

Dance and Math Infused Lesson

Lesson Three: *Choreographing the Area and Perimeter*

Author: Debbie Gilbert

Grade Level: Third

Reference: Cathy Carini, Grant Center for the Expressive Arts, *Area and Perimeter*



Enduring Understanding

Movement around the edges of a rectangle and filling the inside of the rectangle can show perimeter and area.

Lesson Description (Use for family communication and displaying student art)

In this math and dance lesson, students create dances of the area and perimeter of rectangles. They review measuring area and perimeter. Students explore bound or tight movement and free or loose movement. After calculating the area and perimeter of a rectangle, they create a dance with a partner in which they dance the perimeter with bound movement and the area with free movement.

Learning Targets and Assessment Criteria

Target: Calculates area and perimeter of a polygon.

Criteria: Records the number of square units in the inside surface of a rectangle. Records the number of units in the distance around a rectangle.

Target: Creates a dance showing perimeter or area.

Criteria: Performs bound movement for the total number of counts matching the measurement of the distance around a rectangle, or performs free movements for the total number of counts matching the measurement of the surface inside the boundary of the rectangle.

Vocabulary	Materials	Learning Standards
<p><u>Arts Infused:</u> Rectangle Shape Measurement</p> <p><u>Math:</u> Area Perimeter</p> <p><u>Arts:</u> <u>Bound Energy</u> <u>Choreographer</u> <u>Free Energy</u></p>	<p><u>Museum Artworks or Performance</u></p> <p>Seattle, WA Pacific Northwest Ballet UW World Series of Dance</p> <p>Tacoma, WA Broadway Center for the Performing Arts</p> <p>Materials: <i>Math Dances</i> CD by Debbie Gilbert; <i>Music for Creative Dance, Volume IV</i>, by Eric Chappelle; CD player; Drum/percussion instrument; White board, document camera, or chart paper & markers; Computer with internet connection and projector; 8.5x11" white copy paper: copy <i>Choreographing the Area and Perimeter Demonstration Worksheet</i> and <i>Choreographing the Area and Perimeter Student Worksheets</i>, one per student; Writing pencils; blue tape (optional); Class Assessment Worksheet</p>	<p>WA Arts State Grade Level Expectations <i>For the full description of each WA State Arts Grade Level Expectation, see: http://www.k12.wa.us/Arts/Standards</i></p> <p>1.1.3 Elements: Energy 1.2.1 Skills and Techniques: Focus 1.4.1 Audience Skills <u>2.1.1 Creative Process</u> 2.2.1 Performance Process 2.3.1 Responding Process</p> <p>Early Learning Guidelines (Pre-K – Grade 3) <i>For a full description of Washington State Early Learning and Child Development Guidelines see: http://www.del.wa.gov/development/guidelines/</i> (3rd grade) 3. Touching, seeing, hearing and moving around: Using the large muscles (gross motor skills): show good form in basic movement (locomotor skills). (3rd grade) 6. Learning about my world: Math: determine the perimeter and area of rectangles. Arts: create and perform movement, showing balance through coordination and muscle control; show interest in developing skills in dance.</p> <p>Common Core State Standards (CCSS) in Math <i>For a full description of CCSS Standards by grade level see: http://www.k12.wa.us/CoreStandards/Mathematics/default.aspx</i> 3.MD. Geometric measurement: understand concepts of area and relate to multiplication and to addition</p>
	<i>continued</i>	<i>continued</i>

Pacific Northwest Ballet images:
Mara Vinson in Nacho Duato's
Rassemblement



Carla Korbes in Twyla Tharp's *Opus 111*



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Video

The Narrowing - AXIS Dance Company (2011): duet featuring one dancer who uses a wheelchair and one who doesn't
<http://www.youtube.com/watch?v=8Fe2XIB0Dh0>

Seattle Art Museum: Nick Cave, In the Classroom
http://www.youtube.com/watch?v=OcvfW1HNrs&feature=player_embedded


Refraction excerpt, Alonzo King LINES Ballet
<http://www.youtube.com/watch?v=ooUXXE7PQDU>

3.MD.5. Recognize area as an attribute of plane figures and understand concepts of area measurement.
3.MD. Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measurement.
3.MD.8. Solve real world and mathematical problems involving perimeters of polygons, including exhibiting rectangles with the same area and different perimeters.

