CREASED

Magazine for Paper Folders

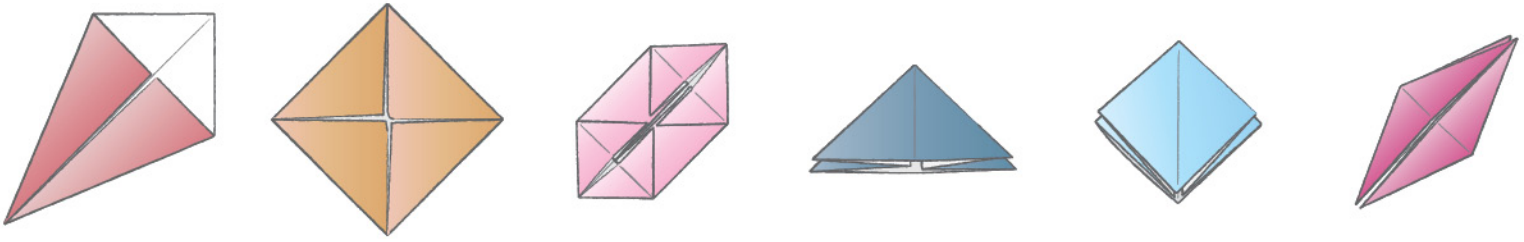
Teachers' Corner

LESSON PLAN OUTLINE
Detailed outline of all the lessons for first year.

TRADITIONAL DIAGRAMS
Easy to follow traditional diagrams.

ORIGAMI BASE-ICS
Diagrams of the most common bases in Origami!

TEACHING TIPS
Tips and Techniques to help you teach in the classroom in each lesson.



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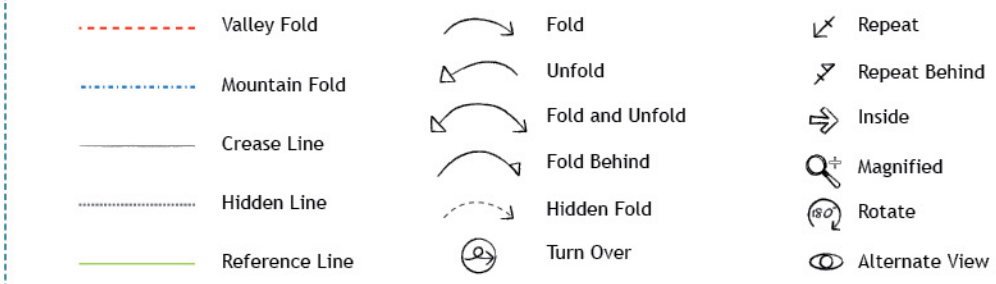
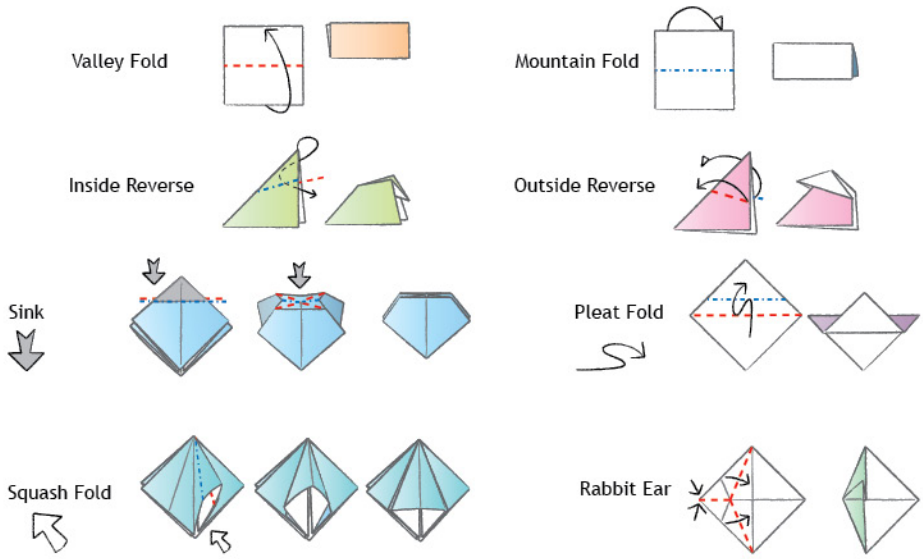
SYMBOLS





TEACHERS' CORNER

Editors: *Shrikant **Iyer** and Rachel **Katz***

We are delighted to launch this Teachers' Corner feature of Creased. Over the course of the year, we will be creating 6 lesson plans with accompanying diagrams of one origami base and 2 traditional models in each issue. The lessons will be geared for elementary to middle school students with an emphasis on math using NCTM standards. The diagrams of the models will be printed in the print magazine and the lesson plans, including the diagrams, will be available for everyone to download at *www.creased.com/teachers*.

Most people think of origami as an art form or craft. We think of origami as the perfect tool for teaching people of all ages a multitude of skills, sometimes without them even knowing they are learning.

Paper folding is a wonderful way to engage children in learning basic math concepts like shape, size, and numbers. The magic comes when they also learn patience and concentration as they make the fold neatly on their paper. They use their imagination as they see the beginnings of a bird emerging from the paper. They learn sequencing and problem solving as they realize that, to create an origami dog, specific steps must be followed in a logical order. As students practice models and learn more difficult models, their fine motor skills will also improve.

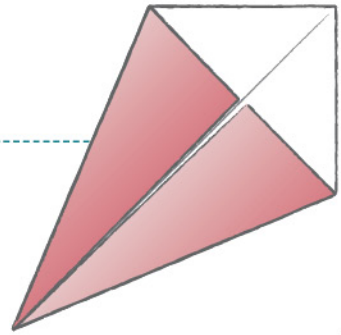
Most importantly, students will gain self-esteem as they succeed in finishing a model and take pride in their work. They will know that sense of satisfaction we all feel when we have turned simple paper into a flower or butterfly, all to the amazement of those not familiar with folding. Students can learn to be teachers by showing others how to fold a model. It's a wonderful vehicle for getting students to share their skills and knowledge.

All the lesson plans will be great resources for anyone teaching Paper Folding to beginners whether in a classroom or workshop or fun one-on-one session of teaching.

Visit *www.creased.com/teachers* to download your lesson plans and traditional diagrams.

-Shrikant Iyer and Rachel Katz

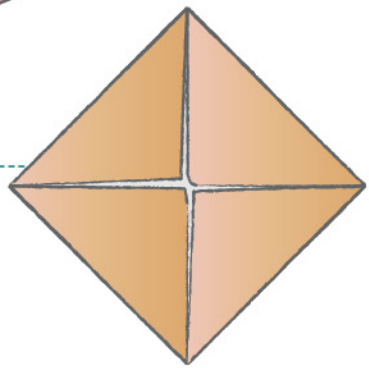
LESSON PLAN OUTLINE



Issue 1 - Kite Base

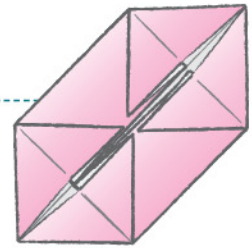
(also known as the Ice Cream Cone Base)

This lesson is used with the traditional whale and swan diagrams. Math concepts stressed include shape, symmetry, and angles.



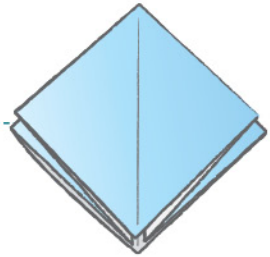
Issue 2 - Blintz Base

This lesson is used with the traditional photo frame and Chinese lantern. Math concepts stressed include shape, symmetry, counting, and patterns.



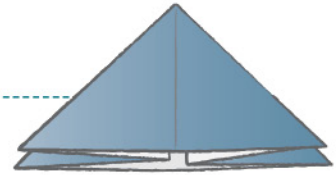
Issue 3 - Pig Base

This lesson is used with the traditional pig and traditional windmill models. Math concepts stressed include shape, symmetry, angles, and velocity.



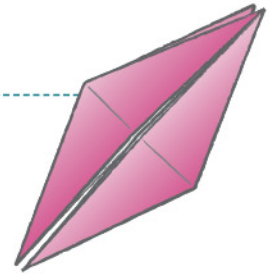
Issue 4 - Preliminary Base

This lesson is used with the traditional flower and basket models. Basic math concepts covered will include angles, symmetry, shape, fractions, and size.



Issue 5 - Waterbomb Base

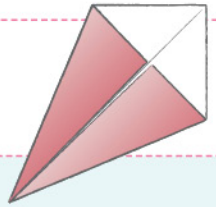
This lesson is used with the traditional waterbomb and for older students the blow up rabbit. Math concepts covered will include shape, symmetry, angles, and volume.



Issue 6 - Bird Base

This lesson is used with the traditional flapping bird and traditional crane. Math concepts stressed will include symmetry, angles, shapes, and degrees.

LESSON 1: KITE BASE



Activities

Activity 1: Make a square from a rectangle

Activity 2: Fold a Kite Base

Activity 3: Simple Traditional Whale

Activity 4: Traditional Swan

Models for this lesson:

Kite Base (also called the Ice Cream Cone Base), Traditional Simple Whale, and Traditional Swan

Materials needed:

letter sized paper (8 ½ x 11), scissors, square origami paper

Targeted grade levels:

Kindergarten, 1st, 2nd, 3rd (additional tips for older students)

Math Concepts:

shape, symmetry, fractions, division, numbers

NCTM Standards:

1. recognize, name, build, draw, compare and sort two- and three-dimensional shapes;
2. describe attributes and the parts of two- and three-dimensional shapes;
3. investigate and predict the results of putting together and taking apart two- and three-dimensional shapes, understand how to measure using nonstandard and standard units;
4. understand how to measure using nonstandard and standard units.

Math Vocabulary:

rectangle, square, triangle, diagonal, angle, right angle, bisect

Teaching Tips and Techniques:

- Become familiar with origami terminology and basic symbols as these will be used over and over in each new model.
- Try folding the model several times before the lesson. You should be familiar with all the steps before teaching others.
- Show the students a completed model so they know what they will be making.
- Anticipate where students might have a problem.
- Use oversized paper when you are teaching - it will be easier for students to see the folds you are making.

ACTIVITY 1 - *Make a square from a rectangle*

Reference illustration in diagrams to the right.

1. What shape are we starting with? Hold up different sized papers and ask if they are all rectangles. How do you think the size of the rectangle affects the size of the square we are making? Which side of the rectangle is longer?

Take left short side of the paper and lay it on the top long side and crease sharply - what shape have you made?

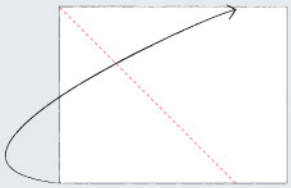
2. What shape is left over? Cut this rectangle off. Does this small rectangle share an attribute with the original rectangle? What shape do you have now?

3. Open the paper. What shape do you have now? What shapes do you see in the square?

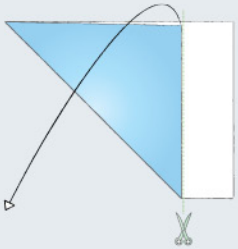
Experiment with rectangles of differing dimensions to see how the widths of the strips vary. Use the rectangular strips to make more squares. With older students you can discuss area measurements. Does the area of the original rectangle equal the sum of the area of the square and the area of the small rectangle cut off in Step 2?

How to make a square from any rectangle

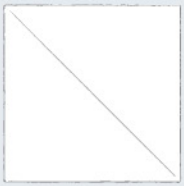
Most origami begins with a square sheet of paper. You can make it yourself from any rectangle. Look around for copy paper, magazines, advertisements, gift wrap, stationery or any other paper you have in the house. Then follow the diagrams to make your square.



1. Place the rectangle sideways the long way. Valley fold the left-hand side up to meet the top, thereby making a triangle.



2. Cut the extra strip off along the side of the triangle.



3. Open out the triangle into the square.

ACTIVITY 2 - *Fold a Kite Base*

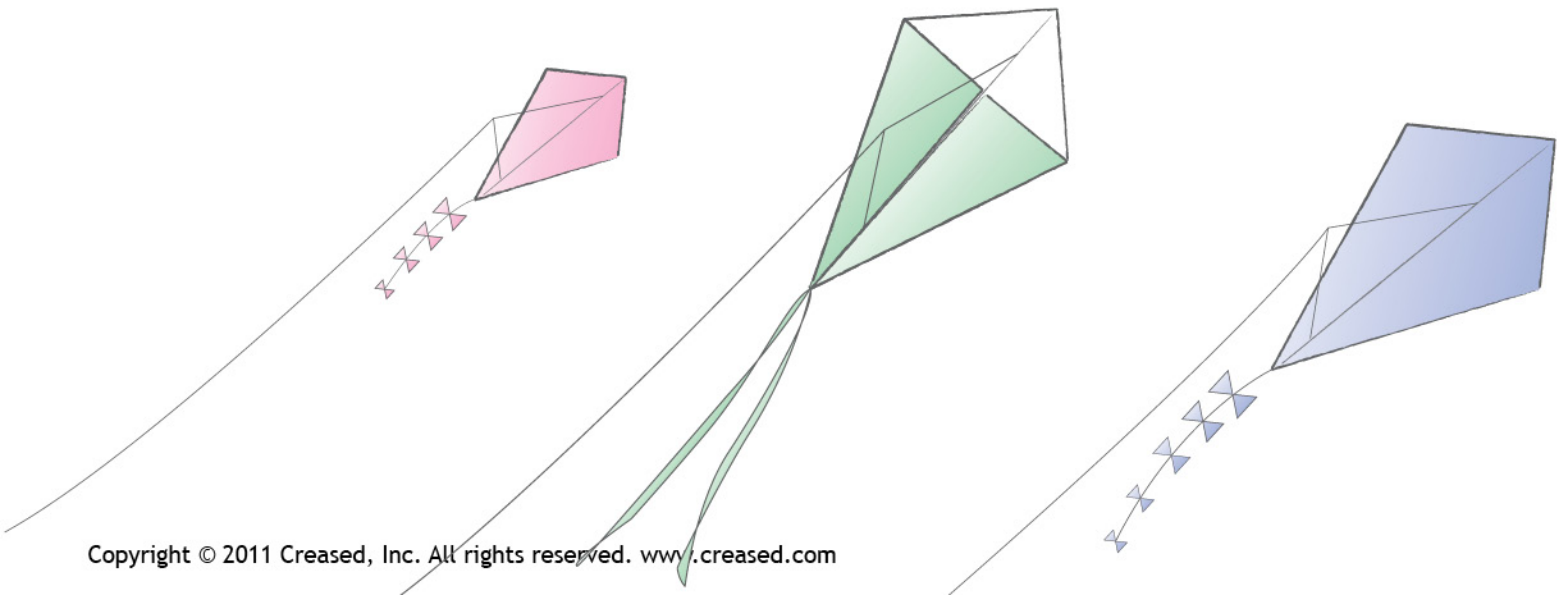
1. Have students orient the paper with a corner of the paper pointing towards them. The paper is square but does it remind them of another shape. Remind students to line the points up at the bottom and on the sides before making a crease. What shape have we made with this crease? How many triangles did we create in the square?

2. Here we bisect the angle. Are the two triangles the same size? As you turn the model over and repeat the fold on the other side, discuss the fact that often origami is symmetrical - the crease made on one side is repeated on the other. What does that mean? Which triangles are the same? What else do you see that is symmetrical (maybe the eyes or ears on a person's face or the classroom windows)?

3. Remind the students to open the model so they see both colors of the paper. What shape is this? Remind the students that this is called the Kite Base and is also known as the Ice Cream Cone Base. How many triangles do you see? Are they all the same size?

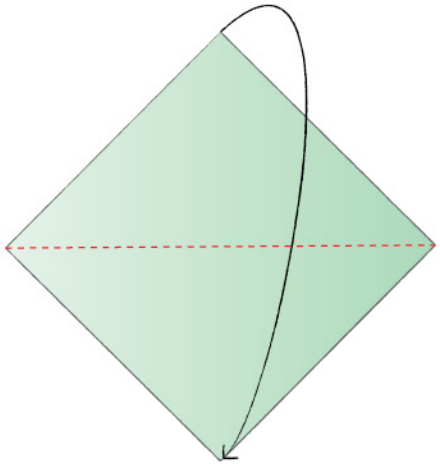
For older children, have them open the model and look at the creases they have made. What could you call those creases? They are angle bisectors. What size angle did you start with? 90 degree. What size angles do you have now? There are four 22.5° angles.

Also for older students, discuss the areas of the triangles, figure out the resulting angle when you bisect the angles in steps 1 and 2. Figure out the areas of the different triangles.

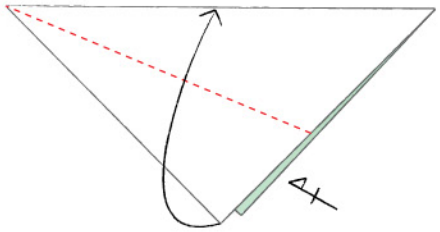


KITE BASE *Traditional*

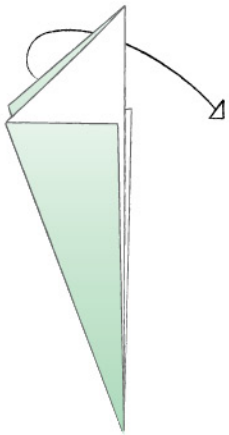
Also known as the Ice Cream Cone Base, this base is one of the most common beginnings to a number of traditional models.



