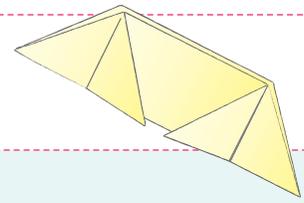


LESSON 3: PIG BASE



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:

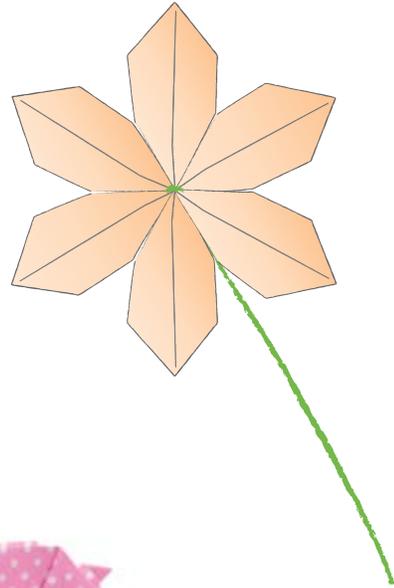
Square, trapezoid, hexagon, rectangle, triangle, right triangle, parallel, diagonal, angle

Teaching Tips and Techniques:

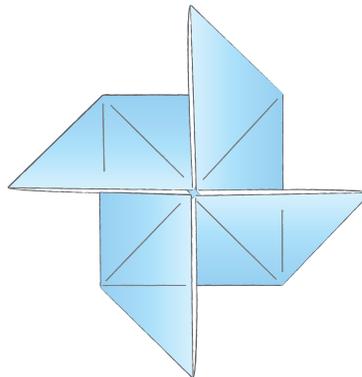
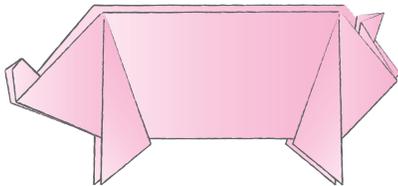
- Select paper that will help ensure successful completion of the model. For most beginners, paper that has two distinctly different colored sides works best. Refer to white side and colored side of the paper.
- Review and practice basic moves - make a valley fold, make a mountain fold - before beginning 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.



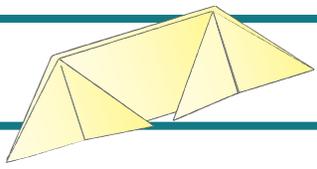
Pipe Cleaner Flower



Traditional Pig

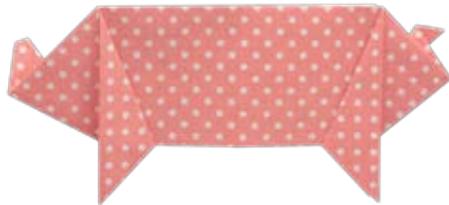


Windmill

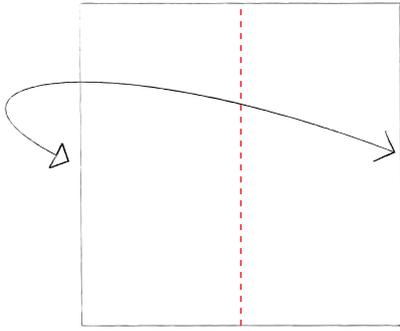


ACTIVITY 1 - Fold a Pig Base

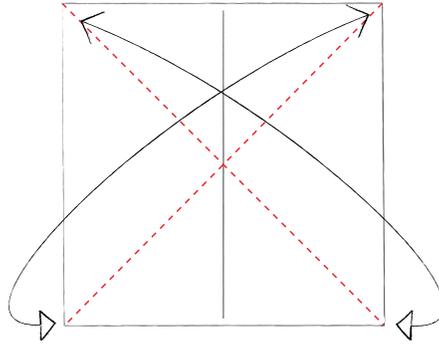
1. What shape is created by dividing the square in half? Rectangles.
2. What shape is created by dividing the square in half? Triangles. Is the area of each triangle equal to the area of each rectangle created in Step 1? Yes.
3. Before unfolding the blintz, what shape have you created? A square. How 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.