CCSS Mathematical Practices

MP.2. Reason abstractly and quantitatively.
MP.4. Model with mathematics.
MP.6. Attend to precision.
MP.7. Look for and make use of structure.

ICON KEY:

 = Indicates note or reminder for teacher

 = Embedded assessment points in the lesson

Pre-Teach

Practice the Math BrainDance, see lesson step 3. Explore finding area and perimeter.

Lesson Steps Outline

Day One


1. Introduce dancing the area and perimeter of a rectangle. Analyze photographs or video of dancers using free and bound movement.

2. Remind students about agreements for appropriate dance behavior.

3. Lead students in *Math BrainDance* warm-up.

Music: "Math BrainDance (Third Grade)" #4, *Math Dances* by Debbie Gilbert

4. Introduce and lead exploration of free and bound movement. Use a drum or other instrument for accompaniment.


 Criteria-based process assessment: Moves with bound and free energy.

5. Demonstrate calculating and dancing the perimeter and area of a rectangle with a partner.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle

6. Support students as they calculate and dance the perimeter and area of a rectangle with a partner. Distribute worksheet and pencils to each duo.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle

 Criteria-based teacher checklist, self-assessment: Records the number of square units in the inside surface of a rectangle. Records the number of units in the distance around a rectangle. Performs bound movement for the total number of counts matching the measurement of the distance around a rectangle, or performs free movements for the total number of counts matching the measurement of the surface inside the boundary of the rectangle.

7. Lead reflection.

Criteria-based reflection: Analyzes how rectangles with different perimeters can have the same area.

Day Two

1. Review measuring area and perimeter.

2. Remind students about agreements for appropriate dance behavior.

3. Lead students in *Math BrainDance* warm-up.

Music: "Math BrainDance (Third Grade)" #4, *Math Dances* by Debbie Gilbert

4. Support students as they refine and rehearse their area and perimeter dances.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle

Criteria-based teacher checklist: Performs bound movement for the total number of counts matching the measurement of the distance around a rectangle, or performs free movements for the total number of counts matching the measurement of the surface inside the boundary of the rectangle.

5. Direct performance of the area and perimeter dances and response. Review performer and audience expectations.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle

Criteria-based teacher checklist: Performs bound movement for the total number of counts matching the measurement of the distance around a rectangle, or performs free movements for the total number of counts matching the measurement of the surface inside the boundary of the rectangle.

6. Lead reflection.

Criteria-based reflection: Makes a connection between dance and math.

LESSON STEPS

Day One

- ▣ Prepare the classroom for dance.



Moving Desks/Set-up

1. Introduce dancing the area and perimeter of a rectangle. Analyze photographs or video of dancers using free and bound movement.

- *Dancing Mathematicians, what is the perimeter of a rectangle? (distance around a shape) How do you find the measurement of the perimeter? (e.g. count units on the sides, $P = 2L + 2W$)*
- *What is the area of a rectangle? (measure of the size of the surface inside a two-dimensional space of a region) How do you find the measurement of the area? (e.g. count the tiles that fill the polygon, $A = LW$)*
- *Let's do a hand dance. Draw the perimeter of a rectangle in the air with your hand. Now, show the area of the rectangle by filling it with movement.*

▣ You may use these photos: Pacific Northwest Ballet: Mara Vinson in Nacho Duato's *Rassemblement* and Carla Korbes in Twyla Tharp's *Opus 111*. You could also choose to find your own photos or videos that represent a variety of styles and cultures. If you would like to use video examples of bound and free movement, preview the video clips below. You could show them before or after the dance explorations.

