

Montshire at Home: Teacher Guide

WEEKLY THEME: CARDBOARD CREATIONS – Cardboard as a building material is easy to access and use, sturdy yet flexible, and has a surprising amount of textures that you can incorporate into your designs.

MONTSHIRE AT HOME is a series of learning activities, resources and short videos, developed, hosted and curated by the Montshire's Education team. It's designed to support children, families, and teachers with easily accessible concepts, content, and materials while learning at home.

Teachers can use these materials to support remote science learning opportunities for their students at home. Below is a suggested learning progression using this week's theme, activities, and resources found on the Montshire's Online Resource web page.

SUGGESTED LEARNING PROGRESSION

Day 1: Cardboard City

EXPLORE

Design and construct a structure or a whole city for a favorite toy or book character

Think about:

- ▶ What do they need?
- ▶ Where would they like to go?
- ▶ Any special design features that they need?
- ▶ Scale: how big does your design need to be for your toy to fit?

DISCOVER

Features of cardboard as a material:

- ▶ Strength vs. flexibility as a function of going with or against the "grain" of corrugates.
- ▶ That peeling off the top papery layer of cardboard reveals its "cords."
- ▶ Cords make a really cool effect and new texture of material, both from the papery "peelings" and the corrugated piece left behind.
- ▶ Helpfulness of scoring as a way to make corners.

Day 2: 2D to 3D Design

EXPLORE

Go from flat to space-filling with a single piece of cardboard!

- ▶ 3D shapes can be "flattened" into a 2D design.
- ▶ Those 2D designs can be folded back up into a 3D shape.
- ▶ You can use a model to help you figure out how a 3D shape comes together.
 - ▶ You can use blocks or Magnatiles as a model.
 - ▶ You can sketch a model.
 - ▶ You can think about a model.

DISCOVER

- ▶ Models help you understand how to approach a problem.
- ▶ Math and geometry help you make an elegant structure.

EXTENSIONS

- ▶ *Cardboard City* at the Montshire focuses on designing a city with principles of sustainability in mind. All buildings that receive approval from the "City Planning Board" incorporate a certain number of sustainability points. Feel free to use the "Sustainability Points" model in your classes!
- ▶ Explore other geometric shapes like: cones, rectangular prisms, etc.
- ▶ Use a timer to keep track of how long it takes to get from the top to the bottom of your rollway.

Day 3: Abstract Art

EXPLORE

Sometimes you just need to play! Construction for its own sake is an important piece of getting to know a material and for getting out of your own head to find new directions.

- ▶ Can you build something fast and fun and for its own sake?
- ▶ Do these "blocks" help you build something more concrete?
- ▶ Do these "blocks" help you think of something new to make?

DISCOVER

Iteration, making a change based on previous results, is an essential part of the design and engineering process.

- ▶ How did you iterate in this project?

Day 4: Rollways or Marble Run

EXPLORE

- ▶ How can you build ramps and tunnels with boxboard?
- ▶ How can you make your ramps and tunnels stronger?
- ▶ How can you make a rollway last longer?
- ▶ How many different features can you build into your rollway?

DISCOVER

Iteration again!

- ▶ How many attempts does it take to get your marble all the way down your completed rollway?

Day 5: Wearables

EXPLORE

- ▶ Make a hat base.
- ▶ Use skills you gained over the week to create a whole new creation – not just blocks and shapes, but something you can wear!

DISCOVER

- ▶ Expressive design



MONTSHIRE AT HOME: CARDBOARD



Activity: Planning Your Cardboard Design

Develop an amazing 3D creation out of the simplest tools and materials: cardboard, tape, and scissors.

Design a structure or city for a favorite toy or book character. Let your imagination run wild and transform the world around you!

Getting Started

When planning your structure or city, there are a few things to keep in mind. Answer the questions below to help guide your work.

- ▶ Who are you building for?

- ▶ Where do they live?

- ▶ Where would they like to go?

- ▶ What do they need?

- ▶ Any special design features that they need?

Thinking About Scale and Design Constraints

- ▶ If you're building for a real life toy (a doll, action figure, or car), how big does the structure need to be to accommodate your toy? (Think about the size of entryways, windows, etc.)
- ▶ If you're building a world for an imaginary toy or character, how big do you want to go? Consider how much material you have to work with as you plan this.

