
Geometry

Set 2: Translations and Rotations

Instruction

Goal: To provide opportunities for students to develop concepts and skills related to translations and rotations of plane figures through space

Common Core Standards

Geometry

Understand congruence and similarity using physical models, transparencies, or geometry software.

- 8.G.1.** Verify experimentally the properties of rotations, reflections, and translations:
 - a. Lines are taken to lines, and line segments to line segments of the same length.
 - b. Angles are taken to angles of the same measure.
 - c. Parallel lines are taken to parallel lines.
- 8.G.2.** Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
- 8.G.3.** Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

Student Activities Overview and Answer Key

Station 1

Students construct rectangles and tape them around a pencil to see how rotating a rectangle forms a cylinder. They then reflect on what part of the rectangle formed the parts of the cylinder.

Answers: a cylinder; the width of the rectangle; a cylinder

Station 2

Students examine a penny and then spin it. They look at what solid the penny looks like when it spins. They then reflect on their experience and apply this to new shapes.

Answers: a circle; a sphere; yes; rotate it around a point on the side of the penny

Station 3

Students explore what happens when a square is translated through space. They first imagine what shape would form, and then place tiles back to back to form the figure. Finally, they apply what they have learned to answer a related question.

Answers: Answers will vary; a rectangular prism; you'd need to know the height or by how many units you were translating the square

Station 4

Students explore how they would turn a circle into a cylinder through translation. They also discuss the volume of the figure they create through either a translation or rotation in space.

Answers: Answers will vary; a translation through space; we just have to multiply the area of the circle by the height of the cylinder to get the volume; answers will vary; no, and the volume would change

Materials List/Setup

Station 1 enough scrap paper and scissors for all group members; tape and a pencil

Station 2 enough pennies for all group members

Station 3 15 one-inch square tiles

Station 4 a paper towel roll

Discussion Guide

To support students in reflecting on the activities and to gather some formative information about student learning, use the following prompts to facilitate a class discussion to “debrief” the station activities.

Prompts/Questions

1. What is the difference between translating a circle through space and rotating a circle in space?
2. What solid would you get if you rotated a triangle in space?
3. When do we rotate solids in real life?
4. What solid would you get if you translated a triangle in space?

Think, Pair, Share

Have students jot down their own responses to questions, then discuss with a partner (who was not in their station group), and then discuss as a whole class.

Suggested Appropriate Responses

1. translation—cylinder; rotation—sphere
2. a cone
3. There are many examples, such as when using a pottery wheel.
4. a triangular prism

Possible Misunderstandings/Mistakes

- Having trouble visualizing plane figures moving through space
- Not correctly taping the paper to the pencil
- Believing that you must always rotate around a figure’s center

NAME: _____

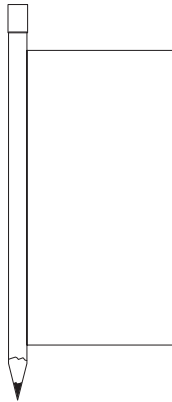
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Station 1

At this station, you will find enough scrap paper and scissors for all group members. You will also find tape and a pencil.

Decide on the dimensions of a rectangle that you would like to use for this task. Each group member should cut out several rectangles of the same size. Tape each rectangle to the pencil so that one side of the rectangle (the length side) is touching the pencil.



Repeat this process at different points around the pencil until all the rectangles are attached.

What solid have you formed? (Look at the pencil from all sides and imagine that there were many more rectangles taped to it.)

In this case, the radius of your solid is equal to what part of the rectangle? _____

If you have a rectangle and spin it, what solid does it form? _____

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Station 2

At this station, you will find enough pennies for all members of your group.

What shape is a penny? _____

Spin your penny. Look at it as it spins. Does it look like it turns into a three-dimensional shape?

What shape?

Do you think the radius of the penny is the same as the radius of the three-dimensional shape you seem to see?

Discuss with your group. How would you rotate a penny through space to get a ring or doughnut? Explain.

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Station 3

At this station, you will find 1-inch square tiles. Work with your group to learn about translating squares in space.

Take one of the squares and move it along the table with one of the sides (not the face) touching the table.

Describe the figure a square makes when it is translated in this manner.

Now place ten of the squares so their faces are touching and they are standing on one of their sides. What figure did you make?

Describe how you could find the volume of a rectangular prism by translating a square through space.

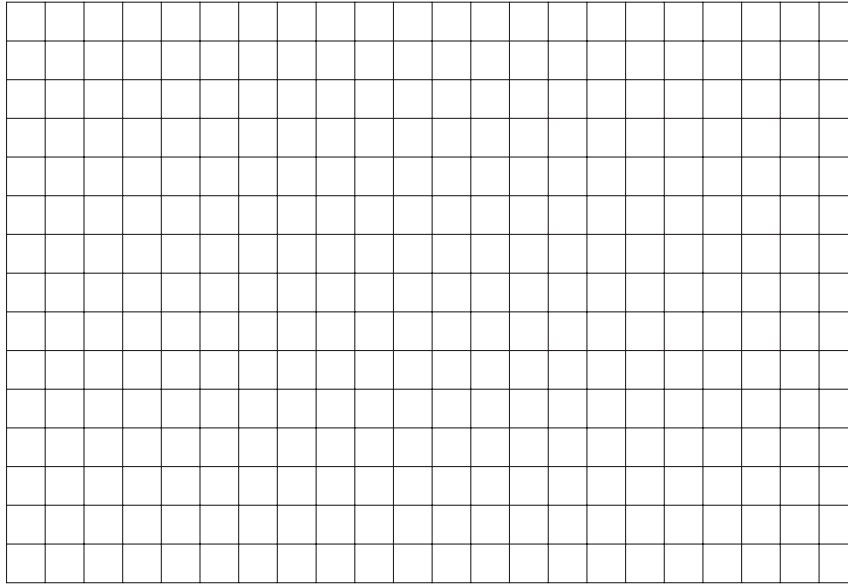
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Station 4

At this station, you will find a paper towel roll. Trace an end of the paper towel roll on the grid below.



Discuss with your group and answer the questions below.

What is the area of this circle? _____

What could be done to this circle to form a cylinder (e.g., translation, rotation, etc.)?

How is knowing the area of the circle the first step to finding the volume of a cylinder?

What is the volume of the cylinder? _____

If you spun the circle through space, would you still get a cylinder? Would the volume be the same?