The Narrowing - AXIS Dance Company (2011): duet featuring one dancer who uses a wheelchair and one who doesn't

<http://www.youtube.com/watch?v=8Fe2XIB0Dh0>

Seattle Art Museum: Nick Cave, In the Classroom

http://www.youtube.com/watch?v=OcvfW1HNrs&feature=player_embedded

Refraction excerpt, Alonzo King LINES Ballet

<http://www.youtube.com/watch?v=ooUXXE7PQDU>



- *Dancing Mathematicians, today we are going to dance the area and perimeter of rectangles.*

- We'll use bound or tight movements to dance the perimeter. Look at the tight shape made by the dancer in this photograph.
- We'll use free or loose movement to dance the area. Look at the free shape made by the dancer in this photograph.

2. Remind students about agreements for appropriate dance behavior.

- Remind me, how can you be creative and safe at the same time?

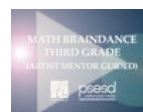


Movement Safety

3. Lead students in **Math BrainDance warm-up.** (BrainDance originally developed by Anne Green Gilbert, www.creativedance.org, reference: *Brain-Compatible Dance Education*, video: *BrainDance, Variations for Infants through Seniors.*)

Music: "Math BrainDance (Third Grade)" #4, *Math Dances* by Debbie Gilbert

- The BrainDance is designed to warm up your body and make your brain work better at the same time. Notice when we use area and perimeter in the BrainDance.



BrainDance by Artist Mentor



BrainDance by Students

Breath

- *Dancing Mathematicians, breathe gently.*

Tactile

- *Tap the top of your head five times. Tap your shoulders five times. Tap your stomachs five times. Tap your knees five times. Tap your feet five times. That was five sets of five. How many counts total was that?*

Core-Distal

- *Grow into a huge shape, filling the area of a gigantic polygon. Shrink into a small shape, filling the area of a tiny polygon.*

Head-Tail

- *Curl your backbone forwards and backwards four times. Bend from side to side four times. That was two sets of four. How many counts total was that?*

Upper Half

- *Freeze the lower half of your body. Draw the perimeter of a giant rectangle in the air with your hand. Cover the area of the rectangle with big movements with your arms.*

Lower Half

- *Freeze the upper half of your body. Draw the perimeter of a small rectangle on the floor with your toes. Cover the area of the rectangle with small movements with your feet.*

Body-Half Right

- *Freeze the left side of your body. Dance with the whole right side of your body. Dance with one half of your right side. Dance with one fourth of your right side. Dance with one eighth of your right side.*

Body-Half Left

- Freeze the right side of your body. Dance with the whole left side of your body. Dance with one half of your left side. Dance with one fourth of your left side. Dance with one eighth of your left side.

Eye-Tracking

- Focus on your right thumb. Watch it as you draw the perimeter of a polygon in the air. Watch your left thumb as you draw the perimeter of a polygon in the air.

Cross-Lateral

- Reach across your body up high, up high, down low, down low. We'll count to eight: 1, 2, 3 ... 8. Let's cut that in half: 1, 2, 3, 4. Let's cut that in half again: 1, 2.

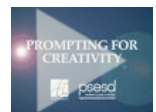
Vestibular

- Turn, then freeze in a rectangle shape. Turn, then freeze in a square shape. Turn, then freeze in a rhombus shape. Turn, then freeze in a different quadrilateral shape.

Breath

- Breathe gently, Dancing Mathematicians.

4. Introduce and lead exploration of free energy and bound energy movement. Use a drum or other instrument for accompaniment.



Prompting for Creativity

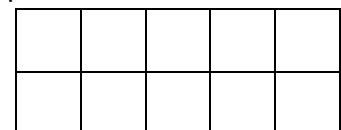
- Dancers can move with free or loose movement. (Demonstrate.)
- Look for the empty spaces around you so you don't touch anyone. Move freely with your arm. Move freely with your backbone. Move freely with your whole body in one spot.
- Dancers can move with bound or tight movement. When you do bound movement, all your muscles are really tight. (Demonstrate.)
- Do bound movement with your shoulders. Do bound movement with your legs. Do bound movement with your whole body as you travel around the room.

Criteria-based process assessment: Moves with bound and free energy.

5. Demonstrate calculating and dancing the perimeter and area of a rectangle with a partner.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle

▮ Use the board, document camera, or chart paper to show filling out the demonstration worksheet.