Make a sketch of your design:



Activity: Transforming 2D to 3D Design

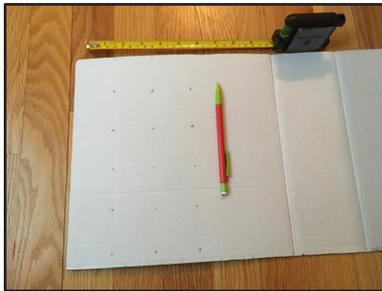
Make a cube from a single flat sheet of cardboard!

MATERIALS

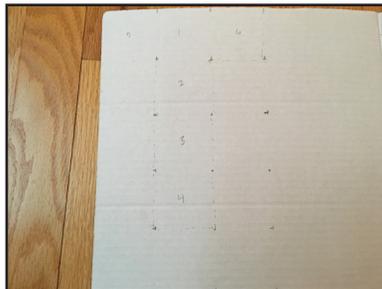
- ▶ Printed template
- ▶ Scissors
- ▶ Pencil
- ▶ Cardboard
- ▶ Tape



1. Print out the template of the "T."
2. Cut out the "T" on the solid lines of the template.



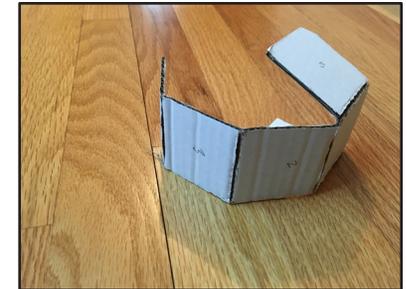
3. Trace the "T" onto cardboard. Mark the dotted lines, too.



4. Cut out the "T" on the solid lines of the cardboard.
5. Score along the dotted lines of the cardboard. Get a grown up to help with this.



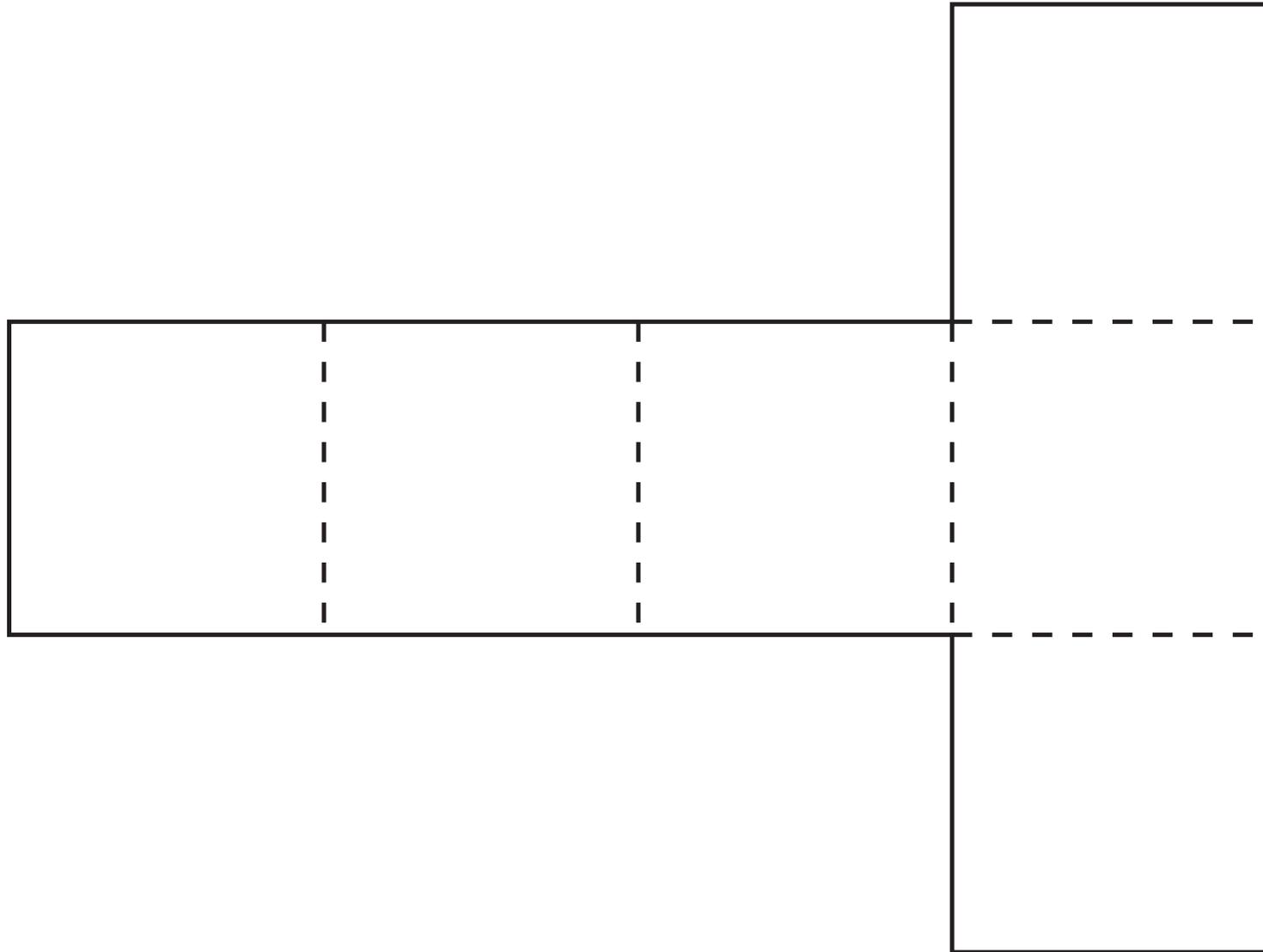
6. Fold along the scored lines.