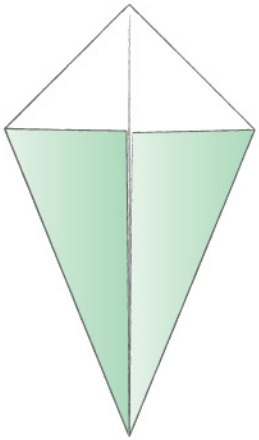
1 Start with the color side up. Fold in half by bringing the top corner to the bottom.



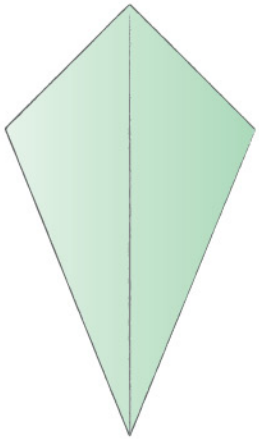
2 Fold up one layer so the bottom left side matches the top edge and makes a nice sharp point on the left side. Repeat on other side.



3 Open up to the Kite Base (also called the Ice Cream Cone Base).



Finished Kite Base!



The other side.

ACTIVITY 3 - *Simple Whale*

1-4. We have included the diagram steps of the Kite Base again as a reference. Start with a Kite Base with both the color and white of the paper showing. After folding the top corner, what is the resulting shape? Have the students count the number of sides. There are 5 sides, but they are not equal so it's an irregular pentagon.

5. How many sides do you count now?

6. Your finished whales! Remind the children that, just as in the open ocean, no two whales look exactly alike.

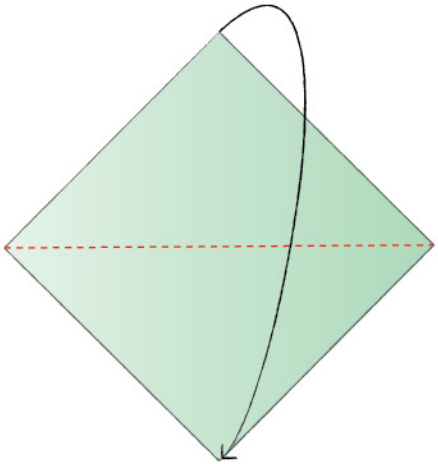
When you have finished your whales, have the children unfold (they are simple to refold) their models and look at the creases inside. How many triangles do you see? How many different shapes can you find? Can you find the little kite shape (at one corner of the paper)? You can have them mark the pairs of triangles with different colors.

You can also have students fold more models out of progressively smaller paper.

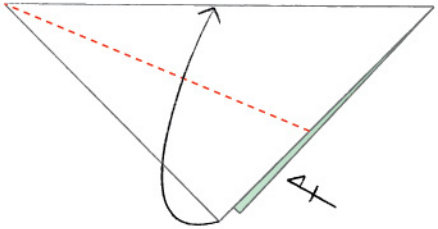
SIMPLE WHALE *Traditional*

PAPER INFO: 6-inch square paper was used to make this 5 ½-inch model.

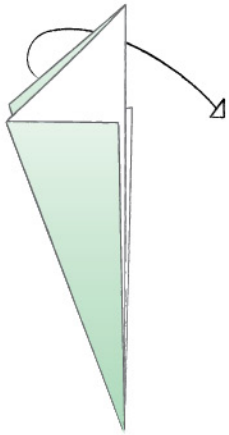
TIPS AND TRICKS: The tail can be inside reversed for more advanced folders. Have students decorate the model with eyes and mouth using markers or stickers.



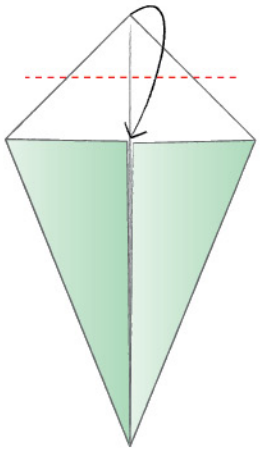
1 Start with the color side up. Fold in half by bringing the top corner to the bottom.



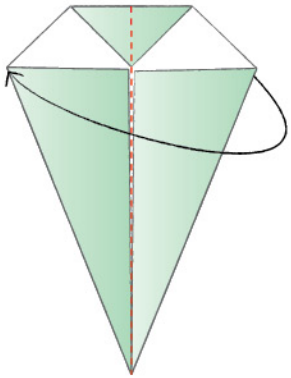
2 Fold up one layer so the bottom left side matches the top edge and makes a nice sharp point on the left side. Repeat on other side.



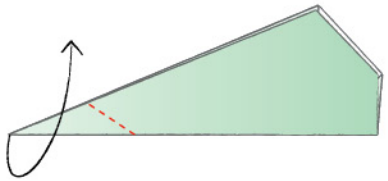
3 Open up to the Kite Base (also called the Ice Cream Cone Base).



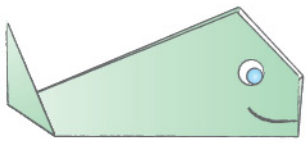
4 On the top white triangle, fold down corner to other points.



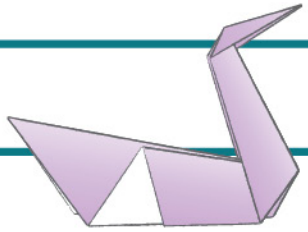
5 Fold in half the long way.



6 Fold back point at an angle to create the tail.



Finished Traditional Whale!



ACTIVITY 4 - *Traditional Swan*

1. Remind students you've made this base before when you folded your whales. What shape do we have? Do you remember the name of the base? Either Kite Base or Ice Cream Cone Base is a correct answer.

2. Here we're making the swan's beak so we want it pointy. Have the students identify the center crease - what does center indicate? Start the fold at the tip and roll the edge to the center line. We are bisecting - or cutting in half - this angle. (For older students you can have them unfold the model to examine the angles. What size is the angle made in this fold? In the previous fold?)

3. What shape have we made now? How many sides can you count?

4. Discuss fractions. Is 1/3 larger or smaller than 1/2?

5 - 7. At this point it is easier for some to hold the model flat on a hard surface with one hand and pull up the neck with the other. The same is true for the head.

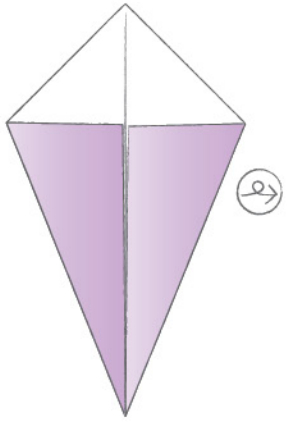
For Older Students

- Discuss where other examples of paper that can be used for folding might be found around the house.
- Discuss concepts of habitats, ecology, and conservation for the animal just folded.
- Fold another model and open up to examine the creases. Color shapes that are similar.
- Discuss symmetry and then have students figure out what the next fold is after you show them a step.

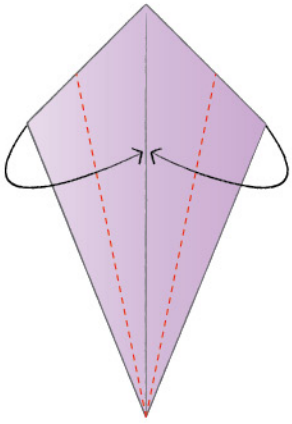
SWAN *Traditional*

PAPER INFO: 6-inch square paper was used to make this 4¼-inch long model.

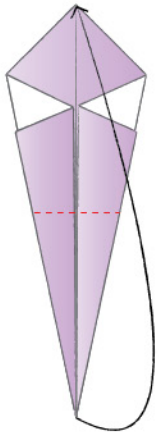
TIPS AND TRICKS: To make a nice sharp point, start folding from the tip when bringing sides into center. If the swan is unbalanced and falls forward, adjust the angle of the neck and open up the body from the bottom.



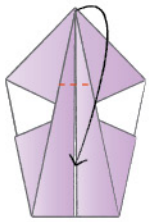
1 Start with a Kite Base; turn over.



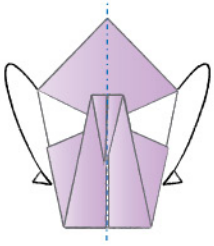
2 Fold long sides into center.



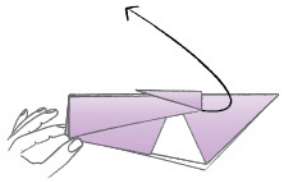
3 Fold in half, bottom point to top.



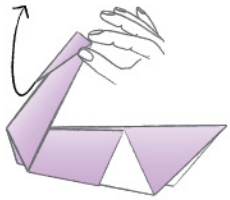
4 Fold tip back down about one third.



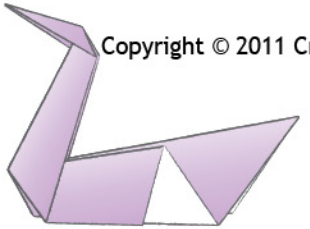
5 Mountain fold entire model in half the long way.



6 Pull up neck at a slight angle; pinch lower part to make it stay.

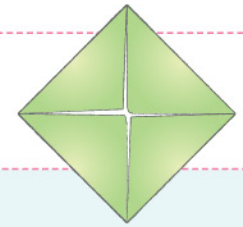


7 Pull head up and pinch the base to make it stay.



Finished Traditional Swan!

LESSON 2: BLINTZ BASE



Activities

Activity 1: Fold a Blintz Base

Activity 2: Simple Picture Frame

Activity 3: Multiform - Lantern, Shirt, Pants, Camera

Models for this lesson:

Blintz Base, Picture Frame, Multiform creating a Chinese Lantern, Shirt, Pants, and Camera

Materials needed:

Square paper - ideally 8 inches or larger, especially for the Multiform

Targeted grade levels:

Kindergarten, 1st- 6th grades

Math Concepts:

Shape, symmetry, counting, pattern, division, fractions, midpoint, congruence

NCTM Standards:

1. Recognize and describe the attributes of length, area, angles, and shapes;
2. Investigate and predict the results of putting together and taking apart two and three-dimensional shapes;
3. Explore similarity and congruence;
4. Sort and classify objects according to their attributes and organize data about the objects;
5. Understand that measurements are approximations and how difference in units affects precision.

Math Vocabulary:

Triangle, midpoint, intersection, diagonal, angle, altitude, similar, congruent, line of symmetry, trapezoid, perpendicular

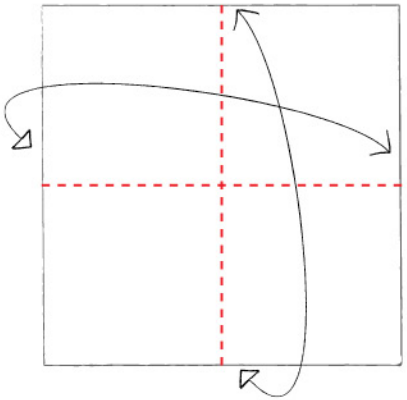
Teaching Tips and Techniques:

- Practice folding the model. You should be familiar and comfortable with all the steps before teaching others
- Think of the math concepts you want to include in the lesson. Ask questions about shapes, area, and numbers, as appropriate, with each step of the model.
- Keep your words consistent.
- Have students learn in clusters. Remind them that in origami looking at your neighbor's paper is good.

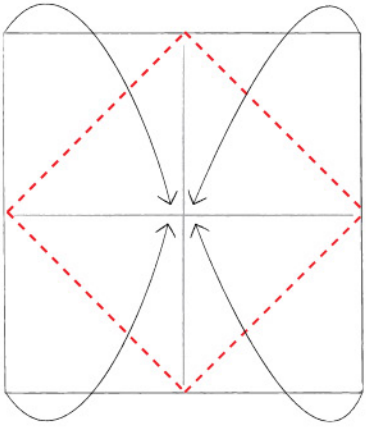
ACTIVITY 1 - *Fold a Blintz Base*

1. This step is often referred to as a book fold. What did the crease do to the square? What kinds of rectangles were formed? 2:1
2. Where is the intersection of the two lines? Is this the midpoint of both lines? Can you get to this stage if step 1 was a diagonal fold? Yes, the point of intersection would be the same.

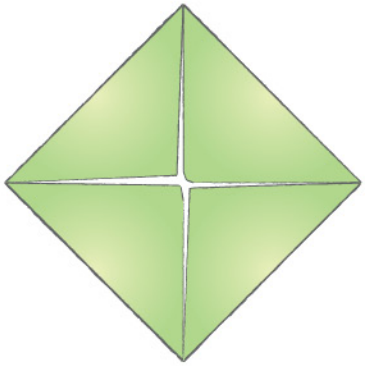
BLINTZ BASE *Traditional*



1 Start with white side up. Fold in half and unfold. Fold in half the other way and unfold.



2 Fold each corner point into the center.



Finished Blintz Base!

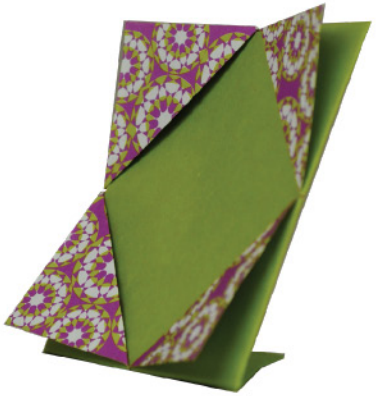
ACTIVITY 2 - *Simple Picture Frame*

PICTURE FRAME

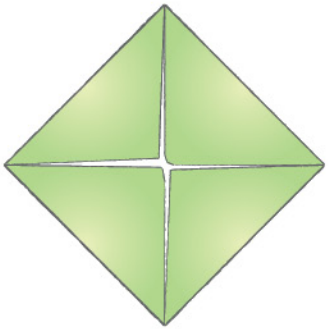
1. Start with a Blintz Base. You can refer back to the diagram.

2. After you form the second Blintz, have students unfold the paper. Find the trapezoids, hexagons, isosceles triangles, 45-degree angles, and 90-degree angles. Have students draw around the shapes.

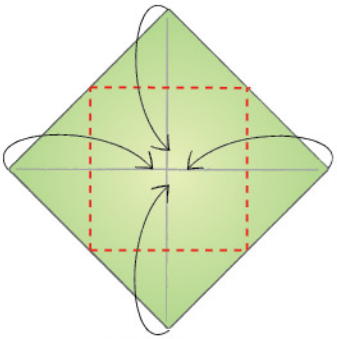
3-4. Have the students refold the double Blintz and continue to finish the model. Try a variation by not folding the points all the way to the outer corners but leaving a gap. What does this change do to the area of the center of the frame?



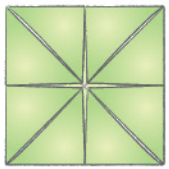
PICTURE FRAME *Traditional*



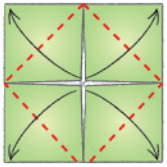
1 Start with the Blintz Base. Turn over.



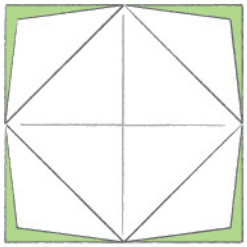
2 Fold each corner point into the center.



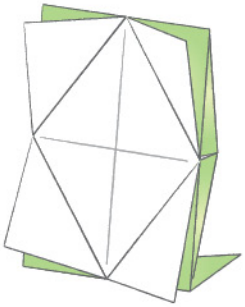
3 Turn over.



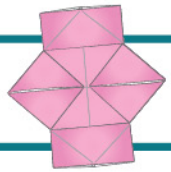
4 Fold each inner point out to the corner.



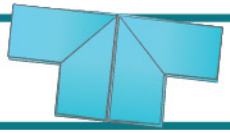
Finished Picture Frame!



Side view

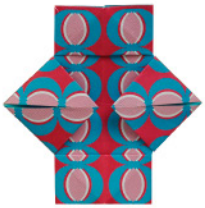


ACTIVITY 3 - *Multiform*



MULTIFORMS

Multiforms are models that change with the addition of one or two steps. Each builds upon the previously folded model. You will need to begin each one with the Blintz Base. In this lesson first fold the Chinese Lantern. Then fold another Lantern that you will turn into a Shirt. Fold another Lantern so you can make the Pants. Fold another pair of Pants to make the final model, the Camera.



CHINESE LANTERN

1-2. You begin with step 3 of the Picture Frame. How many blintz moves (bringing the corners into the center) have you made? Two. Now you blintz again. How many blintz moves does that make? Three.

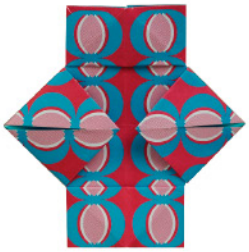
3. What shape is this? What shapes do you see within the square? How many different shapes do you see? How many of each?

SHIRT

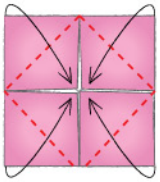
1. Start with a Chinese Lantern. You can either use the one you just folded or fold a second one. Is it easier to fold the second time? Why?

2. Is the model symmetrical before you fold it in half? Does it matter in which direction you fold it in half? Try both ways. Is it the same?

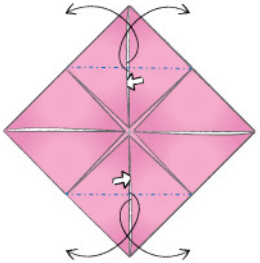
CHINESE LANTERN *Traditional*



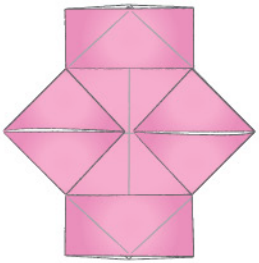
1 Begin with step 3 of the Picture Frame. Turn over.



