

# Fabricate and Assemble a Spinning Top

## Grade Span

3-8

## Subject Area

Math

## Materials

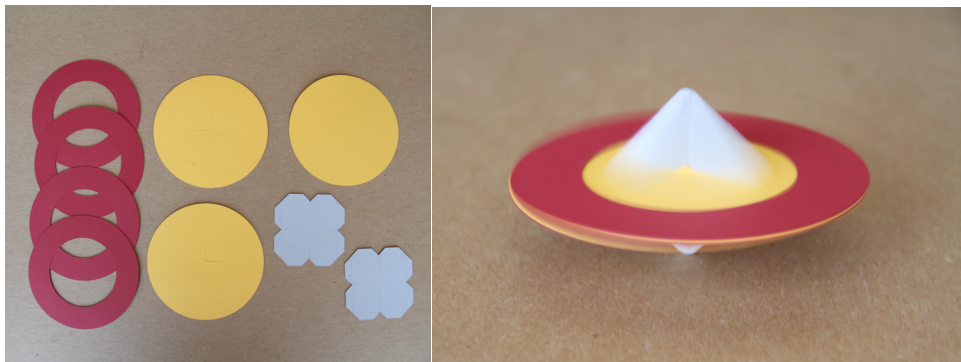
- Fab@School Maker Studio
- Printer
- Digital fabricator or scissors
- 65lb or 110lb cardstock
- Tape or glue
- Popsicle stick (optional)

## Online Resources:

[Fab@School Fabrication Quick Start Guide](#)

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From simple games to physics demonstrations, Spinning Tops are an iconic toy with big scope. They are one of the earliest invented toys in history, and have found a place in many cultures around the globe.

Through this Fab@School Maker Studio project your students will fabricate and assemble their own paper spinning top. Set it spinning and watch as the power of inertia keeps it balanced on its tip!

This model is a light challenge to assemble, and will incorporate the folding and gluing of paper. Read the instructions carefully before assembly.

The top parts are listed below with the color used in this guide:

- 2 Tips (gray)
- 1 Disc (yellow)
- 2 Slitted Discs (yellow)
- 4 Weight Rings (red)

## Objectives

- Students will use Fab@School Maker Studio to fabricate and assemble their own paper spinning top.
- Students may experiment with new prototype top designs based on what they have learned.

## Big Idea

Functions help to determine form.

## Driving Question

What makes things spin?

## Learning Standards

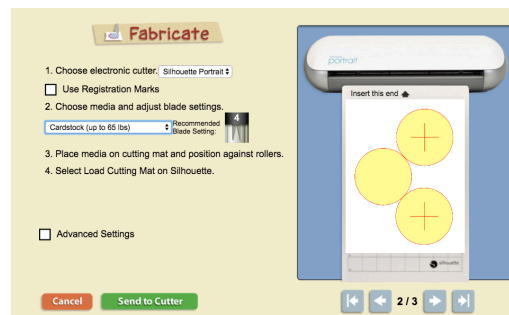
## NGSS

- [PS2.A: Forces and Motion](#)

## Part 1 - Fabricate the Spinning Top

1. Log in to **Fab@School Maker Studio**. From the **Main Menu**, select **Ready-Made Projects** and choose the tab for **3D Stuff**. Locate the **Spinning Top** from the list and select **Open**. The top parts will open in the **Edit Screen**. The top parts are spread across two pages. You can navigate between pages by using the arrows on the bottom-left of the screen.

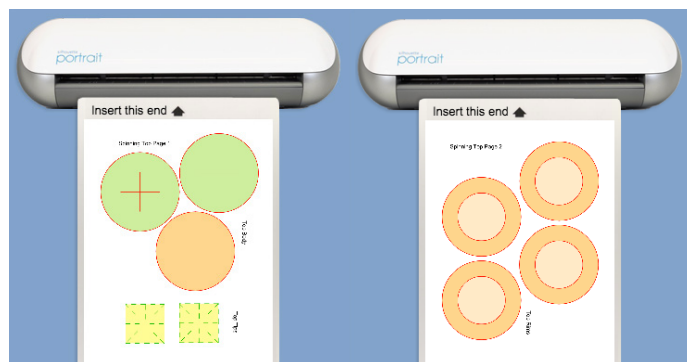
2. Be sure the **FabPrintServer** app is running and your digital fabricator is connected, then click the **Fabricate** icon in Fab@School Maker Studio. Place a sheet of cardstock on the sticky side of the cutting mat as shown in the dialog and feed it into the Silhouette digital fabricator. Follow the directions and click **Send to Cutter**.



