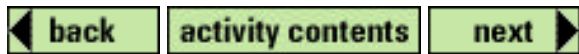


ACTIVITY CONTENTS:

Tiling Shapes

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- [Thinking About the Question](#)
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- [Safety](#)
- [Investigation I: Tiling parallelograms and hexagons](#)
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- [Investigation III: Tiling trapezoids and parallelograms](#)
- [Technical Hints](#)
- [Analysis](#)
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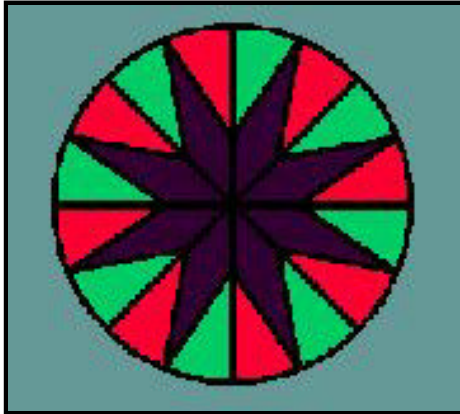
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Tiling Shapes Introduction

Discovery Question: Can I use different polygons to tile a flat surface?



In this activity you will create tile patterns with different regular polygons.

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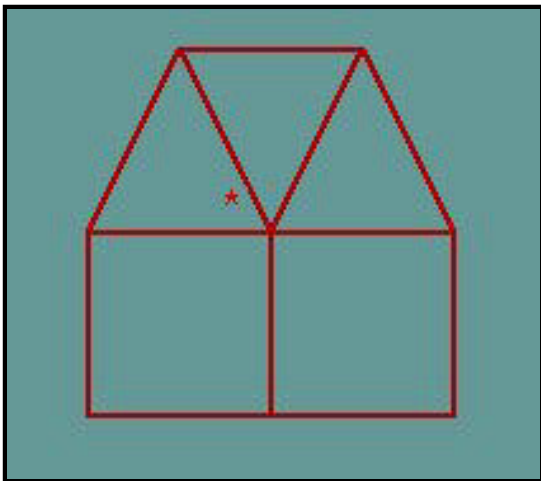


Thinking About the Question

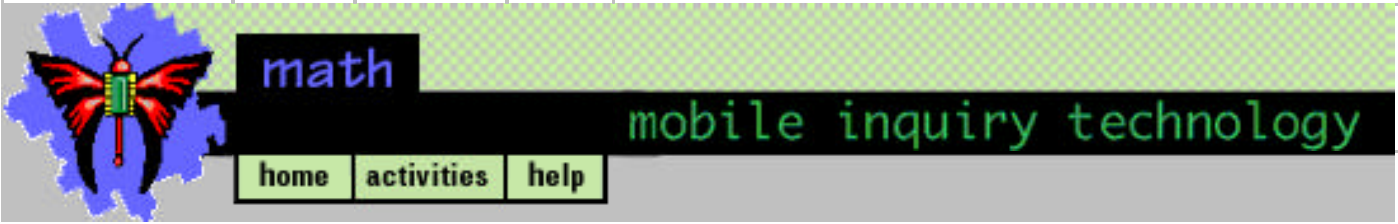
Can I use different polygons to tile a flat surface?

Have you ever wondered how beautiful mosaic tile designs are made? The tiles must cover a flat surface with shapes that fit together without any gaps. The lengths of the sides of the tile pieces must match up and the angles must be correct for this to work.

Polygons are simple closed figures with straight-line sides. **Regular** polygons are easy to tile since all sides and angles are the same size. Some examples of regular polygons are equilateral triangles (3 equal sides and 3 equal angles) and squares (4 equal sides and 4 equal angles).



Discuss within your group combinations of different regular polygons that you can tile. For example, three triangles and two squares can be used to surround one of the vertices of one of the triangles. A vertex is a point on the tilings where the corners of the polygons fit together shown in the diagram by the star. Use a piece of graph paper to display your combinations. Be prepared to share your combinations with the class.

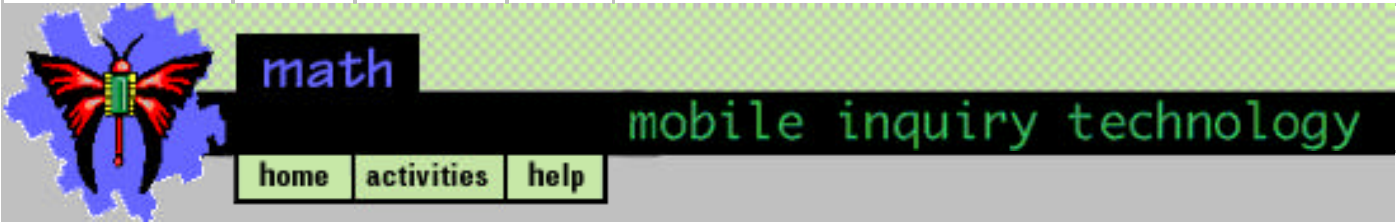


Tiling Shapes Materials

- paper patterns of regular polygons (one per group)*
- graph paper
- ClarisWorks Draw program

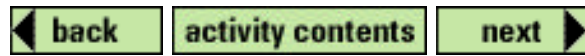
*Foam rubber regular pentagons can be purchased from Tessellations (<http://www.tessellations.com/index.html>) for \$0.25 each





Tiling Shapes Safety

No specific safety instructions are needed for this activity.

