

Pentominoes

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If five squares are joined in all possible ways, the 12 shapes that result are called pentominoes.

Materials:

1. floor tiles
2. gummed squares
3. cubes
4. construction paper
5. scissors
6. squared paper
7. overhead
8. geoboard
9. mira

Exploratory Period:

- Use items 1, 2, or 3 and arrange them to make the 12 pentomino shapes.
- Once the pupils have discovered all the shapes, have them build these shapes on graph paper.
- You can then hand out construction paper with the images printed on them. Have the students cut these out.
- Now let's get familiar with the 12 shapes. Can you make some of these pieces fit these geometric shapes?

Game: Pent Up¹

"Pent Up" is a strategy game for two or three players. It uses the 12

¹Dr. John L. Ginther, *Math Experiments with Pentominoes* (Midwest Publications Company, Incorporated), p.LR-9. Available through Western Educational Activities Ltd., 10234 - 103 Street, Edmonton, Alberta.

pentominoes and the 8-by-8 playing field.

Rules for Pent Up:

1. Place the set of 12 pentominoes in a pile near the players.
2. Players take turns. In his turn, a player chooses a pentomino from the draw pile and places it so that it covers five squares on the playing field.
3. Any pentomino may be placed either side up.
4. The last player who can play a pentomino is the winner.

Pentominoes and Perimeter

Let's make a *conjecture*.

Since the area of the 12 shapes is the same, it follows that their respective perimeter is the same. Discovery actively follows to prove or disprove the conjecture.

Other Activities:

- Place two pieces together; trace the figure. Do this for a number of examples (six). Compare the perimeters.
- Place three pieces together; trace the figure. Do this for six examples. Compare the perimeters.
- What conclusion can you draw?

Do Pentominoes Tesselate?

Discovery Activity:

Assign each student to work with a certain pentomino shape. Attempt to use that shape to tessellate the plane. See if you can make it tessellate in more than one way.

Follow Up:

- Color them; decorate the classroom with them.
- Work with different geometric shapes to tessellate the plane. Are there certain shapes that do not tessellate?

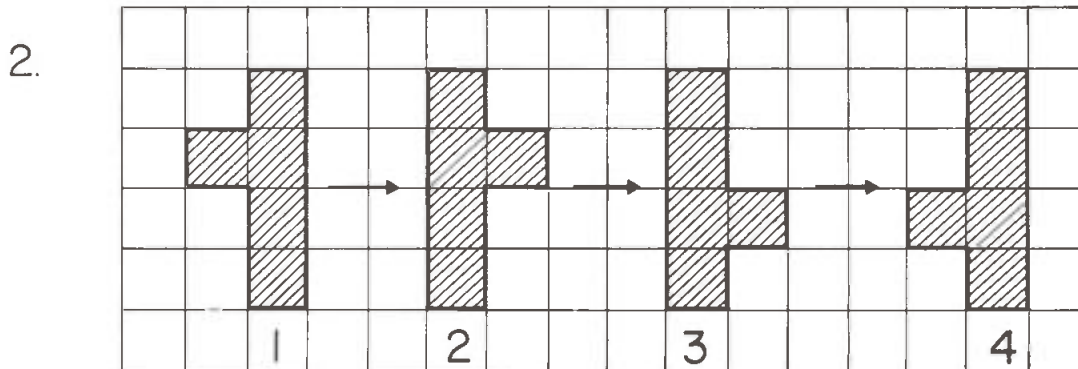
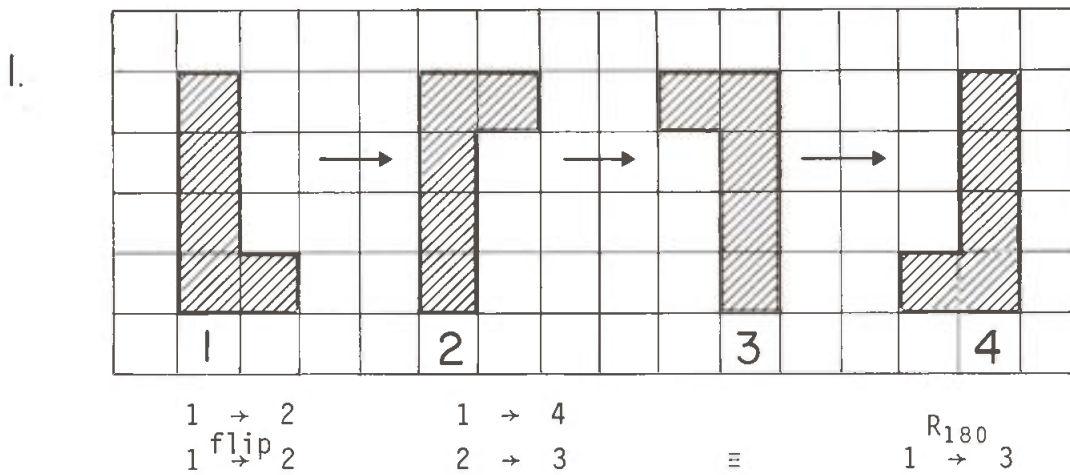
- Devise other activities.

