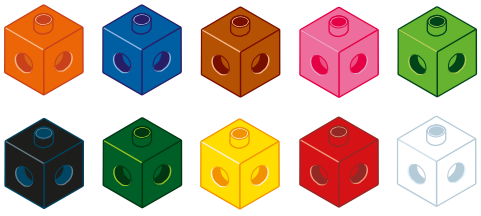
Nothing but Net!

OBJECTIVE

Students will build three-dimensional models to help them draw the nets of figures composed of rectangles and triangles. They then use these nets to find the surface area of such figures.

WHAT YOU WILL NEED

Snap Cubes, 8 rods



OVERVIEW

In this two-player game, students work together with Snap Cubes to create three-dimensional geometric solids that are composed of rectangles and triangles. They then draw the net that, when cut and folded, will model such figures. Once they have verified the net's accuracy, they use it to help them determine the surface area of the geometric solids they have built.

THE BIG IDEA

Nothing but Net! provides an entertaining activity for exploring the relationship between nets and the surface areas of three-dimensional geometric figures that are made up of rectangles and triangles. Remind students that a net is a two-dimensional drawing that can be cut and folded to model a three-dimensional geometric solid. Point out to them that because they break three-dimensional geometric solids into their component parts, nets make finding the surface area of such figures easier.

By drawing its net, students should be able to compute the surface area of a specific three-dimensional figure. As they repeat such surface area computations, they should be able to derive general formulas for finding the surface area of three-dimensional solids of the same general shape.

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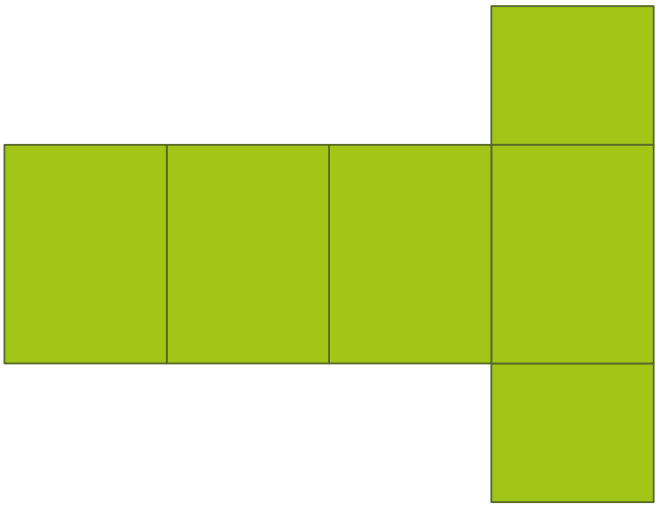
For example:



The surface area of any rectangular prism equals $2(wl + hl + hw)$, regardless of its actual dimensions.

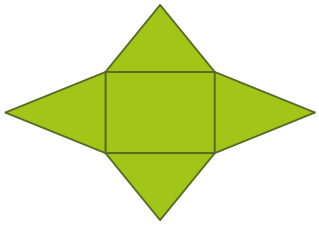
As they increase their knowledge, students should also be able to extend their spatial visualization skills to envision geometric solids that include triangles in addition to rectangles, and they should be able to create nets to model these composite solids. In so doing, they will be able to find the surface areas of three-dimensional geometric solids composed of both rectangles and triangles.

Those students who think ahead and feel motivated will examine their surface area computations to draw this key conclusion: The surface area of a three-dimensional solid is the sum of the areas of its faces.

When students first play *Nothing but Net!,* it is likely that their ability to draw nets and to explain how they are used to find the surface area of a three-dimensional geometric solid will be limited. As they compute actual surface areas from the two-dimensional nets that they draw, they will become more comfortable with modeling three-dimensional solids two-dimensionally on paper and become more comfortable with computing surface areas from such models.

1 INTRODUCTION

- Before working with the class, build a 2 × 2 × 2 cube made up of 8 Snap Cubes.
  - Display the cube and identify its various parts to students: edges, faces, and vertices.
  - Invite students to make observations about which of the cube's parts determine its surface area.
  - Have students suggest how they might take the cube apart and render it as a two-dimensional drawing, or net. Ask them to explain how they can use such a model to help them find the cube's surface area.
- Before sending students off on their own, display a three-dimensional drawing and the net for a rectangular pyramid for use later in game play.



2 ON THEIR OWN

Students will complete On Their Own. During this time, the teacher's role is to:

- ask probing questions to guide and extend
- promote confidence by offering reinforcement
- record student thinking
- record student conversation that promotes collaboration

Use the information gathered to inform the Math Talk.

3 MATH TALK

Invite students to talk about their games.

Use prompts such as these to promote class discussion:

- What was easier, drawing the net or finding the surface area of the three-dimensional solid it modeled once it was drawn? Why?
- What did you notice during the game?
- Would the net and surface area of your three-dimensional geometric solid change if you flipped the figure so that a different side served as its base? Explain.
- How can you use what you've learned to find the surface area of a three-dimensional geometric solid without drawing its net?

4 EXTENSION

Have students work in pairs with the rectangular solids that they developed during game play. Have them consider what the figure would look like if a rectangular pyramid were added to the top of their solid. Challenge them to draw a net to represent this composite three-dimensional solid and to then come up with an equation for its surface area. Have students discuss their thought process in creating and solving such an equation.

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ON THEIR OWN

Play Nothing but Net! | Players: 2

By order of Flatland law, all three-dimensional solids are hereby commanded to become two-dimensional solids. To save all these figures from banishment, you need to make them flat…and fast! But do the Flatland legislatures know what they are doing? Are they going to be able to make room within their borders for all these flattened figures? To find out, you've been assigned to help them calculate the surface area of the three-dimensional figures that live in Flatland.

Game rules:

1. Players start with several rods of Snap Cubes. Each player builds a rectangular solid from his or her cubes.

2. Players then switch places and draw the net for the rectangular figure that their co-player built. If necessary, they cut out and fold their net to ensure that it models their three-dimensional geometric solid.

3. Once both players have completed drawing their nets and have verified their accuracy, they work together to find the surface area of both of their rectangular solids.

   - In the two-dimensional nets that you drew, what patterns did you notice in the faces, edges, and vertices of your three-dimensional figures?
   - What patterns did you notice in the surface areas of your rectangular solids?
   - What conclusions can you draw about nets and the surface areas that result from them?
   - Play several rounds of *Nothing but Net!* using different dimensions and layouts for your solids.
   - Be ready to talk about your games and findings.

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