

# ***SYMMETRY IN NATURE***

Spotting Radial and Bilateral Symmetry  
in Plants and Animals

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# Tennessee 4-H Youth Development

## Symmetry in Nature

*Spotting Radial and Bilateral Symmetry in Plants and Animals*

### Skill Level

Beginner

### Learner Outcomes

*The learner will be able to:*

- Define bilateral (reflectional) and radial (rotational) symmetry.
- Recognize examples of symmetry in nature.
- Create a symmetrical pattern.

### Educational Standard(s) Supported

Math: 4.G.A.3, 8.G.A.1

Life Sciences: 3.LS4.C

### Success Indicator

*Learners will be successful if they:*

Can identify reflectional and rotational symmetry.

### Time Needed

30 minutes

### Materials List

- Pictures of variety of objects from nature: flowers, pinecones, pineapples, stem with leaves, shells, fiddlehead ferns, etc. You could also collect actual objects from outdoors if time allows.
- Small mirror.
- Foam board.
- Pins or thumbtacks.
- [Optional] Art supplies for symmetry art projects:
  - For butterfly project: Butterfly cutouts, stamps, stickers, markers or paint.
  - For snowflakes: Square white paper.

### Introduction to Content

In this lesson, students will learn what reflection and rotational symmetry are through examples, then identify items in nature that are characterized by these properties.

### Introduction to Methodology

After seeing some examples of symmetry, students will classify pictures of objects from nature according to whether they are bilaterally symmetrical, radially symmetrical or asymmetric. After the main lesson, two optional extensions are included: 1) nature scavenger hunt and 2) symmetry art project.

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## Terms and Concepts Introduction

**Symmetry** — In mathematics, if an object has symmetry, it is invariant (i.e., does not change) to various transformations, including reflection, rotation or scaling.

**Reflectional (or bilateral) symmetry** — An object has reflectional symmetry (line or mirror symmetry) if there is a line going through it, which divides it into two pieces that are mirror images of each other.

**Rotational (or radial) symmetry** — An object has rotational symmetry if the object can be rotated about a fixed point without changing the overall shape.

## Tips for Engagement

Show pictures of simple shapes and geometric designs to get students comfortable with identifying symmetry before moving on to objects in nature.

**WATCH:** “The science of symmetry” from TED-Ed  
<https://youtu.be/3drtbPZF9yc>

## Setting the Stage and Opening Questions

Ask, “Does anyone know what ‘symmetry’ means? Can you identify something in this room that is symmetrical?”

Say, “If an object has symmetry, it means you can transform it and it will look the same. For example, if you divided it into two pieces that mirror each other, it has reflectional symmetry. Or, if you can rotate it around a center point and it looks the same, you have rotational symmetry.” Show example shapes and objects to illustrate.

In nature, most animals and plants have one of these types of symmetry. In biology, we refer to reflectional symmetry as bilateral symmetry and rotational symmetry as radial symmetry.

## Experience

After showing some mathematical examples of symmetry, have students classify pictures of objects in nature according to whether they have bilateral symmetry, radial symmetry or no symmetry (asymmetrical). Alternatively, students could use real items gathered from outdoors.

1. Set up three areas on a table or board labelled “Bilateral Symmetry,” “Radial Symmetry” and “Asymmetric” where students can place the pictures.
2. Hand out pictures to students.
3. To identify bilateral symmetry, hold a small mirror across the object. Does the object look the same in the reflection? Have students rotate the mirror to see if there is bilateral symmetry across multiple planes.
4. To identify rotational symmetry, put the picture of the object on the foam board and push a pin or thumbtack through the center. Rotate the picture around the pin. Does it look the same from multiple angles?
5. Once they decide which category the object falls into, they may place it in that group. Note that some objects will exhibit both bilateral and radial symmetry. They can be placed in either category, or halfway in between.

## Share

Were you able to classify all the objects according to their symmetry? Did any objects have both radial and bilateral symmetry?

## Process

The type of symmetry is related to how the organism experiences its environment.

For an animal that is motile (i.e., moves around), what part of its body does it use to sense its environment?

Answer: Head, face, feelers, nose, mouth (i.e., the “front” end).

For an animal that is sessile (i.e., is attached or rooted or tends to stay in one place), what part of the body experiences the environments?

Answer: All sides

## Life Skill(s)

- Follow instructions.
- Gather relevant information for decision-making.
- Use the senses to gain new information or find new ways to use information.
- Use basic reading, writing and mathematical skills.

## Generalize

Some animals are bilaterally symmetrical for part of their life, then radially symmetrical when they are older. Why do you think they change shape?

Answer: They are motile and bilaterally symmetrical when they are young so that they can disperse to new environments. Once a new environment is found, they can attach, become sessile, and take on a radially symmetrical shape. An example of this is a starfish.

## Apply

### Optional extension 1: Symmetry scavenger hunt

Have students go outside and collect items from nature that are bilaterally, radially and asymmetric. Challenge them to find at least one item from each category.

### Optional extension 2: Symmetry art projects

- 1) Bilateral symmetry: Have students decorate cutouts of symmetrical animals, like butterflies.
  - a. Option A: Use stamps, stickers or markers, being sure to mirror the same pattern on both sides. For younger children, consider doing a pattern on one side and having them mimic it on the other.
  - b. Option B: Fold butterfly in half and open it back up. Apply paint to one side, then fold and press to transfer paint to the other side.
- 2) Radial symmetry: Make a paper snowflake.
  - a. Decide how many folds of symmetry you want to do and fold a square piece of paper that many times. Three to five folds is recommended, depending on paper size and thickness.
  - b. Make small cutouts around the folded paper.
  - c. Unfold and enjoy! Spin it around to see the radial symmetry.

## ***Supplemental Information***

### ***Educational Standards Met***

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**4.G.A.3** Recognize and draw lines of symmetry for two-dimensional figures.

**8.G.A.1** Verify experimentally the properties of rotations, reflections and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.

**3.LS4.C** Adaptation: For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.