

GEOMETRY PLAYGROUND

Activities | Grades 6–8

www.exploratorium.edu/geometryplayground/activities

BUILDING THREE-DIMENSIONAL (3D) STRUCTURES

Draw a 3D structure in two dimensions.

[60 minutes]

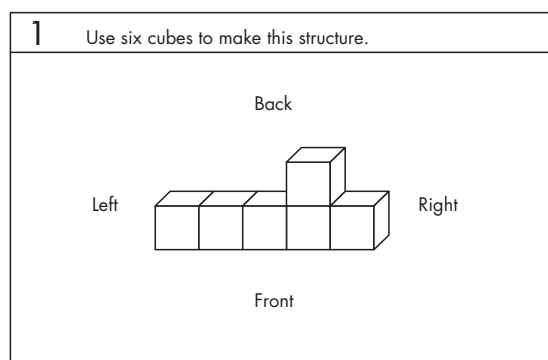
Materials:

- Six cubes (any cubes, such as centimeter cubes, sugar cubes, Multilinks, etc.)
- Centimeter Grid Paper (attached)
- Building Mat (attached)
- Paper
- Pencil
- Activity Cards showing cube structures (attached)

Try This:

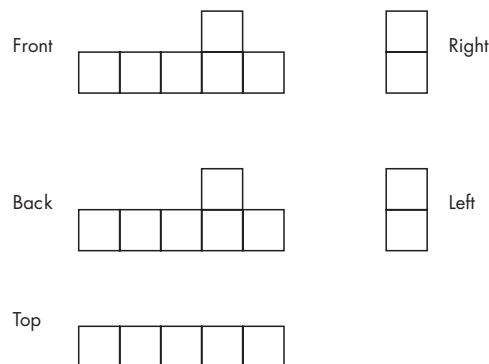
Step 1 Orient the Building Mat so that the side labeled “Front” is closest to you.

Step 2 Use six cubes to build the following structure—from Activity Card 1—on your Building Mat:

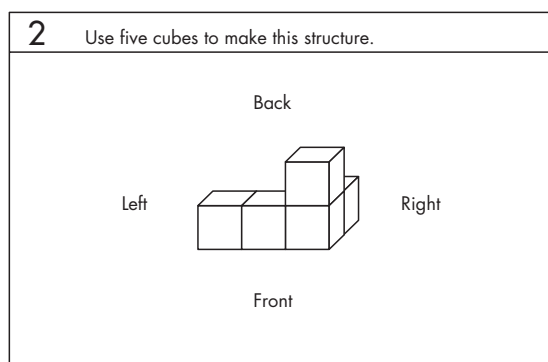


Does the structure you built look like the one your neighbor built?

- Step 3 Let's try representing this three-dimensional building with two-dimensional maps. What does the front view of the structure look like? Bring your eye level close to the table height, and draw the front view as a flat arrangement of block faces (squares) on the grid paper. Label this drawing "Front".
- Step 4 Rotate the building mat so that the right side of the structure is facing you. Bring your eye level close to the table height, then draw this view as a flat arrangement of block faces (squares). Label this drawing "Right Side".
- Step 5 Rotate the building mat so that the back of the structure is facing you. Bring your eye level close to the table height, then draw this view as a flat arrangement of block faces (squares). Label this drawing "Back".
- Step 6 Rotate the building mat so that the left side of the structure is facing you. Bring your eye level close to the table height, and draw this view as a flat arrangement of block faces (squares). Label this drawing "Left Side".
- Step 7 Now look straight down on top of the structure. Draw this view as a flat arrangement of block faces. Label this drawing "Top".
- Step 8 Compare the five drawings you have made with those of your neighbors. Your five two-dimensional drawings should look like these:



- Step 9 Use five cubes to build this structure from Activity Card 2:



Does your structure you built look like the one your neighbor built?

- Step 10 Repeat steps 3–7.
- Step 11 Compare the five drawings you have made with those of your neighbors.
- Step 12 Compare the “Front” and “Back” views of this structure. How do they relate to each other? They are mirror images, or *reflections*, of each other.
- If you have time, build the structures on the other Activity Cards, and follow the steps above to draw the five views of each.
- Step 13 Now design and build a simple structure of your own on your building mat. Use no more than six blocks. The faces of the cubes that touch one another must line up completely.
- Step 14 After you build your structure, draw and label the five different face views: Front, Right Side, Back, Left Side, and Top.
- Step 15 Give your partner the grid paper drawings and have him or her build it.
- Step 16 After you have each built a new structure, compare the two structures.

What’s Going On?

Most things look different depending on where you are when you look at them. When you looked at the cube stacks from five different points of view, you saw different images of this same three-dimensional (3D) structure. The drawings you made of the cube structures are flat, or two-dimensional (2D) depictions of the 3D stack.

In some cases, such as this pair of drawings, the 2D drawings are reflections, or mirror images, of each other.

