MathLinks

GRADE 8 TASKS
Geometry

A RECTANGLE PARADOX

geometry - area

Create and then cut up a 5 x 21 rectangle as shown in Figure 1. Then put the pieces back together as shown in the Figure 2 to make an 8 x 13 rectangle. Some area has been lost. What was lost, and why? Construct a mathematical argument to explain.

Figure 1

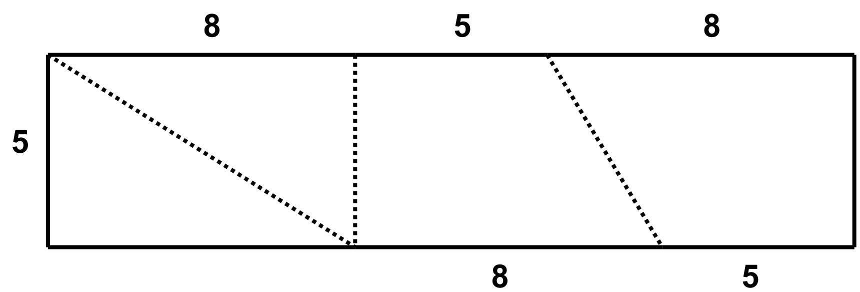
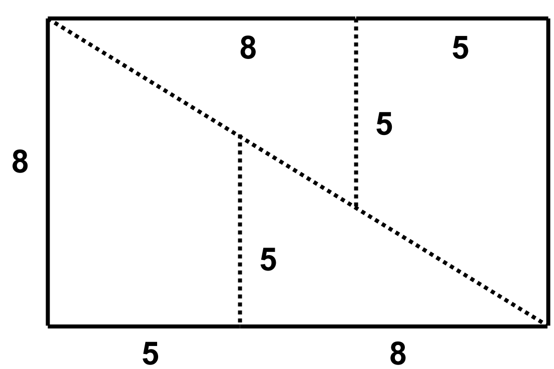


Figure 2



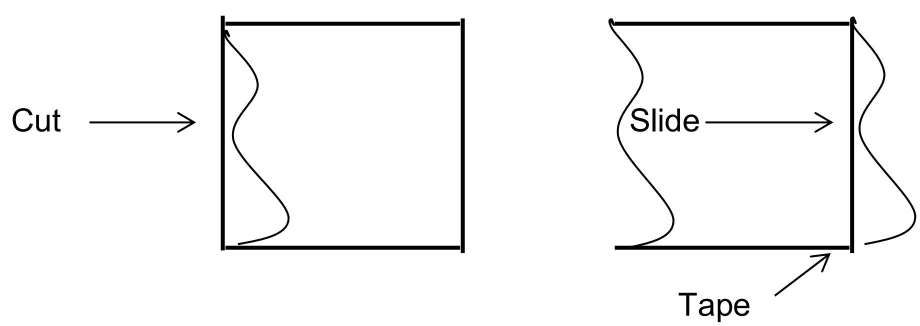
TESSELLATION DESIGN PROJECT

geometry - tessellations

A tessellation is a complete covering of a plane by one or more figures in a repeating pattern with no gaps or overlaps. M.C. Escher was a Dutch graphic artist who created beautiful repeating pattern designs. You may want to research some of his designs on the internet for inspiration for this project.

In this lesson you will create a translation tessellation.

1. First make a template.
   a. Begin with a square cut from a note card (about 2 inches on each side).
   b. Draw a curve joining two consecutive vertices.
   c. Cut along the curve you drew and slide it to the opposite side of the square. Tape it into place.



   d. Repeat steps b and c on the other two sides of the square
   e. Look at your resulting figure. Allow your imagination to suggest what it represents. Could it be a fish or a tree? Add a few details to your template.

2. Now tessellate.
   a. Use a large sheet of paper.
   b. Trace around your template.
   c. Perform translations so that your tracings completely cover the plane with no gaps or overlaps.
   d. Color your design to bring out the shape suggested by your imagination.