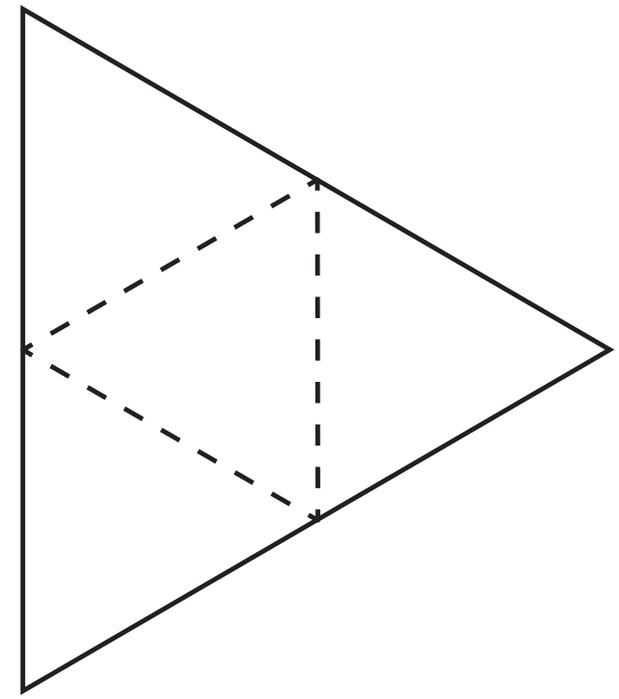
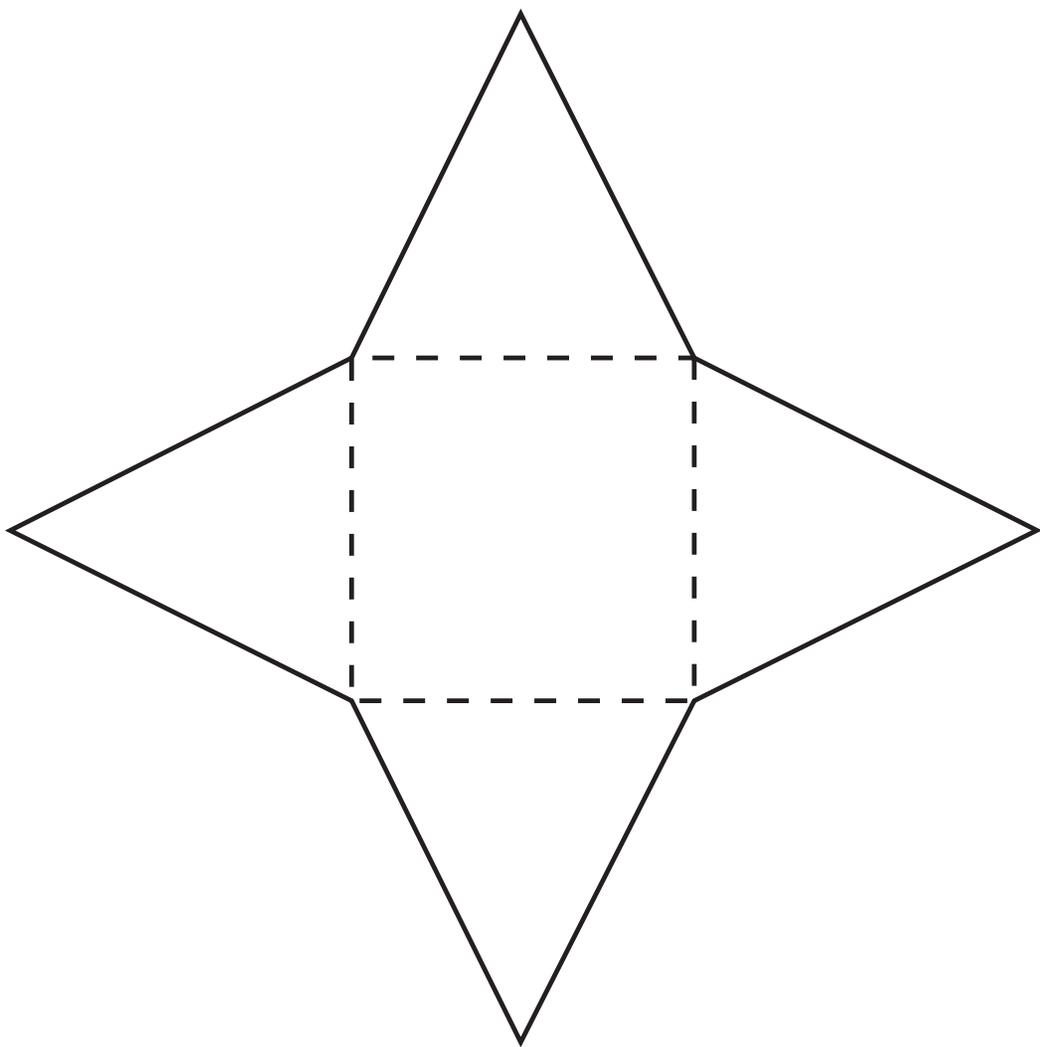
7. Fold up into a cube and tape to hold in place.