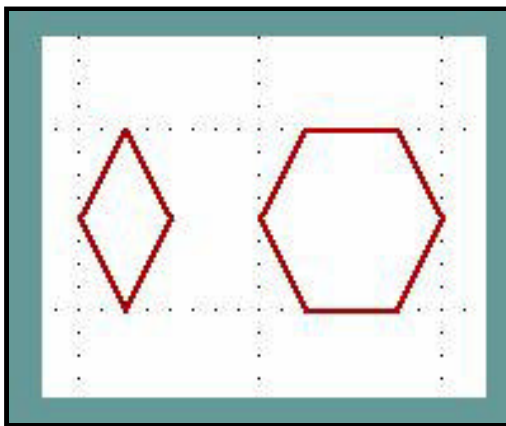




Tiling Shapes Investigation I

Tile parallelograms and hexagons

1. Using the draw computer program, make a parallelogram and hexagon similar to those shown below. Refer to [Technical Hints](#) to see how to use the draw program. Make sure to lock the shapes into the grid. Refer to [Technical Hints](#) to see how to align to grid.



2. Copy the shapes so that you have four parallelograms and six hexagons. Refer to [Technical Hints](#) to see how to copy. Tile these shapes in as many ways as possible.

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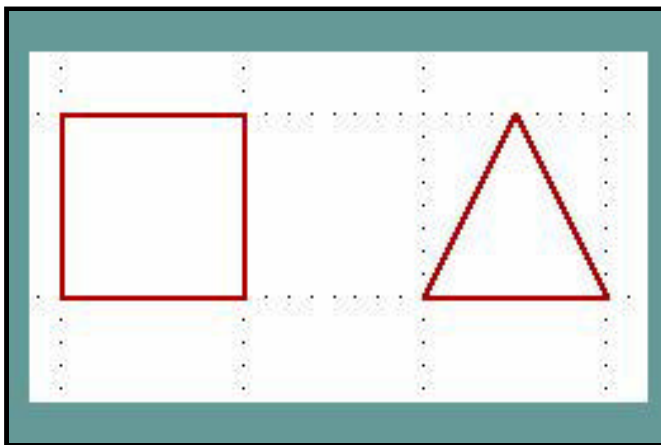
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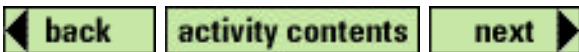
Tiling Shapes Investigation II

Tile squares and triangles

1. Using a draw computer program, make a square and triangle similar to those shown below. Refer to [Technical Hints](#) to see how to use the draw program. Use the program to flip the triangle vertically (upright). Refer to [Technical Hints](#) to see how to transform objects.



2. Copy the shapes so that you have ten equilateral (3 equal sides and 3 equal angles) triangles and four squares. Refer to [Technical Hints](#) to see how to copy. Tile these shapes in as many ways as possible.
3. Go to Questions 3 and 4 in "Analysis".

