



# MAGICAL MARBLE COASTER

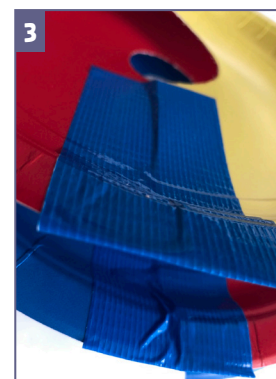
You don't have to be The Grand Jerome to build a roller coaster! With the basic technique described here, you can create a marble coaster full of twists and turns—just like in Adventure Kingdom!



## YOU'LL NEED:

- 1 paper towel tube
- Pencil
- 6 large paper plates with high edges
- Scissors
- Duct tape
- Marbles

1. Use one end of the paper towel tube to trace a circle in the center of each plate.
2. Use scissors to cut a straight line from the edge of a plate to the center circle, then cut out the circle. Repeat on four more plates.
3. Stack the plates with their cut edges lined up. Use duct tape to attach one cut edge of the top plate to the opposite cut edge of the plate below it, as shown. Repeat with the remaining three plates, creating a spiral.



**Use a longer tube and more plates to create a taller, more gravity-defying spiral!**

4. Slide the tube through the center of the plates. Position the top plate about 1 inch from the top of the tube, and tape the inside edge of the plate to the tube. Repeat with the remaining plates, spacing them about 2 inches apart.
5. Tape the bottom of the tube to the center of the uncut plate, and tape down the bottom of your spiral. Put your marbles at the top of the coaster and send them for a spin!



## MAGICAL MARBLE COASTER (CONT.)

Try adding a second spiral of smaller plates or connecting multiple spirals with smaller cardboard tubes, or experiment with steeper spirals and different building materials! How do these different configurations affect the speed (velocity) of the marble? Note your observations and hypotheses below, then conduct a few tests to see if you were right!



OBSERVATION	HYPOTHESIS	EXPERIMENT	OUTCOME



# MYSTICAL MIRRORS: INVESTIGATE REFLECTION AND REFRACTION

Clark and Karoline need to rescue The Grand Jerome from the Hall of Mirrors—a carnival illusion that can make you question everything you see. Create your own illusions with these mirror experiments!

## YOU'LL NEED:

- Paper
- Markers or crayons
- 2 small plastic mirrors with straight sides



## REPAIR THE MAGIC COIN

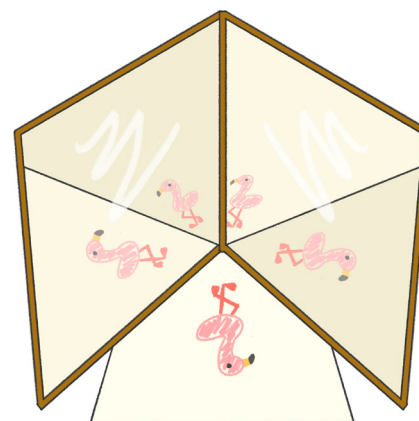
Draw half of The Grand Jerome's coin on a piece of paper. Stand a mirror along the flat edge of the coin you drew, and just like magic, you'll see a whole coin! Now place the second mirror next to the first so their edges are touching on one side, with the coin between them. How many coins do you see? What happens if you angle the mirrors toward each other? How about farther away?



## COMPLETE THE CAROUSEL

Draw an Adventure Kingdom carousel animal. Can you use the mirrors to create the illusion of a full carousel?

**What other patterns can you create or complete with mirrors?**



## FUN FACT

For a mirror to work correctly, it has to be a perfectly flat, smooth, reflective surface.

When mirrors are bowed in (concave) or out (convex), our eyes see a distorted image—just like you'd see in a fun house or hall of mirrors!

## HUNT FOR THE GRAND JEROME

Reflected light bounces off a surface, but refracted light passes through. You can find both reflective and refractive surfaces around your house (or classroom).

For this experiment, you'll need a partner, two flashlights, and a dark space! Creep through your own hall of mirrors, aiming your flashlights at different objects. Decide together if they have reflective or refractive properties. Hint: Check out the oven door, a glass of water, and even the silverware (or anything else you can find made of glass, metal, or another surface you think might reflect or refract light!)