**Tip:** For more information on using the Silhouette digital fabricator, read the [Fabrication Quick Start Guide](#).

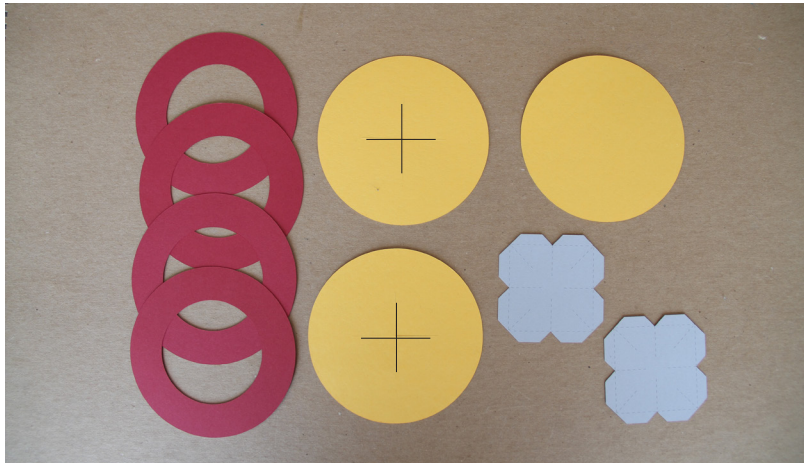
3. When the digital fabricator is done, remove the mat from the machine and peel the cardstock from the mat. Place the parts aside and recycle the scraps.

4. The Spinning Top project uses two sheets of paper. Click the **Fabricate** tool again and use the arrows underneath the preview image to select the next page to fabricate. Repeat the process in Step 2 with the second page of the project.

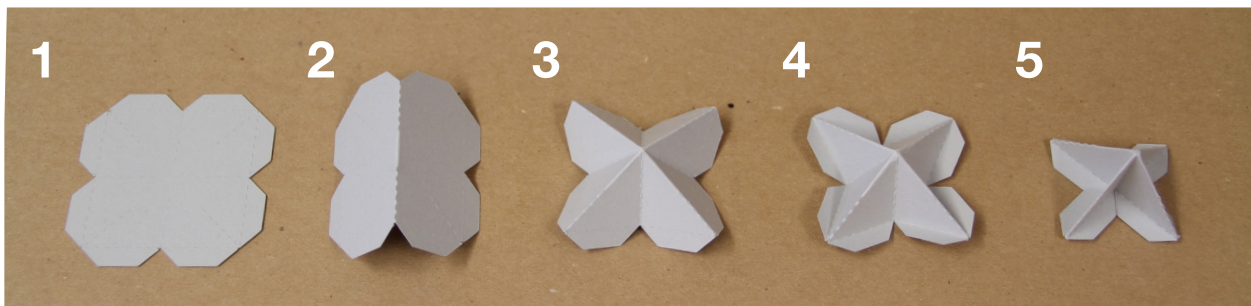


## Part 2 - Assemble the Spinning Top

1. Locate and arrange the parts pictured below. There will be two foldable tip pieces, three discs, and four ring shapes. Two of the discs will have a plus-shaped slit in the center.

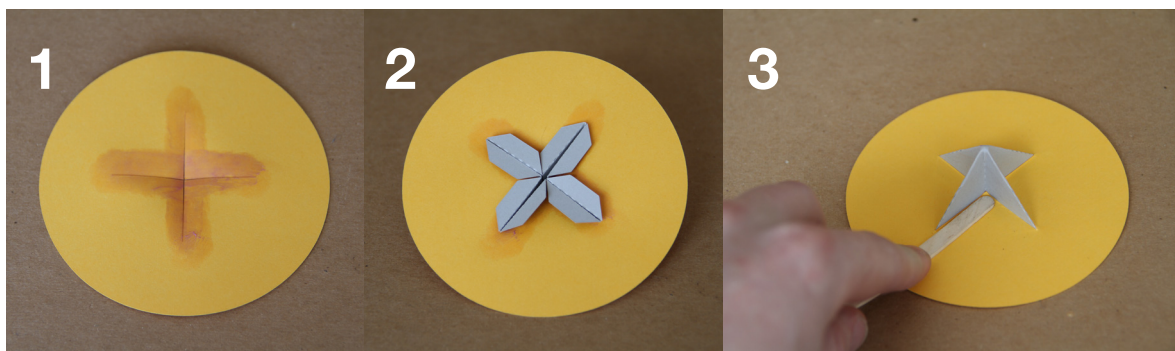


2. Fold the two tip pieces as shown in the picture below. The longer folds on the corners should fold out like mountains, and the shorter folds in between should fold in like valleys.