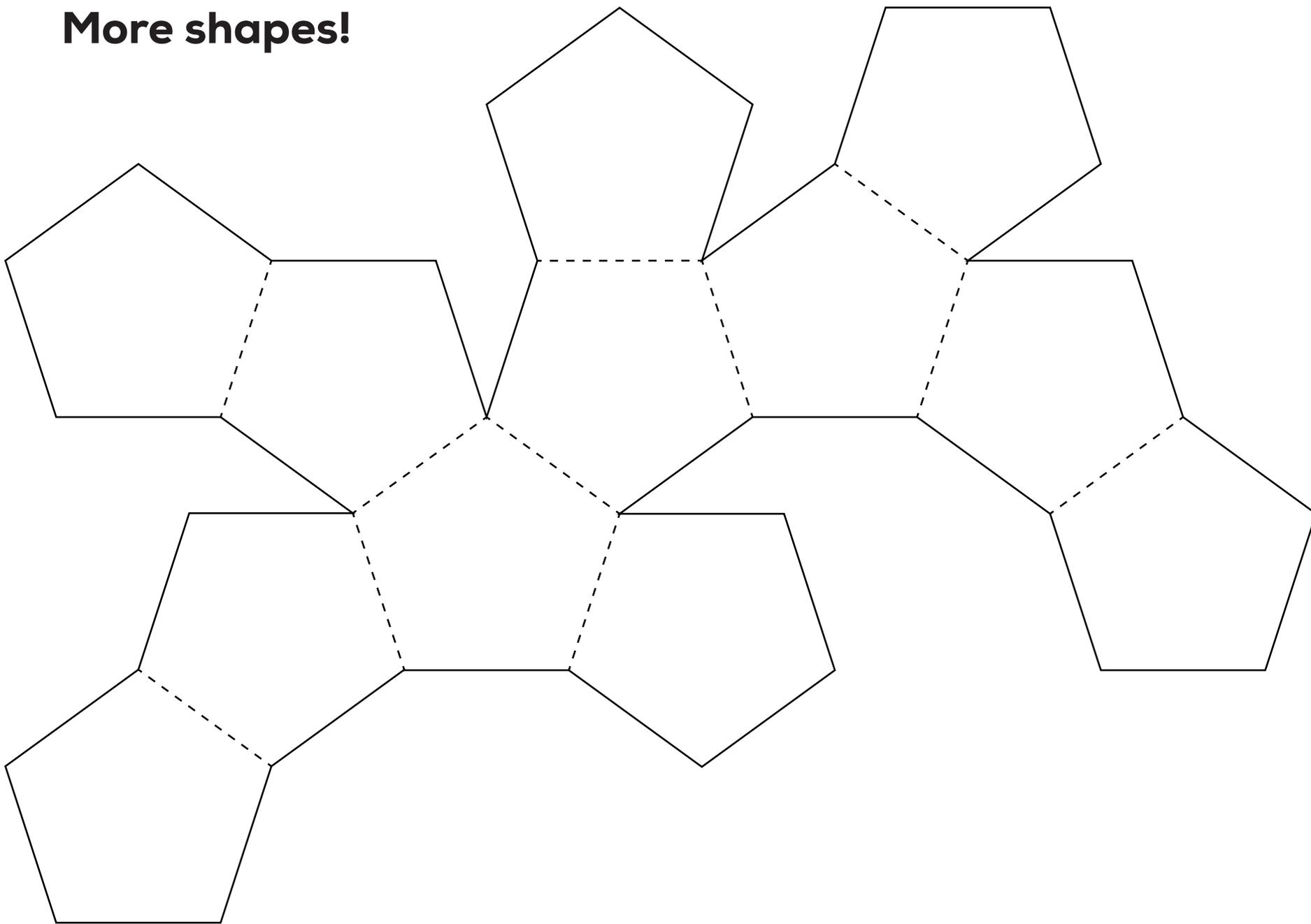
Template



More shapes!



More shapes!





Activity: Create a Cardboard Work of Art

Create a beautiful work of art using a variety of shapes. Each shape will have slots that will allow you to attach different pieces together to form a sculpture that you've designed. The result is a masterpiece from your own imagination!

MATERIALS

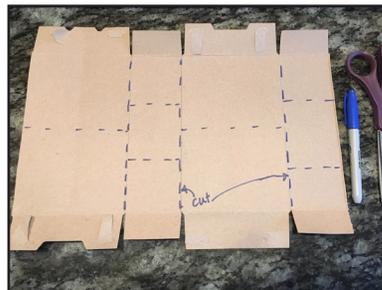
- ▶ Printed template
- ▶ Scissors
- ▶ Pencil
- ▶ Cardboard or boxboard

1. Print out the shape templates.

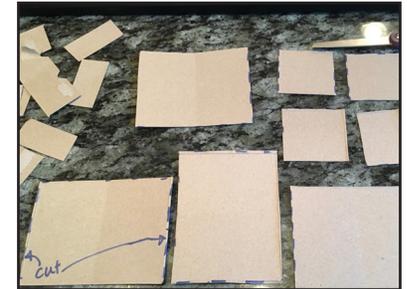
2. Cut out the shapes.



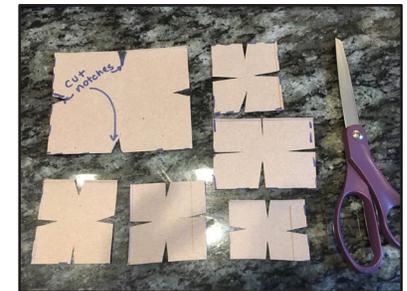
3. Trace shapes onto cardboard.