2 Fold corners to center. Turn Over.

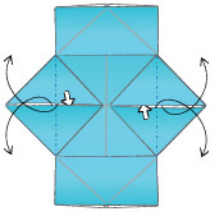


3 Pull open the top triangle and flatten, repeat on the bottom triangle.

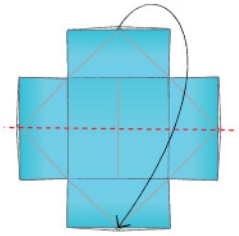


Finished Chinese Lantern!

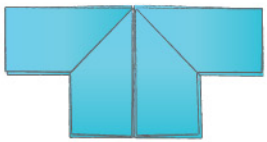
SHIRT *Traditional*



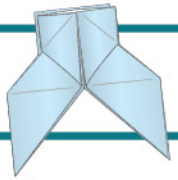
1 Start with a Lantern. Open the side triangles and flatten them (as you did for the top and bottom triangles when you made the Lantern).



2 Fold the model in half from top to bottom.



Finished Shirt!



ACTIVITY 3 - *Multiform (cont.)*

PANTS

1. Start with a Chinese Lantern. If you made the Shirt, you can unfold it back to the Chinese Lantern or fold a new Chinese Lantern.

2. Remind students that it is usually best to fold on a hard surface like a desk. For this step you must lift up your model. If students are having difficulty pulling out the sides in this step, have them turn the model over and identify the blintz. If they pull on the corners (now on the other side) they will see that they are unfolding one blintz layer that then goes to the inside of the model.

3. Can you fold this model in half both ways to make the Pants as you could the Shirt? No. Do you see different kinds of triangles?

CAMERA

1. Start with the Pants. As for the other models in this Multiform, you can start with the Pants you just made or make a new pair.

2. Is the model symmetrical? What shapes can you find - do you see the rectangles and triangles?

3. It might be easier for some to hold the model in the air while performing this step. Is the model still flat or has it assumed a 3-dimensional shape?

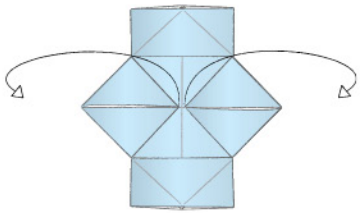
4. Unfold the model completely and explore the various shapes and areas. See the addition of smaller triangles becoming larger triangles and trapezoids and squares. How many triangles did it take to make these shapes?

Extending the lesson and other activities:

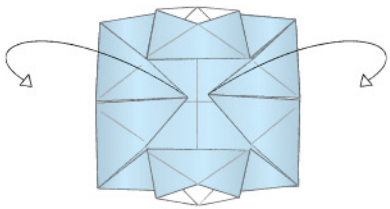
Multiforms are great opportunities for the children write a story as a group with the teacher or to write their own stories based on the models. Use the models to fire their imaginations.

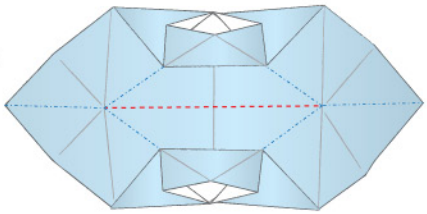
The word Blintz is derived from another language. Have the children think of other words we use everyday that come from other languages and cultures.

PANTS *Traditional*

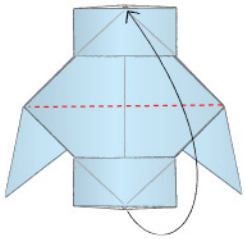


1 Start with a Lantern. Holding the model in the air, grasp the inside corner of the two squares and gently lift up to pull the model open.

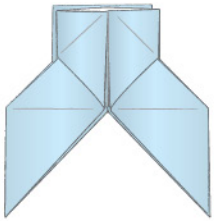




2 Keep pulling the corners until the model pops into a new position. No new folds!

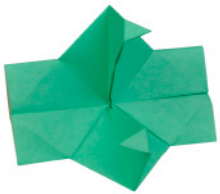


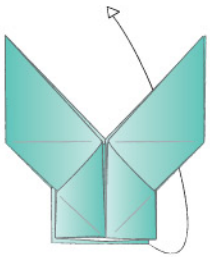
3 Fold the model in half so the two rectangles from the lantern meet at the top.



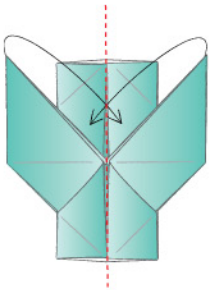
Finished Pants!

CAMERA *Traditional*

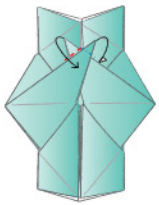




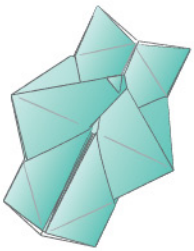
1 Start with a Pants model with the legs facing up. Pull the bottom layer of the Pants up from behind.



2 Stand the flaps (Pants legs) upright. Start folding the model in half lengthwise until the two flaps cross over each other.



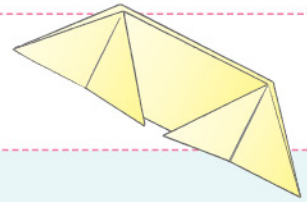
3 Fold the tips down (one to the front, one to the back) so the flaps are locked together.



4 Finished Traditional Camera! To operate your camera, have the flaps facing away from you and push with your thumb on the back of the camera. You will hear a "pop" and the flaps will open.

If your camera doesn't work, make sure the tips you folded down in step 3 are not too large. You can put a picture inside the model under the flaps to "capture" your shot.

LESSON 3: PIG BASE



Activities

Activity 1: Fold the Pig Base (Grades 3 and up)
Activity 2: Fold the Pipe Cleaner flower (for grades 1-2)
Activity 3: Fold the Pig (Grades 3 and up)
Activity 4: Fold the Windmill. (Grades 3 and up)

Models for this lesson:

Pipe Cleaner Flower, Traditional Pig, Windmill

Materials needed:

Paper
Pipe cleaner/ wire
Stick
Thumbtacks

Targeted grade levels:

Kindergarten, 1st- 6th grades (additional tips for older students)

Math Concepts:

Shape, counting, symmetry, velocity, fraction, congruence

NCTM Standards:

1. Recognize, name, build, draw, compare and sort two dimensional shapes.
2. Investigate and predict results of putting together two dimensional shapes.
3. Classify two dimensional shapes according to their properties and develop definitions of classes of shapes.
4. Explore congruence and similarity.
5. Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.

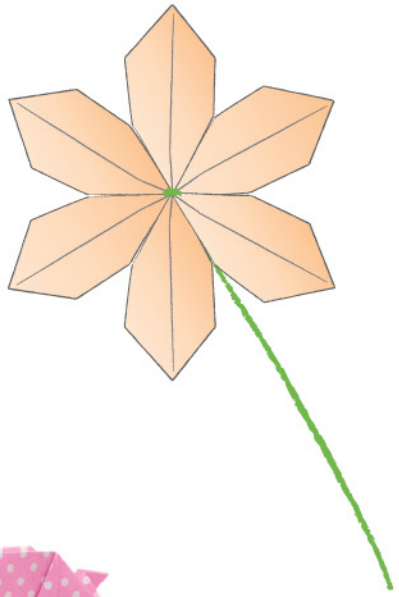
Math Vocabulary:

Square, trapezoid, hexagon, rectangle, triangle, right triangle, parallel, diagonal, angle

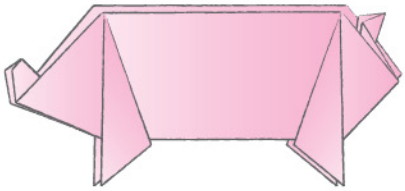
Teaching Tips and Techniques:

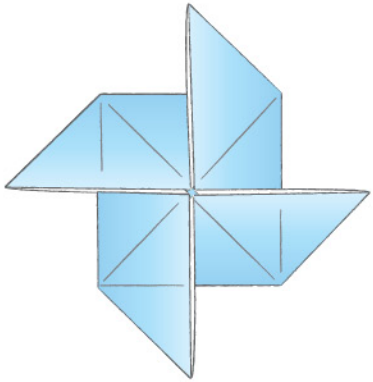
- Select paper that will help ensure successful completion of the model. For most beginners, paper that has two distinctly different colored sides works best. Refer to white side and colored side of the paper.
- Review and practice basic moves - make a valley fold, make a mountain fold - before beginning the model.
- Demonstrate how to line up edges before making a hard crease.
- Remind students to keep their paper on their desks or other hard flat surfaces.

Pipe Cleaner Flower

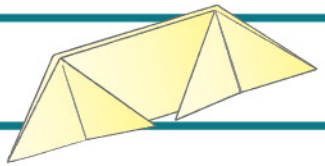


Traditional Pig





Windmill



ACTIVITY 1 - *Fold a Pig Base*

1. What shape is created by dividing the square in half? Rectangles.

2. What shape is created by dividing the square in half? Triangles. Is the area of each triangle equal to the area of each rectangle created in Step 1? Yes.

3. Before unfolding the blintz, what shape have you created? A square. How do you think it compares in size and area to the original paper?

4. How does the combined area of the two new rectangles relate to the area of the larger center rectangle? The areas are equal.

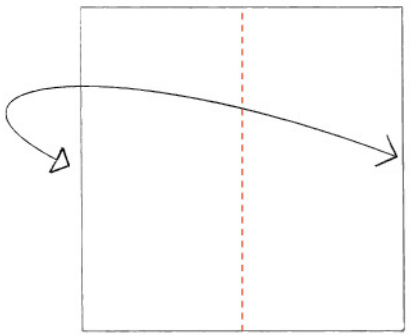
5. If you combine the areas of the 3 rectangles, does that equal the area of the piece of paper you are folding? Yes.

6. Your paper started with 4 sides. How many sides does this form have now? 6. Notice that the two triangles with their bases to each other form a square. Are these 4 triangles congruent? Yes.

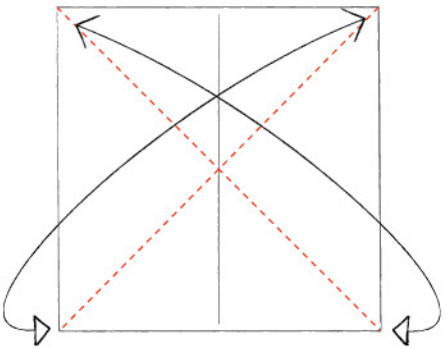
7. Is this base symmetrical? Yes. Show the axes of symmetry.

PIG BASE

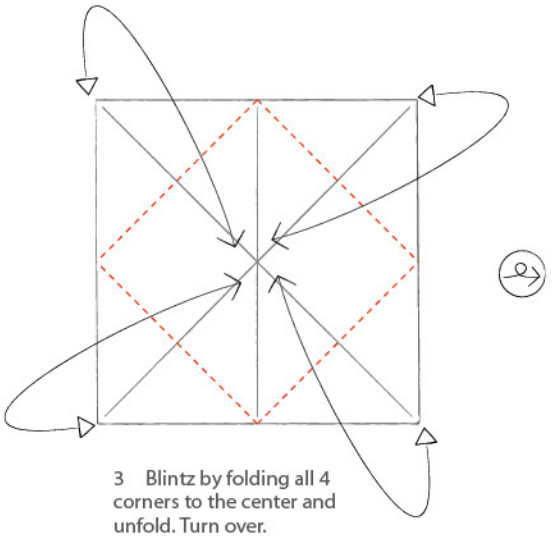
Traditional



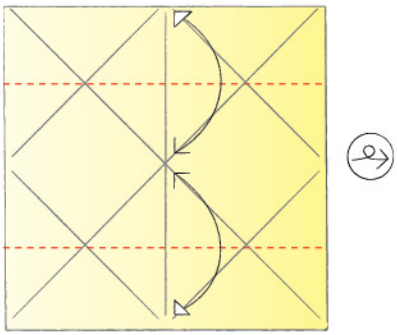
1 Start white side up. Fold in half, left to right. Unfold.



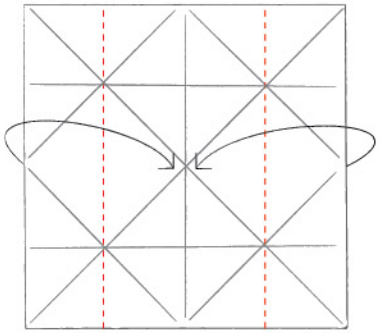
2 Fold in half, corner to corner, in both directions. Unfold.



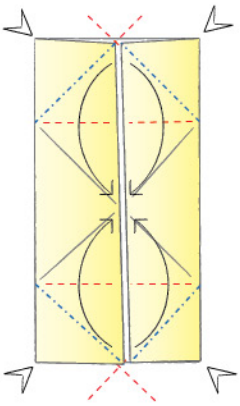
3 Blintz by folding all 4 corners to the center and unfold. Turn over.



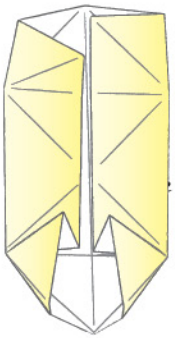
4 Make sure the crease made in step 1 is running top to bottom. Fold the top and bottom edges to the center. Unfold. Turn over.



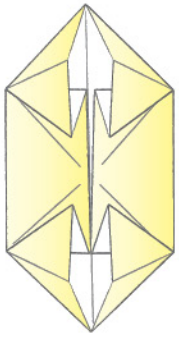
5 Fold the other two sides to the center.



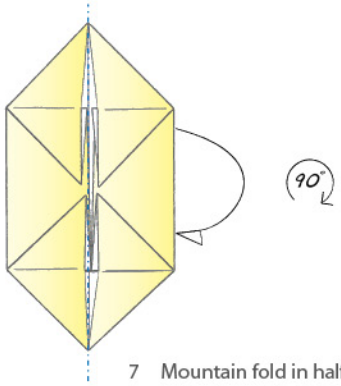
6a Push in on all 4 corners until the flaps meet at the center and lie flat.



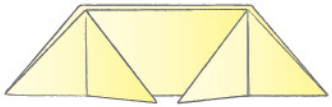
6b



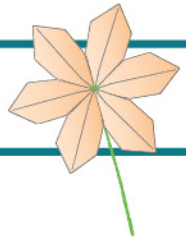
6c



7 Mountain fold in half to finish.



Finished Pig Base!



ACTIVITY 2 - *Pipe Cleaner Flower*

Note: this model can be folded from either a square or a rectangle. If you begin with a rectangle, skip step 1-2 and start with a book fold then fold in the corners as in step 3.

1. Start with a square. What shape results from folding the paper in half? A rectangle.
2. In Origami this step is often referred to as a cupboard door fold. Can you tell why? Do you see any cupboard doors around you? How are they the same?
3. After folding the corners to the center crease, do you still have a rectangle? No. Did you bisect the angle when making this fold? Yes. What kind of angle did you create? A right angle. How many sides does this shape have? 6. What is this shape called? Hexagon.
4. After folding the long edges into the center crease, is your paper the same shape as it was in step 3? Not exactly. It is less wide. Does the shape have the same number of sides as in step 3? Yes.
5. How many sides does the model have now? 4. Is it still a hexagon? No. Do you know what it is called? Trapezoid. Why? Because there are two parallel sides.

Assembly

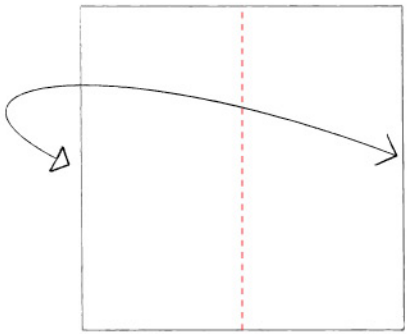
Grades K-2: sometimes children have trouble twisting the pipe cleaner tight enough to hold the units together, they might need some help.

Grades 3 and up: they should have no trouble with the pipe cleaners. You can also use thin wire or plastic covered twist ties like those used by gardeners. Try making the flower with more petals, reversing the petals (upside down), and explore other variations. You can also make this flower with narrow strips.

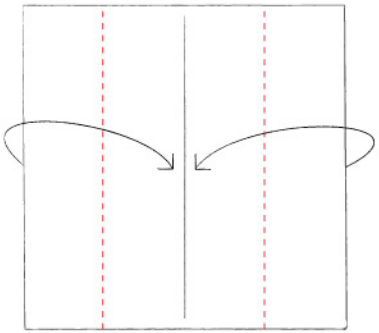
For higher grades, try narrowing the petals by adding an extra fold after step 3 - fold the corners in again to make a pointier unit. Put 4 units together rather than 3.

PIPE CLEANER FLOWER

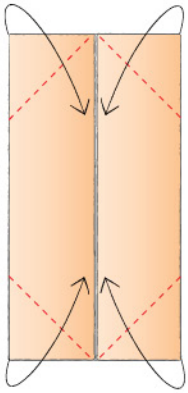
Traditional



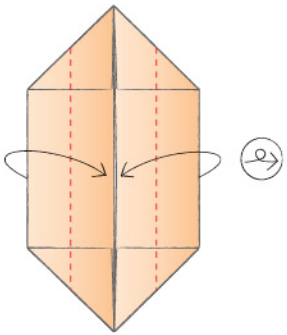
1 Start with white side up. Fold in half and unfold.