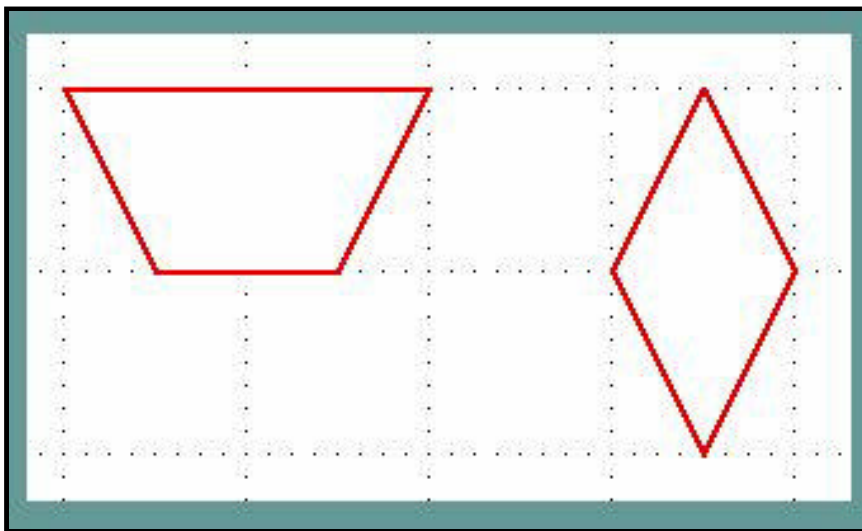




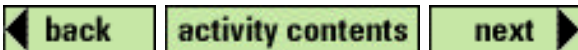
Tiling Shapes Investigation III

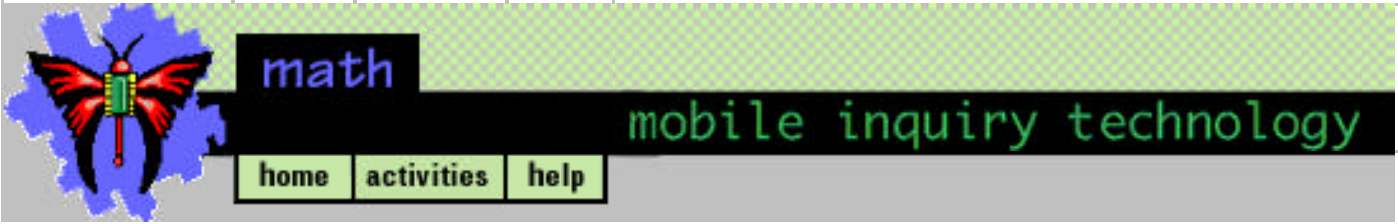
Tile trapezoids and parallelograms

1. Using a draw computer program, make a trapezoid and parallelogram similar to those shown below. Refer to [Technical Hints](#) to see how to use the draw program. Use the program to flip the triangle vertically. Refer to [Technical Hints](#) to see how to transform objects.



2. Copy the shapes so that you have four trapezoids and three parallelograms. Refer to [Technical Hints](#) to see how to copy. Tile these shapes in as many ways as possible.
3. Go to Questions 5, 6, and 7 in "Analysis".





Tiling Shapes Technical Hints

- Using the draw program
- Aligning shapes to grid
- Writing on diagrams
- Copying shapes
- Transforming objects

