Beading Patterns Using Reflections

Fast Facts

Curriculum Area: Beading patterns Using Reflections
Grade Level: Grade 10
Suggested Duration: 110 minutes

Stage 1 Desired Results

Established Goals

Geometric Reasoning Mathematics Content Standard 3: A student, applying reasoning and problem solving, will understand geometric properties, spatial relationships, and transformation of shapes, and will use spatial reasoning and geometric models to analyze mathematical situations within a variety of relevant cultural contexts, including those of Montana American Indians.

IEFA Essential Understanding 1: There is great diversity among the 12 tribal Nations of Montana in their languages, cultures, histories and governments. Each Nation has a distinct and unique cultural heritage that contributes to modern Montana.

IEFA Essential Understanding 2: There is great diversity among individual American Indians as identity is developed, defined and redefined by entities, organizations and people. A continuum of Indian identity, unique to each individual, ranges from assimilated to traditional. There is no generic American Indian.

IEFA Essential Understanding 3: The ideologies of Native traditional beliefs and spirituality persist into modern day life as tribal cultures, traditions, and languages are still practiced by many American Indian people and are incorporated into how tribes govern and manage their affairs.

Additionally, each tribe has its own oral histories, which are as valid as written histories. These histories pre-date the “discovery” of North America.

Understandings

- Properties of figures using transformations.
- An isometry created by a reflection.
- Reflection of coordinates through the x and y
- axis using the preimage creating the image.

Essential Questions

- How are the coordinates of the preimage being reflected?
- How is a reflection created?
- Why is a reflection an isometry?

- How are the x and y coordinates changed when reflected through the x axis or the y axis?
- What is the importance of the line of symmetry to a reflection?

Students will be able to…

- identify the x and y coordinates of each point for the shape.
- reflect the coordinates through the x axis or the y axis.
- identify the pattern when reflecting the coordinates through the x or y axis.
- identify an isometry.
- identify the coordinates of the preimage and the image.
- identify the line of symmetry.

Students will know…

- the quadrants of the Cartesian graphing system.
- how to form a conjecture about the x and y coordinates after reflecting the coordinates through the axis.
- how to identify the line of symmetry.
- how to determine the image coordinates after reflecting preimage through the x axis or the y axis.

Stage 2 Assessment Evidence

Performance Tasks

1. Use graph paper to plot points and create a design to be reflected.
2. Complete reflections, reflecting the preimage creating the image.
3. Identify the coordinates of the image using the prime notation.
4. Identify an isometry.
5. Identify the line of symmetry.
6. Develop a conjecture regarding the line of symmetry and the line connecting a preimage point with an image point.

Stage 3 Learning Plan

Learning Activities

Before beginning this reflection project, have students observe examples of beadwork. Some Native American beadwork provides beautiful examples of rotations, translations and reflections.

Refer to the excerpt found on page 71 of *Native America in the Twentieth Century: An Encyclopedia*, which was distributed to all Montana public school libraries, to find background information on the history and cultural importance of beadwork and beads.

For additional information regarding beadwork see the Smithsonian National Museum of the American Indian Web site *Identity by Design - tradition, change, and celebration in native women's dresses*.

Before beginning the transformation, find an image from the website above that includes transformation and reflection. The pattern will be used for steps 11-17.

Procedure

1. Each student needs three sheets of graph paper, ruler, and a minimum of four different colored pencils.

2. Draw the x and y axis in the center of the graph paper.

3. Plot the following points and draw the line segment AB. Next, reflect through the x axis by using the definition of reflection: transformation that uses a line that acts like a mirror, with an image reflected through the line.
   A(2, 4) B(4, 2)

4. Draw the image (the line A'B') formed by reflecting the points.

5. Discuss the following questions as a class: What is the line of symmetry? (Answer: the x axis) Does the line of symmetry always have to be the x or the y axis? (Answer: no, it could be any line, horizontal, vertical or y = x.) Is this an isometry? (Answer: yes, because it preserves length.) (isometry: A transformation that preserves length, angle measure, parallel lines, and distance between points)

6. Students should form a conjecture after plotting the points and reflecting the line through the x or y axis. Their conjecture should contain the following:
   a. if (x,y) is reflected through the x-axis, its image is the point (x, -y)
   b. if (x,y) is reflected through the y-axis, its image is the point (-x, y)

7. Have students write their conjecture on the graph paper they are using for this first reflection.

8. Discuss with the class: (Have students answer in class)
   a. What happened to the x coordinate as the point was reflected about the x axis?
   b. What happened to the y coordinate as the point was reflected about the x axis?
   c. What happened to the x coordinate as the point was reflected about the y axis?
   d. What happened to the y coordinate as the point was reflected about the y axis?

9. Have students draw segment AA', using the preimage point A and the image point A'.

10. Discuss with the class how the line of symmetry and the segment AA' are oriented with each other? (Answer: Students should recognize that they are perpendicular to each other and that the segment AA' is bisected by the line of symmetry.)

11. Using their second piece of graph paper, have students plot the following points forming a geometric figure, the preimage:
    A(0, 0) B(0, 3) C(-1, 2) D(-3, 0)
    E(-3, 4) F(-9, 4) G(-3,0)

12. Connect the following points forming a polygon: AB, BC, CD, ED, EF, FG, GA.

13. Using the conjecture they formed in the discussion from steps 7 and 8, reflect these points about the x axis forming the image. Remember to use the pattern (x, y) ---> (x, -y) if reflecting about the x axis and (x, y) -----> (-x, y) if reflecting about the y axis.

14. Label the image points using the prime notation: A'.

15. Connect the image points as the preimage points were connected above.

16. Next, reflect the preimage points about the y axis forming another image, labeling the new image points with double prime notation: A''.

17. Reflect the new image through the x axis, labeling the image point with the triple prime notation: A'''.

18. Color the pattern using different colors.

19. Using the third piece of graph paper, try the next reflection and color it in using different colored pencils. Here are the points to form the preimage for the next reflection:
    A(0, 2) B(-4, 4) C(-4 1) D(-7, 1) E(-6, 0) F(-7, -1) G(-4, -1) H(-4, -4) I(0, -2)
    Squares inside the polygon: (-1,1) (-3,1) (-3,-1) (-1,-1)

20. Connect the following points: AB, BC, CD, DE, EF, FG, GH, HI and the points for the square inside the polygon.

21. Now reflect these points across the y axis forming the image. Remember the rule for reflection through the y axis: (x, y) then (-x, y).

22. Label the image points using the prime notation A'.

23. Connect the image points which will create an isometry (An isometry preserves length, angle measures, parallel lines and distance).

24. Color the design using different colors.

25. Now create your own design.

At the end of this lesson students will:

- plot points and identify the x and y coordinates.

- reflect points through the x axis or the y axis and identify the pattern.
- apply the reflection to create the pattern.
- understand the project is an isometry

Extension Activities

- Design or pattern and object to be beaded (watch band, key chain, pen cover, or barrette)
- Seed beads (a variety of colors)
- Thread
- Needles
- Leather (chamois works well)
- Cloth to wrap the object and beads into

Teacher Resources

Identity by Design - tradition, change, and celebration in native women's dresses provides information about the history and cultural value of native women's dresses. The site also provides examples of beautiful beadwork and allows one to see the geometry involved in this art form.

Materials

- Graph paper (1 cm squares, 8 ½ x 11)
- Colored pencils
- Rulers