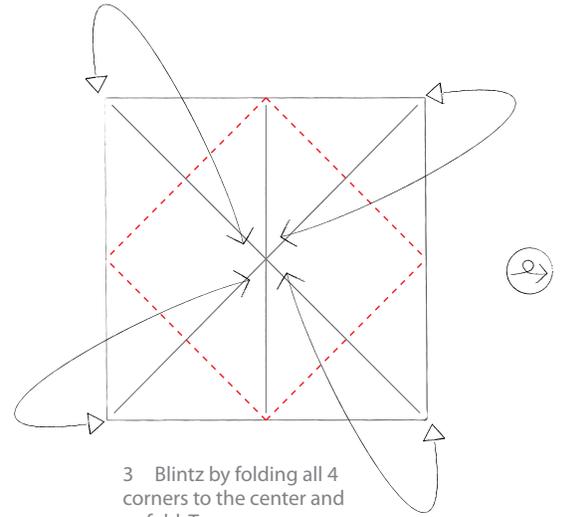
PIG BASE *Traditional*



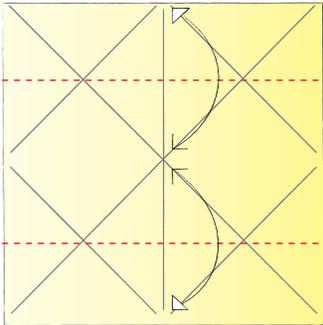
1 Start white side up. Fold in half, left to right. Unfold.



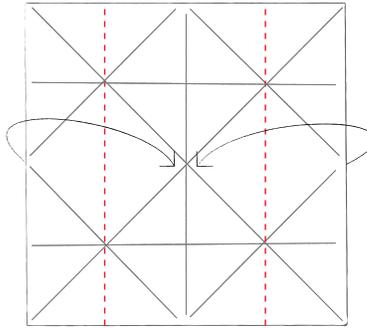
2 Fold in half, corner to corner, in both directions. Unfold.



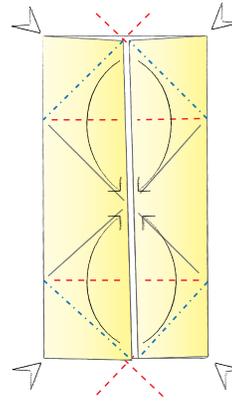
3 Blintz by folding all 4 corners to the center and unfold. Turn over.



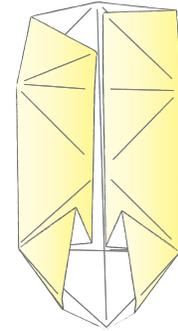
4 Make sure the crease made in step 1 is running top to bottom. Fold the top and bottom edges to the center. Unfold. Turn over.



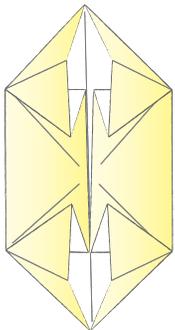
5 Fold the other two sides to the center.



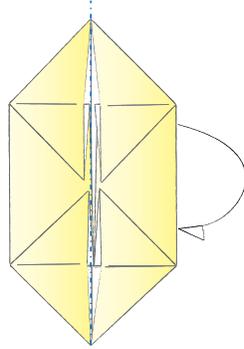
6a Push in on all 4 corners until the flaps meet at the center and lie flat.



6b



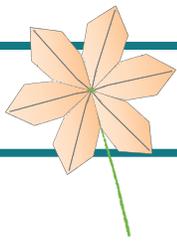
6c



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

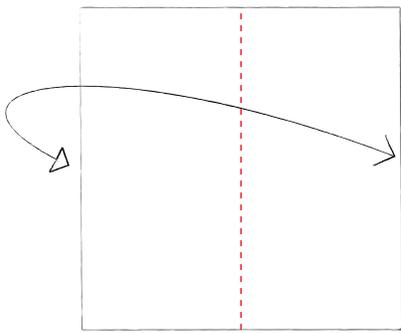
Grades K-2: sometimes children have trouble twisting the pipe cleaner tight enough to hold the units together, they might need some help.

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.

