

BOOK LIST

- ***Patterns! Action Math*** by Ivan Bulloch. New York, NY: Two-Can Publishers, 2002.
- ***Arabic Geometrical Pattern and Design*** by Jules Bourgoïn. New York, NY: Dover Publications, 1973.
- ***Beach Patterns: The World of Sea and Sand*** by Stella Snead. Barre, MA: Barre Publishing, 1975.
- ***By Nature's Design*** by Pat Murphy. Vancouver, B.C: Raincoast Books, 1993.
- ***Forms and Patterns in Nature*** by Wolf Strache. New York, NY: Pantheon Books, 1973.
- ***Kente Colors*** by Deborah M. Newton Chocolate. New York, NY: Walker and Company, 1996.
- ***Lots and Lots of Zebra Stripes: Patterns in Nature*** by Stephen R. Swinburne. Honesdale, PA: Boyds Mills Press, 1998.
- ***Mathematics: The Science of Patterns*** by Keith Devlin. New York, NY: Scientific American Library, 1997.
- ***Math For Fun: Discovering Patterns*** by Andrew King and Tony Kenyon. Brookfield, CT: Copper Beech Books, 1998.
- ***Math in Science and Nature: Finding Patterns in the World Around Us*** by Robert Gardner. New York, NY: Franklin Watts, 1994.
- ***The Nature and Science of Patterns*** by Jane Burton and Kim Taylor. Milwaukee, WI: Gareth Stevens Publishing, 1998.
- ***Nature's Paintbrush: The Colors and Patterns Around You*** by Susan Stockdale. New York, NY: Simon and Schuster Children's Publishing Division, 1999.
- ***On the Surface of Things*** by Felice Frankel and George M. Whitesides. San Francisco, CA: Chronicle Books, 1997.
- ***Once Upon a GEMS Guide: Connecting Young People's Literature to Great Explorations in Math and Science*** by Lawrence Hall of Science. Berkeley, CA: University of California, 2000.
- ***Patchwork Patterns*** by Jinny Beyer. McLean, VA: EPM Publications, 1979.
- ***Symmetry in Chaos: A Search for Pattern in Mathematics, Art, and Nature*** by Michael Field and Martin Golubitsky. New York, NY: Oxford University Press, 1992.
- ***The Spider Weaver: A Legend of Kente Cloth*** by Margaret Musgrove. New York, NY: Blue Sky Press, 2001.
- ***What's Next, Nina? (Math Matters)*** by Sue Kassirer. New York, NY: Kane Press, 2001.

COLLECTION OBJECT DESCRIPTIONS

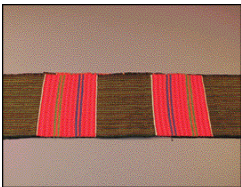
LINEAR REPETITION

INDIA PRINTING BLOCK



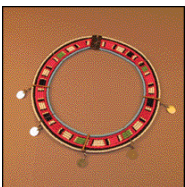
This stamp or block, made of teak or a similar wood, is decorated with a design that is used to create a repeating pattern in textile printing. Wood block textile printing is still done in some places in India. A printer dips the surfaces of the stamp into a tray filled with dye and repeatedly presses it onto the cloth, taking care to line up each impression. Elaborate patterns may require multiple blocks each with an element for a particular design—for example, one block for the outline, another for filler, and a third for highlights. To create a multicolored pattern, each block is dipped in a different color and then stamped one on top of the other, creating the final design. Both chemical and vegetable dyes are used.

KENTE CLOTH



The process of textile weaving is a form of linear repetition in action. The designs of many textiles are also linear repeating patterns. Traditional kente is handwoven in three to four inch wide strips on a horizontal treadle loom by the Asante peoples of Ghana, Africa. The strips are then assembled into large pieces of cloth that are wrapped around the body to make dresses or robes. Traditionally kente is a high-status garment worn for ceremonial occasions. Patterns are named and colors may be symbolic. Today's kente may be printed rather than woven. Kente cloth has become very popular. Contemporary kente may be found in a wide array of products from backpacks to baseball caps.

MAASAI NECKLACE

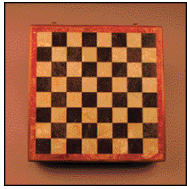


This necklace, created by a cooperative of Maasai women for export, is similar to traditional Maasai neck collars. With their bold geometric patterns, beaded collars are a good example of linear repetition. Maasai women often wear many collars at one time. Maasai women shave their heads, which makes their decorative ornaments especially striking. Neck collars with jingles, like this one, are worn during singing ceremonies. The women perform stylized head movements and the jingles add another musical layer to their songs. Maasai girls make beaded jewelry to catch the attention of Maasai warriors. Beads were introduced to the Maasai about 200 to 250 years ago. Since then, patterned beadwork has played an important role in the lives of Maasai women. The tradition of creating beadwork is passed along from mother to daughter.