2 Fold each side edge into the center crease.

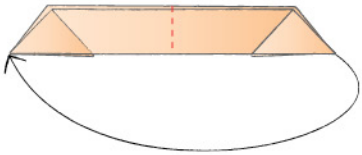


3 Fold the top right edge down along the center crease. Repeat on other 3 corners.

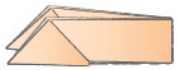


4 Fold long edges into center crease. Turn over.

5 Fold in half lengthwise.

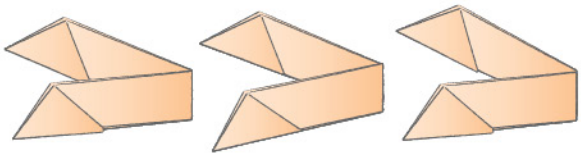


6 Fold in half bringing the tips together. Make 2 more units.

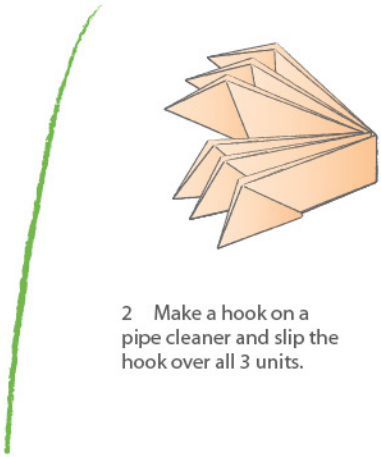


Finished Flower Unit!

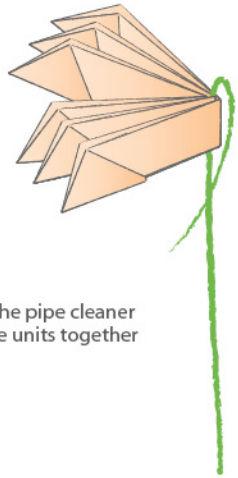
ASSEMBLY



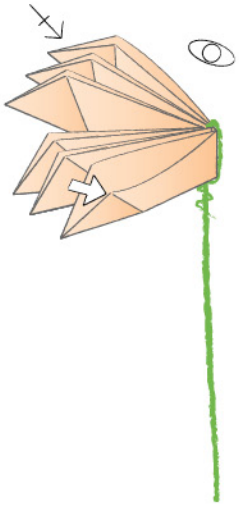
1 Take 3 units and line them up as shown.



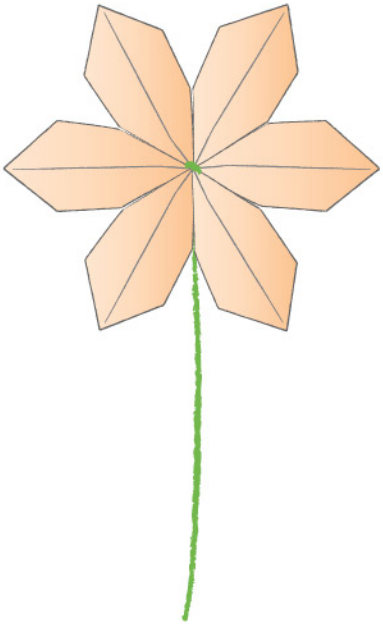
2 Make a hook on a pipe cleaner and slip the hook over all 3 units.



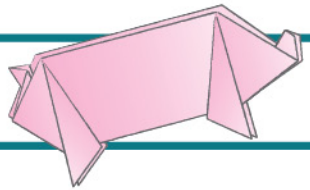
3 Twist the pipe cleaner to hold the units together snugly.



4 Open the petals while pushing the tip down and spread them out evenly to finish.



Finished Pipe Cleaner Flower!

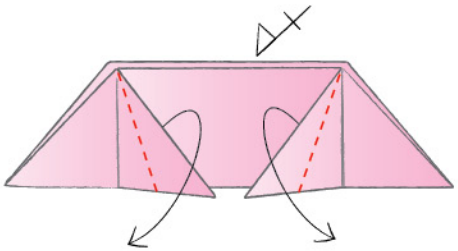


ACTIVITY 3 - *Fold a Pig*

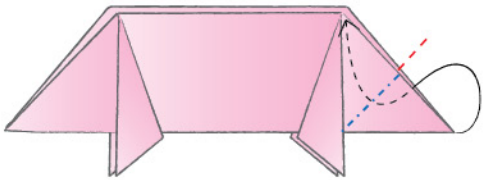
1. What is the outline shape? Trapezoid. Why? There are two parallel sides. After making this fold, have you bisected the angle? Yes. What is the angle formed? 22.5 degree angle - 1/2 of a 45 degree angle.
2. Are you bisecting this angle too? Yes.
3. Are the triangles on the outside and the inside equal? Yes. Why? Because you bisected the angle creating two equal triangles.
4. Note how we lost one of the axis of symmetry. We now have only one axis of symmetry going through the spine of the pig.

TRADITIONAL PIG

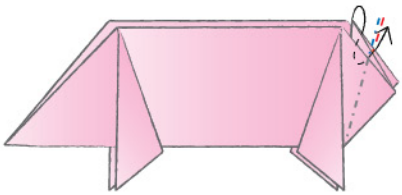
Traditional



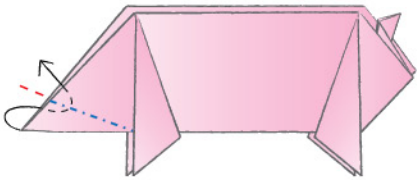
1 Start with a Pig Base. Take the folded edge of the flaps and fold along the existing creases to create legs. Repeat behind.



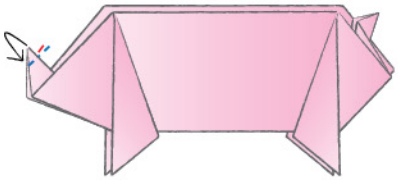
2 Fold the right hand tip up to the top of the leg and unfold. Slightly open the triangle and push the tip inside.



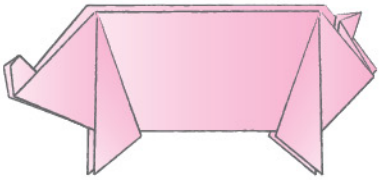
3 Pull out the tail slightly so it sticks out.



4 On the other end fold the tip up about 1/4 of the triangle's edge and unfold. Slightly open the triangle. Push the tip inside to make the snout.



5 With the triangle still slightly open, push the tip down to blunt the snout.



Finished Traditional Pig!

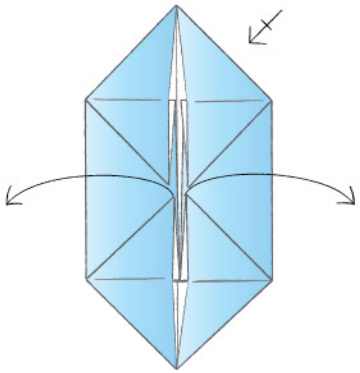
ACTIVITY 4 - *Fold a Windmill*

1. In this step you are rearranging the folds.
2. Is the shape the same as in Step 1? Yes? Is the model symmetrical? Yes.
3. Again you are rearranging the folds. Is the model still symmetrical? Yes. What changed? The axes of symmetry.

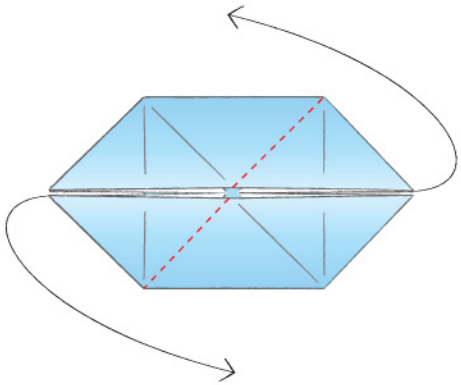
You can use the finished model to make an action model by pinning it with a thumbtack to a chopstick or other small stick. Have students blow on the model to see if it will move. What can you do to the 4 blades to change the velocity, to make the model move faster or slower?

WINDMILL

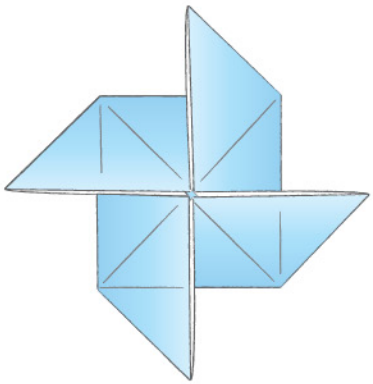
Traditional



1 Start with step 7 of the Pig Base. Hold the tips of the bottom pair of flaps and pull them outward. The paper will flatten without making any new creases. Repeat on the top pair of flaps.

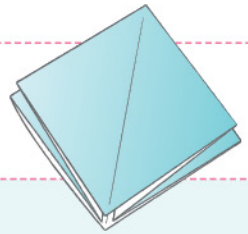


2 Note that there are 4 flaps now. Take the upper right flap and fold up on the existing crease. Repeat with the bottom left flap.



Finished Windmill!

LESSON 4: PRELIMINARY BASE



Activities

Activity 1: Fold the Preliminary Base
Activity 2: Fold a Simple Flower
Activity 3: Fold a Star Basket

Models for this lesson:

Preliminary Base, Simple Flower, and Star Basket

Materials needed:

Paper

Targeted grade levels:

Grades: 4,5,6,7

Math Concepts:

Square, ratio, bisect, quadrant, intersection

NCTM Standards:

1. Investigate, describe, and reason about the results of subdividing, combining, and transforming shapes;
2. Explore congruence and similarity;
3. Understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
4. Describe, extend, and make generalizations about geometric and numeric patterns;
5. Create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.

Math Vocabulary:

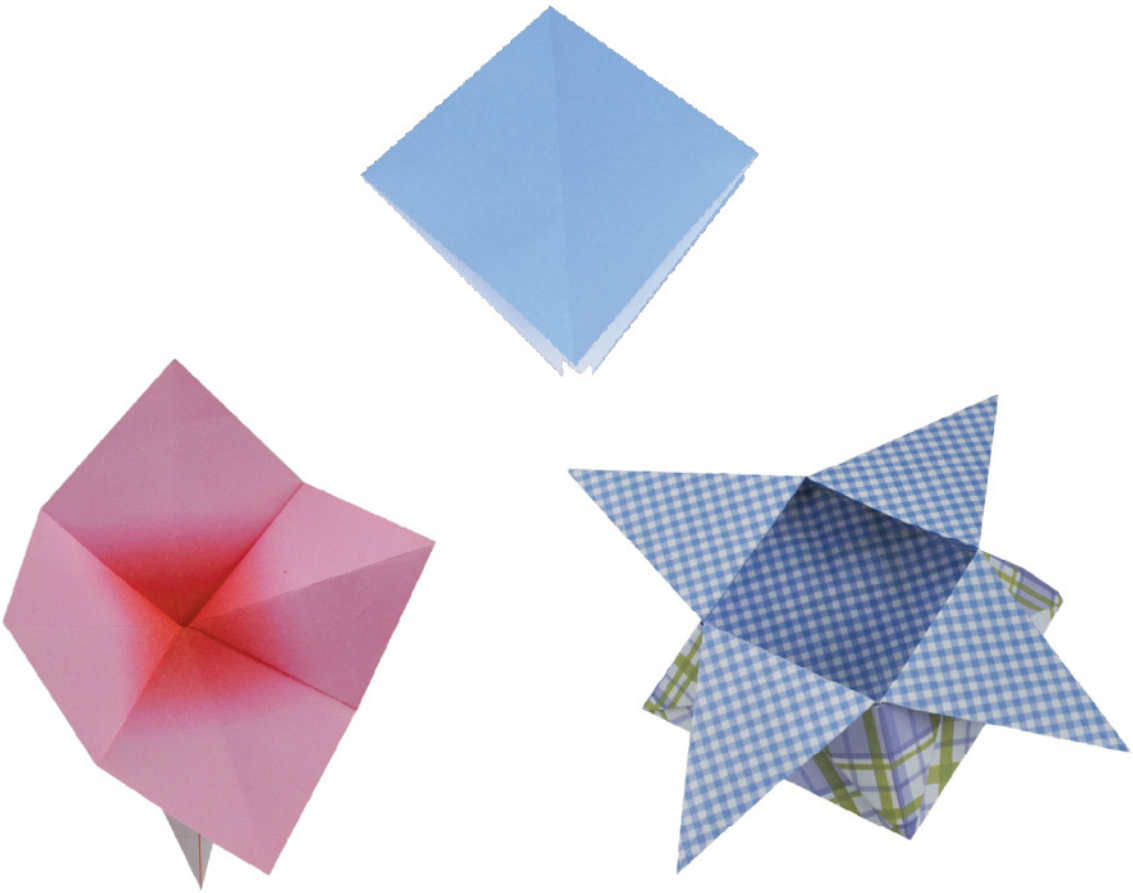
Square, triangle, congruence, similarity, perimeter, area, volume, symmetry, diagonal

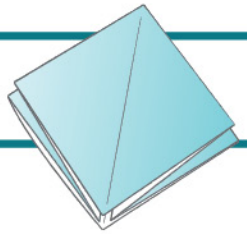
Teaching Tips and Techniques:

- Remind students to make sharp creases.
- Have students keep their papers on the table or other hard surface. It will help them to have neater folds.
- Demonstrate how to line up the edges when making a diagonal in order to achieve accurate creases and sharp points.
- If the students fold two copies of a model, have them unfold one so they can examine the crease patterns they made. Have them name or color the different shapes.

Lesson Introduction

We hope you are enjoying the bases and models we have been presenting in the last few chapters. We are truly excited to present this section and see you progress into more advanced levels of folding. This chapter is dedicated to the Preliminary Base, one of the most important bases in origami. A very large number of models begin with this Base and it is therefore critical to master the Preliminary (sometimes referred to as the Square) Base. There are more than a dozen methods of getting to this Base and here we present one of them. The Preliminary Base is also the first steps to learn the Bird Base, which will be covered in chapter 6.





ACTIVITY 1 - *Fold a Preliminary Base*

In making the Preliminary Base, neatness really pays off, especially in step 5 (the collapse). Take the time to make your first diagonal neatly. How many diagonals does the square have?

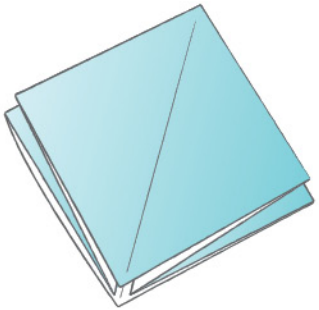
1. If the length of square is a, what is the length of diagonal?

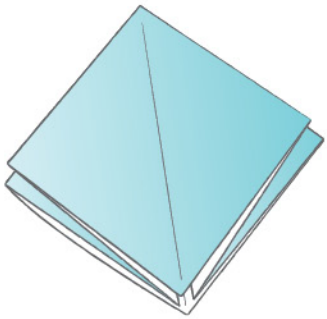
2. What is the perimeter of the triangles?

3. The intersection of the two diagonals and the two "book folds" is a point. How many mini-triangles resulted from this? What is the area of each triangle? Are they all the same? If yes, how?

4. When collapsing the base in step 5, pay close attention to the fact that all the four corners of the square come together.

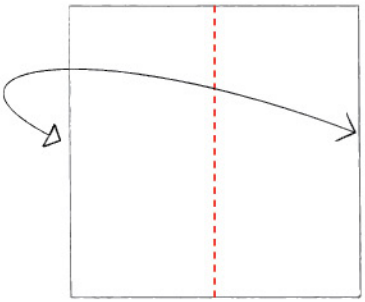
5. The Preliminary Base has two flaps on one side and two on the other.



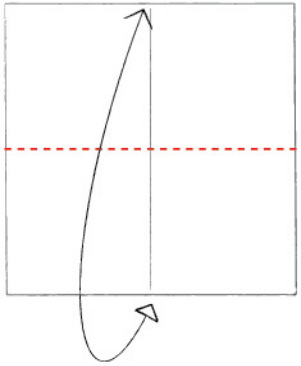


PRELIMINARY BASE

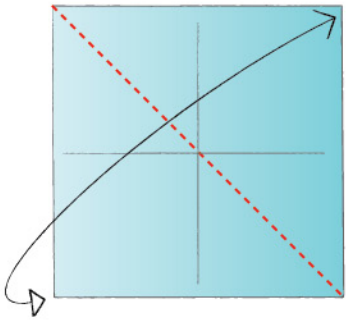
Traditional



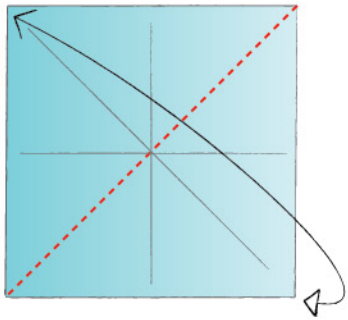
1 Start with white side of paper facing up. Fold in half side edge to side edge. Unfold.



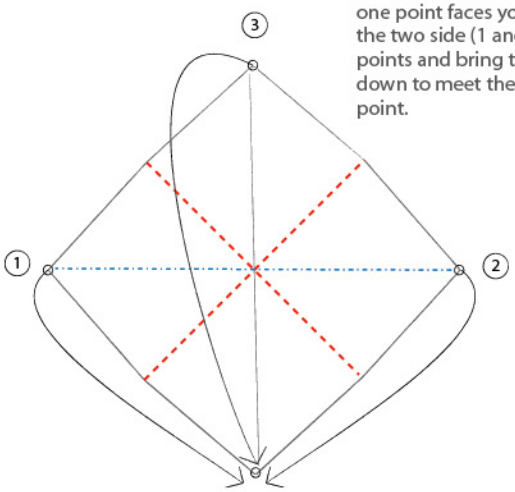
2 Fold in half bottom edge to top edge. Unfold. Turn over so the colored side is facing up.



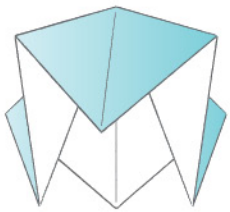
3 Fold the top right corner down to the bottom left corner, creating a diagonal crease. Unfold.