4. Cut slits into the cardboard shapes using the dashed lines as a guide.



5. Experiment with the depth and width of the slits.

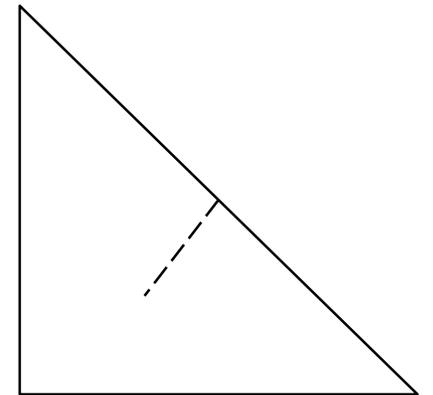
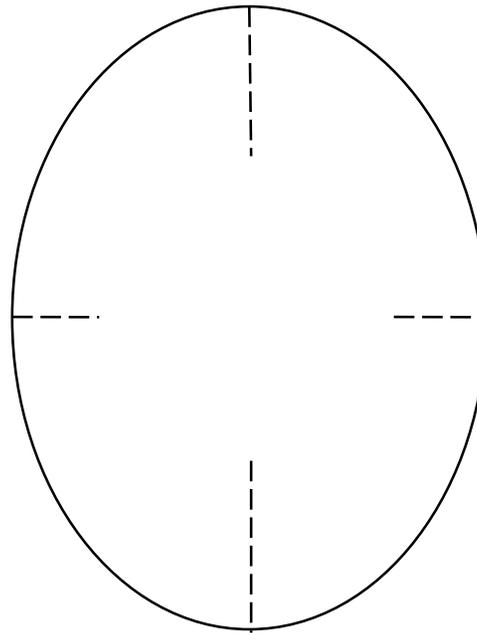
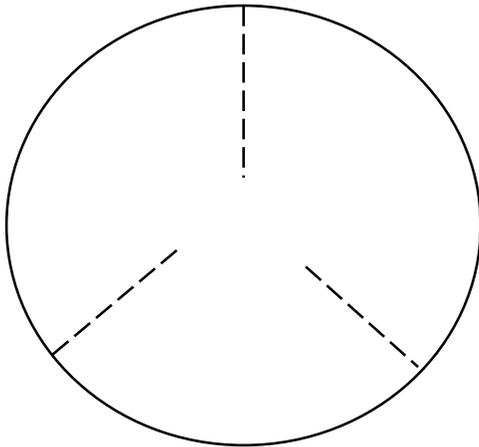
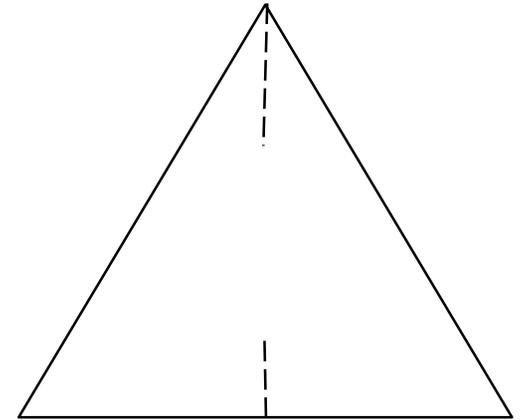
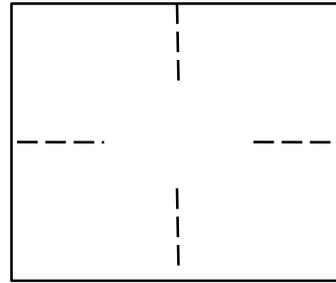
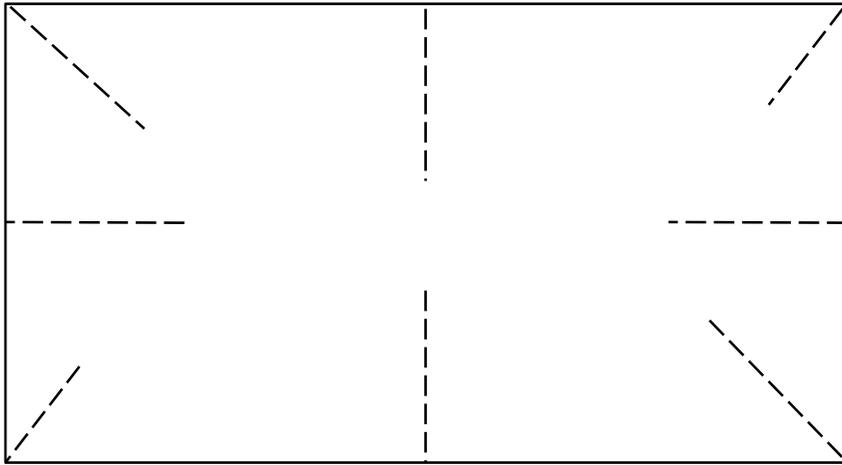