3. Explain your project.
   a. Write up step by step directions to show how you made your template and your tessellations.
   b. Use appropriate vocabulary to explain the mathematics behind your tessellation.

4. Challenge: Try to make a tessellation that involves rotations or reflections.

ROTATION DESIGN PROJECT

geometry - rotations

1. Here is a technique for making a design that features a rotational symmetry of 60^{o} about a center.

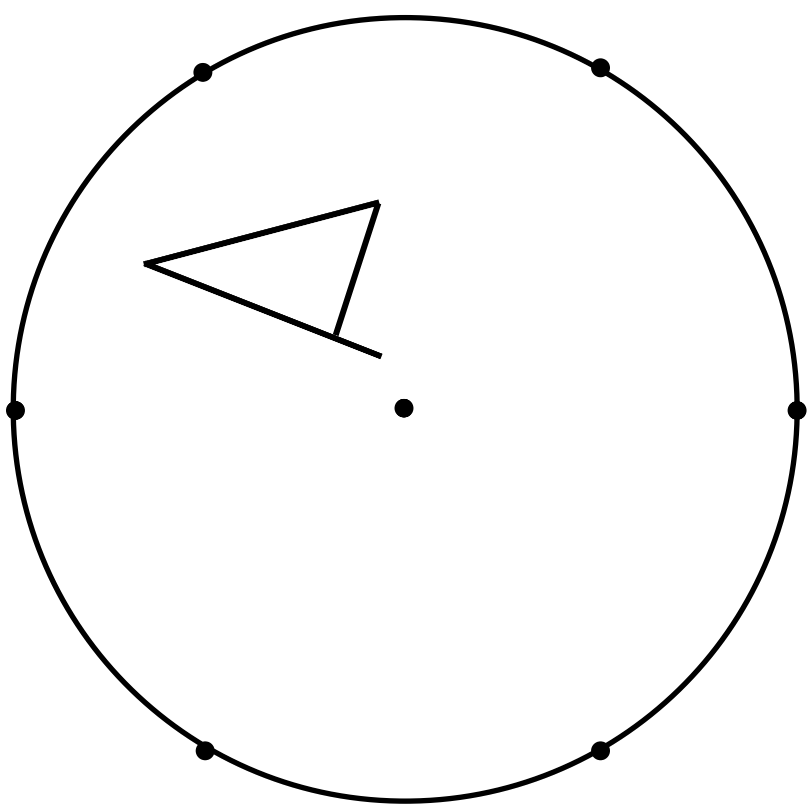
   - Step 1: Place a sheet of patty paper over the circle below. Mark the six equally spaced points on the circle, the center of the circle, and the figure.

   - Step 2: Put the point of your pencil on the center of the circle and rotate until the 6 points align. Trace the triangle flag in its new location.

   - Step 3: Repeat step 2 until there are six congruent figures on your patty paper.

2. Label the center point of rotation *P*.

3. Explain why the angle of rotation is 60^{o}. ________________________________

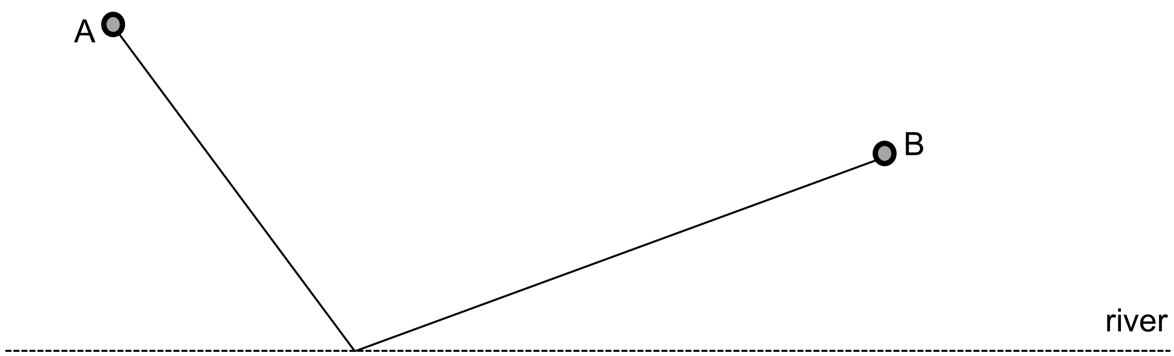


Create your own design using the technique above. You may begin with any number of equally spaced points on the circle and rotate any shape(s) you like. Describe your process, including any tools that you use. Identify the center of the rotation and angle of rotation. Color your design.

