# NVACS:  Geometry

In First Grade, students must:

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**Reason with shapes and their attributes.**
Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for measurement and for initial understandings of properties such as congruence and symmetry.

**1.G.1** - Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.

**1.G.2** - Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.  Students do not need to learn formal names such as —right rectangular prism."

**1.G.3** - Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves*, *fourths*, and *quarters*, and use the phrases *half of*, *fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

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## Defining and Non-defining Attributes:

First grades need to determine which attributes of shapes are defining compared to those that are non-defining. Defining attributes are attributes that must always be present, such as, number of sides, lengths of sides, vertices, etc. Non-defining attributes are attributes that do not always have to be present, such as, size, color, orientation, etc. The shapes can include triangles, squares, rectangles, and trapezoids. 1.G.2 includes half-circles and quarter-circles.

For Example:   All triangles must be closed figures, have 3 sides an 3 vertices.
These are defining attributes.
Triangles can be different colors, sizes and be turned in different directions. These attributes are not relevant to whether a shape is a triangle or not, so they are non-defining.

It is important for students to see both regular and irregular shapes to help them communicate defining and non-defining attributes.

Students should see the shapes in various orientations and focus on the defining attributes. A square turned sideways is still a square, not a "diamond." A triangle is still a triangle when turned, not an "upside down triangle.."

Students should use appropriate language to describe a given three-dimensional shape: number of faces, number of vertices/points, and number of edges.

For Example:   A cylinder may be described as a solid that has two circular faces connected by a curved surface (which is not considered a face). Students may say, "It looks like a can."

Students should compare and contrast two-and three-dimensional figures using defining attributes.

For Example:

- List two things that are the same and two things that are different between a triangle and a cube.
- When given a sphere and a circle, students are asked to identify the sphere as being three-dimensional but both are round.
- Present a trapezoid. Ask the students to find another two-dimensional shape that has two things that are the same and two things that are different.

**Composing and Decomposing Shapes:**

Students in first grade compose (build) a two-dimensional or three-dimensional shape from two shapes. This standard includes shape puzzles in which students use objects (e.g., pattern blocks) to fill a larger region.

The ability to describe, use and visualize the effect of composing and decomposing shapes is an important mathematical skill. It is not only relevant to geometry, but is related to children's ability to compose and decompose numbers.

For Example:

Show the different shapes that you can make by joining a triangle with a square.
Show the different shapes you can make joining a trapezoid with a half-circle.
Show the different shapes you can make with a cube and a rectangular prism.

Pattern blocks, plastic shapes, tangrams, or computer games can be used for student to make new shapes. The teacher can provide students with cutouts of shapes and ask them to combine them to make a particular shape.

For Example:

What different shapes can be made from four squares?
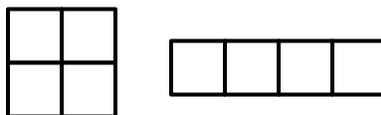
What different shapes can you make from two triangles?

**Partitioning Shapes:**

In first grade, students begin partitioning regions into equal shares using a relevant context such as cookies, pies, pizza, etc... This is a foundational building block of fractions, which will be extended in future grades. Students should have ample experiences using the words, **halves, fourths,** and **quarters**, and the phrases **half of, fourth of,** and **quarter of**. Students should also work with the idea of the whole, which is composed of two halves, or four fourths or four quarters.

For Example:    You have a piece of paper. How can you share it equally with your friend?
Students come up with multiple ways to share the paper equally.
Ask if we can prove each way works?
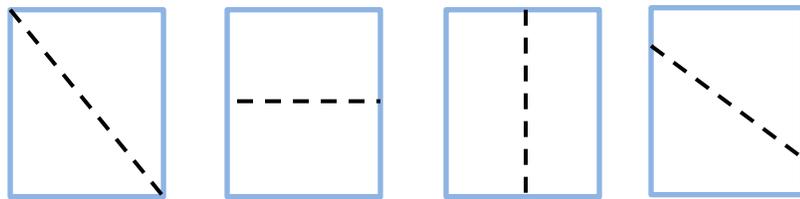
First graders also need to have multiple experiences with different sized circles and rectangles to develop an understanding that the larger the denominator, the smaller the pieces, if the whole is the same. Exploring what happens when we cut objects up into more pieces will help to develop this idea.
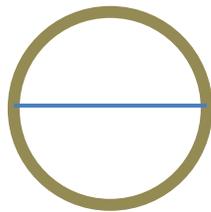
A pizza cut into 2 pieces has larger pieces.
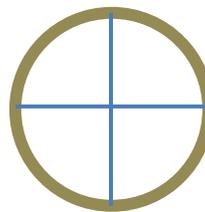
The same pizza cut in to 4 pieces has smaller pieces.