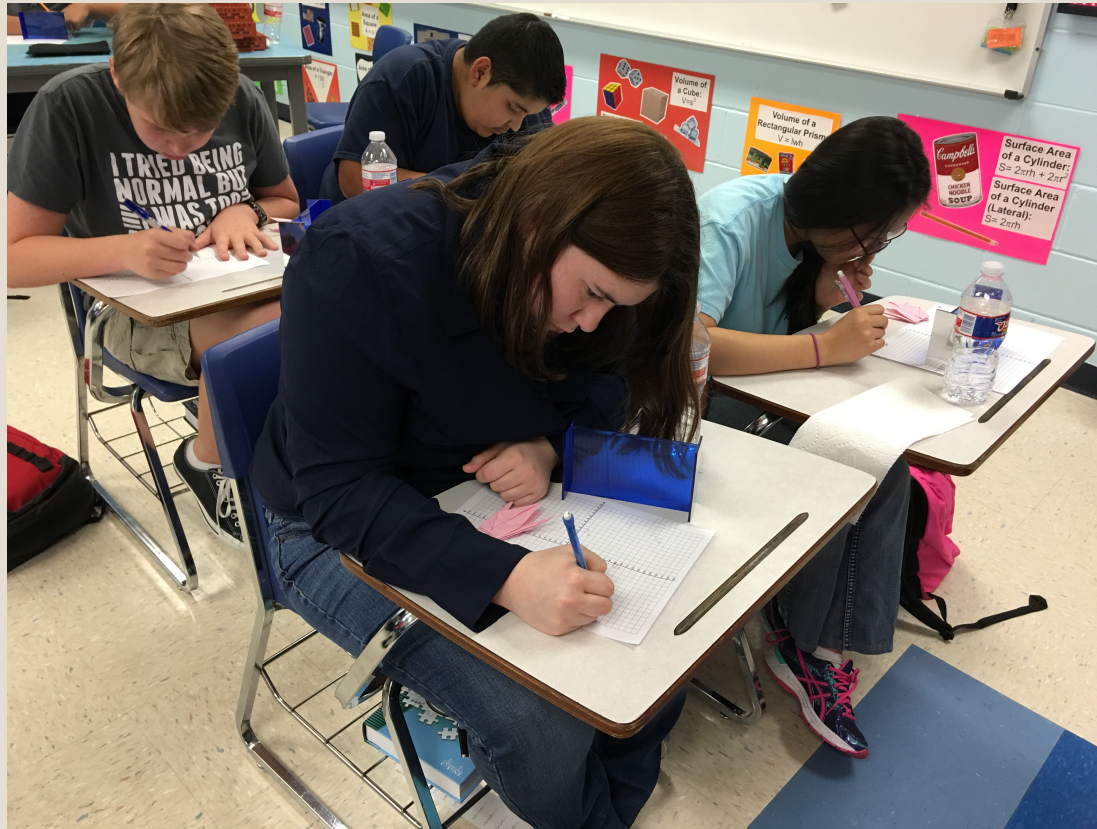
Step 12



Inside reverse fold one side to make a head,
then fold down the wings.

Finished Product! Let's Get Graphing!





Reflection: Reflecting Across the y -axis!

- Items you would need
 - Origami Paper (have students make cranes)
 - Graph Paper
 - Miras

