

Penrose Tiles

They were invented in 1974 by Roger Penrose, a British scientist. The shapes were named "kites" and "darts" by John Conway, a mathematician at Princeton University.

These tiles have many amazing properties. For one thing, they are non-periodic. You can tile forever with them, but if you trace your tiling on tracing paper, you can't slide the tracing paper and make it match up.

The best way to begin to understand them is to play with them! Make a bunch of tiles on card stock, using the pattern given. Color the arcs blue and red so you can use your tiles with other students. Put your name on the back of each tile. As you tile, your pieces must touch edge to edge, and the colors must match up. If you reach a place where no tile fits, take a few tiles off and try again.

- 1) Create a beautiful Penrose tiling!
- 2) Write a paragraph describing what you made and what you've learned about Penrose tiles.
- 3) How many different ways can you tile around one point? (For example, five kites will do it.)
- 4) What are the angles in each shape?
- 5) Use a ruler, compass and protractor to draw a neat kite and dart "from scratch." Make the smaller sides 3 inches. How long will the longer sides need to be?
- 6) Draw a large regular pentagon with all its diagonals. You will see a five pointed star, with a smaller regular pentagon in the center. Draw one diagonal of that smaller pentagon. Now how can you find the kite and dart shapes in this drawing?
- 7) How could you tell someone, using only words, how to draw the two shapes?
- 8) No Penrose tiling has translational (sliding) symmetry. But can you make tilings with rotational or reflectional symmetry?
- 9) What is the ratio of the longer side to the shorter side in each shape?
- 10) Can you learn more about Roger Penrose and the Penrose tiles? About other tilings?
- 11) Have fun!