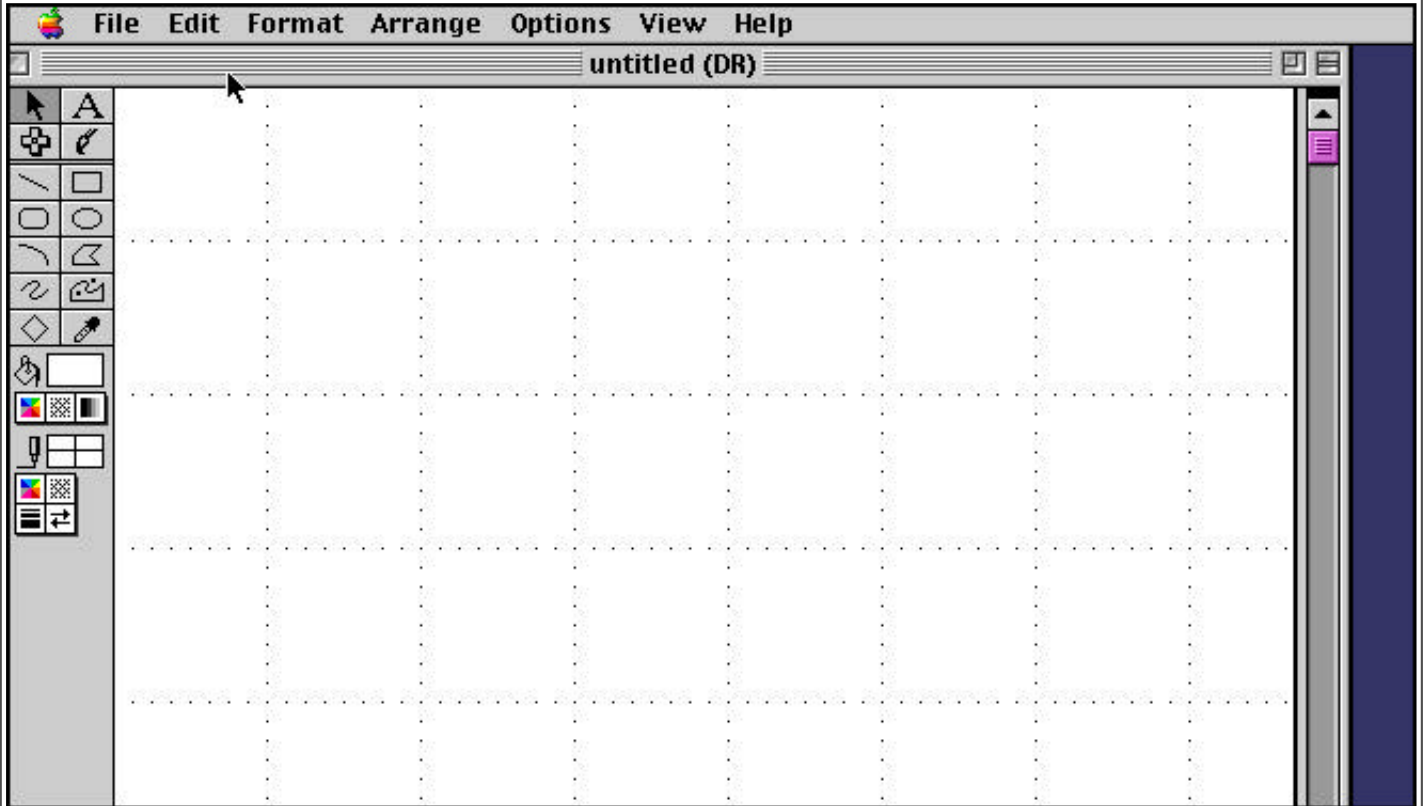




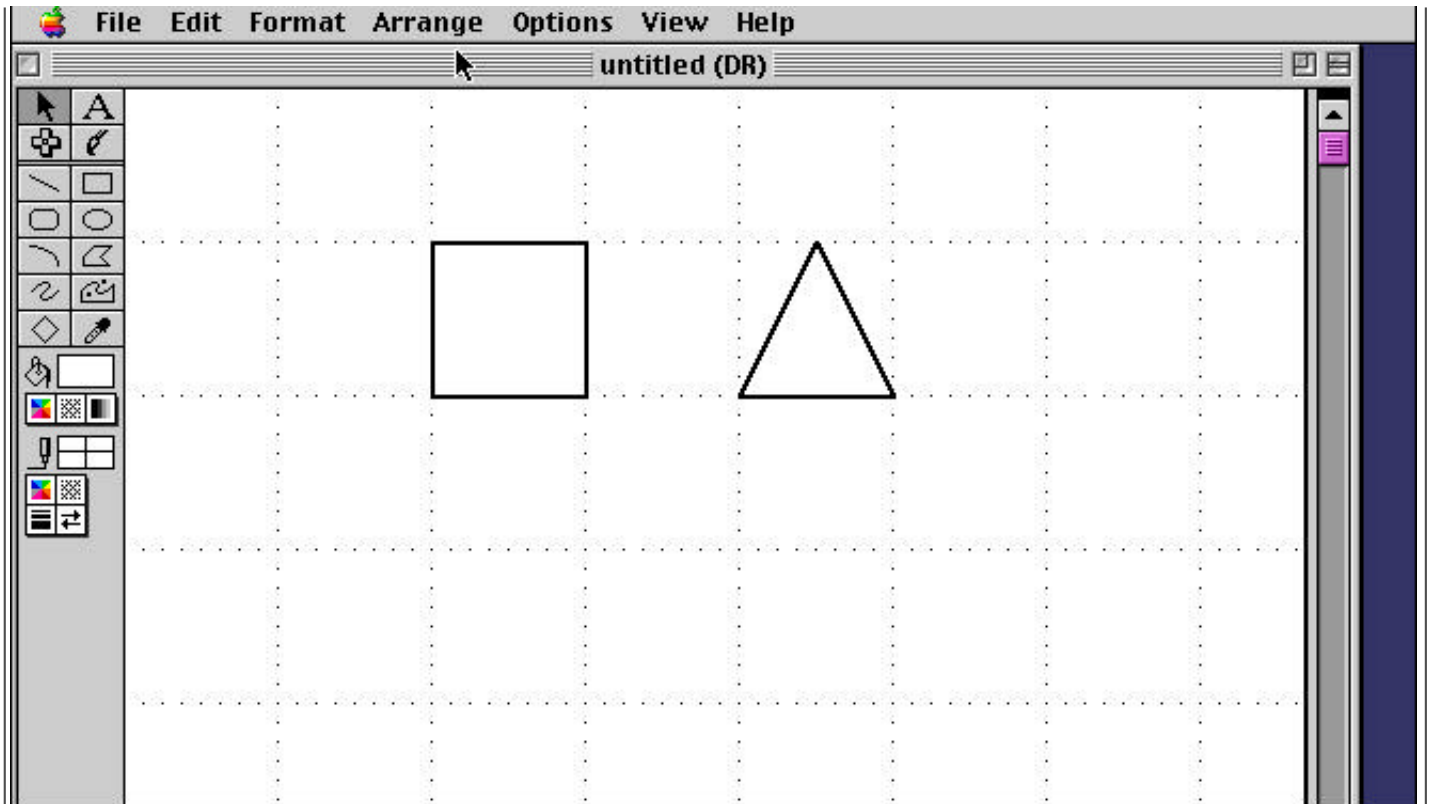
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Tiling Shapes Technical Hints

To use the draw program:

1. Select drawing option in ClarisWorks.



2. Select the Square tool and drag the tool over the area that you would like to add the shape.
3. Change the thickness of the sides by selecting from the thickness below the Pen tool below the Tool bar.
4. You can move the position of the square by clicking on the square (four small squares will appear on its corners) with the Arrow tool. Drag the square to the location of your choice.
5. To draw a triangle, select the Line tool and drag over the area that you would like to have one of the sides. For each side you will need to select the Line tool.
6. Change the thickness of the sides again by selecting from the thickness below the Pen tool below the Tool bar.



7. To move the triangle you will need to group the three sides together. Click on each side with the Arrow tool while the shift key is depressed.
8. Select from the Arrange menu the Group option. Click on the side of the box (with four squares) with the Arrow tool and move the triangle to the new location.