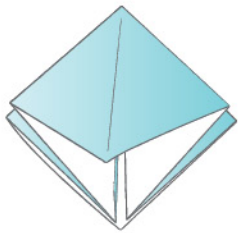
4 Fold the top left corner down to the bottom right corner, creating a second diagonal crease. Turn over to the white side.



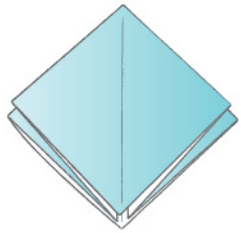
5 Orient the paper so one point faces you. Take the two side (1 and 2) points and bring them down to meet the bottom point.



6 As you bring the three points together at the bottom, the point of the top layer (3) will start to move toward that meeting point.



7 Bring the final point down to meet the others and reinforce the creases on the sides.



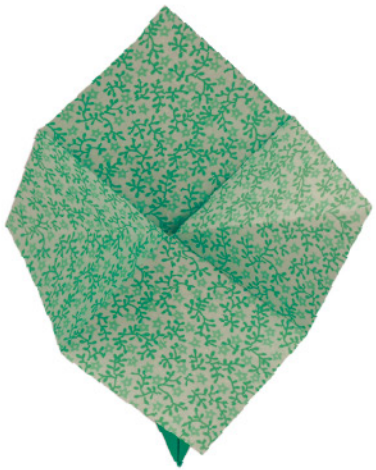
Finished Preliminary Base!

ACTIVITY 2 - *Simple Flower*

1. This model starts with a white Preliminary Base. Start with the white side up when you make the first diagonal fold in the Base.

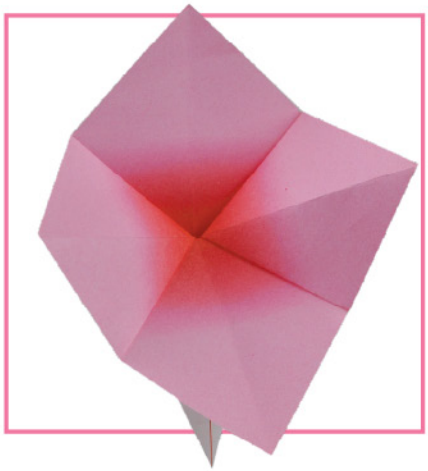
2. Make sure when you make the first folds (step 2) that the folds are on the closed side of the flaps. Notice the symmetry of the model. After we put the folds in, has the symmetry changed?

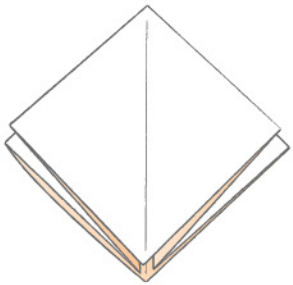
3. While opening the flower in step 6, be aware that the flower starts to get three dimensional around the petals, and you will need to gently squash them symmetrically to make it flat.



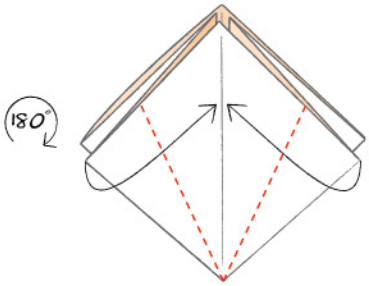
SIMPLE FLOWER

Traditional

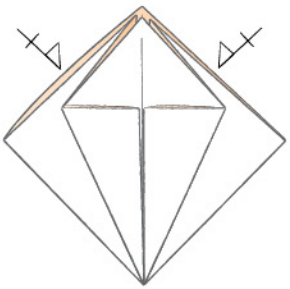




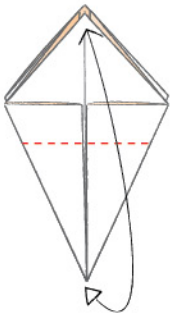
1 Start with a white Preliminary Base. Refer to the Preliminary Base and start with the colored side up.



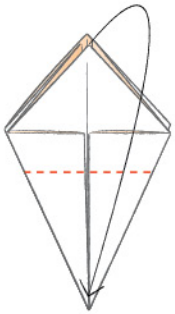
2 Make sure the open end of the Base is pointing away from you. Fold the lower side edges into the center crease.



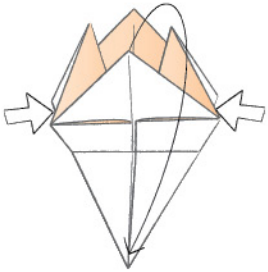
3 Turn the model over and again fold the lower side edges into the center crease.



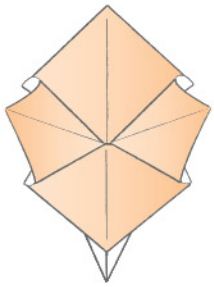
4 Fold the bottom tip up to the top. Unfold.



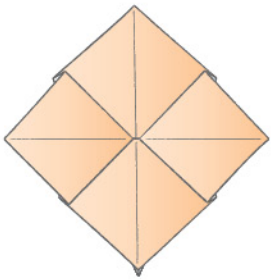
5 Take just the top layer and fold it down on the crease line made in step 4.



6 Gently push down the back layer and press down the two side layers.



7 Reinforce your creases. The flower will not be completely flat.



Finished Simple Flower!

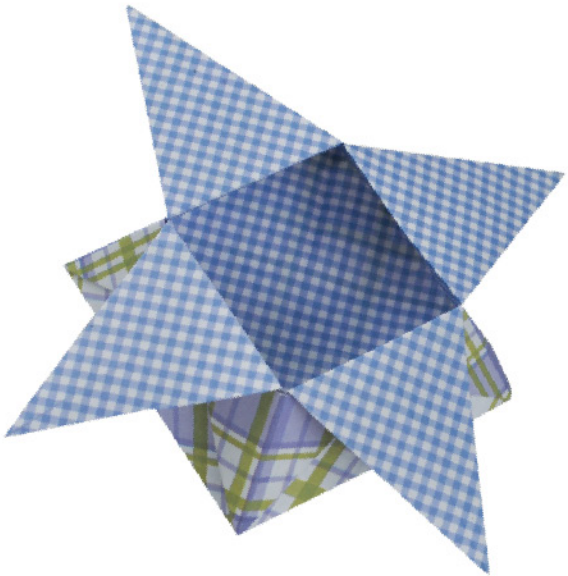
ACTIVITY 3 - *Fold a Star Basket*

1. This model starts with a colored Preliminary Base. See the instructions for the Preliminary Base for reference.

2. Make sure when you make the first folds (step 2) that the folds are on the open side of the flaps. Compare symmetry change with step 3 of the Simple Flower.

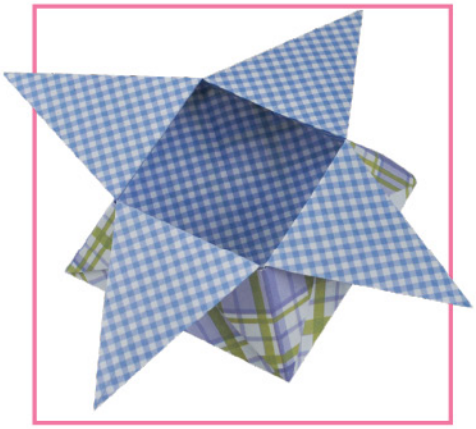
3. In step 5 and 6, notice how the symmetry of the model changes and step 6 is more symmetrical than step 5.

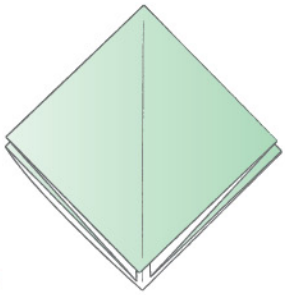
4. Try making the Star Basket with different sizes and compare the size of the baskets and the stars.



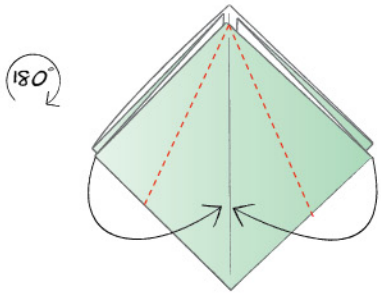
STAR BASKET

Traditional

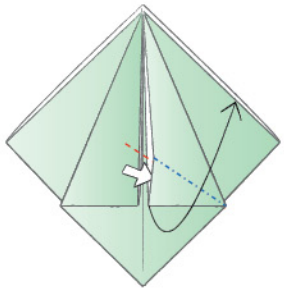




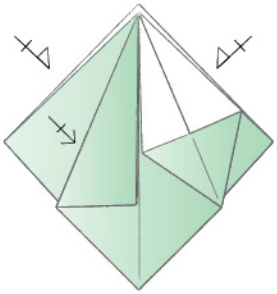
1 Start with a colored Preliminary Base.



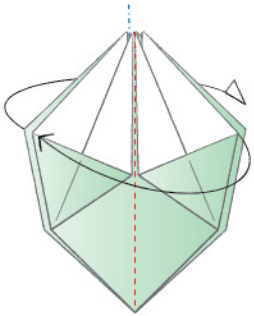
2 Orient the Base so the open end points away from you. Fold the upper sides to the center crease.



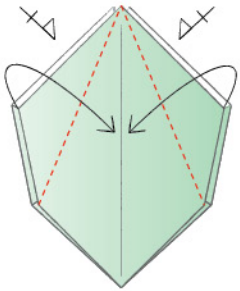
3 Put your finger inside one of the folds you made in step 2. Start opening the fold up. Line the crease on the colored part of the paper with the white folded edge and flatten. This is called a squash fold.



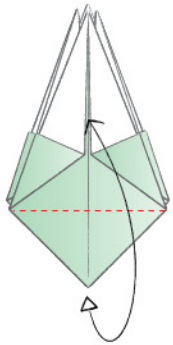
4 Repeat the squash fold on the other side. Turn over. Repeat the squash fold on both sides.



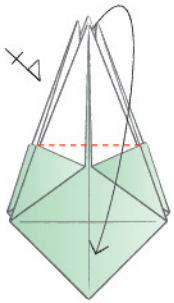
5 Take the top right layer and fold it over to the left. Turn the model over. Again take the top right layer and fold it over to the left.



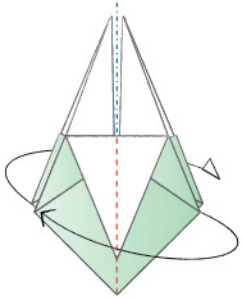
6 Fold the upper right edge to the center crease. Repeat by folding the upper left edge to the center crease. Turn over. Again, fold the upper right edge to the center crease and repeat with the upper left edge.



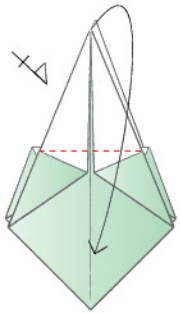
7 Fold the bottom tip up making a crease at the widest part of the model and unfold.



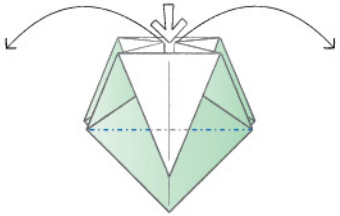
8 Starting at the tip, fold the upper layer down as far as it will comfortably go. Turn over and repeat.



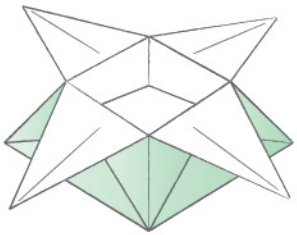
9 Take the top right layer and fold over to the left. Turn over. Repeat by taking the top right layer and folding it over to the left.



10 Starting at the tip, fold the upper layer down as far as it will comfortably go. Turn over and repeat.

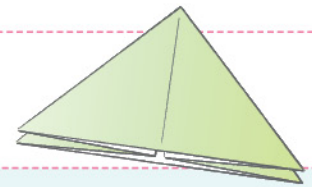


11 Stand the model up with the bottom point on your desk. Put your fingers inside the model and gently open while pushing the point down on the desk to flatten the base.



Finished Star Basket!

LESSON 5: WATERBOMB BASE



Activities

Activity 1: Fold the Waterbomb Base
Activity 2: Fold a Waterbomb
Activity 3: Fold a Blow Up Bunny

Models for this lesson:

Waterbomb Base, Waterbomb, and Blow Up Bunny

Materials needed:

Square Paper

Targeted grade levels:

Grades: 4,5,6,7

Math Concepts:

Square, area, bisect, intersection

NCTM Standards:

1. Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers and use models, benchmarks, and equivalent forms to judge the size of fractions;
2. Investigate, describe, and reason about the results of subdividing, combining, and transforming shapes;
3. Explore congruence and similarity;
4. Make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.

Math Vocabulary:

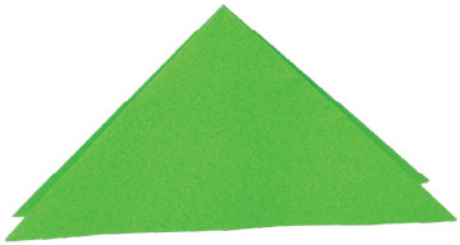
Similar, congruent, symmetry, diagonal, intersect

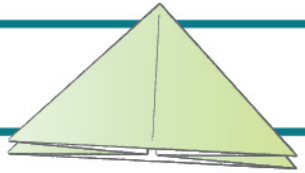
Teaching Tips and Techniques:

- Define the origami term before you make the fold.
- Use descriptive language that is appropriate for the age of the student.
- Take cues from your students - are you proceeding too quickly or too slowly.
- Introduce models that will challenge but not frustrate the students.
- Have students who are more advanced folders act as your assistants, have them help other students with the folding.

Lesson Introduction

The Waterbomb Base derives its name from the Japanese "waterbomb" which, when folded, can be blown up or filled with water and used for play. The folding sequence of the Waterbomb is somewhat similar to the Preliminary Base from Lesson 4. However, the order of the folds is different so the collapse yields a triangular shape as opposed to the square shape of the Preliminary Base. They are identical in terms of the number of flaps or layers. In fact, if you turn a Preliminary Base inside out, you will have a Waterbomb Base.





ACTIVITY 1 - *Fold a Waterbomb Base*

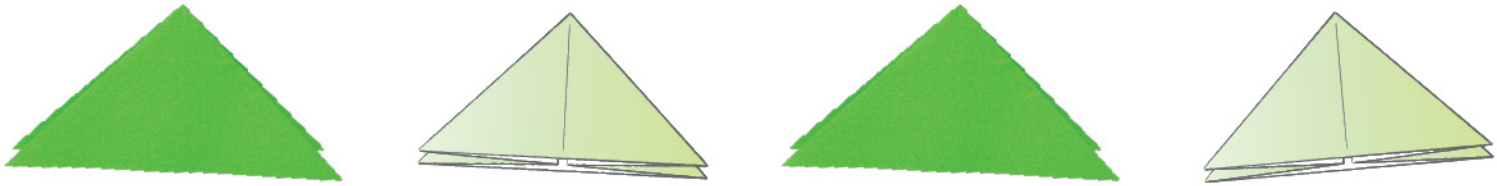
Neatness and precision really pay off in the Waterbomb Base. The collapse is easiest when all the creases pass through the same point of intersection, thereby providing a precise Waterbomb Base to make the models.

1. If the length of the square is A, what is the area and perimeter of the squares produced by the Book Folds. What is the length of the Book creases?

2. When making the diagonals, try to make all the creases go through the same point. This greatly helps with the collapse.

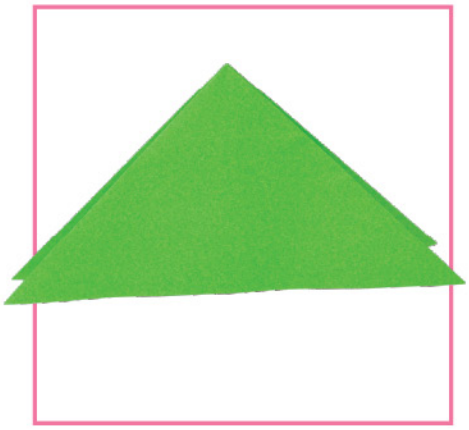
3. Do you see the similarity between the Waterbomb and Preliminary Bases? The creases are same but reversed in the Waterbomb Base (compared to Preliminary Base).

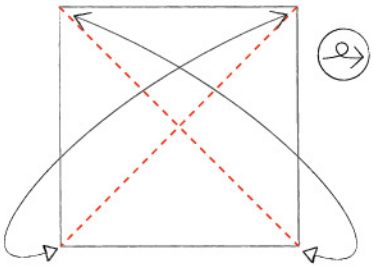
4. The Waterbomb Base has 4 triangular flaps, 2 on each side.



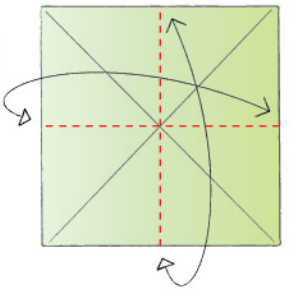
WATERBOMB BASE

Traditional

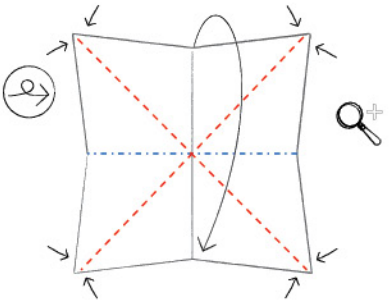




1 Start with white side of paper facing up. Fold in half diagonally in both directions. Unfold and turn over.

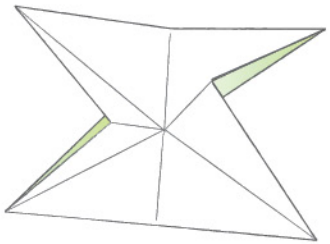


2 Fold in half in both directions. Unfold and turn over.

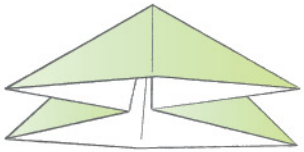


3 a Pinch the corners and collapse using existing creases.

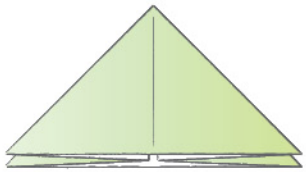
continued →



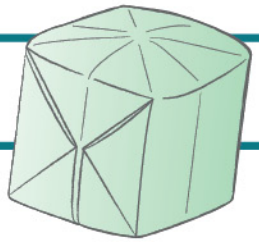
3b Collapse in progress.



3c Collapse in progress.



Finished Waterbomb Base!



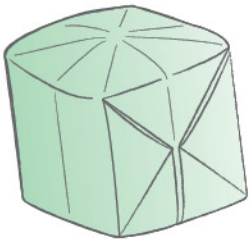
ACTIVITY 2 - *Fold a Waterbomb*

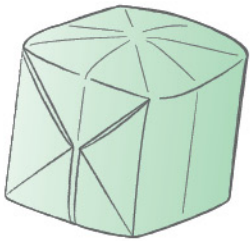
1. Although sharp precise creasing generally leads to a better result, there is a danger of layers overlapping in this model. Therefore, when bringing the corners of the Waterbomb up in step 1, be sure to leave a little gap (engineers and artists refer to this as a 'fudge' factor) in the middle.

2. Write a message in the center of the paper. When you inflate the waterbomb try locating the message by holding it against a light.

3. How does this whole structure hold up and stay inflated?

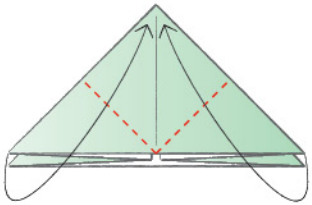
4. Explore different sized Waterbombs with different paper sizes. See the surface area and volume of the cubes. You can calculate the volume by filling it with water and measuring the volume of water. Surface area can be calculated by marking the visible area and then adding up the area of squares and triangles. Do you see a correlation?

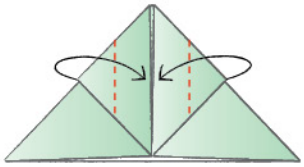


WATERBOMB

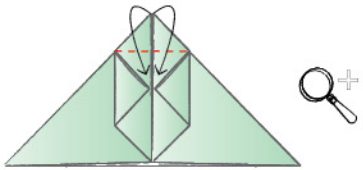
Traditional



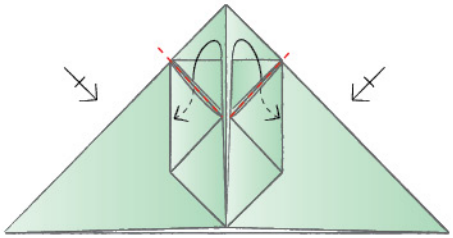
1 Start with the Waterbomb Base. On the front layer, fold bottom points up to top.



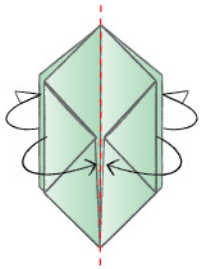
2 Fold side corners in to center.



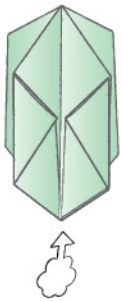
3 Fold top loose corners down as shown.



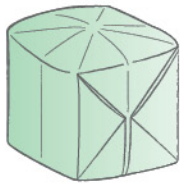
4 Fold triangle tabs down and insert into the pockets below to lock the paper inside. Repeat steps 1-4 on other side. Note: this will lock the paper so it won't open up when you blow up the Waterbomb.



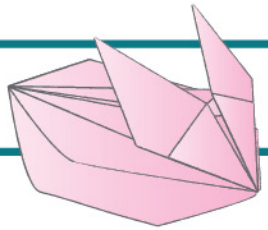
5 Arrange flaps so they are separated in 4 directions.



6 Hold gently not pinching the locks and blow into the opening at the bottom. Note: hold the model loosely by the folded edges so you don't prevent it from inflating when you blow.



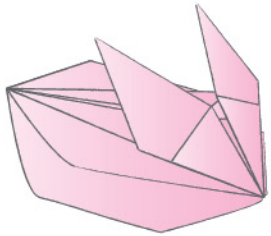
Finished Waterbomb!

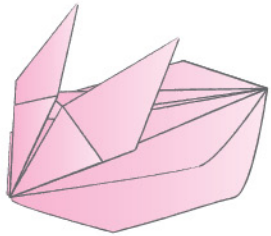


ACTIVITY 3 - *Fold a Blow Up Bunny*

1. If you have trouble inflating the Bunny, try clapping the ears together and hold by their tips very loosely as you blow.

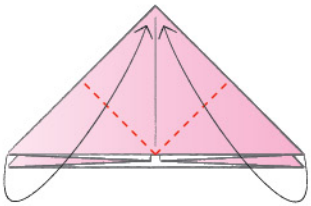
2. Does the message show up in the Bunny? You can use this model as a nice decoration for festive occasions such as Chinese New Year, spring festivals, and Easter.



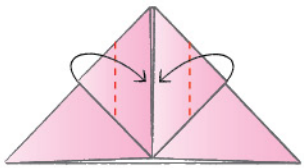


BLOW UP BUNNY

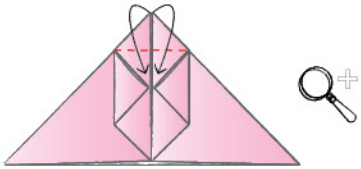
Traditional



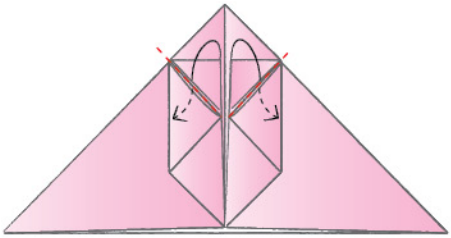
1 Start with the Waterbomb Base. On the front layer, fold bottom points up to top.



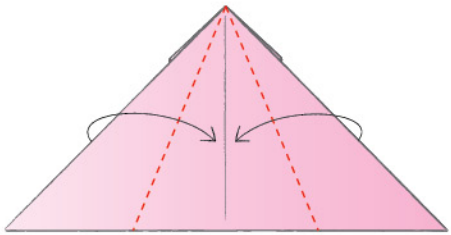
2 Fold side corners into center.



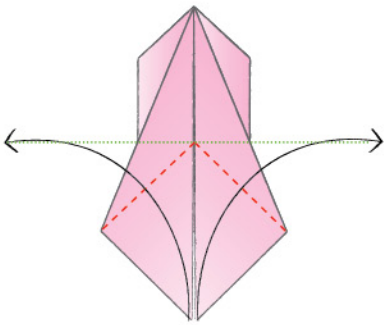
3 Fold top loose corners down as shown.



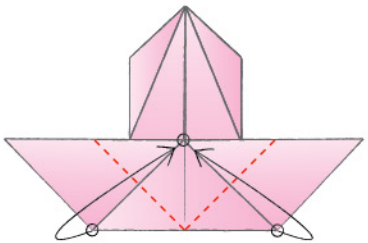
4 Fold triangle tabs down and insert into the pockets below to lock the paper inside. Turn over to other side. Note: this will lock the paper so it won't open up when you blow up the bunny.



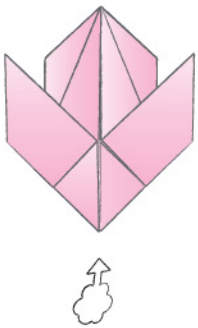
5 Fold side edges to center as shown.



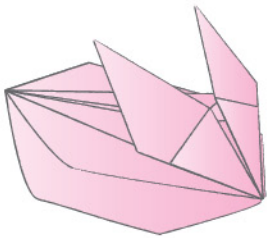
6 Fold up the corners so they are perpendicular to the center line.



7 Fold the ears up by bringing the bottom corners to the center as shown.



8 Pinch the ears at the base and hold together while blowing into the opening at the nose.



Finished Blow Up Bunny!

LESSON 6: BIRD BASE

Activities

Activity 1: Fold the Bird Base
Activity 2: Fold a Flapping Bird
Activity 3: Fold a Crane

Models for this lesson:

Bird Base, Flapping Bird and Crane

Materials needed:

Square Paper

Targeted grade levels:

Grades: 5,6,7

Math Concepts:

Subset, symmetry, rotation, angle bisector, rhombus

NCTM Standards:

1. make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.
2. precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties
3. understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
4. develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers;

Math Vocabulary:

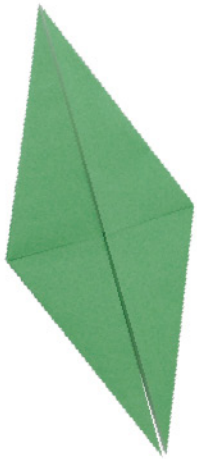
Triangle, angle, bisect, diagonal, intersect, congruent

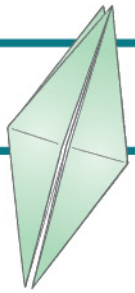
Teaching Tips and Techniques:

- Try to choose models that are relevant to the curriculum whenever possible.
- Focus on innovation and encourage students to create variations on models.
- Especially in higher grades, encourage group activity. Let the students develop projects they can display in school.
- Stringing cranes and other models for displaying in school art shows or on holiday trees is a great way to boost team building and collaboration.

Lesson Introduction

Welcome to Lesson 6! Congratulations on reaching this chapter on the Bird Base. In Lesson 4 we learned the Preliminary Base which is the foundation for the Bird Base. When you have mastered the Bird Base, you have graduated to the next level of folding - from simple to intermediate folding. This base is the starting point for folding many different models including stars, animals, flowers, and, of course, birds. The Bird Base is sometimes referred to as the Crane Base because the crane is probably the best known Origami model created from this base. The petal fold that we learn in the making of the Bird Base is also very useful in several models which are considered to be intermediate level. As you can see, the Bird Base starts out with the Preliminary Base.

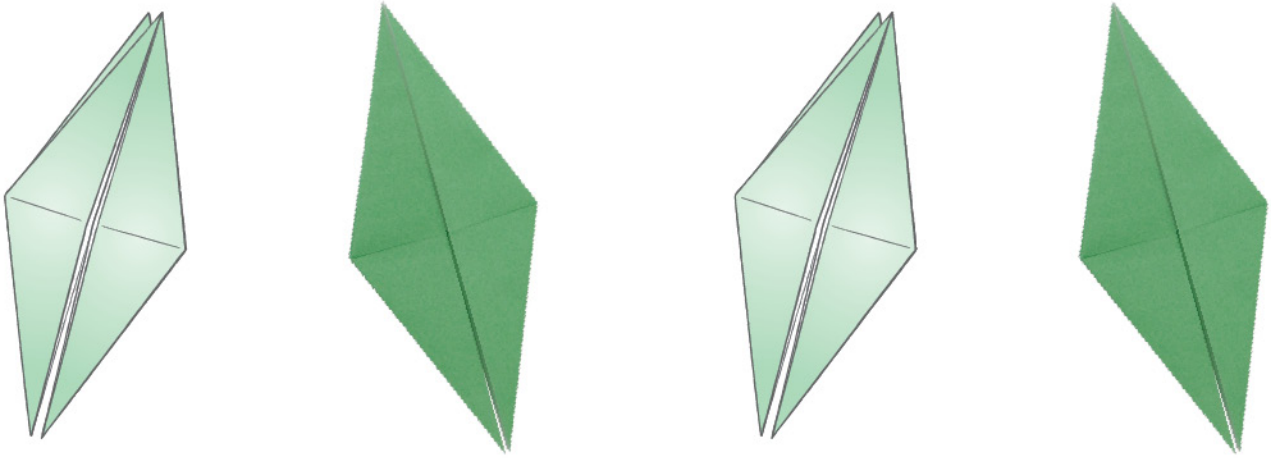




ACTIVITY 1 - *Fold a Bird Base*

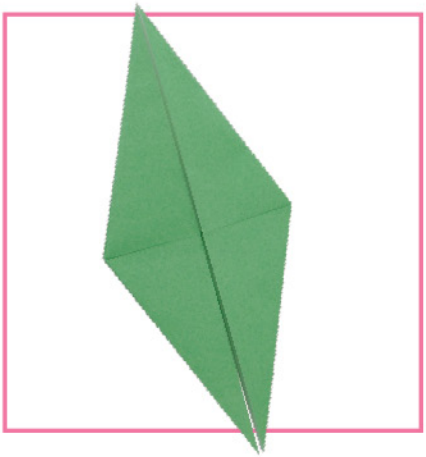
Neatness and precision are key in this model. It will make the layers line up better and also help with initial collapse of the Preliminary Base.

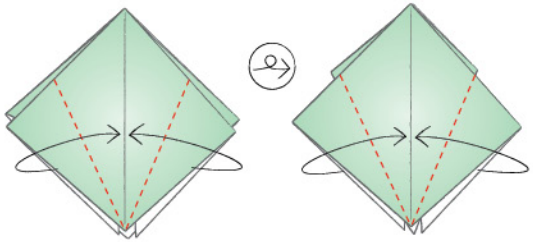
- The first fold is a precrease and also an angle bisector. When making this precrease, make sure you do not overlap the layers/flaps. It might even be helpful to leave a gap between the flaps. This is often referred in origami as fudge factor.
- Step 5 is called a petal fold. This is a very important maneuver and is often used in several models.
- Explore the symmetry of the models before and after the formation of the petals.



BIRD BASE

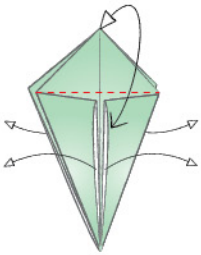
Traditional



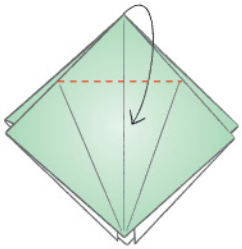


1 Start with a Preliminary Base (Lesson 4), with the closed corner at the top. On the front layer only, fold both side edges to the center line. Be careful to make sharp points at the bottom.

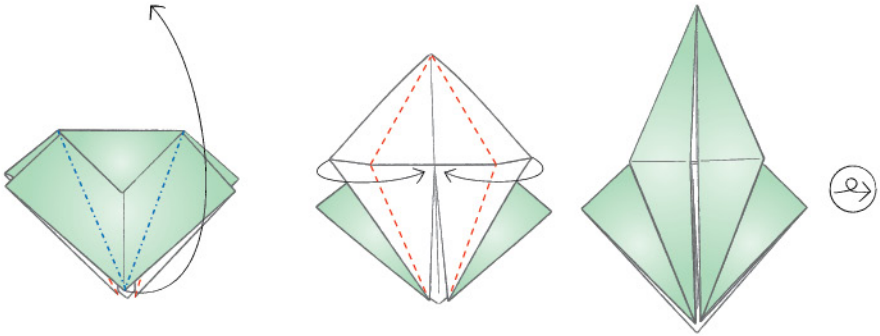
2 Turn over and repeat on the other side.



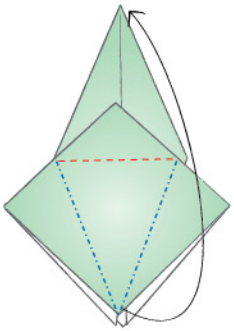
3 Fold the top down, and then unfold back to the Preliminary Base.



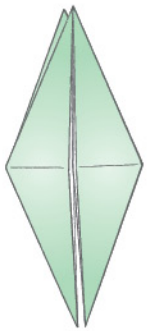
4 Fold the top down along the existing crease.



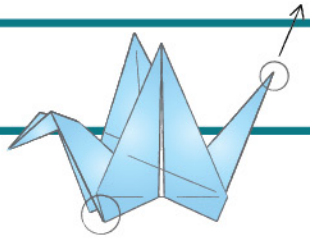
5 Open the top layer by bringing the bottom corner up while holding down the other layers. Collapse along existing creases. Turn over.



6 Fold the top triangle down along the existing crease. Repeat step 5.



Finished Bird Base!

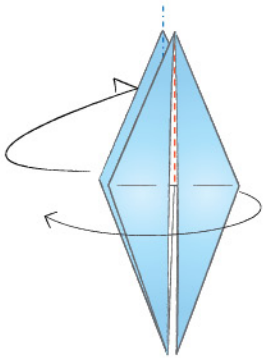


ACTIVITY 2 - *Fold a Flapping Bird*

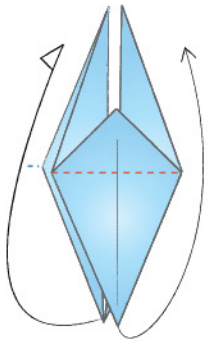
- Make sure you begin with a properly folded Bird Base with no overlapping layers
- When reorienting the layers, make sure there are two flaps on each side. Notice the various triangles forming as all this happens.
- Notice the symmetry elements changing as we move the layers around.
- The exciting part of this model is the flapping action of the wings. If this proves to be troublesome, make sure you've left a gap (fudge factor) when you folded the Bird Base. You can also try to curl the wings forward or change the angle in step 5. Make sure the wings are pointed up and not down.

