TITLE

Area UNIT (5 days)

Cube Fellow: Amy Heilman **Teacher Mentor: Katrina Easterling**

Goal: Discover and apply the area formulas for parallelograms, squares, rectangles, trapezoids, triangles.

Grade and Course: 8th grade – Algebra/Geometry

KY Standards:

1. MA -08-3.1.2 Students will identify and compare properties of two-dimensional figures and will apply these properties and figures to solve real-world and mathematical problems.
2. MA -08-2.1.1 Students will measure lengths (to the nearest sixteenth of an inch or the nearest millimeter) and will determine and use in real-world or mathematical problems: area and perimeter of triangles and quadrilaterals; area and circumference of circles; area and perimeter of compound figures composed of triangles, quadrilaterals and circles; area from circumference or perimeter and circumference or perimeter from area.
3. MA -08-2.1.3 Students will estimate measurements in standard units in real-world and mathematical problems.

Objectives:

1. Student will be able to find the area formula for any given two-dimensional shape.
2. Students will be able to apply the area formulas to solve real-world mathematical problems.
3. Students will be able to recognize and use the relationship between the area and perimeter of the given two dimensional shape.

Resources/materials needed:

1. Handouts
2. scissors
3. rulers
4. calculators
5. Graphs

Description of Plan

1. Day 1: Defining Area and estimating area w/ hand trace activity.
2. Day 2: Area of Parallelograms. Students will first discover the area formula for a parallelogram and then apply it to various questions and situations.
3. Day 3: Area of triangles and trapezoids. Students will self-discover the area formulas for both triangles and trapezoids and apply these formulas.
4. Day 4: Practice w/ the different area formulas.
5. Day 5: Looking at the connections and relationships between the area and perimeter of any given two dimensional shape.

Lesson Source: Problems with a Point, NCTM Illuminations

Instructional Mode: individual work, small group activity, teacher-lead examples

Date Given: October 2006 (several days) **Estimated Time**: 5 days of instructional time

Date Submitted to Algebra^3: 10/9/07

AREA UNIT

AREA Day 1: Defining area and estimating area

AREA Day 2: Area of Parallelograms

AREA Day 3: Area of Triangles & Trapezoids
(may take two days – if so, use extra worksheets)

AREA Day 4: Worksheets solving for area of Parallelograms, Triangles, & Trapezoids

AREA Day 5: Area & Perimeter

AREA Day 1: Define Area & Estimate Area of Irregular Shapes

We just finished talking about perimeter and circumference....

- What part of any object is measured?

(the distance around an object, the length of all the sides...)

What does *AREA* measure about an object?

(how many units it takes to *cover* the object)

ex. How many index cards will *cover* the surface of the table?

- We are solving for the *AREA* of the table in index cards.

Can we solve for the same area with different units?

What are different ways to measure the AREA of the table?

* Books, hands, paper, feet, meters, inches, centimeters.etc

—compare units—?

HAND - TRACING ACTIVITY

Define area: *AREA IS THE TWO-DIMENSIONAL SPACE INSIDE A REGION.*

TWO-PIECE SHAPES ACTVITY

-students fold & cut the rectangles on the diagonal, making 2 identical Δ's

Conclusion: The size (area) of an object remains constant...even if the object is rearranged.

HAND-TRACIING ACTIVITY: Name _____

1. Trace your hand, with fingers spread, on the CM paper.
2. Estimate the area of your hand with your chosen unit.
   (circles, lima beans, etc.)
3. How would you define your area? (in terms of your units?)
4. Compare your measurement with a neighbor's measurement.
   * Is it easy to compare? Why or why not?
   * Do the type of units matter when comparing?
   * What could we do to make it easier to compare our different area measures?
5. Now estimate the area of your hand using the square centimeters on the paper.
   *Does this unit now make it easier to compare? Why or why not?
   *What is a STANDARD UNIT?
6. Now, on the 2nd piece of CM paper, trace your hand, but with all fingers together.
7. Estimate the area of your hand using the standard unit of squared centimeters.
8. How do the two areas compare?
   * Are the measurements the same? Why or why not?
   * Did the size of your hand change?
   * Does the rearrangement of a shape change its area?
     Why or why not?
9. Is there an easier way to estimate the area of your hand?
   * Draw a rectangle that fits tightly around the trace of your hand.
   * Solve for the area of the rectangle.
   * Find the area of the rectangle that is not inside the trace of your hand.
   * What if we subtract the area that is outside the trace from the area of the rectangle?
   *Will this give us the area of our hand? Why or why not?