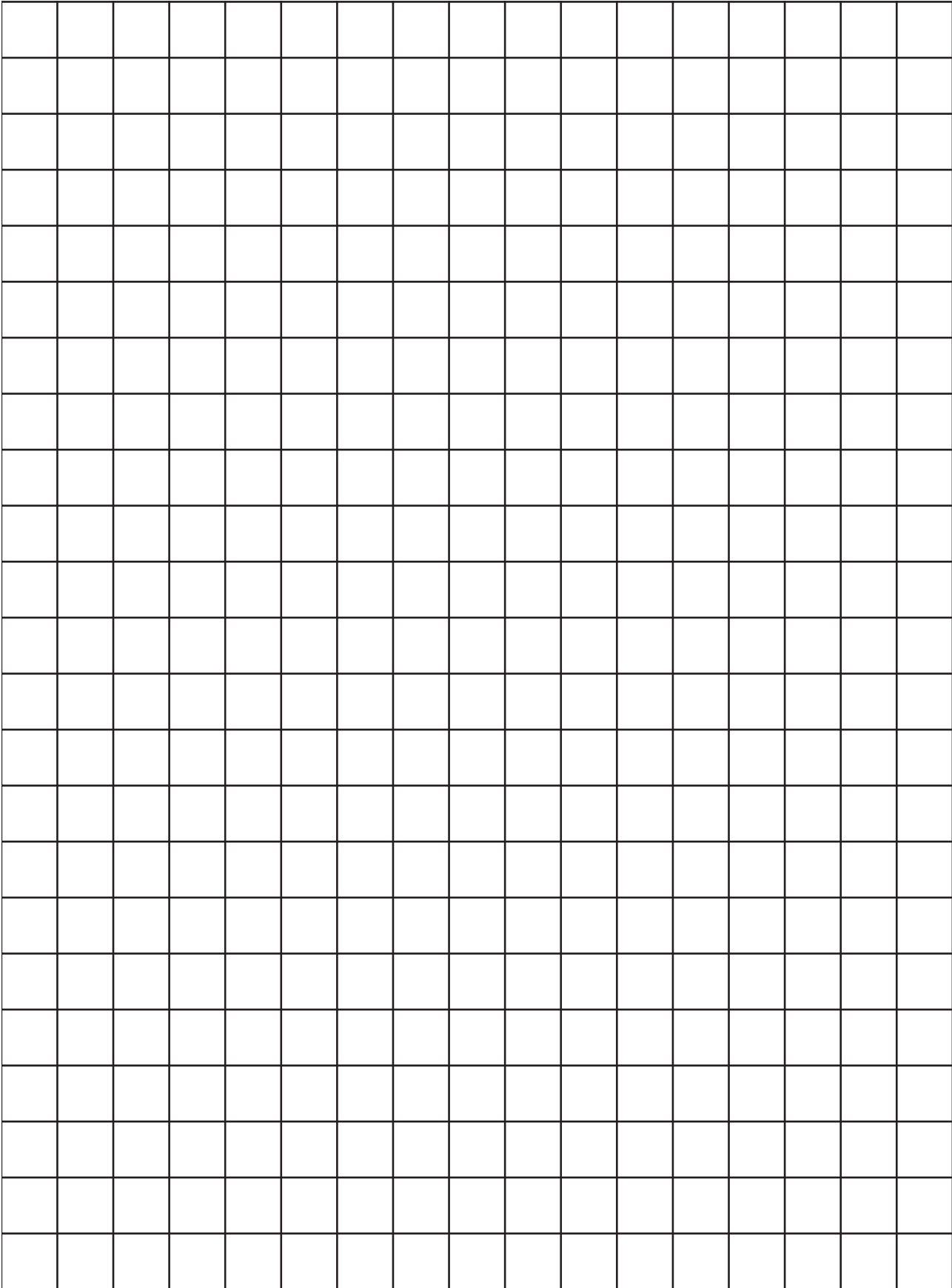


Can you find other pairs that are reflections?

Using 2D representations of 3D objects is very useful; architects, artists, scientists, and mapmakers all depend on this skill.

A French artist named Felice Varini specializes in drawing huge figures that only look right from one perspective. Visit this website: <http://www.varini.org/05vid/vid01.html> to see videos of his work. He paints on three-dimensional objects to create images that appear to be two-dimensional.

