From the Yes, It's Math! Gallery: Sisyphus

At Discovery Museum, we use magnetic force to create detailed patterns in our

Sisyphus Kinetic Art Table, a component of our Yes, it's Math! Gallery. Let's make some of our own eye-catching patterns using the same materials and magnetic force that Sisyphus does. And as always, please share your experiences with us using the email address found on the last page. We'd love to know what you discover!

Make Your Own Sisyphus Exhibit

Supplies

Be sure to ask an adult for help as you gather your supplies to create your exhibit!

- Sugar, flour, sand, dirt, or another fine substance to serve as your art medium
- A canvas on which to smooth out your art medium, like a tray, cutting board, portable tub, driveway, or other outdoor area
- Tools to use as stamps and pencils on your canvas, like toothpicks, forks, sticks, spoons, cups, cookie cutters, combs, and anything else you want to try
- Ball to roll on your canvas

*Don't have the suggested supplies? We've got you covered! Check out the "**Get Creative!**" section below.*

Exploration: Create Your Canvas

- Spread your medium evenly onto your canvas.
- Play with making shapes and patterns on your canvas with different objects by pressing them into your art medium, or drawing with them, or both! Remember that you can clean some or all of your canvas with your hand whenever you want.
- Choose a pattern you like and try repeating it across your entire canvas.

What do you notice?

Things To Try

- Experiment with using both thick and thin lines on your canvas.

  What do you observe about the movement of your medium?

- Experiment with how hard you push objects into your canvas.

  What do you observe about the movement of your medium?

- Play with the spacing of the pattern you repeat—also called your *repeating unit*.

  What do you notice when your repeating units are far apart? Overlapping?

  Do your repeating units ever interlock?

- Vary the size of your repeating units.

  What do you observe about the number of repeating units you can make when your repeating units are large? When they are small?

- Explore making a larger image out of small repeating units.

  What do you notice about your creation process when you try this?

- Explore making a large shape and then dividing it into smaller shapes.

  What happens to the space inside your larger shape?

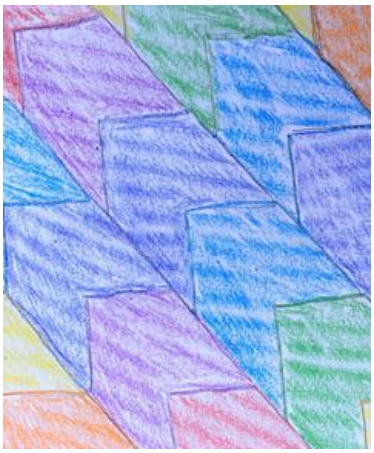
- Try rolling your ball through your art medium on your canvas

  What do you notice about the shape of the path the ball makes?

What's Going On?

What happens when you draw on your canvas? What sorts of patterns do you see? Do you notice both big and small patterns in your artwork?

A pattern is anything that repeats, and if you start to look for patterns in your world, you might notice them all around. Patterns can be found in tiger fur and zebra stripes, quilts and blankets, music and poetry, and graphs and number tables. Patterns can take up lots of space, like those formed on sand dunes by blowing wind (see photo), and they can be tiny, like those in a snowflake. What sort of patterns do you notice around you now?



Shapes and numbers are fun places to make and find patterns. When you count by twos ("2, 4, 6, 8…who do we appreciate? Patterns!"), you are counting in a pattern. When you draw a big circle with smaller and smaller circles inside of one another, you are drawing a pattern. One very famous artist from the mid-1950s named M.C. Escher loved to play with patterns and shapes. Many of his best-known works of art are *tessellations*, a type of pattern where shapes fit closely together, often interlocking with their neighboring shapes (see photo).

M.C. Escher also played with *symmetry*—the property of an image looking the same from different perspectives. Have you ever noticed that the number zero looks the same right-side up and upside-down? That's because it has symmetry. Or that the letters W and M look like each other, just upside-down from one another? That's because of symmetry, too. At the Museum, many of the designs that appear in our Sisyphus exhibit have symmetry. Next time you're here, look for that symmetry by standing at different spots around the exhibit and notice whether the image looks the same from each place you stand.
Now that we have investigated the world of patterns a little bit, let's explore what happens underneath the exhibit to make those patterns appear.