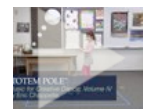


- I'll need an assistant to be my partner. First, we'll look at our rectangle and find our perimeter. How should we do that?
- Next, we'll find the area of our rectangle. How should we do that?
- We will be choreographers, or inventors of dances, and create an area and perimeter dance.

- *I will dance the perimeter. My partner, who will be dancing the area, will freeze in a low shape in the middle of the rectangle. To do my perimeter dance, I need to know the perimeter measurement of my rectangle. We discovered that was 14 units. I'll dance around the edge of my rectangle with 14 bound, or tight movements (2 on the short sides and 5 on the long sides). I'll count to 14 as I move. Then, I'll freeze.*
- *My partner will dance the area. To do that, she needs to know the area measurement of my rectangle. We discovered that was 10 square units. She will cover or fill the space inside the rectangle with 10 free or loose movements. She'll count to 10 as she moves. Then, she'll freeze.*

6. Support students as they calculate and dance the perimeter and area of a rectangle with a partner. Distribute worksheet and pencils to each duo.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle



Area and Perimeter Dance

▣ Copy enough student worksheets from the lessons so that each duo has one. There are four different rectangles. The worksheets all have rectangles with an area of 12. The perimeters are different (6L and 2W, 2L and 6W, 3L and 4W, 4W and 3L). Don't use the demonstration worksheet since the area for that is different.

▣ Optional: Put tape or spots on the floor to define the rectangles.

- *First, calculate the perimeter and area of your rectangle and write them on your worksheet. How will you figure out what the area is? How will you figure out what the perimeter is?*
- *One of you will dance the perimeter by dancing with tight or bound energy around the edge of your rectangle. Dance the same number of counts as the measurement of the perimeter, counting softly to yourself as you move. End by freezing in a low shape. The other dancer will be frozen during the perimeter dance in a low shape in the middle of the rectangle.*
- *Next, the other dancer dances the area by filling or covering the space with free or loose movements. Dance the same number of counts as the measurement of the area, counting softly as you move. End by freezing in a shape.*
- *Practice your dance. Ask yourselves, do the number of counts you are dancing match the measurement of your perimeter and area? Are they the same or different from each other? Why?*

☑ Criteria-based teacher checklist, self-assessment: Records the number of square units in the inside surface of a rectangle. Records the number of units in the distance around a rectangle. Performs bound movement for the total number of counts matching the measurement of the distance around a rectangle, or performs free movements for the total number of counts matching the measurement of the surface inside the boundary of the rectangle.

7. Lead reflection.

- *Dancing Mathematicians, look at your worksheets. Let's compare our rectangles. What were the perimeters of your rectangles? What were the areas? What did you notice? Why do you think that is true?*

☑ Criteria-based reflection: Analyzes how rectangles with different perimeters can have the same area.

Day Two

1. Review measuring area and perimeter.

- *Dancing Mathematicians, remind me what is the area of a rectangle? How do we measure it?*
 - *What is the perimeter of a rectangle? How do we measure it?*
 - *Today, we'll refine and rehearse our area and perimeter dances and perform them for each other.*
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2. Remind students about agreements for appropriate dance behavior.

- *Remind me, how can you be creative and safe at the same time?*
-

3. Lead students in *Math BrainDance* from Day One.

- *The BrainDance is designed to warm up your body and make your brain work better at the same time. Notice when we use area and perimeter in the BrainDance.*
-

4. Support students as they refine and rehearse their area and perimeter dances.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle

▣ To help the students remember their dances, pass out their worksheets from the previous lesson. Consider how the students will have to increase or decrease the scale of their movements depending on the amount of space you have available.

