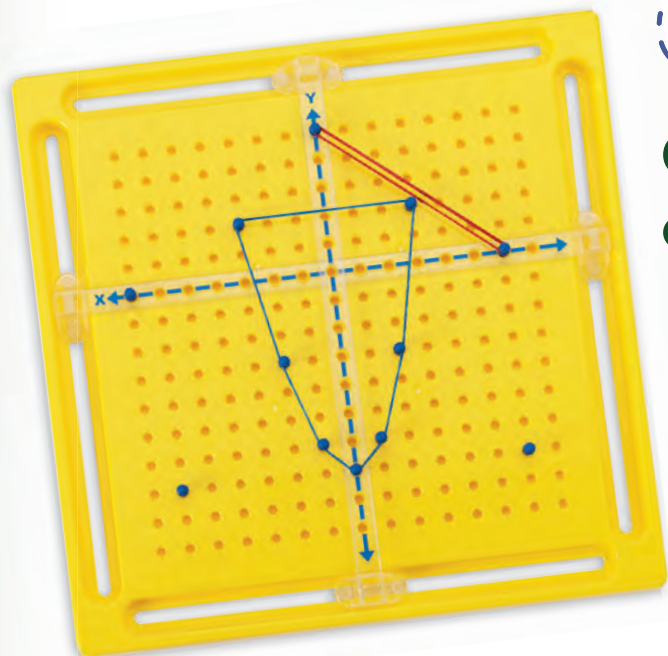


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MATH

$$a^2 + b^2 = c^2$$

Works!



Coordinating a shape's area and perimeter.

Developed by Kristin Ulrich
Grades 4-6

Content

- Finding perimeter and area of various shapes using points on the coordinate plane.



Materials

- X-Y Coordinate Geoboard (Cat. No. TB24598T)



Objectives

Students will...

- Be able to construct various shapes on their geoboards given specific coordinates.
- Be able to calculate both the area and the perimeter of each polygon.
- Be able to create their own shapes given specific parameters.



Common Core State Standards

- CCSS.Math.Content.4.MD.A.3** — Apply the area and perimeter formulas for rectangles in real-world and mathematical problems.
- CCSS.Math.Content.5.G.A.2** — Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
- CCSS.Math.Content.6.G.A.1** — Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
- CCSS.Math.Content.6.G.A.3** — Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.



Introduction

The main focus of this lesson is finding area and perimeter. Students should already have some familiarity with these concepts. Review two examples on the board with students of each formula. One example should be with a quadrilateral and one should be with another polygon.

- These calculations can be completed on a white board in front of the entire class, or students can complete them on individual white boards. Once students complete on their own white boards, the teacher will do the problem on the front board to reinforce the concept and answer.

Rectangle: 5" side, 5" side, 7" side, 7" side

Perimeter: (5 + 5 + 7 + 7 = 24")

- Remind students that when finding perimeter, the unit stays the same. If the sides are inches, the perimeter is also inches.

Let's find the perimeter of a pentagon...

Here are the sides: 3", 5", 6", 3", 2"

(3 + 5 + 6 + 3 + 2 = 19")



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Activity

The problems in this activity will be recorded on numbers 1 and 2 on Worksheet #1. This way, they will have a reference when they work independently.

Have each student follow these directions as you do it in front of them. Circulate so students can check their work along with yours as you create the class model on your own geoboard.

1. On your geoboard, put a peg at (1, 1).
2. Put a second peg at (6, 1). Connect those two pegs with a white geoband.
3. Put a third peg at (6, 5). Connect that to the peg at (6, 1) with a small, yellow geoband.
4. Put a fourth peg at (1, 5). Connect that to the peg at (6, 5) with a white geoband.
5. Connect the peg at (1, 5) to the first peg at (1, 1) with a small, yellow geoband.

What shape have you created? (*Rectangle*)

How do you know? (*It has 4 sides, 4 right angles, and 2 pairs of parallel lines*)

6. Draw the shape on your geoboard dots for Problem 1.
7. Fill each hole that is covered by an geoband with a peg. (This will be creating the perimeter of your rectangle.)
8. Count the pegs on the top of your rectangle. (*6 pegs*)
9. Count the pegs on the bottom of your rectangle. (*6 pegs*)
10. Count the pegs on the left side of your rectangle. (*5 pegs*)
11. Count the pegs on the right side of your rectangle. (*5 pegs*)
12. Record the length of each side.
13. Add them all up and what do you get? (*22 pegs*) That is the perimeter of the rectangle. Record on Worksheet #1.