The Sisyphus exhibit at the Museum uses a powerful magnet located underneath the table to move a metal ball around the sand canvas. The relationship between this magnet and the metal ball makes possible the intricate patterns that we see. Let's recreate this important relationship now. But keep your canvas handy—we'll play with it again soon.

Supplies

Be sure to ask an adult for help as you gather your supplies to create your exhibit!

- Magnets
  - Look in your kitchen, on white boards and file cabinets, and in games
  - Not all magnets attract one another…do yours?
- Small ferrous objects
  - An object that is ferrous is attracted to magnets because it contains something called iron. Iron is attracted to magnets due to its material properties. (Did you know? An early word for iron was "ferrum," which is why we call objects with iron in them ferrous!)
  - Nuts and screws, paperclips, and buttons that you can pin to fabric are often ferrous. How can you tell? Use your magnets to test for attraction!
- Thin, somewhat see-through materials such as a sandwich bag, wax paper, parchment paper, and tracing paper.
- A rigid recyclable top or wide tub

*Don't have the suggested supplies? We've got you covered! Check out the "**Get Creative!**" section below.*

Exploration: Investigate Your Magnets

- Grab two of your magnets and hold them together. If they push apart, flip one around—if that's possible—until they pull together and connect.
- Pull your magnets apart again and place one on each side of one of your thin materials you collected so that they clamp together across your material (see photo).
- Grab onto the magnet on the bottom, and very slowly move it around your material.

What do you notice?

Things To Try

- Start to move your bottom magnet faster.

What happens?

- Try placing different thin materials between your magnets.

What do you observe?

- Use different magnet pairs with your thin materials.

What do you notice?

- If your material is rigid enough, pull your bottom magnet off of the material and slowly move it around, holding it just below the surface of your thin material.

What do you observe?

Exploration: Inspect Your Ferrous Materials

- Now grab your favorite magnet to move around, your favorite thin material, and one of your small ferrous objects.
- Put the magnet on the bottom of your favorite thin material and place the small ferrous object on top.
- Grab onto the magnet on the bottom, and very slowly move it around your material.

What do you notice?

Things To Try

- Start to move your bottom magnet faster.

What happens?

- If your material is rigid enough, pull your bottom magnet off of the material and slowly move it around, holding it just below the surface of your thin material.

What do you observe?

- Try different thin materials while keeping your magnet and small ferrous object the same.

What do you notice?

- Try different magnets while keeping your thin material and small ferrous object the same.

What happens to the movement of your ferrous object?

- Try different small ferrous objects while keeping your thin material and magnet the same.

What do you notice about the movement of your objects?

From this series of experiments, have you discovered some materials that work better than others? Let's use these data to gather supplies for the finishing touches on our Sisyphus exhibit.

Supplies

- Favorite thin materials & your rigid piece of plastic
- Favorite magnets & strongest magnet
- Favorite small ferrous objects & most magnetic small ferrous object

You only need one of each type of material listed above, so it's okay if your favorite magnet is also your strongest—you can just use the one magnet.

Exploration: Magnetic Motion

- Experimenting with our final exhibit may get a little messy so try to locate a surface where it's okay to spill your art medium.
- In your messy lab area, evenly spread your medium onto your rigid piece of plastic.
- Place your favorite ferrous object onto your canvas.
- Place your favorite magnet below your canvas and move it around until it connects with your ferrous object. This may require you to hang part of your canvas off of a table (see photo). If you run into challenges getting your magnet and object to connect, check out the **Get Creative!** section below for some troubleshooting tips.

- Very, very slowly move your magnet around the underside of your canvas. Try not to spill too much of your medium!

What do you notice?

Things To Try

- Using the pile of tools you collected, try out some of the designs you made in our **Exploration: Create Your Canvas**.
  What do you notice?
- Experiment with different ferrous objects.
  Does their shape affect the path they carve?
- Experiment with different magnets.
  Does their shape and strength change the movement of your objects?