- *Let's review what happens in our dances and then you can practice with your partner.*
- *One of you dances the perimeter by dancing with tight or bound energy around the edge of your rectangle. Dance the same number of counts as the measurement of the perimeter, counting softly to yourself as you move. End by freezing in a low shape. The other dancer freezes during the perimeter dance in a low shape in the middle of the rectangle.*
- *Next, the other dancer dances the area by filling or covering the space with free or loose movements. Dance the same number of counts as the measurement of the area, counting softly as you move. End by freezing in a shape.*
- *Mathematicians check their work to make sure it is the best it can be. Choreographers refine their work for the same reason.*
- *If you are doing bound energy, how can you make it tighter? If you are doing free energy, how can you make it looser?*
- *Perimeter dancers, make sure you are making 90 degree angles at the corners of your rectangle. Area dancers, make sure you are filling the whole area with movement.*
- *When you practice your dance, think about how you can use your whole body, not just your feet or your arms, to show either bound or free movement.*

Criteria-based teacher checklist: Performs bound movement for the total number of counts matching the measurement of the distance around a rectangle, or performs free movements for the total number of counts matching the measurement of the surface inside the boundary of the rectangle.

5. Direct performance of the area and perimeter dances and response. Review performer and audience expectations.

Music: "Totem Pole" #13, *Music for Creative Dance, Volume IV*, by Eric Chappelle



Audience and Performer Expectations

Depending on the amount of space available, you can have one or two duos perform at a time.

- *What do the performers want from their audience? What does the audience want from the performers?*
- *Each group will perform its dance. Audience, describe the free and bound movements that you saw. How could you tell when the dancers were dancing the perimeter? How could you tell when the dancers were dancing the area?*

Criteria-based teacher checklist, peer assessment: Performs bound movement for the total number of counts matching the measurement of the distance around a rectangle or performs free movements for the total number of counts matching the measurement of the surface inside the boundary of the rectangle.

6. Lead reflection.

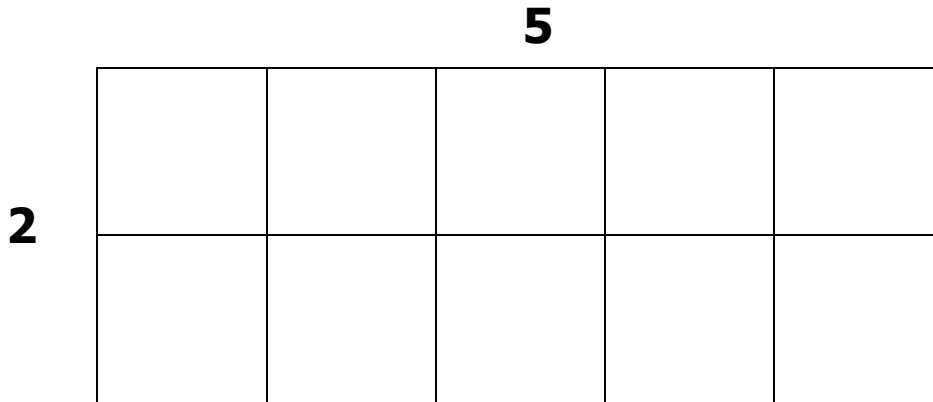
- *Dancing Mathematicians, what did you discover about math when you danced the area and perimeter? What did you discover about dance when you danced the area and perimeter?*
- *The next time you measure area and perimeter in math, think about how you danced them and it will help you remember what they are and how to measure them.*

Criteria-based reflection: Makes a connection between dance and math.

Choreographing the Area and Perimeter Demonstration Worksheet

Teacher name: _____

Date: _____



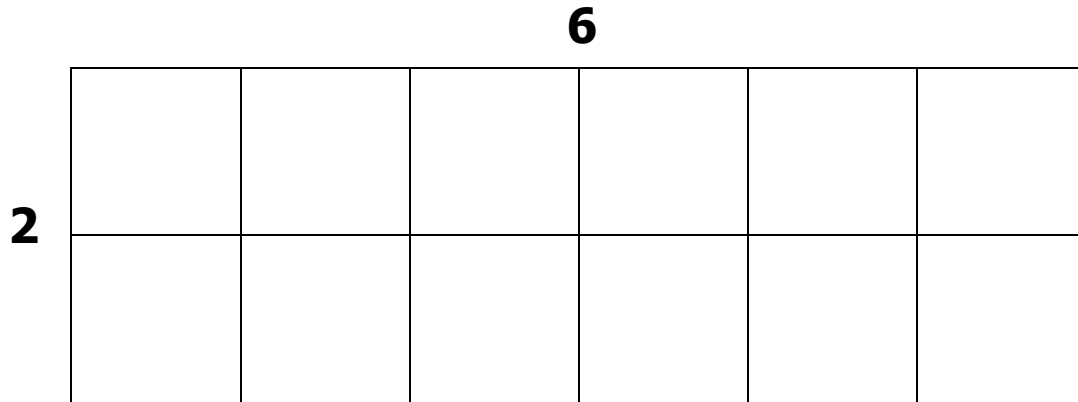
What is the perimeter of your rectangle? _____ units