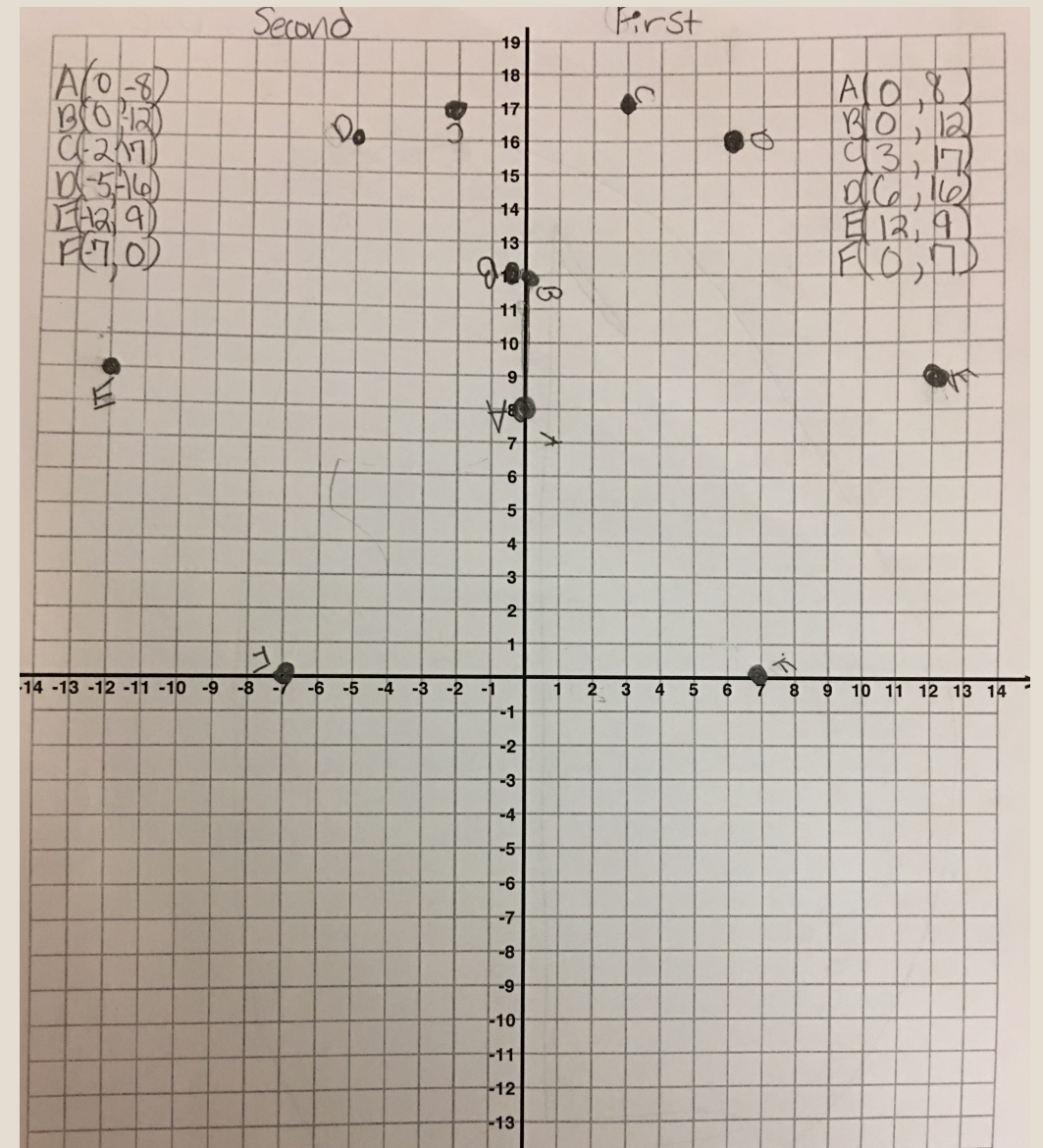
Reflection:

Reflecting Across the y -axis!

1. Lay your crane against the y -axis.
2. Plot and write down ordered pairs for your crane. Trace the outline of your crane as well.
3. Lay your Mira on the y -axis.
4. Plot and write down the ordered pairs for your reflected crane (by looking through your Mira).
5. Now physically reflect your crane.
6. What do you notice about the crane?
7. What do you notice about the ordered pairs?
8. Can you create a rule to describe what happens to ordered pairs when you reflect across the y -axis?

Student Work Samples

- Misunderstandings:
 - Don't use graph paper that is numbered.
 - Make sure students are physically on the y-axis. Just a little bit off will affect their ordered pairs on the reflection.
 - Make sure students correctly label the crane and understand transformation notation.
 - Make sure students trace the crane so they can physically see the reflection.



Reflection:

Reflecting Across the x-axis!

Can you predict what the rule will be for reflection across the x-axis?

1. Lay your crane against the x-axis.
2. Plot and write down ordered pairs for your crane. Trace the outline of your crane as well.
3. Lay your Mira on the x-axis.
4. Plot and write down the ordered pairs for your reflected crane (by looking through your Mira).
5. Now physically reflect your crane.
6. What do you notice about the crane?
7. What do you notice about the ordered pairs?
8. Can you create a rule to describe what happens to ordered pairs when you reflect across the x-axis?

Rotation/Translation

Items you would need

- Patty Paper (pack of 1000) on Amazon for \$9.
- Patty Paper can also be used to teach Reflections and Translations.

How do we do it?

1. First we have students play the rotation game in order to learn their rotation degrees and directions.
2. Lay Patty Paper mainly in Quadrant 1; however, a little bit of Patty Paper needs to be in each quadrant.
3. Lay crane on top of Patty Paper in the first quadrant on the x-axis. Label your 6 points on the Patty Paper and connect your lines. Also trace over your x-axis & y-axis. Remove crane when finished.

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