● COLLECTION OBJECT DESCRIPTIONS ●

TESSELLATIONS

MOSAIC CHECKERBOARD



This mosaic checkerboard is a regular tessellation. Each square piece is fitted together without any gaps, and the pattern goes in all directions. This contemporary piece of mosaic work is part of a much longer mosaic tradition; and while not all mosaics are tessellations, many are. Mosaic work dates back to 4,000 B.C. in ancient Mesopotamia. The first mosaics were bits of shell, rock, and clay. Later mosaic work incorporated stone and colorful glass. This checkerboard was made in India of precisely-cut and inlaid stones. Game boards like this have been used to play chess, checkers, and draughts for centuries. There are even images of checkerboards on ancient Greek urns and in Egyptian tombs!

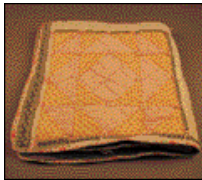
CENTRAL ASIAN TORTOISE SHELL

Testudo horsfieldi



The Central Asian tortoise, also called the Russian tortoise, is found in the semi-arid grasslands and rocky hillsides throughout southern Russia and parts of the Middle East. The protective shell of the Central Asian tortoise is made of a bone substructure, covered by pieces of hard horn-like material. These tessellating plates are called scutes. As the shells of turtles and tortoises grow, the diameter of each of the scutes increases. A hardy plant eater, the Central Asian tortoise feeds on the dried grasses and twigs of the harsh Central Asian landscape.

AMERICAN QUILT



If you look closely you can see that the tessellating pattern of this quilt is made up of triangles, squares, and long rectangles. This is a good example of a typical American-style quilt from the 1930s. Women of the Catskills region of New York made the quilt on consignment for sale at Russell's General Store in Bovina, New York. The popular art of making pieced quilts dates back to the 1800s in America when machine-made fabric became widely available. In principal, quilting is very simple. To create a bed covering, small pieces or scraps of fabric are sewn together. In practice, however, master quilt makers demonstrate their skills and artistry through highly complex patterns and designs.

● COLLECTION OBJECT DESCRIPTIONS ●

SPIRAL OBJECTS

FOSSIL AMMONITE



Like the living nautilus, this ammonite grew its spiral shape slowly, adding successively larger segments to the coil as the animal matured. Ammonites are the fossil relatives of the living octopus, squid, and nautilus. Ammonites became extinct, together with the dinosaurs, at the end of the Cretaceous period about 65 million years ago. Ammonite fossils help paleontologists determine the age of certain sedimentary rocks. Among the most beautiful fossils, ammonites were once animals that lived deep in the open water of the world's oceans. Paleontologists have found many species of them, including long knife-shaped and spiral-shaped forms. The largest ammonites grew to a diameter of over six feet!

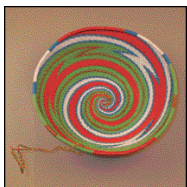
SPLIT NAUTILUS SHELL

Nautilus pompilius



Nautilus, part of an ancient line of sea-dwelling creatures, have been on Earth for 500 million years. Like ammonites, nautilus are cephalopods and are related to octopuses and squid. The hard spiral-shaped outer shell consists of a series of chambers separated by curved cross plates; the last and largest chamber houses the living animal. As the nautilus grows, a new and larger chamber is added. Each chamber is connected by a small hole or septa. It is believed that nautilus control their buoyancy by filling the smaller, empty chambers with gas. Because nautilus live deep in the ocean, their life and habits are something of a mystery to scientists.

IMBENGE BASKET



For centuries, Zulu men of South Africa have been famous for their sturdy and beautiful spiral baskets woven from grasses and palm leaves. During apartheid, Zulu men often worked as watchmen at construction sites. These workers, who could not find traditional natural materials like palm fronds, began to use materials that they found—including colorful, plastic-coated wires discarded from telephone installation. The practice of using this recycled material caused some problems, however, as craftspeople began to disassemble telephone hardware to gather material for their weaving. Salvaged telephone wire is now supplied directly to the weavers. Traditional imbenge are small baskets used to store dry food or as beer pot covers. The construction and patterning of today's imbenge baskets have been adapted from traditional Zulu designs and are made by women as well as men.

● COLLECTION OBJECT DESCRIPTIONS ●

BRANCHING OBJECTS

BRUSH CORAL

Pocillopora species



Stony corals, like this branching brush coral, form the backbone of the world's coral reefs. Surprisingly, each coral is a colony of very tiny animals, called polyps. The branching shape of these corals probably helps the organisms in the colony to receive an adequate supply of food. As each new generation of coral animals grows, it adds to the branching shape of the colony. Over the course of thousands of years, the calcareous skeletons of corals, algae, and sponges have cemented together, forming the giant coral reefs. You can see the location of each tiny polyp by looking at an empty coral under a magnifier. As they grow, coral polyps secrete a hard structure called chitin. The chitin anchors the coral and protects the living polyps from predators. The polyps open up at night and filter food from the surrounding ocean waters. All living coral is part of a very fragile ocean community that is in danger from the by-products of industries such as agriculture, fishing, and recreational diving.