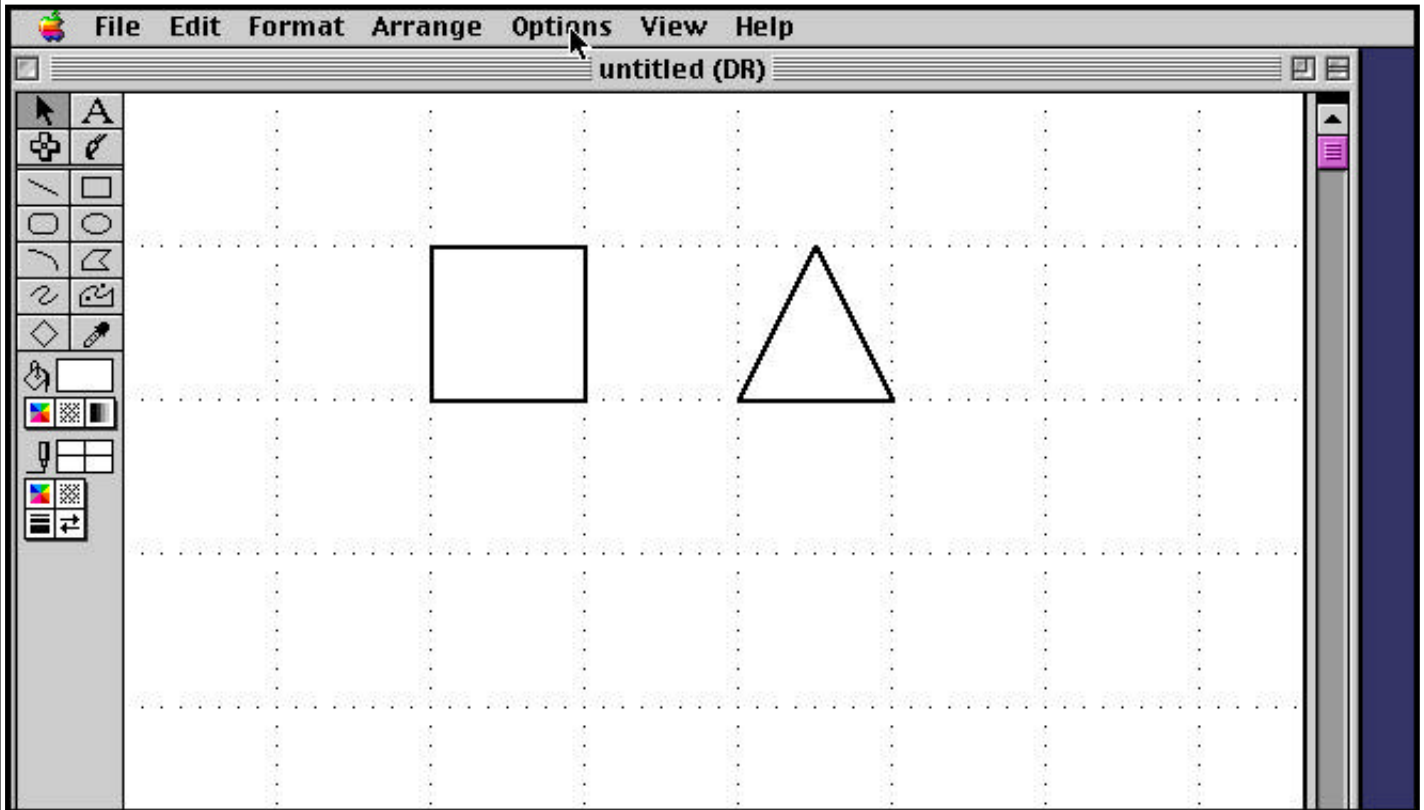
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Tiling Shapes Technical Hints

To align shapes to grid:

1. From the View menu, select Show Tools.
2. From the Options menu, select Turn AutoGrid On.
3. Click on the sides of the diagram to highlight it. From the Arrange menu, select Align To Grid.