FLAPPING BIRD

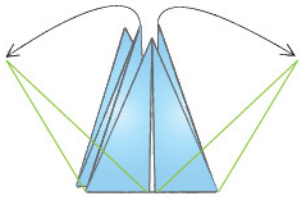
Traditional



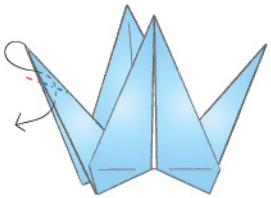
1 Start with a Bird Base. On the top layer turn the right flap over to the left. On the back layer turn the left layer over to the right.



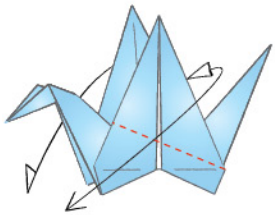
2 Fold up front flap on existing crease line. Repeat on back layer.



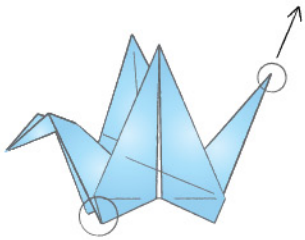
3 Pull out inner points and flatten at the base.



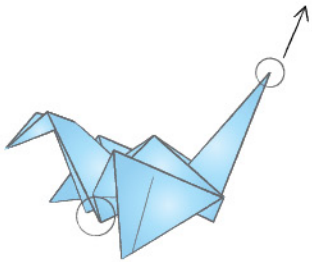
4 Form the head by partially opening and pulling the tip down. Pinch the head closed.



5 Fold the front wing down forming a crease from the base of the wing to a point that meets the neck. Fold wing on back to match. Unfold.



Finished Flapping Bird!



Hold the model at the bottom of the neck and gently pull on tail to make the bird flap.

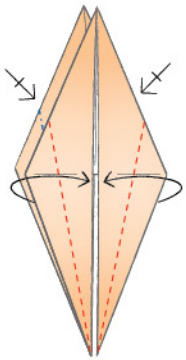
ACTIVITY 3 - *Fold a Crane*

- This Crane is often called a peace crane and is one of the most folded and widely recognized model in Origami.
- While narrowing the bottom portion of the model in step 1, make sure you do not lose your sense of orientation and that the flaps in the bottom are split. This is another angle bisector.
- Explore the various types of triangles and other shapes which are being formed at various stages. Which of these triangles are congruent? Explain.

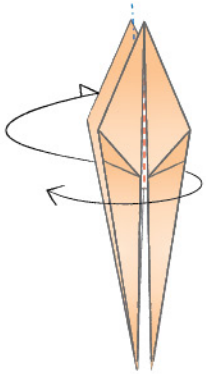


CRANE

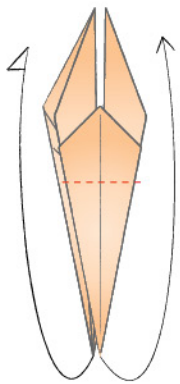
Traditional



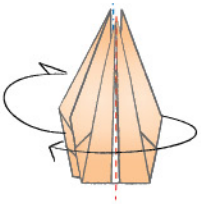
1 Start with a Bird Base. On the top layer fold both side edges to the center. Repeat on back layer.



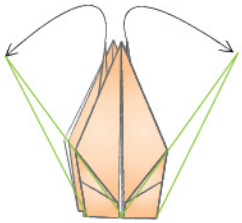
2 On the front layer turn the right flap over to the left. On the back layer turn the left flap over to the right.



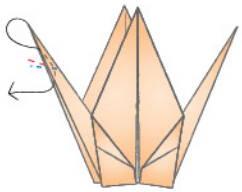
3 Fold the bottom point up along existing crease. Repeat on the back.



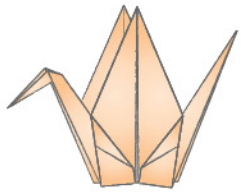
4 On the front layer turn the right flap over to the left. On the back layer turn the left flap over to the right.



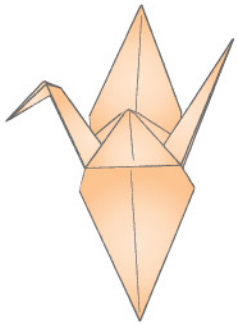
5 Pull the inner points out to line up as shown and flatten at the base.



6 Form the head by partially opening and pulling the tip down. Pinch the head closed.



7 Finished Crane!



You can open the Crane by holding each wing close to the body of the Crane and pulling gently.

LESSON 7: RE-USE OF PAPER

Activities

Activity 1: Fold a Magazine Cover Box

Activity 2: Fold a Spiky Star

Models for this lesson:

Magazine Cover Box, Spiky Star

Materials needed:

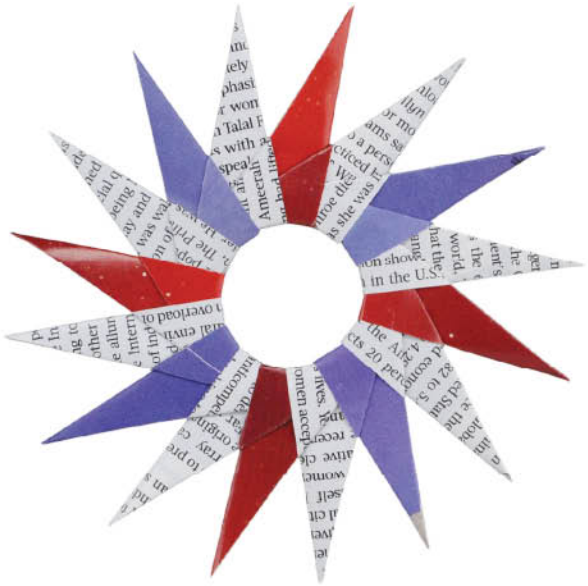
Square paper, rectangular paper

Targeted grade levels:

Grades 1 and above

Teaching Tips and Techniques:

- Investigate the patterns inside business envelopes.
- Try folding the model several times before the lesson. You should be familiar with all the steps before teaching others.
- Display or use the folded models in the classroom.



Lesson Introduction

Welcome to Lesson 7! First of all, we would like to thank everyone for being with us for one year. Whether you have mastered all the bases we have covered or not, we are super excited for the upcoming second year where we will cover models for which one may not need to know the traditional bases.

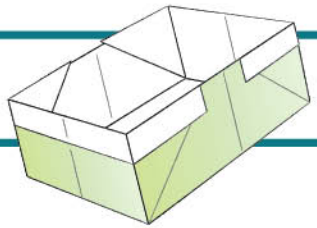
This year we will show you how to utilize Origami lessons to enhance other subjects, such as social studies, art, and even physics. We will still cover the math exercises with each of these lessons because the benefits of incorporating Origami in math are numerous.

Our first lesson of this second year is about the "re"-use of paper. We all come across so many brochures, flyers, index cards, magazines, giftwrap, and other beautiful printer paper that is usually discarded. In Origami these castaways have the potential to become unique pieces of art. When looking for materials for Origami, why not consider experimenting with some non-traditional ones like napkins, paper bags, and memo cube paper. You can make your own duo paper by taking two interesting pieces of paper and gluing them back to back. Use colorful tissue paper to brighten up a recycled letter.

Folding models from found paper is a great way to enrich a class or discussion on recycling by demonstrating how one person's used piece of paper or magazine can become a useful box, a colorful decoration, or a beautiful flower. Have the students examine different papers and discuss the qualities of paper - thickness, durability, texture, and suitability of folding.

Have a "found paper" party or contest in class. Have every child bring in a piece of paper and tell a story about how and where they found it and why it is significant.

The Magazine Cover Box in Issue 7 was made from an advertisement in Time Magazine trimmed to a rectangle. The Spiky Star was made from squares cut from pages from Time Magazine.



ACTIVITY 1 - *Fold a Magazine Cover Box*

Because it can be difficult for some students to see the crease landmarks on printed paper (for example, a magazine cover), you might consider using paper with one unprinted side. Making two of these boxes will allow you to use one for a lid. For an easier fit, don't fold all the way to the center crease in steps 2 and 4 when making the second box.

1. What is the area of the new rectangles? Can you prove it mathematically?

2. What is the area of the new rectangles? How do these rectangles relate to those made in step 1?

3. How many rectangles are there now? What is the area of the 8 rectangles?

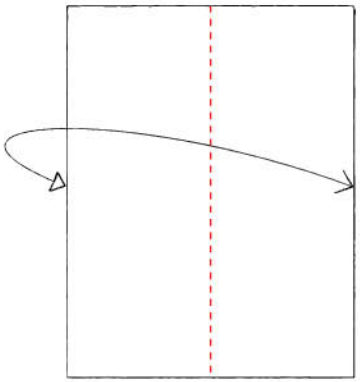
4. How many rectangles are there now?

5. What is the angle the crease makes with the top and bottom edge of the model?

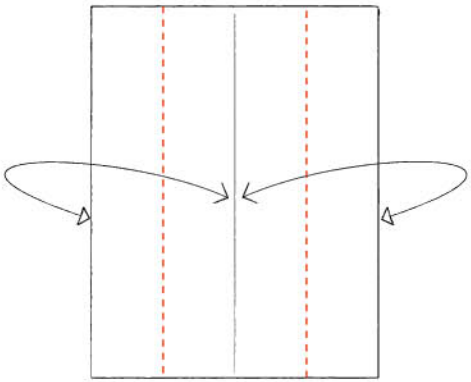
6. If you are using duo paper, note the color change.

7. Measure the length, width, and depth of the finished box. Can you figure out the volume? Make the box with different sizes of paper. Will the volume increase or decrease with the different sizes of paper? Can you make this model with all rectangles?

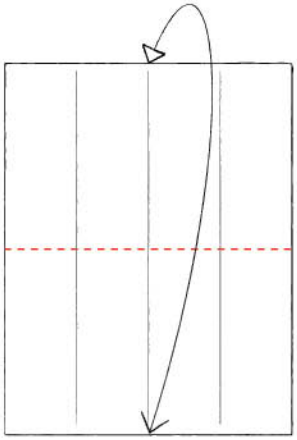
MAGAZINE COVER BOX



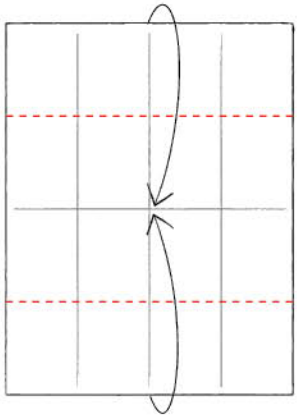
1 Fold left long edge over to right long edge and unfold.



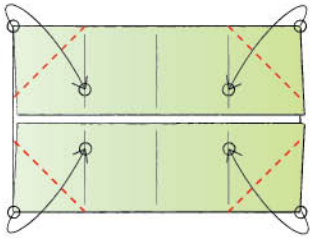
2 Fold left long edge in to the center crease and unfold. Repeat with the right long edge.



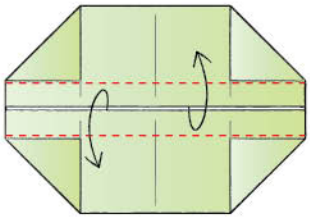
3 Fold top edge down to bottom edge and unfold.



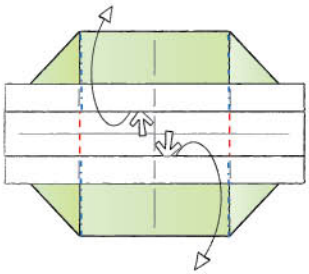
4 Fold top edge down to center crease. Fold bottom edge to center crease.



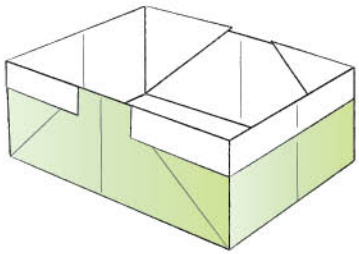
5 At all 4 corners fold the bottom edge to lie on the nearest vertical crease.



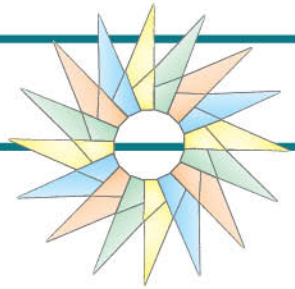
6 Fold the long edges over the triangles created in step 5.



7 Gently pull up the long sides of the model. Reinforce the corner and bottom creases to shape the box.



Finished Magazine Cover Box!



ACTIVITY 2 - *Fold a Spiky Star*

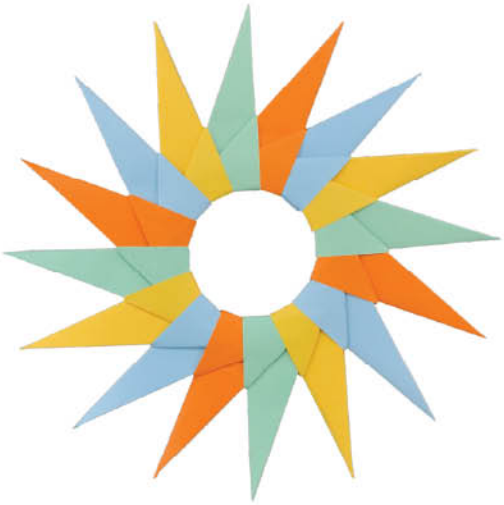
This model is an example of modular Origami - a model made of more than one piece of paper. You can use all one color of paper or mix up paper colors. Use this model as a group activity with students each folding a unit to make one star. Have students figure out how many units each must make to create the desired number of completed Stars. You can cut squares to any size. Younger students should start with 6-inch squares.

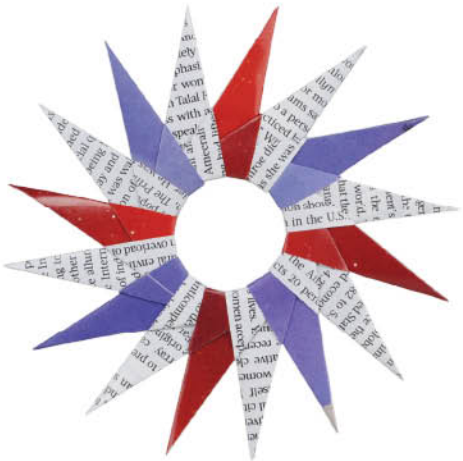
1. Identify the squares and the rectangles. How many of each is there?

2. Do you remember the name of this base? It's the Blintz base from Lesson 2.

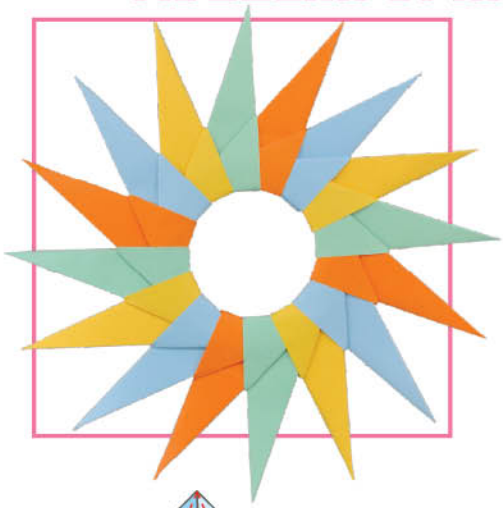
3. Explore the symmetry of the model. What shape is this?

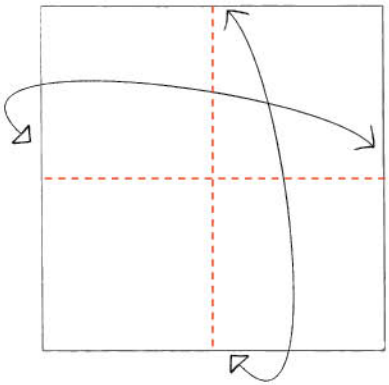
You will need to make 13 - 16 identical units. The more units you assemble, the more stable the model will be. You can use a little glue as you put the units together, being careful to keep the center circular. Or put a little invisible tape on the back to help hold the Star's shape. You definitely must use glue or tape if you wish to hang the Star.



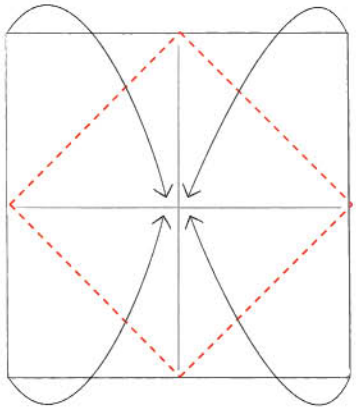


MODULAR SPIKY STAR

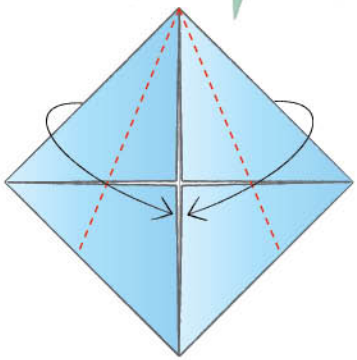




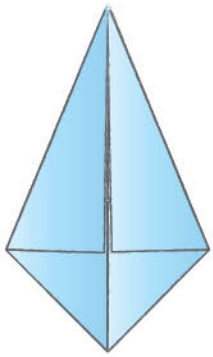
1 Starting with white side up, fold in half and unfold. Fold in half the other way and unfold.



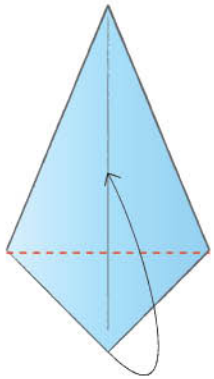
2 Fold each corner point in to the center.