LICHTENBERG FIGURE



The beautiful tree-like branching pattern seen inside this plastic cube is the result of discharged electricity. To create the pattern, tiny negatively-charged particles called electrons were fired at the plastic, traveling at almost the speed of light using a Linear Particle Accelerator. When the plastic could not hold any more, the electrons escaped along the shortest path, leaving a branching figure behind. In a sense, a Lichtenberg figure is captured lightning. The first Lichtenberg figures were discovered by accident by the pioneering German electrical experimenter, Georg Christoph Lichtenberg (1742–1799).

MANGANESE DENDRITES



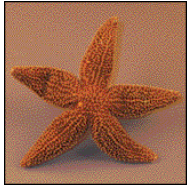
Dendrites look like fossil ferns, but they are really a special type of mineral crystal. Many minerals can form dendrites when conditions are right. This specimen was formed by the mineral called manganese oxide. Dendrites are most commonly found in sedimentary rocks and form when those rocks come in contact with mineral-rich waters. Over time the minerals from the liquid migrate up thin fractures in the rock. Small amounts of mineral attach to the flat surfaces of the rock. The random process of attachment and growth is part of the reason that dendrites have a very organic looking form. Like snowflakes, no two dendrites are exactly the same!

● COLLECTION OBJECT DESCRIPTIONS ●

SYMMETRY OBJECTS

STARFISH

Astroidea sp.



Starfish are rotationally symmetrical creatures with five to six legs. Some species can have up to twenty legs! Starfish are perhaps the best known of a group of animals called echinoderms. (Echinoderms include sea cucumbers, sand dollars, and sea urchins.) With no front or back, starfish can move in any direction without turning. They use a series of tiny tube-like feet on their underside to slowly cruise along sand or rocks in search of mollusks. Once they find potential food, starfish wrap themselves around it, pulling the mollusk open. Once the mollusk has been opened a crack, the starfish inverts its stomach outside of its own body and forces it inside the mollusk's open shell. It then digests the mollusk.

KUNA MOLA



This bold and colorful mola has a symmetrical pattern. Molas are a form of reverse applique traditional to the Kuna people of Panama. Kuna women wear identical molas in pairs as the front and back of a decorative blouse. (The term *mola* refers to both the panel and the blouse.) The pattern is made by sewing together layers of cloth of different colors and cutting parts away. The artists who create molas are inspired by almost anything they come in contact with including nature, village life, dreams, cartoons, books, fantasy and, recently, global popular culture. The most traditional molas are composed of geometric patterns and were developed from ancient body painting designs. Many mola patterns exhibit symmetry.

GREEN-SPOTTED TRIANGLE BUTTERFLY

Graphium agamemnon



All butterfly and moth wings are examples of mirror symmetry. This type of mirror symmetry is common in many animals. In biology it is called bilateral symmetry. The Green-Spotted Triangle, also called the Tailed Jay Butterfly, has apple-green spots on speckled brown ground and “stubby tails” on its two lower wings. The “tail” of the female is longer than that of the male butterfly. The underside of the wing is gray brown with green markings. It is one of a number of related butterflies that live across Asia, the Pacific Islands, and the tropical northeast coast of Australia. The adult butterflies have a wingspan between three and four inches. The adult butterfly is a fast flyer that can be seen frequenting flowers and will also land at puddles and springs to drink water. This specimen is part of a special rainforest conservation project where indigenous people rear butterflies and moths to sell rather than cut down the forest for agriculture.

KIT EVALUATION

Your comments about the Teacher’s Guide and the kit’s collections are extremely important to us. Please help us in the creation of future activity kits by making a photocopy of this questionnaire, filling it out, and sending it the attention of: Senior Exhibition Developer—Pattern Wizardry Kit, The Brooklyn Children’s Museum, 145 Brooklyn Avenue, Brooklyn, NY 11213.

Rate the criteria from 1 to 5, with 5 being the highest:

CRITERIA	1	2	3	4	5	N/A
Overall usefulness of the <i>Pattern Wizardry Portable Museum Kit</i>						
Introduction to Patterns						
Repeat After Me						
Tessellation Formations						
Spiral Spells						
Roots, Shoots, and Rivers						
Symmetry						
Book List						
Addresses math and science						
Addresses art, music, and culture						
Addresses variety of learning styles						
Text easy for teacher to follow						
Text easy for students to follow						
Encourages critical thinking skills						
Useful for small, cooperative learning groups						
Ease of integrating into existing curriculum						
Stimulates and captures students’interest						

Did you use the kit in conjunction with a visit to the Pattern Wizardry exhibition?

What was the single most helpful aspect of the entire kit?

What aspect, if any, worked least well?

Is there anything you would have liked that wasn’t offered?

Additional Comments:
