Put A Lid On It!

OBJECT

Students learn that in order to copy and cut a shape to fit something, they must use that shape's dimensions and other properties so the new shape matches the old shape exactly.

GRADE LEVEL

Elementary school.

THE CHALLENGE

Use a carpenter's square to cut a lid that fits exactly on top of a box.

TIE TO CYBERCHASE EPISODE In Unhappily Ever After, Jackie, Matt, and Inez have to figure out how to make square corners so that three box lids fit exactly, in order to seal forever the Book of Unhappy Endings.

MATERIALS

- carpenter's square, one per pair of kids
- scissors
- pencil
- glue
- precut tagboard pieces, at least one per box (for kids to measure and cut)
- crayons, markers, glitter glue (to decorate the boxes)
- tape or hinges (hinges optional -- available at craft stores)
- *boxes with lengths and widths less than 11 inches, tops removed (one box for each pair of kids)

*Tissue boxes, cereal boxes, and small-size shoeboxes work well.

Estimated time to complete: 60 minutes.

DISCUSSION

Engineers and architects give builders a set of directions that shows how a building should be constructed (blueprint). Builders often have to work with irregularly shaped materials – leftover scraps of plywood or sheetrock, for example – when building things. They use carpenter's squares to make edges straight and corners square so what they make will fit where they want to put it. Measuring with a carpenter's square is an effective way to cut a shape to fit, and can be even more accurate than tracing it by hand.

ACTIVITY

Before the class period, measure the length and width of each box (you don't need the height) and write the dimensions on the bottom. Write these same dimensions on a scrap of paper to give to the pair who will be making the lid for that box. Cut several pieces of tagboard for each pair of kids. Make some of these irregularly shaped (without square corners). Be sure the pieces are larger than what is needed to cover the tops of the boxes. Set up workstations for each pair of students with all materials except for boxes.

Step 1: Share an example with the class where, without measuring, you had a hard time cutting something to fit onto or into something else. (For example: When cutting paper to line a drawer, you didn't measure how wide or long the drawer was, and the paper you cut was too wide and didn't reach the back of the drawer. Or you were cutting a shelf for a bookcase and you cut the right length for the shelf, but the corners weren't square.)

Ask: What could I have done to make this task easier and successful?

Step 2: Tell students that they are going to make special lids. The lids are special because they have to fit exactly so Hacker can't steal the Book of Unhappy Endings and create chaos in cyberspace. There's only one problem: they have to make the lids before seeing the boxes! Fortunately, though, you have been given the measurements for the box lids, and you know that each of the boxes has square corners. Ask: What are some ways we can solve this problem?

Step 3: Students work in pairs. Give each pair the paper scrap with their box measurements. Using the materials you've provided, have them measure and cut a lid for their box.

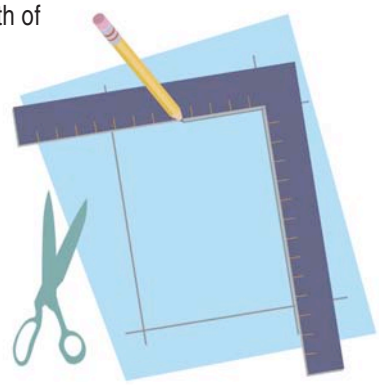
TIP: In some cases, lids may fall into their boxes. To help prevent this, have them cut along the outside of their lines on the tagboard.

As students work, invite them to share problems and successes so that others can benefit from their experience. Help with the use of the carpenter's square as needed. (*See USING THE CARPENTER'S SQUARE* below for more.*)

Step 4: When all the pairs have finished, give them their "magic" boxes to check that the lids fit. (Some pairs may need to re-design: make a second attempt.) Help attach the fitted lids (either with tape or with the optional hinges), and allow time for students to decorate both lids and boxes with the materials provided.

USING THE CARPENTER'S SQUARE

1. Draw a square corner on the tagboard with the carpenter's square. Make the two lines longer than the length and width of your lid.
2. Measure and mark the width of your lid on one of the lines. Measure and mark the length on the other line.



3. Turn the carpenter's square and lay it along the vertical line you just drew. Make the corner of the carpenter's square line up with your mark on the line.
4. Holding the square in place, draw a line across the top. (Make it longer than you need for the lid.)
5. Turn the carpenter's square and lay it along the horizontal line you drew earlier. Make the corner of the carpenter's square line up with your mark.
6. Holding the square in place, draw a line to complete your lid.

**For tips on how to make your own carpenter's square, go to www.eweek.org/site/DiscoverE/activities/index.shtml*

CONNECT TO ENGINEERING

Measurements are especially important to engineers and surveyors. How could they build a house – or a bridge or playground or jelly bean machine – without knowing how BIG or how SMALL to make it? Sometimes you can measure something directly. For example, on a flat lot for a new building, a surveyor could use a chain – one of their tools – or a long tape measure to mark the lot and where the house should be built. But if the lot isn't flat and is BIG, then the surveyor needs to find another way to do the measurements indirectly like the top for the smallest box. They use magnetic compasses to measure angles and math to measure distances that they couldn't do with just a tape. Semiconductor engineers – the people who design the computer chips in games – need to measure things that are less that one hundredth the thickness of a human hair. Astronomers who study the planets and stars measure distances in million and billions of miles or even further.

Build math skills with CYBERCHASE

Check local listings or visit *www.pbskidsgo.org/cyberchase.*