Why

Two- and Three-Dimensional Shapes

Why do we need so many examples of each flat shape for this module?

Young children base their understanding of shapes on examples they can see, touch, and manipulate. To fully master the kindergarten geometry standards, students need access to a variety of two- and three-dimensional shapes.

Typical children's books and media show a very limited set of shapes—generally symmetric, regular shapes. Young children often base their early mental images, or prototypes, on this small subset of shapes.

However, concepts of shape do not build like number concepts. Starting with a small set of prototype shapes and gradually introducing new examples of those shapes over time leads to limited and sometimes inflexible concepts of shape that have to be unlearned. Reliance on typical exemplar shapes can lead students to misclassify shapes because they do not look how students expect. For example, a kindergarten student might say, "That's not a triangle. It's too pointy."

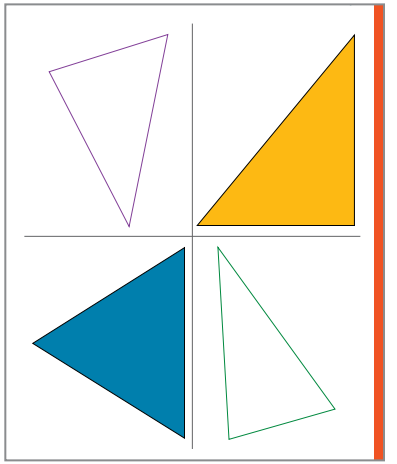
When students work with a variety of examples and nonexamples, they are able to move from a visual level of understanding shapes toward the descriptive level. At the descriptive level, students begin to name a shape based on a set of defining attributes, such as the number of sides and corners, rather than how the shape looks.

What are exemplars, variants, and distractors?

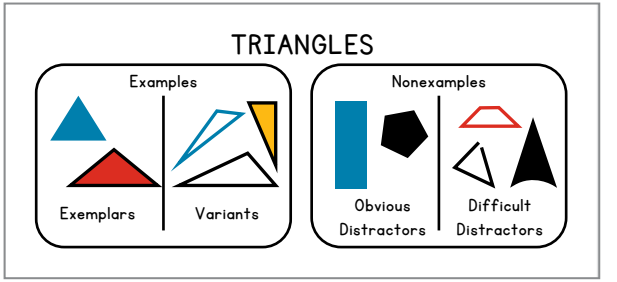
Kindergarten students sort two-dimensional shapes into two groups, examples and nonexamples. Students name these groups based on the target shape. Examples are called *triangles* and nonexamples are called *not triangles*.

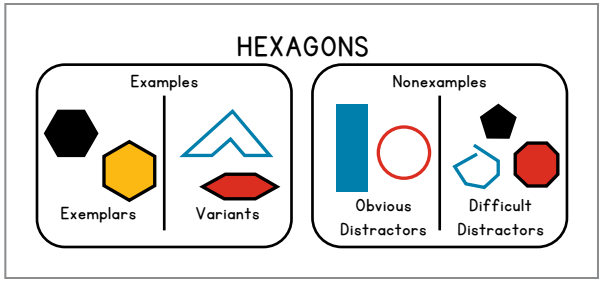
Within the example group, there are exemplars and variants. Exemplars are the shapes that young children typically visualize. They are often symmetrical with a horizontal base. Variants are less frequently encountered in typical children's books and media. To name these shapes, students must pay close attention to defining attributes. Expect to find many variants in the topic A lessons.

Typical Exemplar Shapes



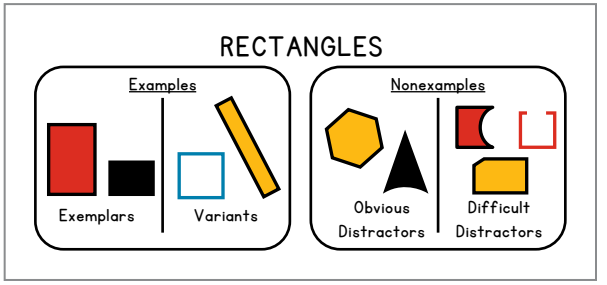
Triangles Removable





The nonexample group can be broken into two parts, obvious distractors and difficult distractors. Obvious distractors do not look much like the exemplars and are easier for children to categorize as nonexamples on sight. They rarely require further investigation. Difficult distractors look more like exemplars, but they do not have all of the defining attributes of the target shape. Difficult distractors require students to attend to defining attributes with more precision. They will be part of all the two-dimensional shape sorts in topic A.

It is not necessary for students to distinguish between exemplars and variants or obvious and difficult distractors. Use the charts to better understand the intentional selection of two-dimensional shapes for each lesson.



How precise do kindergarten students need to be when identifying, building, and drawing shapes?

It is common for students to enter kindergarten at a visual and syncretic level of geometric thinking, which means that their understanding of shape is largely driven by appearance and relationships that are not mathematical. "It's a circle because it looks like a tire." A tire isn't, strictly speaking, a circle, but telling young children this before they begin to understand shape attributes can lead to confusion. Approximation is normal as students develop geometric understanding. Instead of correcting a lack of precision, focus on the mathematical attributes that likely inspired the connection between a real-world object and a shape, "Tires and circles are both round, aren't they?"

The sorting activities and games in this module provide plenty of opportunity to help students develop a more descriptive concept of shape based on defining attributes. Once students become more precise by identifying disqualifiers like openness or curved corners, they are ready to consider why a real-world object might not fit into a shape category, "How are the corners of the train window different from a rectangle's corners?"

When students are constructing and drawing shapes, motor skills and materials significantly impact their precision. Look for intent to create features like straight lines and right angles rather than actual production when assessing student understanding. Gentle pushes toward precision may be appropriate depending on the individual's motor skill development. "Is there a tool you could use to make straight lines?" "Is your shape open or closed? How could you close it?"