What is the area of your rectangle? _____ square units

Choreographing the Area and Perimeter Student Worksheet

Name: _____

Date: _____



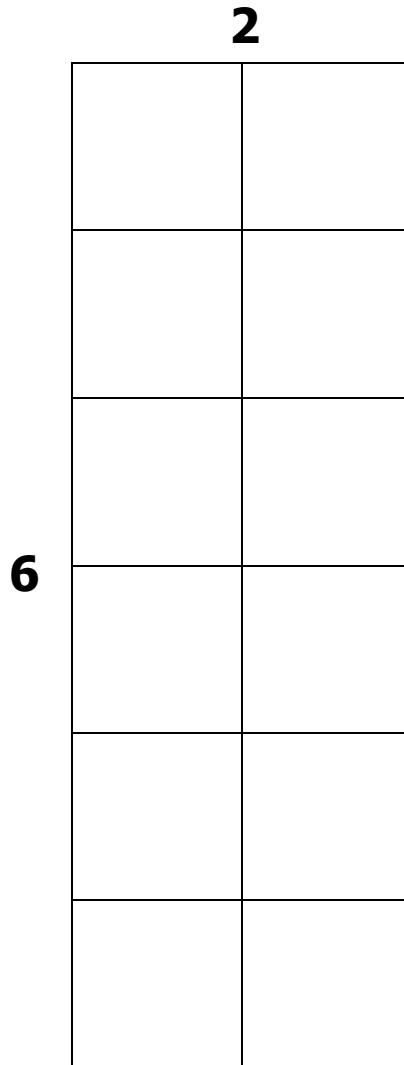
What is the perimeter of your rectangle? _____ units

What is the area of your rectangle? _____ square units

Choreographing the Area and Perimeter Student Worksheet

Name: _____

Date: _____



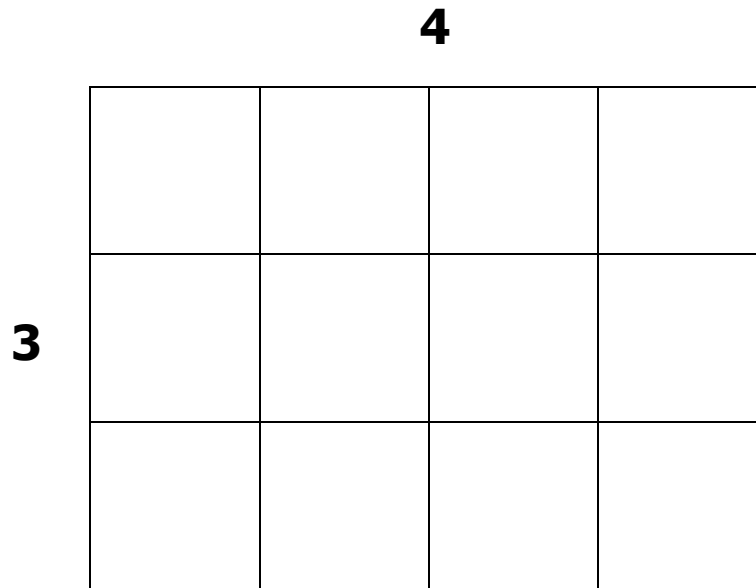
What is the perimeter of your rectangle? _____ units