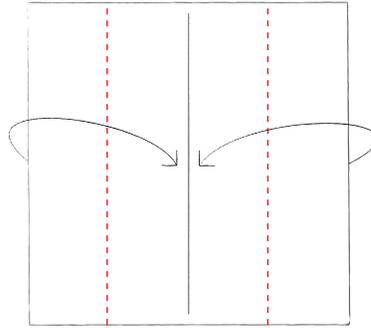
For higher grades, try narrowing the petals by adding an extra fold after step 3 - fold the corners in again to make a pointier unit. Put 4 units together rather than 3.



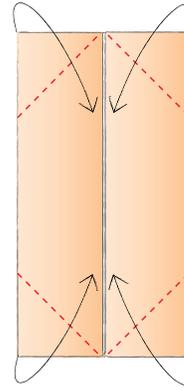
PIPE CLEANER FLOWER *Traditional*



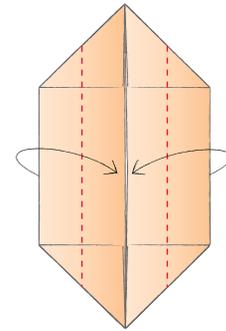
1 Start with white side up. Fold in half and unfold.



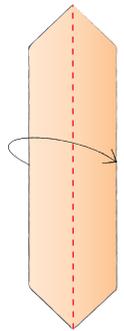
2 Fold each side edge into the center crease.



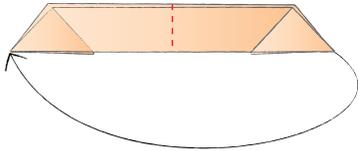
3 Fold the top right edge down along the center crease. Repeat on other 3 corners.



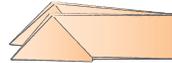
4 Fold long edges into center crease. Turn over.



5 Fold in half lengthwise.

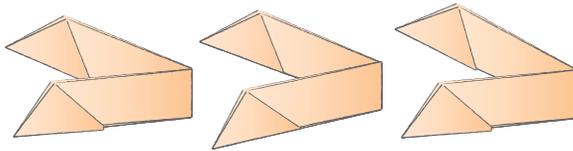


6 Fold in half bringing the tips together. Make 2 more units.



Finished Flower Unit!

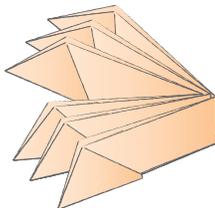
ASSEMBLY



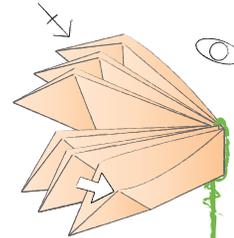
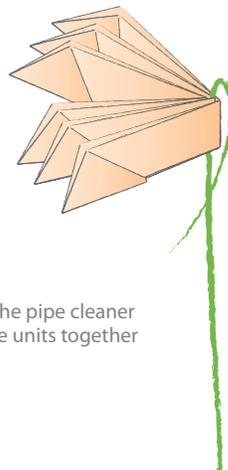
1 Take 3 units and line them up as shown.



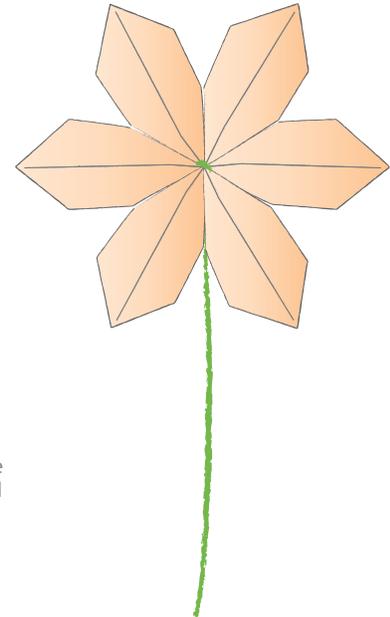
2 Make a hook on a pipe cleaner and slip the hook over all 3 units.



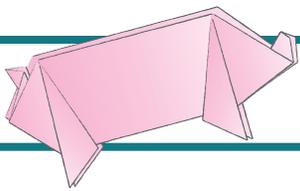
3 Twist the pipe cleaner to hold the units together snugly.