SWIMMING AT THE RIVER

geometry - transformations

Albert and Betty live at houses A and B on the north side of a river. Albert wants to go to the river for a short swim, and then go to Betty's house. If there are no obstacles along the way, where should he stop at the river, so that his total walking distance is minimized?



1. One path that Albert might take is drawn here. Label his stopping point at the river *X*. If one centimeter = 200 feet, what is his total walking distance?

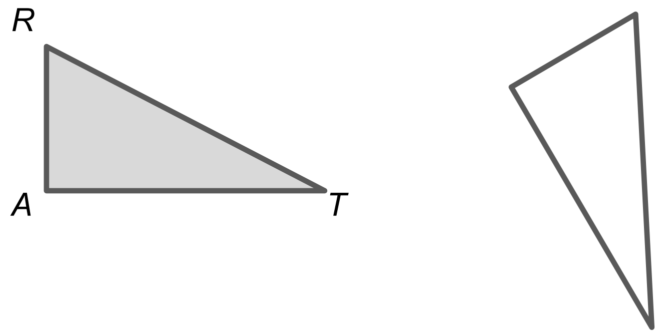
2. Draw another path that Albert might take. Label his stopping point at the river *Y*. What is his total walking distance for this path?

3. If he wants to walk the shortest possible distance, find his stopping point at the river. Label it point *Z*. Find his total walking distance on this path. Explain how you know it is the shortest distance.

FINDING THE CENTER OF A ROTATION

Geometry - rotation

1. Below is triangle *RAT* and its image under some rotation. The original figure is shaded and its image is not. Label the corresponding points $R'A'T'$ on the image.



2. Find the perpendicular bisector of segment RR'. Find the perpendicular bisector of segment AA'. Find the perpendicular bisector of segment TT'. Did they all intersect at one point? _____ Label this point C. What is important about this point?

3. Find the measure of angles: $\angle RCR'$ _____ $\angle ACA'$ _____ $\angle TCT'$ _____

   What is important about this result?

4. Find the measure of segments : $\overline{CR}$ _______ $\overline{CA}$ _______ $\overline{CT}$ _______

   $\overline{CR'}$ _______ $\overline{CA'}$ _______ $\overline{CT'}$ _______

   What is important about this result?

5. Challenge: Create a folding construction to find a sequence of two reflections accomplishing the rotation, taking triangle *RAT* to triangle $R'A'T'$. Record your construction and explain how you did it.

SCALE MODELS
geometry - scale

Select an object (paper clip, band aid, cereal box, etc.) and sketch a model of it on a coordinate axis. Then create a dilation of the model. You may choose to enlarge (scale factor greater than 1) or reduce (scale factor less than 1).

Challenge: Create a distorted model of your object by multiplying all horizontal dimensions by one scale factor and all vertical dimensions by a different scale factor.

PACKING PROBLEMS
geometry - volume

These problems all involve concepts you have studied. They require that you apply mathematics to real situations, make reasonable assumptions or approximations, obtain information to solve the problem, and interpret results in the context of the problem.

State all assumptions and explanations clearly. Explain how you solved each problem using mathematics or other methods. Justify your solution with mathematics.

1. What would be appropriate dimensions for a box that will hold 24 cans of soup?

2. If a team has 12 basketballs for practice, will they fit in one large trash can for storage?

3. Frozen yogurt is packed commercially in 3 gallon cylindrical containers. About how many dessert cones can be made using the yogurt in one of these containers?

4. Grocery stores receive oranges in a box that is about 24” × 18” × 15.” About how many oranges can be packed into the box?