- A point of confusion for students may come when they ask why they can't simply add up all the pegs at the same time. If they just add up all the pegs, they will get 19 pegs, instead of 22 pegs. The corner pegs each need to be counted twice because they are part of two different sides of the rectangle. It is much easier to count each side independently, than to try and double count the corners.

Now, we need to find the area of our rectangle. Remember that area is the amount of units (in this case pegs) that it takes to fill the entire object. We already have the sides filled, now we need to put a peg in every hole that is inside of the shape.

How many total pegs do we have in our rectangle? (*30 pegs*) Record on Worksheet #1.

We know it works with a regular quadrilateral, what about a crazy shape?

1. Put a peg at (-6, -1)
2. Put a second peg at (-2, -1). Connect those two with a geoband.
3. Put a third peg at (-2, -5). Connect that to (-2, -1) with a geoband.
4. Put a fourth peg at (-4, -5). Connect that to (-2, -5) with a geoband.
5. Put a fifth peg at (-4, -3). Connect that to (-4, -5) with a geoband.
6. Put a sixth peg at (-6, -3). Connect that to (-4, -3) with a geoband.
7. Connect that to the first peg at (-6, -1) with a geoband.
8. What kind of shape is it? (*Hexagon*) Is it regular? (*No*)
9. How do you know? (*The sides are all different lengths.*)
10. Draw the shape on your geoboard dots for Problem 2.
11. Fill each hole that is covered by a geoband with a peg. (This will be creating the perimeter of your hexagon.)
12. Count the pegs on the top of your hexagon. (*5 pegs*)
13. Count the pegs on the long side of the hexagon. (*5 pegs*)
14. Count the pegs on the bottom of the hexagon. (*3 pegs*)
15. Count the pegs on the next side. (*3 pegs*)
16. Count the next side. (*3 pegs*)
17. Count the last side. (*3 pegs*)
18. Record the length of each side on the worksheet.
19. Add them all up. (*5 + 5 + 3 + 3 + 3 + 3 = 22 pegs*)
20. The perimeter of the hexagon is 22 units. Record on Worksheet #1.
21. Now, just like we did with the rectangle, we need to fill in the spaces inside the hexagon to get the area.
22. How many total pegs do we have? (*21*)
23. The area of the hexagon is 21 units². Record on Worksheet #1.

Practice

Students will work on questions 3-6 on Worksheet #1 independently.



Assessment

Students will complete Worksheet #1, Challenge Time on page 2, either individually or with a partner. The extension has been added, should you be interested in having students work on that individually or with a partner.



Intervention

1. Have students plot points only in Quadrant I using Worksheet #2, Intervention.
2. Only create regular quadrilaterals (squares and rectangles).



Extension

1. Have students name their own points on the coordinate plane to create a variety of shapes.
2. Have students find the perimeter of shapes with more sides, such as pentagons and hexagons.
3. Have students create shapes given specific area and/or perimeter guidelines.
 - a. Create a 4-sided shape with an area of 32 u²
 - b. Create a 5-sided shape with a perimeter of 22 units



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Page 1

Nasco MathWorks: X-Y Coordinate Geoboard Lesson Worksheet #1

Each problem for the worksheet will have a 7×7 set of geoboard dots. This is where students will draw the shape.

1. GEOBOARD GRID HERE

Side Lengths: _____

Perimeter: _____

Area: _____

2. GEOBOARD GRID HERE

Side Lengths: _____

Perimeter: _____

Area: _____

3. Peg 1 (0, 2), Peg 2 (0, 7), Peg 3 (-6, 7), Peg 4 (-6, 2)

GEOBOARD GRID HERE

Side Lengths: _____

Perimeter: _____

Area: _____

4. Peg 1 (2, 7), Peg 2 (7, 7), Peg 3 (7, 4), Peg 4 (4, 4), Peg 5 (4, 6), Peg 6 (2, 6)

GEOBOARD GRID HERE

Side Lengths: _____

Perimeter: _____

Area: _____

5. Peg 1 (-1, -3), Peg 2 (-1, -5), Peg 3 (5, -5), Peg 4 (5, -3)

GEOBOARD GRID HERE

Side Lengths: _____

Perimeter: _____

Area: _____

6. Peg 1 (0, 6), Peg 2 (-3, 6), Peg 3 (-3, 1), Peg 4 (-1, 1), Peg 5 (-1, 3), Peg 6 (0, 3)

GEOBOARD GRID HERE

Side Lengths: _____

Perimeter: _____

Area: _____

Continued next page...