HAND - TRACING ACTIVITY Name _____

1. Area of my hand (informal units) is:

2. Area of my hand (standard unit of square centimeters) is:

3. Area of my hand (with fingers closed) is:

4. Area of rectangle inclosing my hand is:

5. Area of space in rectangle that is not in my hand trace is:

6. Area of my hand:

HAND - TRACING ACTIVITY Name _____

1. Area of my hand (informal units) is:

2. Area of my hand (standard unit of square centimeters) is:

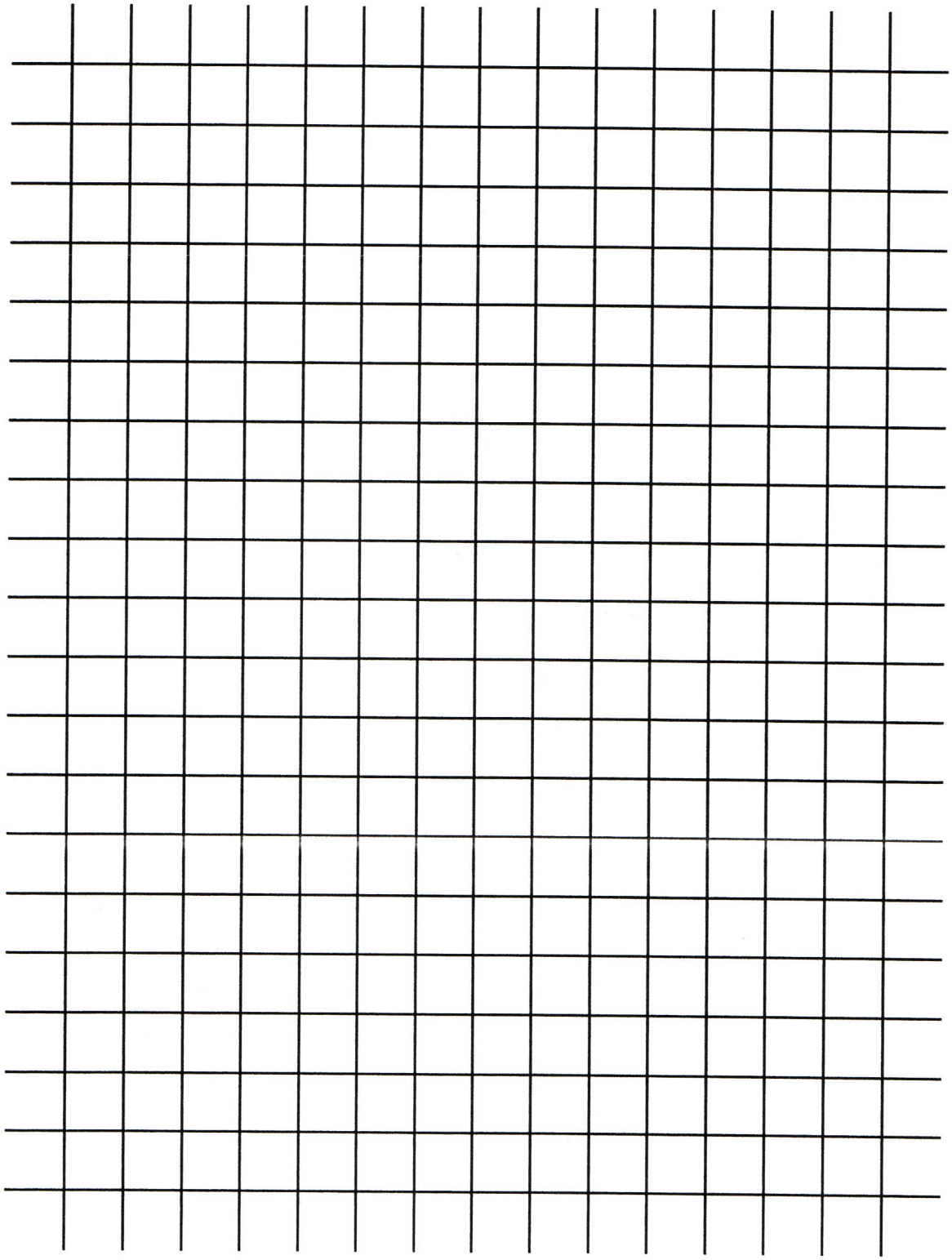
3. Area of my hand (with fingers closed) is:

