

# Design a Custom Package

## Grade Span

3-8

## Subject Area

Math

## Materials

- Fab@School Maker Studio
- Digital fabricator or scissors
- Collection of small objects
- Examples of packaging
- 65lb cardstock
- Rulers, glue, or tape
- Colored pencils or markers

## Online Resources

- [Video: Fab@School Maker Studio Getting Started Tutorial](#)
- [Video: Fab@School Maker Studio Shapes Tutorial](#)
- [Video: Fab@School Maker Studio Video: Cut Fold Tab Tool Tutorial](#)

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Birthdays, holidays, and just because - the perfect package can be hard to find. Using Fab@School Maker Studio, encourage your students to prototype and design the perfect packaging for any object.

## Objectives

- Students will use the engineering design process to define a challenge, criteria and constraints, and brainstorm, design, evaluate, and improve a solution.
- Students will use appropriate math practices and tools to attend to precision while addressing measurement and geometry standards.
- Students will use Fab@School Maker Studio tools including Shapes, Tabs, 3D View, and math tools to design custom packaging and fabricate their design with a digital fabricator.

### Big Idea

Functions help to determine form.

### Driving Question

How can we combine 2D shapes to create 3D shapes?

### Learning Standards

#### CCSS MATH

- [CCSS.MATH.PRACTICE.MP1](#)
- [CCSS.MATH.CONTENT.3.MD.C.5](#)
- [CCSS.MATH.CONTENT.3.MD.D.8](#)
- [CCSS.MATH.PRACTICE.MP5](#)
- [CCSS.MATH.PRACTICE.MP6](#)
- [CCSS.MATH.CONTENT.6.G.A.4](#)

#### NGSS

- [ETS1](#)
- [ETS1.A](#)
- [ETS1.B](#)
- [ETS1.C](#)

#### MA DLCS

- [3-5.DTC.b.2](#)

### Challenge

Design a custom box, gift bag, or other package to hold a small object.

#### Criteria

Ask students to define criteria for success - e.g., the package must be an appropriate size and shape for their object. What else? Explain that sometimes it's not possible to satisfy all criteria. Ask students to decide which criteria are most important.

#### Constraints

Show students what materials are available. Ask them to help define constraints — e.g., limits on time and materials.

### Workshop

#### Brainstorm Solutions

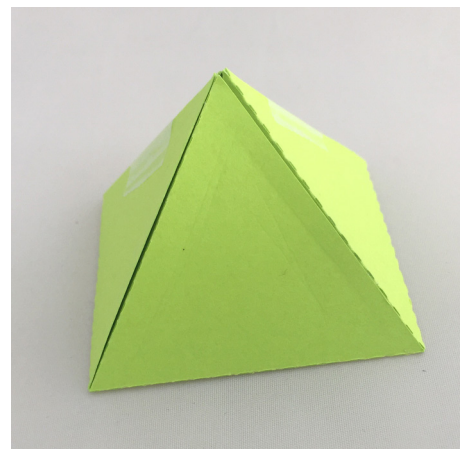
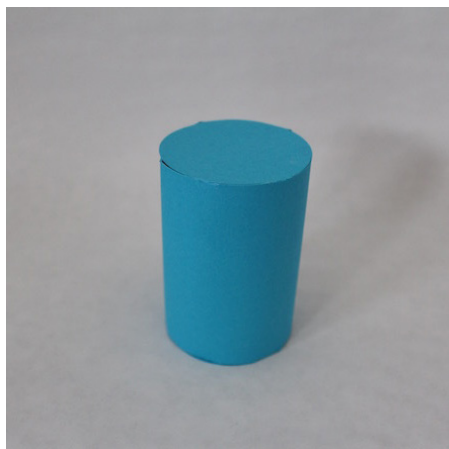
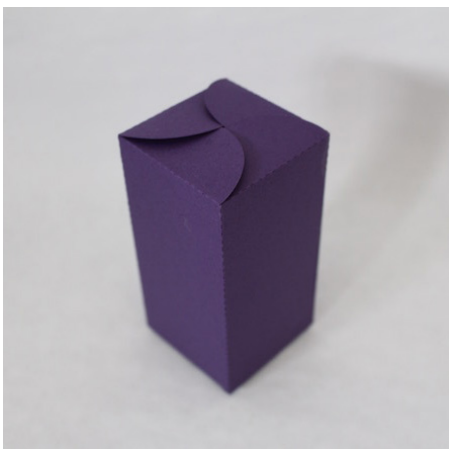
1. Have students work individually, in pairs or small groups to brainstorm packaging ideas for their individual items. Share images of small packages by searching online for images of unique packages for inspiration. You can also have students bring in small boxes, bags, and packages or share examples they've collected. Ask students to unfold packages and explore the flat patterns or nets.
2. Ask students to sketch design ideas.
3. Ask students to evaluate their designs based on the stated criteria and constraints and personal preference. Tell students to choose and refine their favorite design to create in Fab@School Maker Studio.

### Design and Fabricate

1. Have students measure and record their object's length, width, height and then use Fab@School Maker Studio to design a package to fit the object. Students can design their package from scratch or start with a Ready-Made design (Clover Fold Box, Cone, Cube, Cylinder, Hexagonal Box, Party Favor) to modify as needed.
2. Remind students to use Fab@School Maker Studio's Math Tools - **Grid**, **Manipulative Ruler**, **Manipulative Protractor**, **Dimensions**, and **Settings** to choose scale - to be sure their package is sized appropriately for their item.
3. Have students fabricate their package with cardstock.

### Evaluate and Improve

1. Ask students to evaluate their prototypes. What do they like best? What needs improvement? Encourage students to share with each other to elicit more input.
2. Have students use feedback to develop ideas for improving their packages and return to Fab@School Maker Studio to refine their design.



## Fab@School Maker Studio Tips

**Magnetize:** If you want shapes to automatically snap and create fold lines when you drag them together, be sure **Magnetize** tool is on. To learn more about the tool, have students watch the [Fab@School Maker Studio Shapes Tutorial video](#).

**Resizing Shapes:** When creating nets or flat patterns, it's easiest to resize shapes before you snap them together. If you resize a shape that's already snapped to another, you will need to drag the shape away and resnap it to maintain the fold line. To learn more about shapes, have students watch the [Fab@School Maker Studio Shapes Tutorial video](#).

**Cut Fold Tab:** Use the **Cut Fold Tab** tool on the left toolbar to change lines and shape edges into cuts, folds, or tabs. To learn more about cut fold tabs, have students watch the [Fab@School Maker Studio Cut Fold Tab Tool Tutorial video](#).

**3D View:** Expand the 3D View tool in the lower right to preview your folded construction. Note that the first shape you place will be the base and the construction will fold from that plane. Tabs don't show in 3D View.

**Math Tools:** Try using math tools like the **Grid**, **Ruler**, and **Protractor** on the left toolbar to measure elements of your design. You can also display the dimensions of a selected object by opening **Settings** on the top toolbar, and selecting **Show Dimensions** in the **General** tab.

## But Wait, There's More

Now that your students have created boxes for objects, encourage them to explore other design options. Here are a few to get you started:

- Decorate the package with color pencils, markers, or craft materials for a specific event, holiday, or person.
- Modify the package for a different size object or multiple objects.
- Create a package with separate compartments to hold several individual objects.
- Create a package to hold a specified amount of popcorn, nuts, candy, cereal or similar fill.
- Specify additional criteria and constraints and modify your design to meet these requirements.
- Calculate surface area and volume of your package.