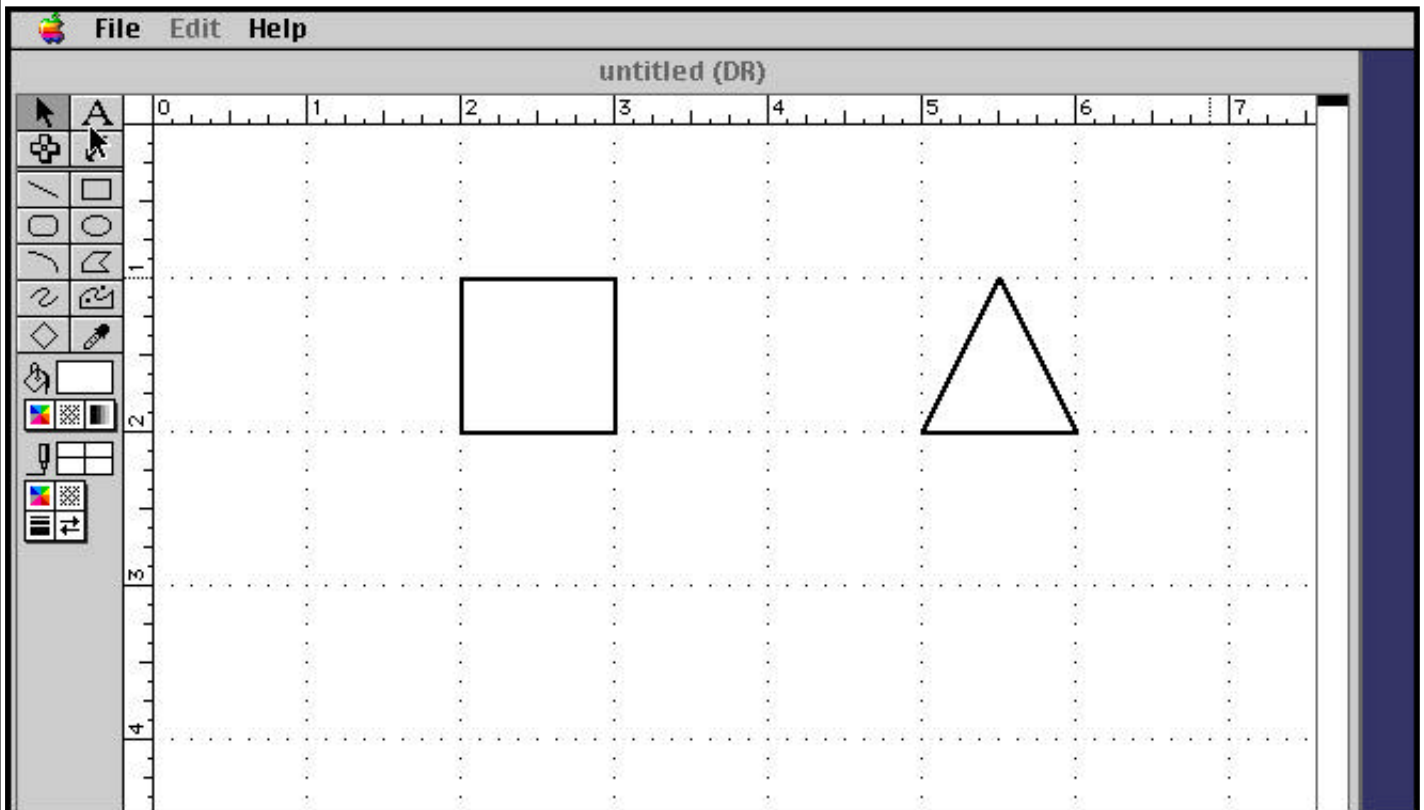
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Tiling Shapes Technical Hints

To write on diagrams:

1. Click on the Text (A) tool.
2. Click on the diagram that you want to label. Type the label.



3. To move a label, click outside of the label with the Arrow tool. The label will be highlighted. Click on the square and move to the location of your choice.