What is the area of your rectangle? _____ square units

Choreographing the Area and Perimeter Student Worksheet

Name: _____

Date: _____



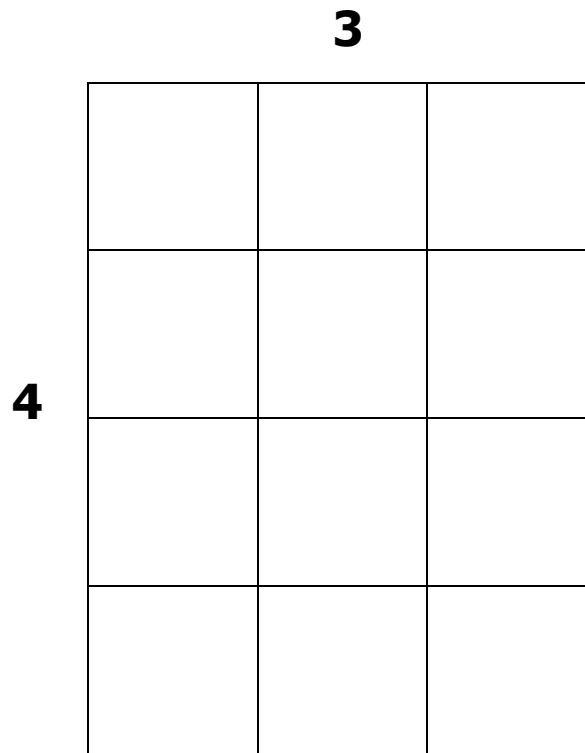
What is the perimeter of your rectangle? _____ units

What is the area of your rectangle? _____ square units

Choreographing the Area and Perimeter Student Worksheet

Name: _____

Date: _____



What is the perimeter of your rectangle? _____ units

What is the area of your rectangle? _____ square units

ARTS IMPACT LESSON PLAN Dance and Math Infusion

Third Grade Lesson Three: *Choreographing the Area and Perimeter*

Teachers may choose to use or adapt the following self-assessment tool.

STUDENT SELF-ASSESSMENT WORKSHEET

Disciplines	MATH		DANCE/MATH		Total 4
Concept	Area	Perimeter	Perimeter and Area		
Criteria	Records the number of square units in the inside surface of a rectangle.	Records the number of units in the distance around a rectangle.	Bound or Free Movement	Measurement	
Student Name			Performs bound movement for distance around a rectangle, or performs free movements for surface inside the boundary of the rectangle.	Performs movement for the total number of counts matching the measurement of the perimeter or area.	

ARTS IMPACT LESSON PLAN Dance and Math Infusion

Third Grade Lesson Three: *Choreographing the Area and Perimeter*

CLASS ASSESSMENT WORKSHEET

Disciplines	MATH		DANCE/MATH		Total 4
Concept	Area	Perimeter	Perimeter and Area		
Criteria	Records the number of square units in the inside surface of a rectangle.	Records the number of units in the distance around a rectangle.	Bound or Free Movement	Measurement	
Student Name			Performs bound movement for distance around a rectangle, or performs free movements for surface inside the boundary of the rectangle.	Performs movement for the total number of counts matching the measurement of the perimeter or area.	
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Percentage					

What was effective in the lesson? Why?

What do I want to consider for the next time I teach this lesson?

What were the strongest connections between dance and math?

Teacher: _____ Date: _____

DANCE AND MATH LESSON: *Choreographing the Area and Perimeter*

Dear Family:

Today your child participated in an **Arts and Math** lesson. We talked about how both mathematicians and dancers can measure and use area and perimeter.

- We reviewed how to measure area (the inside surface) and perimeter (the outside edge) of rectangles.
- We did the Math BrainDance to warm up our brains and bodies.
- We explored bound or tight movement and free or loose movement.
- We calculated the area and perimeter of a rectangle.
- We created a dance with a partner in which we danced the perimeter with bound movement and the area with free movement.
- We performed the dances and talked about how we knew when a dancer was dancing the area and when a dancer was dancing the perimeter.

At home, you could ask your child to help you calculate the area and perimeter of a book or the television. Ask your child to show you how to use movement to show area and perimeter.

Enduring Understanding

Movement around the edges of a rectangle and filling the inside of the rectangle can show perimeter and area.