Get Creative!

Remember, experimenting is about trying new things, observing what happens, and then trying more new things. Not all of the supplies and setups you try will work equally well, and that's ok! It's an experiment! Here are some questions to help you get creative and practice your troubleshooting…

- Don't have a ferrous object? No problem! Try using two magnets instead. Remember to make sure they connect together before placing them in your exhibit.
- Having difficulty moving your ferrous object? Try:
  - positioning the magnet at one end of your object so that you pull the object from its end rather than its middle
  - checking your canvas for stickers or writing that may be interfering. Avoid these areas or replace your canvas with something smoother.
  - decreasing the amount of art medium on your canvas
  - switching out your magnet and/or object
- Having trouble making the pattern or picture that you want? These are very tricky tools to use! The images may not come out exactly how you envisioned them, but keep practicing, or try a new technique or tools. Drawing with magnets and random objects is not easy, but hopefully it is still fun and surprising.

What's Going On?

When you move your magnet around the underside of your canvas, does your ferrous object follow? How do different pairings of magnets and ferrous objects affect the pathways and patterns you make on your canvas?

As you have observed from your homemade Sisyphus exhibit, magnets exert a *force* that has an effect on some objects. The force that a magnet exerts on an

object can vary depending on 1) the distance between the magnet and the object and 2) the strength of the magnet's *magnetic field*.

First let's explore the concept of a magnetic field. A magnetic field is the area around a magnet where its magnetic force can affect the objects around it. As an object moves from the center of a magnetic field out towards the field's perimeter, the magnetic force weakens. Do you notice a difference in your magnet's ability to move your objects when the magnet is touching the thin material compared to when you move the magnet slightly away? By moving your magnet, you move the center of the magnetic field away from your object, therefore weakening the magnetic force on your object.

Perhaps not surprisingly, the strength of a magnet's magnetic field also affects its magnetic force on an object. Which do you think pulls and pushes on an object with more force: a strong magnetic field or a weak magnetic field? A strong one! So, the strength of your magnet's magnetic field also influences how your magnet and ferrous object interact.

Now that you have built your own Sisyphus exhibit, you know how the one at the Discovery Museum works. It uses the invisible force of a magnet to pull a ferrous ball through sand, carving mesmerizing repeating units. A tiny computer underneath the sand canvas controls the magnet's movements. In your Sisyphus exhibit, what controls the magnet's movements? You! You are a critical part of your Sisyphus exhibit, designing a limitless number of new patterns to share.

Discovery Museum Sisyphus Challenge

The Sisyphus exhibit at Discovery Museum (see photo) makes all of its patterns without the ball ever lifting out of the sand. Can you make some patterns without lifting your objects off of your canvas?

- Start with drawing patterns with your finger, being careful to only use continuous lines.
- Find your favorite object from **Exploration: Create Your Canvas**, and create a picture or pattern using it while trying not to lift your object.
- Bonus challenge: Use your favorite magnet and ferrous object to draw a picture on your canvas.

What happened to your patterns when you only used continuous lines and curves?

What is the hardest part of creating an image using only one line?

Are some designs easier to do than others when using continuous lines and curves?

Share Your Discoveries with Us!

We want to know about your Sisyphus exhibit. Share your experience with us in any of the following ways:

- Draw a picture
- Take photos of your very own Sisyphus
- Write down which supplies were your favorites to use, why you liked making your own Sisyphus exhibit, or any other fun things you discovered

Then email us at myhomediscoveries@discoveryacton.org. We can't wait to hear from you!

And next time you're at the Discovery Museum, check out our Sisyphus exhibit on the second floor, and be sure to share with us what you learned from the exhibit you created at home. We'll see you here!

Want even more Sisyphus fun?

Check out these resources!

Activities:

- Create your own Sisyphus, this time with magnets and paint! https://leftbraincraftbrain.com/five-minute-craft-magnet-painting/

Videos:

- Sisyphus artist describes his artwork: https://www.youtube.com/watch?v=W0QmRd0PiOU
- A look inside Sisyphus: https://www.youtube.com/watch?v=-xGQmm7FXD4