Build an Open Box

- Have the students tape the edges of the five pieces.
- Will the figure fold to form an open box?
- Rearrange the five tiles in the other 11 ways and repeat.
- Will all the 12 pentomino shapes form an open box?
- Devise other activities.

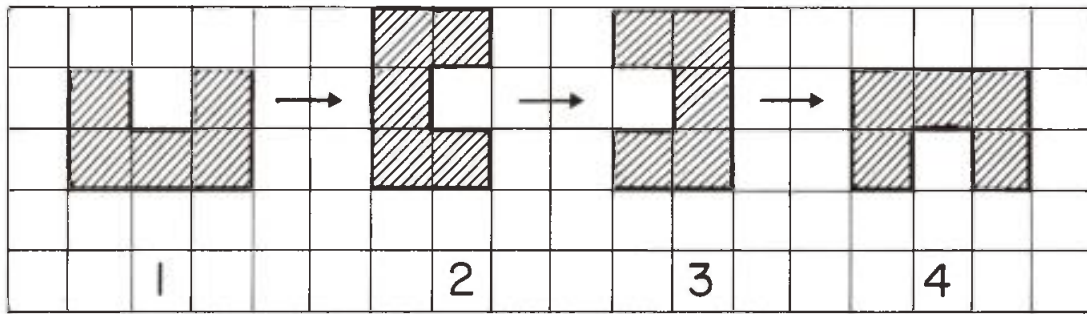
Flips, Slides, and Turns with Pentominoes

Describe the motion as a flip, slide, or turn.



From the above four figures, show 4 flips and 2 rotations.
 On square paper using this shape, demonstrate a slide, and two flips = R_{180} .

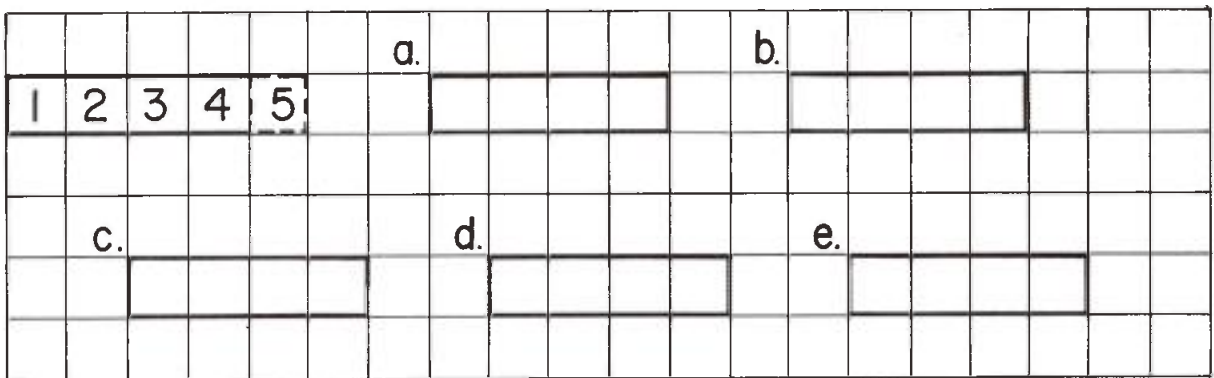
3.



From the above diagrams, describe the following motions:

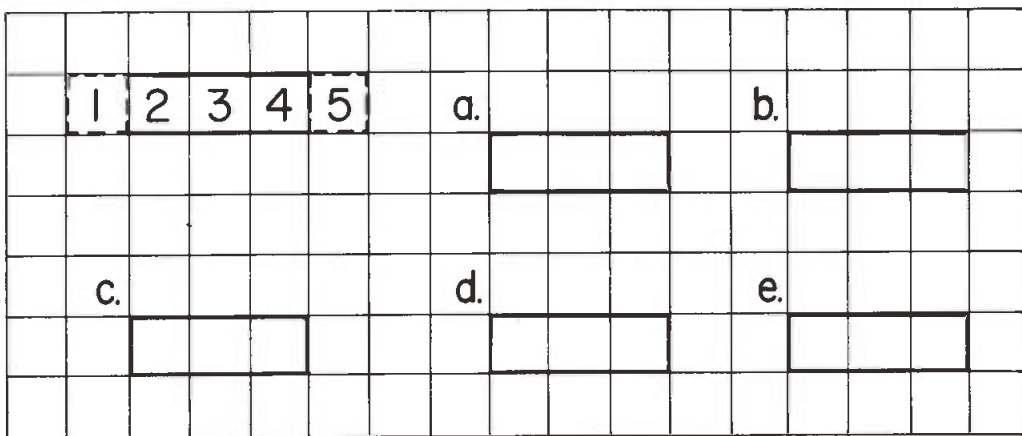
1 → 2 1 → 3 1 → 4 2 → 3 2 → 4 3 → 4

4.