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



Finished Pipe Cleaner Flower!



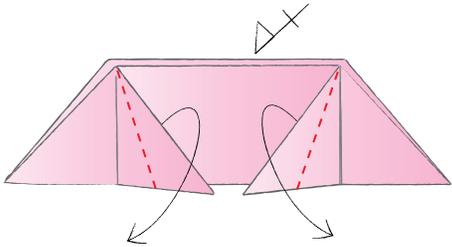
ACTIVITY 3 - *Fold a Pig*

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.

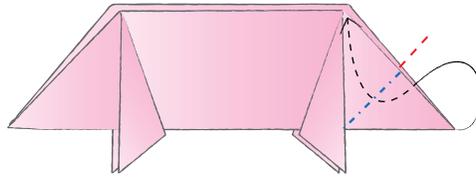


TRADITIONAL PIG

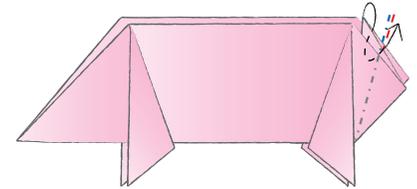
Traditional



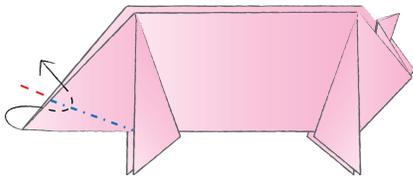
1 Start with a Pig Base. Take the folded edge of the flaps and fold along the existing creases to create legs. Repeat behind.



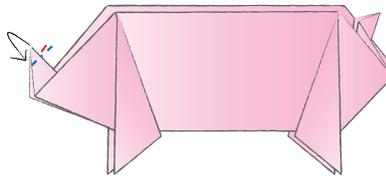
2 Fold the right hand tip up to the top of the leg and unfold. Slightly open the triangle and push the tip inside.



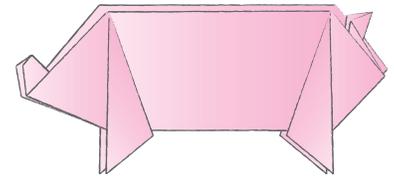
3 Pull out the tail slightly so it sticks out.



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!

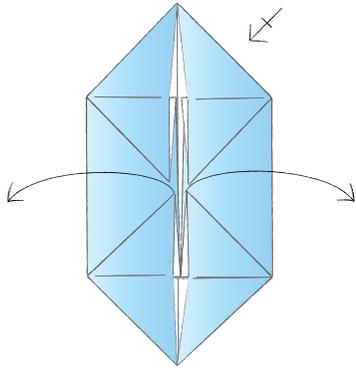
ACTIVITY 4 - *Fold a Windmill*

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.

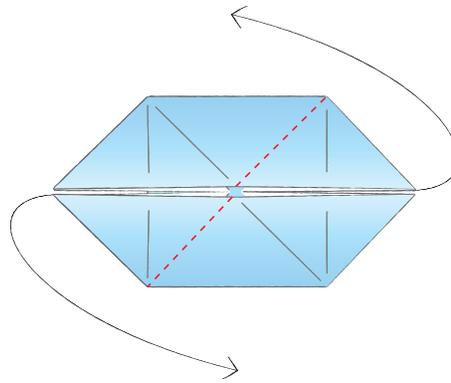
You can use the finished model to make an action model by pinning it with a thumbtack to a chopstick or other small stick. Have students blow on the model to see if it will move. What can you do to the 4 blades to change the velocity, to make the model move faster or slower?



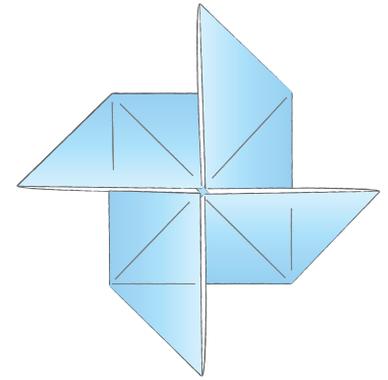
WINDMILL *Traditional*



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!