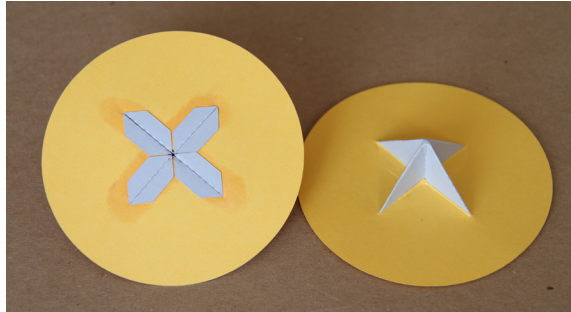
3. Take one of the discs with a plus-shaped slit and glue a plus shape right over the two cuts. Fold the tip part tightly and insert it into the plus-shaped slit until the tabs touch the glue. Press all of the glued surfaces firmly together to make sure they form a strong connection.

**Tip:** A popsicle stick is very useful for pressing together any glued surfaces.

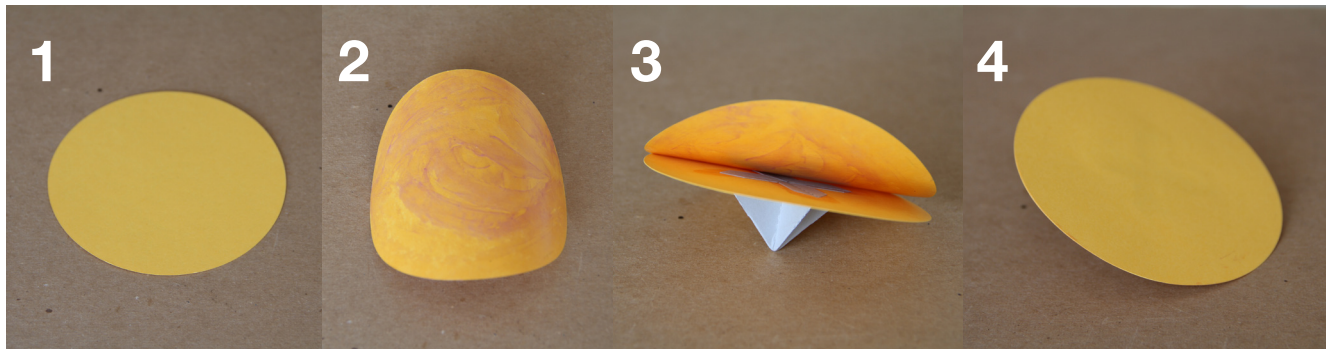




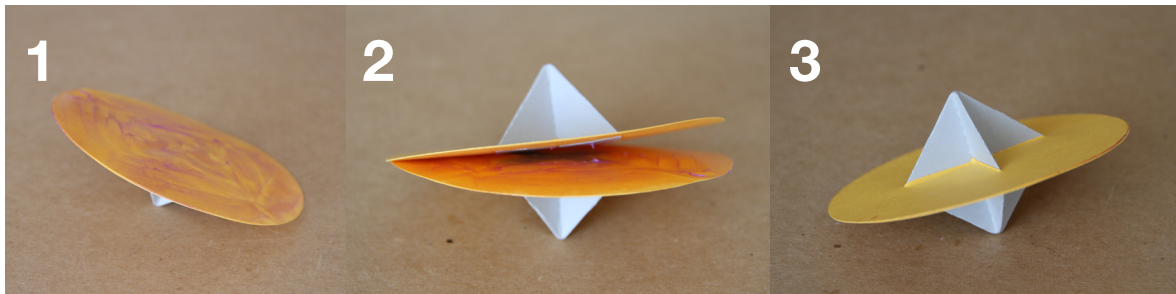
Repeat this process with the other disc and tip so that you have two disc/tip parts.



**4.** Take the one normal disc and glue one entire side. Attach the glued disc over the tabs of one of the disc/tip parts. Make sure the edges of the two discs line up perfectly.