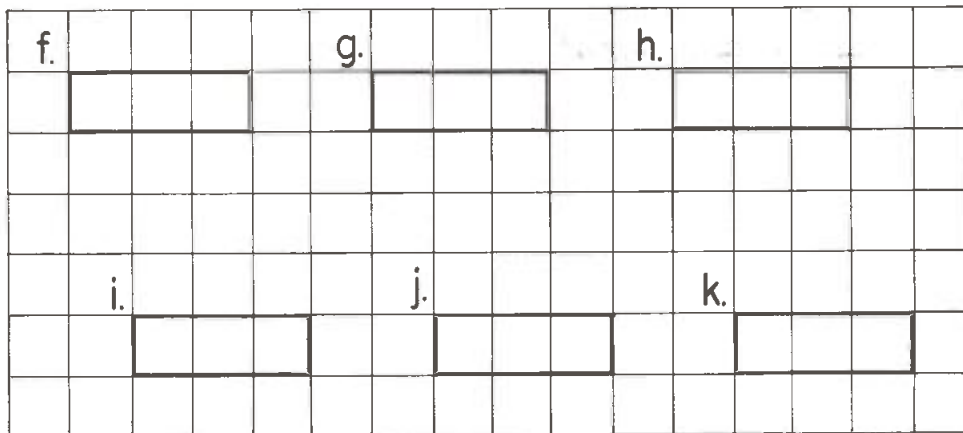
Place square #5 in a different position in figures a, b, c, d, e. Compare these figures.

5.

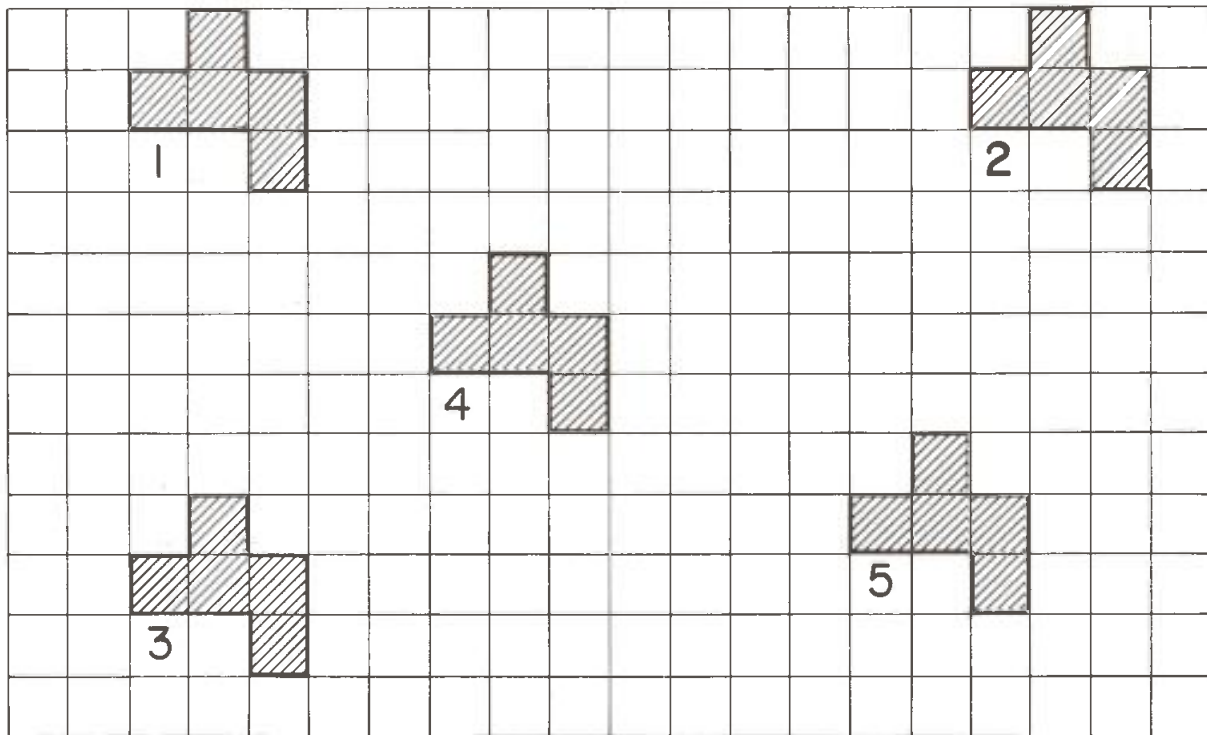


How many shapes can you build by sliding #1 and #5?

5.



6. Describe the following slides: $\begin{matrix} (14) \\ 0 \end{matrix}$ $1 \rightarrow 2$ $1 \rightarrow 3$ $1 \rightarrow 5$
 $4 \rightarrow 2$ $4 \rightarrow 3$ $4 \rightarrow 5$ $3 \rightarrow 2$ $5 \rightarrow 3$



Pentominoes and the Mira

Use the mira to find the axis or axes of symmetry of these pentomino shapes.