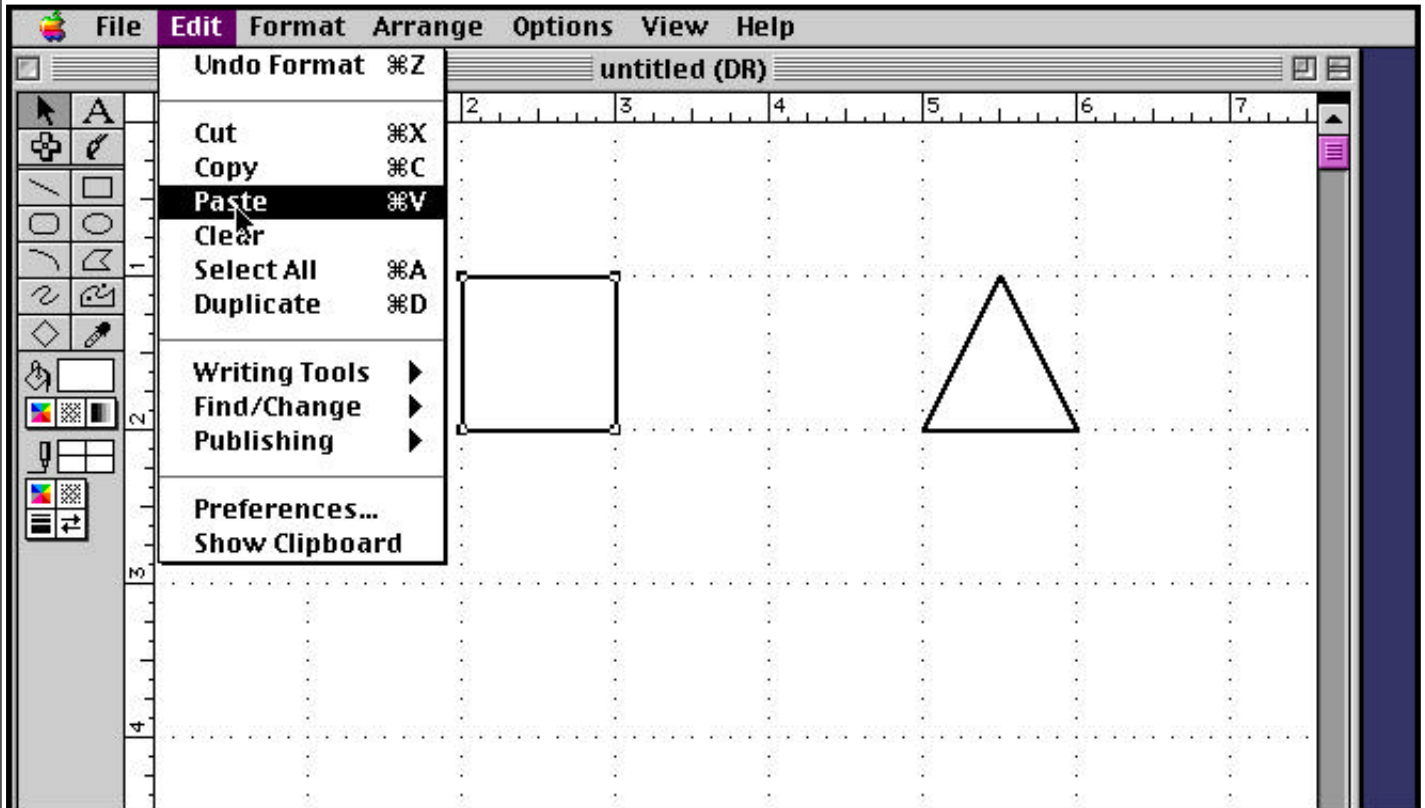




mobile inquiry technology Tiling Shapes Technical Hints

To copy shapes:

1. Use the Arrow tool to highlight the shape.
2. Select Copy from the Edit menu.
3. Click on the location for the copied shape. Select Paste from the Edit menu.



4. Remember the shape can be moved, by highlighting the shape and moving to a new location.

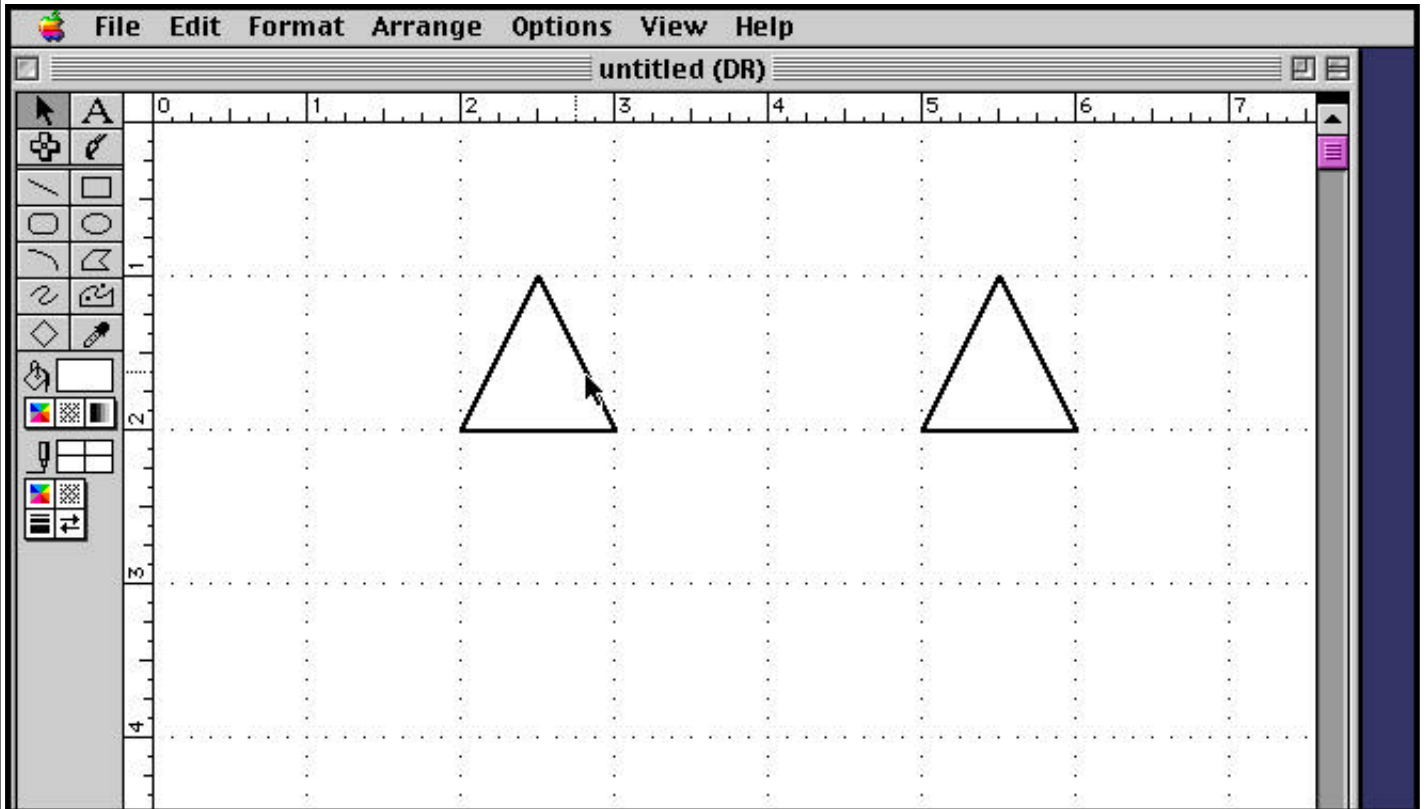
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Tiling Shapes Technical Hints