6. Fit shapes together to make an abstract art sculpture. Fold up into a cube and tape to hold in place.



7. Share what you make!

Shape Templates





Activity: Marble Run

Create a marble run from recycled materials!

MATERIALS

- ▶ Cardboard for backboard
- ▶ Single piece of sturdy cardboard about the size of a board game lid or the side of a medium size box; about 12" x 18"
- ▶ Boxboard (cereal box material) for ramp and other elements
- ▶ Cut into about 1" wide strips; lengths can be cut to size as you build
- ▶ Tape (masking tape, duct tape, painters tape, or scotch tape will work)
- ▶ Scissors
- ▶ Marble or other small object that rolls
- ▶ Paperclips (optional, but highly recommended)
- ▶ Toothpicks (optional)
- ▶ Paper (optional)
- ▶ Straws (optional)

CHALLENGES

1. Keep your marble rolling down your backboard as long as you can. Use a timer!
2. Incorporate at least 10 elements into your rollway.
3. Incorporate at least 3 different types of elements into your rollways (ramps, tunnels, trap doors, seesaw, etc.)

ELEMENTS OF A ROLLWAY

1. Ramps
2. Tunnels
3. Trap Door
4. Jump
5. Hoop
6. Seesaw
7. Pinwheel
8. So many possibilities!

WAYS TO ATTACH RAMPS TO A BACKBOARD

1. Tape
2. Anchor toothpicks into backboard as brace for ramps
3. Make an L bracket out of a paper clip or piece of boxboard
 - ▶ Bend a paperclip or strip of boxboard into an "L" shape
 - ▶ Tape your "L" to the backboard; try both orientations to see what works for you
 - ▶ Rest ramp to "L"
 - ▶ Tape ramp to "L"



Activity: Cardboard Wearables

Make a fashion statement by creating your own hat! Use your newfound cardboard crafting skills to create something fun, different, and wearable.

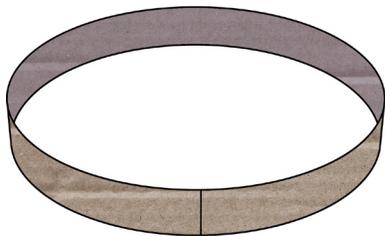
Instructions

Make box board strips

- ▶ Flatten a cereal box or other box made of boxboard.
- ▶ Cut the box board into long, 1.5-2" wide strips.

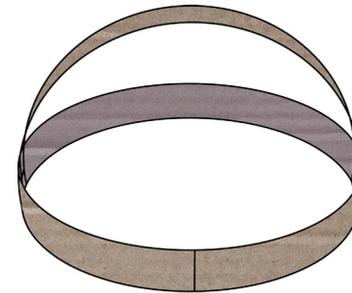
Make the hat band of your hat

- ▶ Measure the circumference of your head where you would like your hat to sit.
- ▶ Tape strips of box board together until it's equal to the length you measured. You may find it easier to overlap the strips by an inch or so.
- ▶ Test that the attached strips are long enough to fit around your head. Then tape it together when it's the right length. You might want to ask someone for help with this.



Make the arch of your hat

- ▶ Wearing your hat band, measure across the top of your head. Start at the base of the rim of your hat, right above your ear, and measure across the very top of your head to the other ear— all the way to the bottom of the rim of your hat.
- ▶ Tape strips of box board together until it's equal to the length you measured. You may find it easier to overlap the strips by an inch or so.
- ▶ Test that the new attached strips are long enough to fit across the top of your head. Tape it in place. You might want to ask someone for help with this.



Use your imagination!

- ▶ Now that you've got a base, you can make any kind of hat that you like – baseball hat, tophat, tiger hat, the sky's the limit!