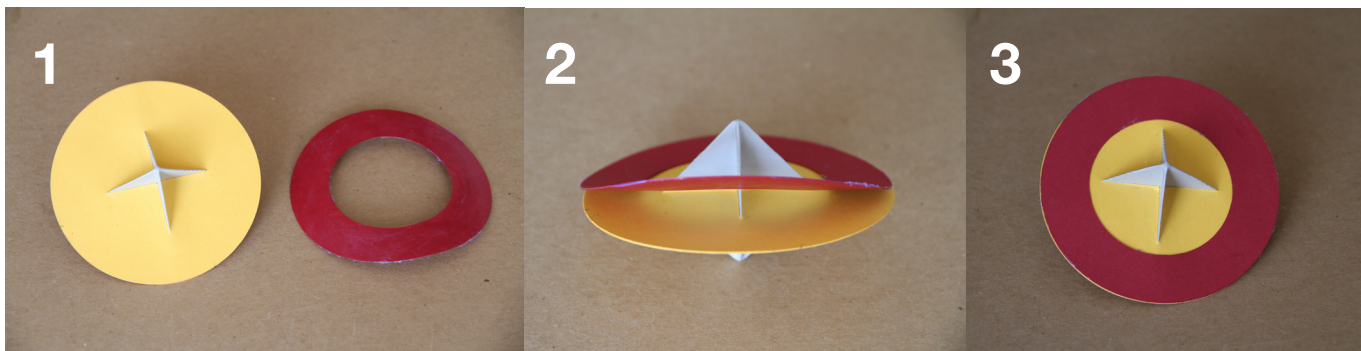
**5.** Glue the exposed side of the normal disc you just glued on, and attach the second disc/tip part onto the glued surface. Make sure the edges of the discs line up perfectly. This will create a solid disc with tips coming out of both sides.



**6.** Locate the four ring shapes. Glue one side of one ring and attach another ring to the glued surface to create a ring twice as thick. Make sure the edges of the rings line up perfectly. Do this twice so that you end with two rings that are each two sheets thick.

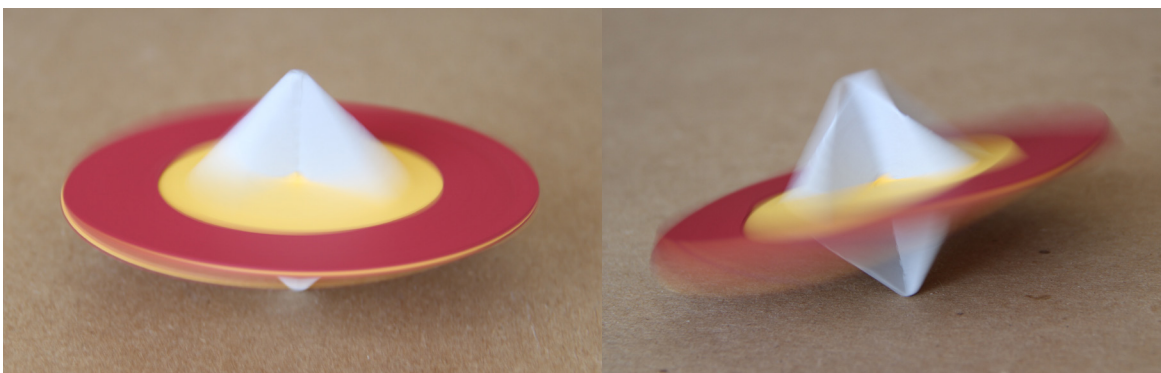


**7.** Glue one side of a thick ring and attach it to the edge of the main disc. Attach one ring to one side, and the second to the opposite side. Make sure the edges of the rings and disc line up perfectly.



**8.** Press everything together firmly to make sure that the glue adheres well. Shape the disc with your fingers so that it is as flat as possible. Your Spinning Top is now fully assembled!

Hold the top from one tip and place the opposite tip on the table, then give it a spin! Your top should balance while it rotates, and then fall over as it slows down.



## Fab@School Maker Studio Tips

**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](#).

**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

### Experiment with different weights of paper

How does a lighter or heavier top change how it spins? Can the top be too heavy or too light?

### Try adding weight to different parts of the top

Does the top spin better with a heavier edge and lighter center, or lighter edge and heavier center?

### Experiment with different shapes

Can you make a top that is not circular? Does that change how it spins? Can you use symmetry in your design?

### Spin Top Challenge!

Introduce a challenge to the class to create a top that spins the longest in the class. The class can also work together to collectively develop and improve one or a few ideas.