Name: _____

Page 2

Nasco MathWorks: X-Y Coordinate Geoboard Lesson
Worksheet #1 — Challenge Time
 (cont. from page 1)

Create a quadrilateral with a perimeter of 24 units.

Here are its 4 sets of coordinates: _____, _____, _____, and _____.

Draw it here:

GEOBOARD GRID

What is its area? _____

Create a quadrilateral with an area of 30 units².

Here are its 4 sets of coordinates: _____, _____, _____, and _____.

Draw it here:

GEOBOARD GRID

What is its perimeter? _____

Create a hexagon with a perimeter of 28 units.

Here are its 6 sets of coordinates: _____, _____, _____, _____, _____, and _____.

Draw it here:

GEOBOARD GRID:

What is its area? _____

Create a hexagon with an area of 26 units².

Here are its 6 sets of coordinates: _____, _____, _____, _____, _____, and _____.

Draw it here:

GEOBOARD GRID:

What is its perimeter? _____

Name: _____

Page 1

Nasco MathWorks: X-Y Coordinate Geoboard Lesson
Worksheet #2 — Intervention
(Only Uses Quadrilaterals in Quadrant I)

Activity 1:

1. On your geoboard, put a peg at (0, 2).
2. Put a second peg at (0, 7). Connect those two pegs with a white geoband.
3. Put a third peg at (6, 7). Connect that to the peg at (0, 7) with a green geoband.
4. Put a fourth peg at (6, 2). Connect that to the peg at (6, 7) with a white geoband.
5. Connect the peg at (6, 7) to the first peg at (0, 2) with a green geoband.

Draw it here.

GEOBOARD GRID

Bottom Length: _____

Top Length: _____

Left Side Length: _____

Right Side Length: _____

Perimeter = _____

Area = _____

Activity 2:

1. On your geoboard, put a peg at (3, 2).
2. Put a second peg at (3, 7). Connect those two pegs with a white geoband.
3. Put a third peg at (5, 7). Connect that to the peg at (3, 7) with a small yellow geoband.
4. Put a fourth peg at (5, 2). Connect that to the peg at (5, 7) with a white geoband.
5. Connect the peg at (5, 2) to the first peg at (3, 2) with a small yellow geoband.

Draw it here.

GEOBOARD GRID

Bottom Length: _____

Top Length: _____

Left Side Length: _____

Right Side Length: _____

Perimeter = _____

Area = _____

Name: _____

Page 2

Nasco MathWorks: X-Y Coordinate Geoboard Lesson

Worksheet #2 — Intervention (Only Uses Quadrilaterals in Quadrant I)

(cont. from page 1)

Activity 3:

1. On your geoboard, put a peg at (0, 1).
2. Put a second peg at (0, 7). Connect those two pegs with a white geoband.
3. Put a third peg at (6, 7). Connect that to the peg at (0, 7) with a green geoband.
4. Put a fourth peg at (6, 1). Connect that to the peg at (6, 7) with a white geoband.
5. Connect the peg at (6, 1) to the first peg at (0, 1) with a green geoband.

Draw it here.

GEOBOARD GRID

Bottom Length: _____

Left Side Length: _____

Perimeter = _____

Top Length: _____

Right Side Length: _____

Area = _____

Activity 4:

Create a rectangle with a perimeter of 14 units.

Draw it here.

GEOBOARD GRID

Bottom Length: _____

Left Side Length: _____

Area = _____

Top Length: _____

Right Side Length: _____

Activity 5:

Create a rectangle with an area of 20 units².

Draw it here.

GEOBOARD GRID

Bottom Length: _____

Left Side Length: _____

Perimeter = _____

Top Length: _____

Right Side Length: _____