To transform objects:

1. To transform or change the orientation of the shape, highlight the shape.
2. Select Transform from the Arrange menu. Choose the function from the submenu. In this case it was flipped vertically.



3. You are then able to tile the object with another by highlighting and moving the shape.

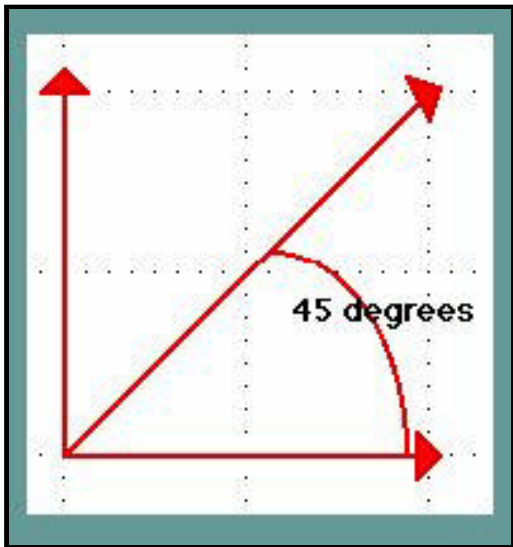
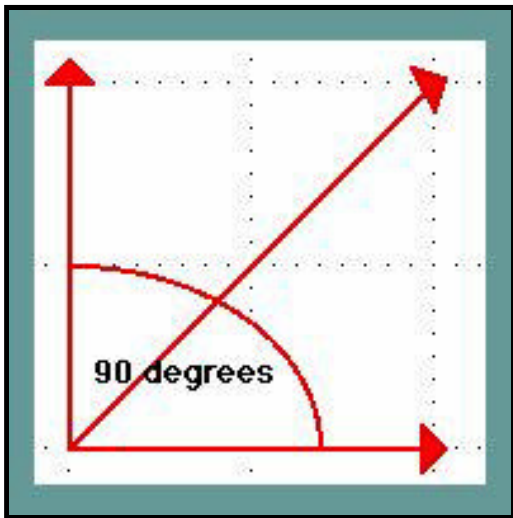




Tiling Shapes Analysis

Use your tiled shapes to complete the following on paper:

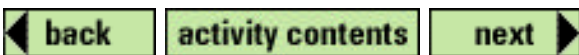
1. How many different types of tiles did you make while tiling parallelograms and hexagons? Compare your tiles to other groups.
2. Use the angle benchmarks below to determine the angles in your tiles. Mark each in your diagram. Refer to [Technical Hints](#) to see how to write on your diagram.

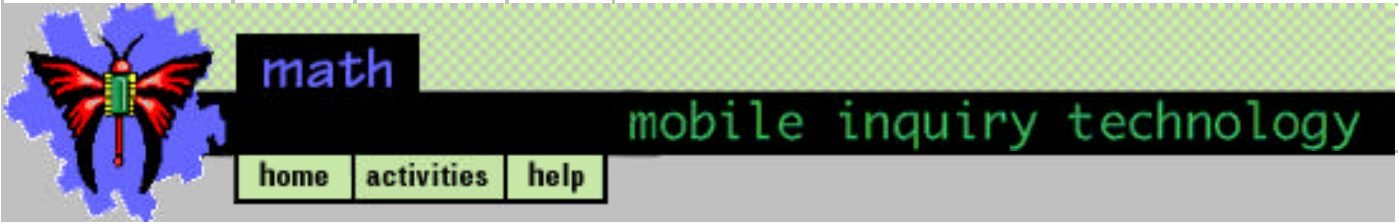


3. How many different types of tiles did you make while tiling squares and triangles? Compare your tiles to other groups.
4. Use angle benchmarks to determine the angles in your tiles. Mark each in your

diagram. Refer to [Technical Hints](#) to see how to write on your diagram.

5. How many different types of tiles did you make while tiling trapezoids and parallelograms? Compare your tiles to other groups.
6. Use angle benchmarks to determine the angles in your tiles. Mark each in your diagram. Refer to [Technical Hints](#) to see how to write on your diagram.
7. Review the angles of each shape you have drawn. Which shape had the least total degrees for a sum of all of the angles? Which shape had the most total degrees for the sum of the angles?





Tiling Shapes Further Investigation

Build your own version of a M.C. Escher tessellation with irregular-shaped polygons. You can observe tessellations on the web at (<http://www.znet.com/~wchow/javagraf.htm>).