Centimeter Grid Paper



Back

Right

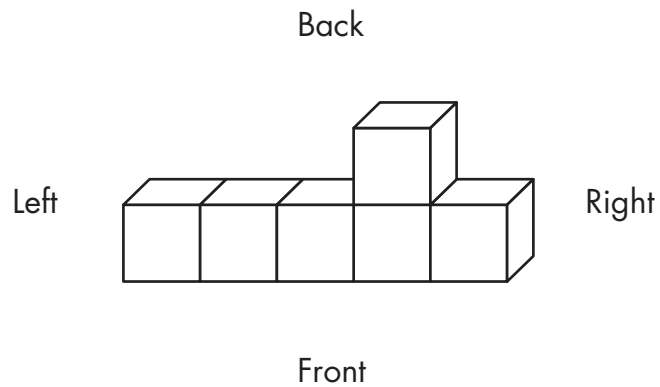
Front

Left

Activity Cards 1 & 2

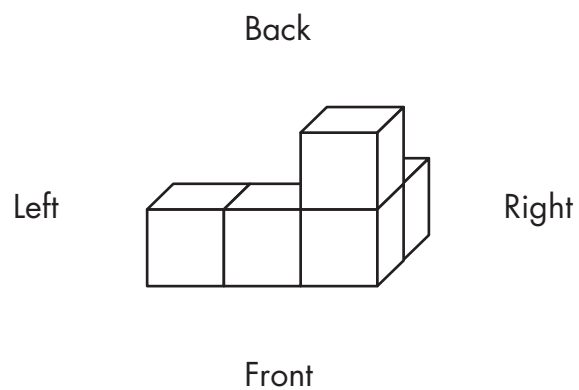
1

Use six cubes to make this structure.



2

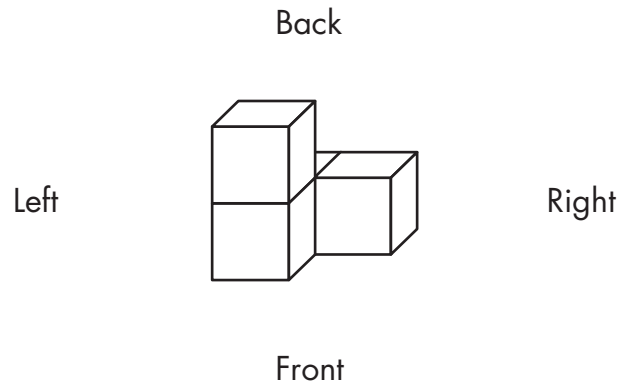
Use five cubes to make this structure.



Activity Cards 3 & 4

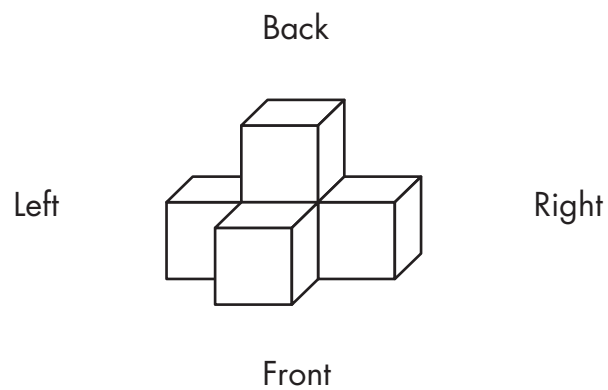
3

Use four cubes to make this structure.



4

Use five cubes to make this structure.

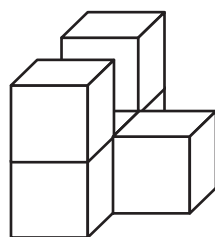


Activity Card 5

5

Use six cubes to make this structure.

Left

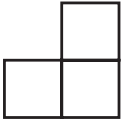
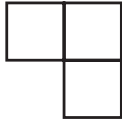
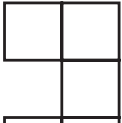
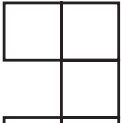
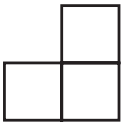
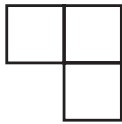
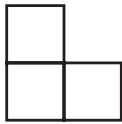
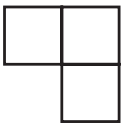
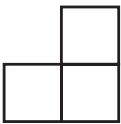
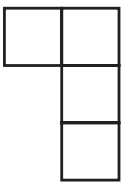
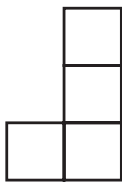
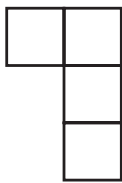
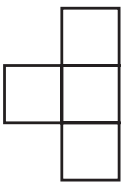
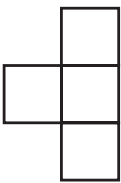



Back

Right

Front

Activity Card Answers

<p>Right</p>  <p>Left</p>  <p>Answers Activity Card 3</p>	<p>Right</p>  <p>Left</p>  <p>Answers Activity Card 5</p>
<p>Front</p>  <p>Back</p>  <p>Top</p>  <p>Answers Activity Card 2</p>	<p>Right</p>  <p>Left</p>  <p>Answers Activity Card 4</p>
<p>Front</p>  <p>Back</p>  <p>Top</p> 	<p>Front</p>  <p>Back</p>  <p>Top</p> 

BUILDING 3D STRUCTURES

Apply transformations and use symmetry to analyze mathematical situations:

- Describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling.

Use visualization, spatial reasoning, and geometric modeling to solve problems:

- Draw geometric objects with specified properties, such as side lengths or angle measures;
- Use two-dimensional representations of three-dimensional objects to visualize and solve problems such as those involving surface area and volume.