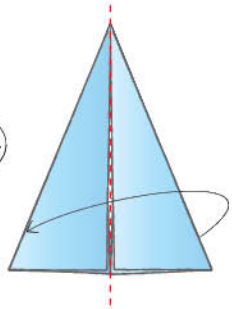
3 Fold the upper right edge in to the center crease. Repeat on the left.



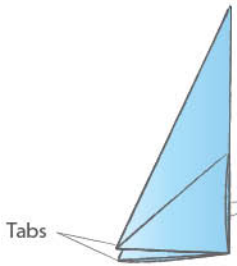
4 Turn over.



5 Fold bottom tip up as shown. Turn over.

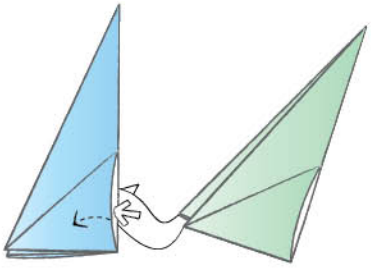


6 Fold in half.

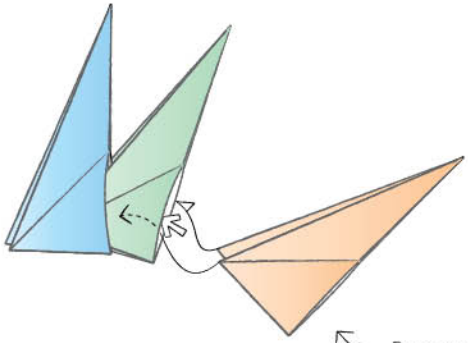


Make 13-16 units.

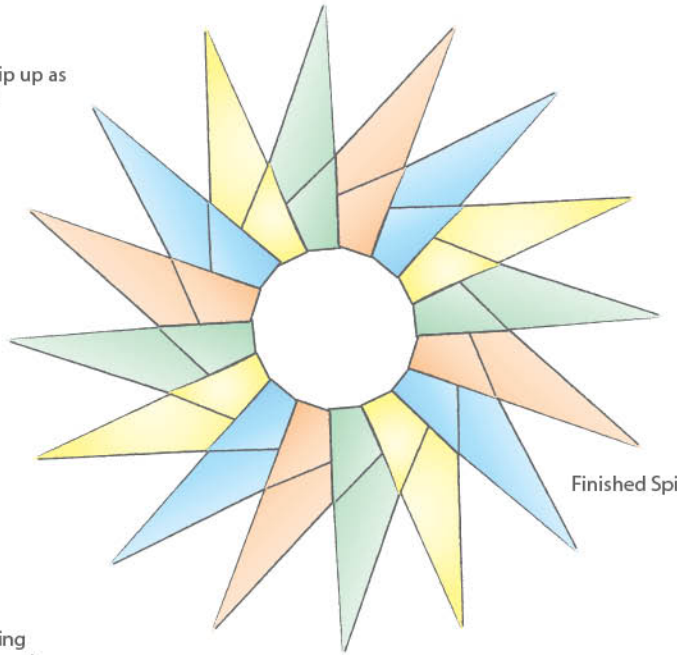
ASSEMBLY



Insert tabs of second unit into pockets of first unit. Continue inserting tabs into pockets.



Repeat using remaining units.



Finished Spiky Star!

LESSON 8: TRADITIONAL PURSE AND PENGUIN

Activities

Activity 1: Fold a Traditional Purse

Activity 2: Fold a Traditional Simple Penguin

Models for this lesson:

Traditional Purse, Traditional Simple Penguin

Materials needed:

Square paper, rectangular paper

Targeted grade levels:

Grades 1, 2, 3 (Penguin only),4 and 5th

Teaching Tips and Techniques:

- Discuss white versus color side (when using duo paper) and the relationship to following diagrams.

- Remind students to check the model at each step with the diagram to make sure it looks like the picture in the next step.

- Emphasize the neatness and precision rather than the speed of folding.

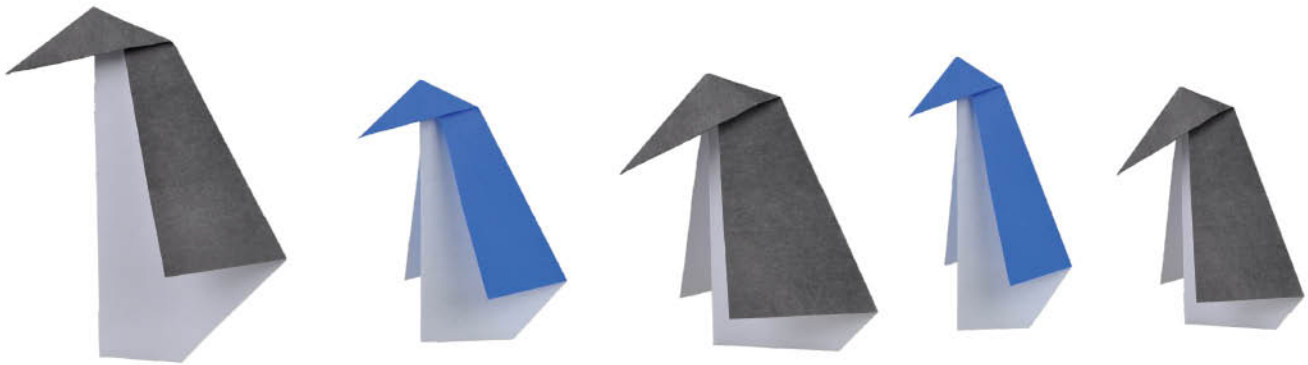
- Encourage practice by giving out more and, if appropriate, smaller sheets of paper to construct families of the models.

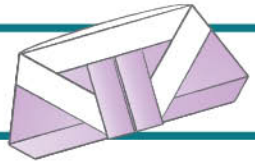
Lesson Introduction

We have very exciting news - Mae Dean Erb is our new co-editor. Mae Dean and I have worked closely together for the past several years and look forward to sharing out teaching experiences with you. We thank Rachel Katz for her valuable role in helping to develop the Teachers' Corner.

This month we feature two traditional models - the Simple Penguin and the Purse. The Simple Penguin model creates opportunities for teaching grouping, counting sides and vertices, and comparing and ordering in early grades.

The Purse is suited for students in 4th grade and older. The model uses letter-sized paper and works best if one side of the paper is either colored or has a pattern.





ACTIVITY 1 - *Fold a Traditional Purse*

Rectangular duo colored paper works best for this model. Students can make their own duo paper by simply coloring one side of copy paper. A more ambitious project would be to have students glue tissue or other decorative paper (even a single layer of a decorative napkin works) to a plain rectangular sheet to create a unique duo paper for folding.

1. This step is often referred to as a book fold. Since the paper is a rectangle, two types of book folds are possible. Come up with a clever way to remember the different orientations.

2. In step 3, make sure you are making the little pleat fold on the closed side of the paper.

3. In step 5, the folds are often referred to as house roof or airplane folds. See if you can imagine why they would be called this. What other shapes do you see? Emphasize creative thinking at all stages of folding these models.

4. Note the symmetry of the model and how it stays bilaterally symmetrical at every stage.

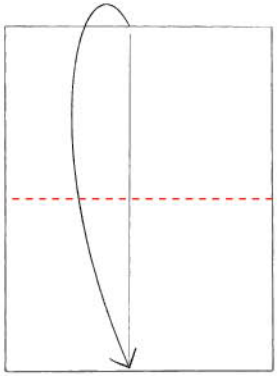
5. When the bottom flaps are folded up, what is the resulting shape?

6. In step 9 leave a little gap when folding the pointed tip to the bottom of the triangle shape in the model. This prevents the paper from ripping when you put the flaps up. What shape is the perimeter of the purse?

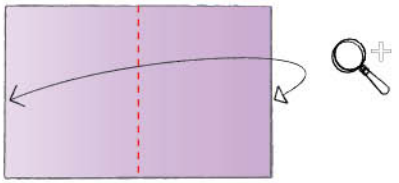
Experiment with different rectangular shapes and see if there is a need to add some folds to form the purse. Discuss how the change in the size of the rectangle changes the finished Purse.

PURSE

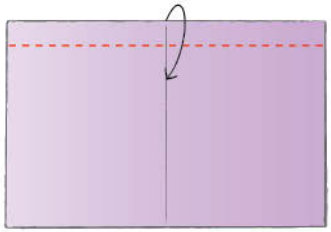
Traditional



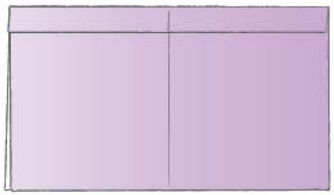
1 Start with letter-sized paper with the colored side down. Fold top short edge down to bottom short edge.



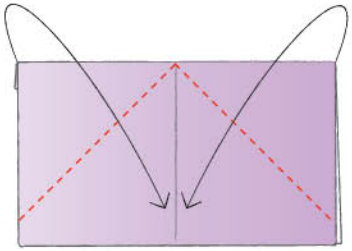
2 Fold in half, side edge to side edge. Unfold.



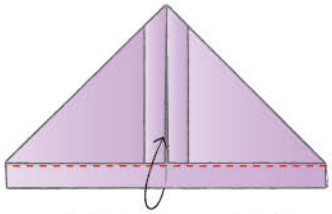
3 Fold top edge down about ½ inch.



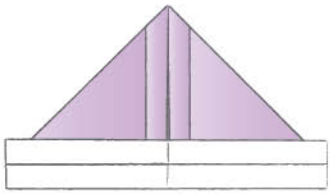
4 Turn over.



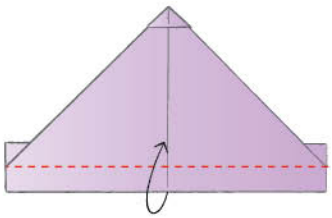
5 Fold top edges down along center crease.



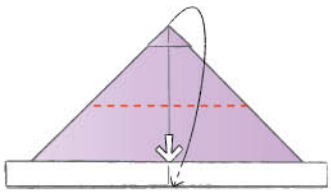
6 On top layer only, fold bottom edge up.



7 Turn over.

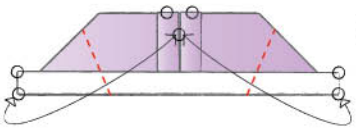


8 Fold bottom edge up to match other side.

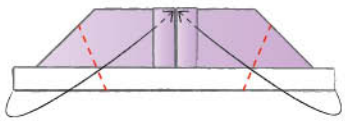


9 Fold top point down and tuck into hem formed in previous step.

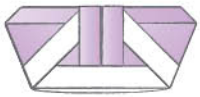
10 Turn over.



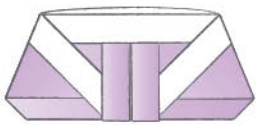
11 Using reference points, fold sides in as indicated. Unfold.



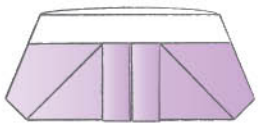
12 Fold on crease made in previous step and tuck ends under center hem.



15 Rotate 180 degrees. Note: in this orientation, this is the traditional Turban model.



Finished Purse!



Back view.

ACTIVITY 2 - *Fold a Traditional Simple Penguin*

The traditional Penguin model is different from the models in previous lessons in that it does not have specific landmarks or folding instructions for many of the steps. This model uses what are known in Origami as RAT (right about there) folds. Remind students that all penguins are not identical though they are similar.

1. What shape do you create when you make the first fold?

2. Explain that this step creates the wings. Encourage students to try to make both wings the same size. Ask for ideas on how to make the wings equal.

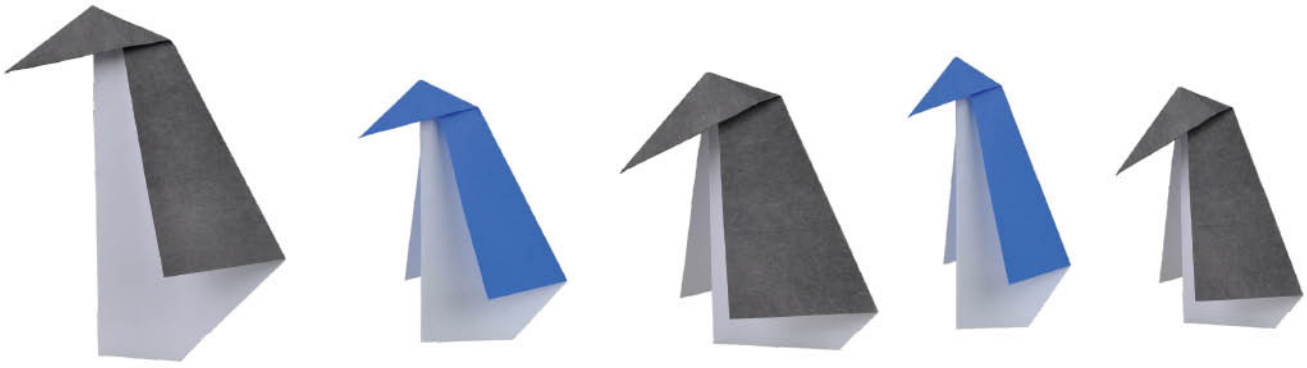
3. Explain that this step creates the head. Discuss how to make a larger or smaller head.

4. Step 5 creates the tail. What happens to the size of the Penguin if you make a large tail? A small tail?

Have students compare their penguins. Encourage students to discuss the differences and similarities. Have the students explain how to make a taller or a thinner Penguin.

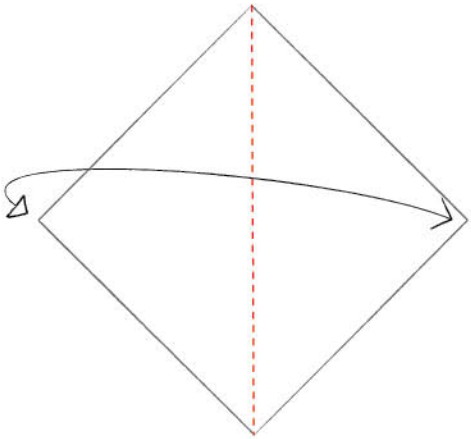
For the youngest students, use this model to develop the concepts of sequencing, grouping, and comparing.

In older grades, use this traditional Penguin model as a teaching tool for students to teach other students a simple Origami model. Teaching others will help students develop clear instructions and sequencing skills.

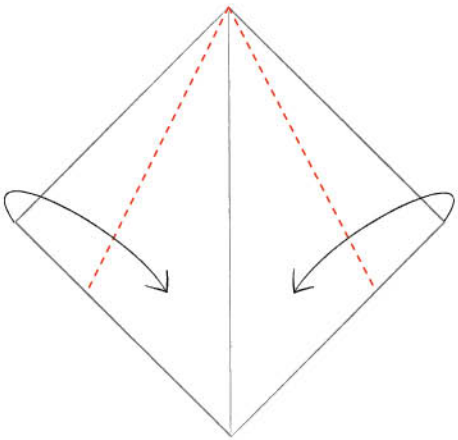


SIMPLE PENGUIN

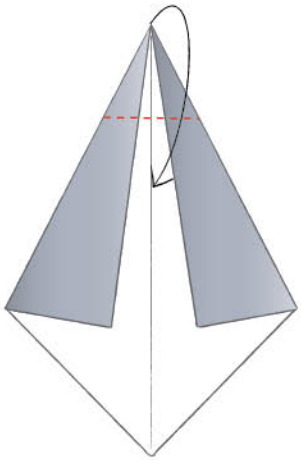
Traditional



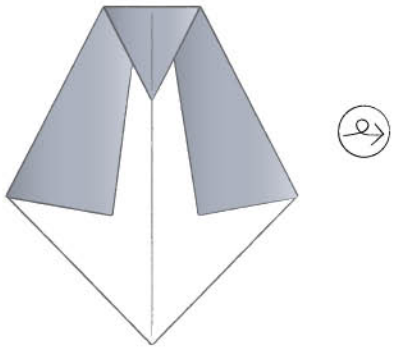
1 Start with paper white side up oriented like a diamond. Fold in half, side point to side point. Unfold.



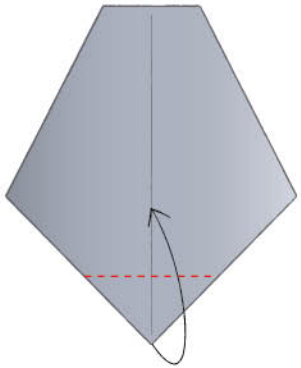
2 Starting at the top point, make a crease by folding sides toward the center crease. The sides should not touch the center crease. This fold creates the wings.



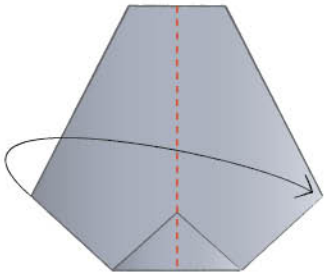
3 Fold the top point down along the center crease. This fold creates the head.



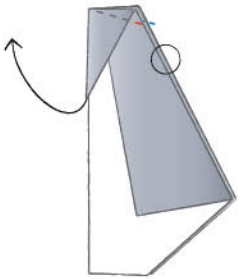
4 Turn over.



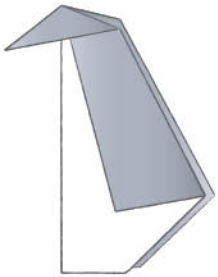
5 Fold bottom point up. This fold creates the tail.



6 Fold in half side to side. The white side will show.



7 Holding the model where indicated, pull up on the head and crease in place.



8 Finished Simple Penguin!