DRAW WHAT YOU SEE

GEOMETRY

- Three-dimensional shapes
- Perspective
- Visual perception

Getting Ready

What You'll Need

Snap Cubes, 3 per child

Isometric dot paper, 1 sheet per child, page 90

Overhead isometric dot paper transparency (optional)

Overview

Children build a train of Snap Cubes, look at it from various angles, and then use isometric dot paper to record what they see. In this activity, children have the opportunity to:

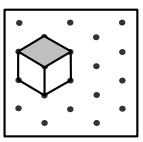
- focus on visual perspective
- represent three-dimensional objects in a two-dimensional plane
- use isometric dot paper as a mathematical tool

The Activity

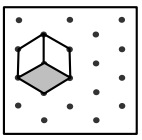
Let children know that while isometric dot paper is helpful when drawing three-dimensional objects in perspective, using it takes practice and can sometimes be frustrating.

Introducing

- Have each child place a Snap Cube on a flat surface and turn it so that three sides are visible. Ask children how many corners, or vertices, they can see.
- Translate what children see in three dimensions into a two-dimensional drawing on isometric paper. Shade the top face.



- Point out that the seven dots in the drawing match the seven corners that children can see on their cubes.
- Connect another set of seven dots and shade the bottom face. Ask children to hold the cube in the position that shows what this drawing represents.



On Their Own

Can you draw all the different views of a 3-cube Snap Cube train?

- Make a train of 3 Snap Cubes.
- Use isometric dot paper to draw as many different views of the train as you can.
- Each view should show 3 sides of the train.
- Compare your results with those of other members of your group.
- Be ready to talk about how your drawings show 3 dimensions.

The Bigger Picture

Thinking and Sharing

Have volunteers take turns sharing the solutions until all six solutions are shown. You may want to suggest that children draw solutions on an isometric dot paper transparency which you can then display on the overhead projector. Have children hold up their cubes in the positions that match each two-dimensional solution.

Use prompts such as these to promote class discussion:

- What did you discover about drawing trains?
- Why are there only six dot-paper drawings for the three-cube train?
- What was difficult about the activity? What was easy? Why?
- In what real-world situations might isometric dot paper be useful?

Writing

Have children make a list of tips for drawing three-dimensional objects in two dimensions that can be used by someone who is just learning to work with isometric dot paper.

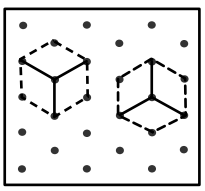
Extending the Activity

1. Ask children to construct a Snap Cube building. Then, tell them to make three or four different isometric dot paper drawings of their building. Have children exchange only their drawings with a partner and use them to try to build each other's structures.
2. Have children use isometric dot paper to discover the 24 possible perspective drawings of a five-cube T-shaped structure. This would be a good long-term class project.

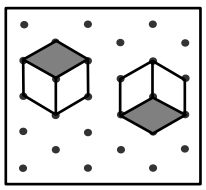
Teacher Talk

Where's the Mathematics?

Being able to draw in perspective is crucial to communicating about three-dimensional objects. By using isometric dot paper, children can record their views of three-dimensional objects in two dimensions. Children can represent each visible corner of a cube by a dot on the paper.



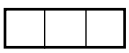
In the *Introducing*, children may have thought that there would be six—or even eight—different drawings possible because they know a cube has six faces and eight corners. Yet every drawing that shows perspective can be recorded in only two ways.



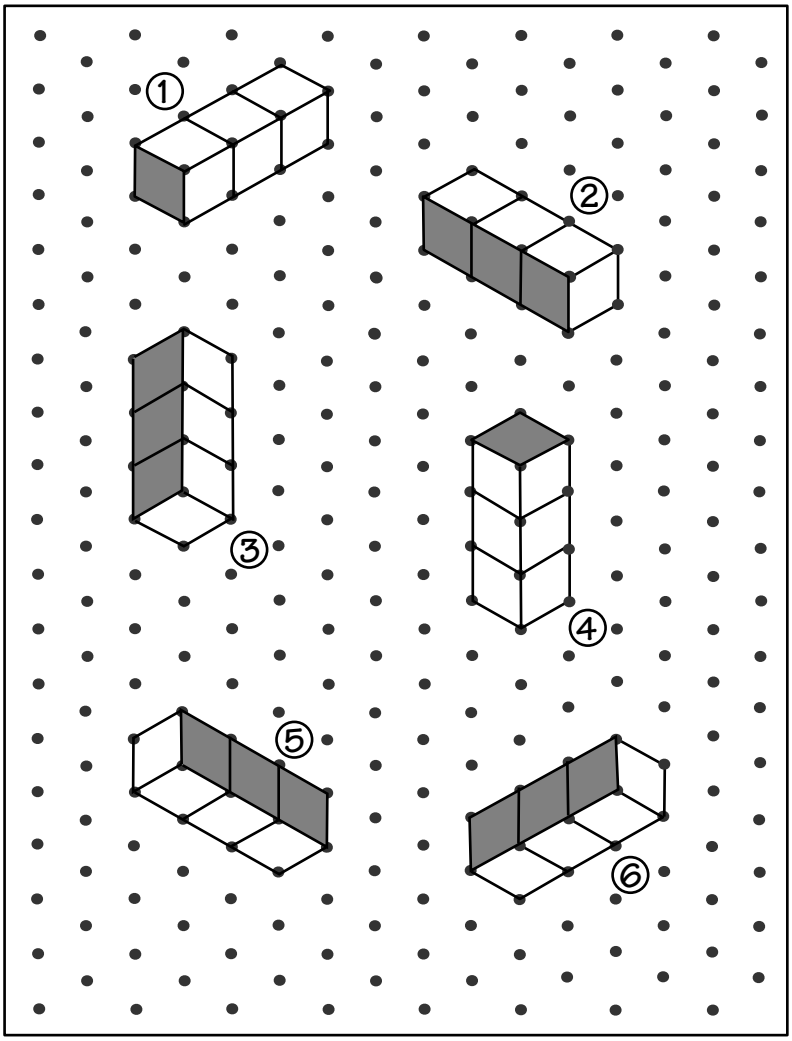
As they draw the different perspectives of their train, children may need to move their train so that the corners of the cubes are positioned to match the dots on the isometric paper. The lines that they draw will then represent the edges of the Snap Cubes.

By investigating different views of the train, children may realize that not all of the views can be or need to be drawn on isometric dot paper. For example, when viewing one of the square faces straight on, the representation could only look like this:

When viewing one of the rectangular faces straight on, the representation could only look like this:



Only six different isometric drawings of the train are possible.



With experience, children discover the fun of communicating visually about objects in space. As they experiment, children begin to grasp the connection between a three-dimensional object and its representation on isometric dot paper. The aspect of perspective may not be evident to children when manipulating the cubes. Eventually, however, most children will notice that parallel edges of a rectangular prism are represented by parallel lines on the paper and the square faces are represented by rhombuses. They will also realize that shading enhances their drawings.

ISOMETRIC DOT PAPER–1-CM