4. Area of rectangle inclosing my hand is:

5. Area of space in rectangle that is not in my hand trace is:

6. Area of my hand:

Centimeter Grid Paper



Names_____

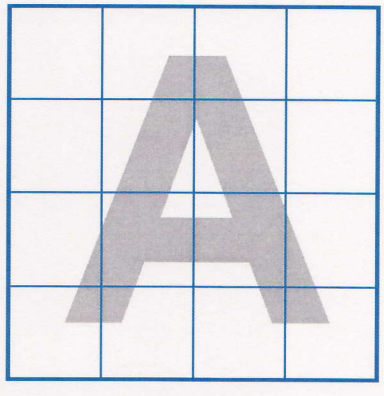
TWO-PIECE SHAPES ACTVITY

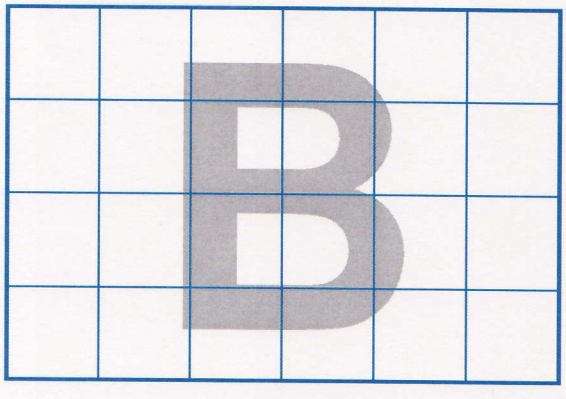
1. Rearrange the triangles into different shapes, including the original rectangle.
2. The rule is that only sides of the same length can be matched up and must match exactly.
3. Have each group find all the shapes that can be made this way, pasting the triangles on paper as a record of each shape.
4. Is one shape bigger than the rest? How is it bigger?
5. Did one take more paper to make, or did they all have the same amount of paper?

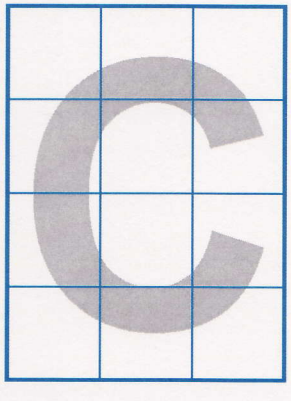
CONCLUSION:

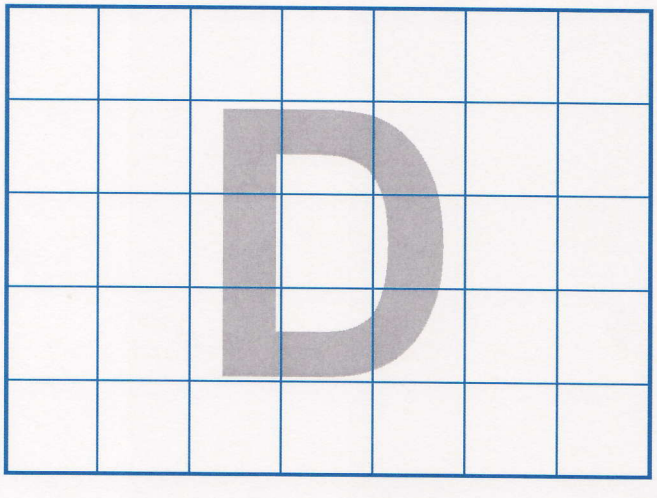
AREA OF SQUARES & RECTANGLES Name _____

1. Measure the length and width of each square and rectangle below, and then calculate its area.
2. What is the general formula for the area of a rectangle?





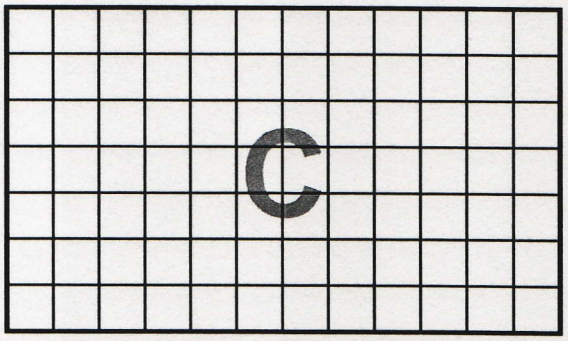


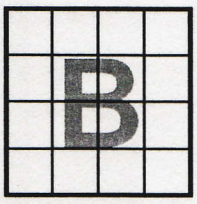


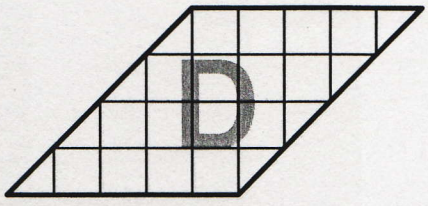
AREA OF PARALLELOGRAM ACTIVITY

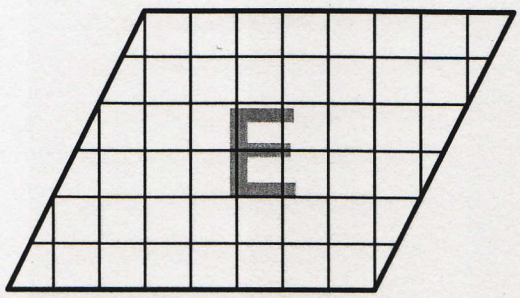
(use rectangle / parallelogram sheet and record sheet)

1. Determine the area of each shape A - E (estimate as accurately as possible)
2. Use what you know about the area of a rectangle to find the area of a parallelogram.
3. If you are stuck, examine the ways that the parallelogram is like a rectangle or how it can be changed into a rectangle.
4. Cut out rectangles A,B,C.
5. For Rectangle A, cut from the bottom left vertex to a point on the top edge that is 3 units from the top left vertex. (do similar cuts for rectangles B and C)
6. Place the removed triangle at the other end of the rectangle.
7. Now determine the area of the resulting parallelograms.
8. Now work in the other direction....cut out shapes D and E.
9. Remove the right triangle and move it to the other side.
10. Determine the area of the resulting rectangles and record.
11. Write a rule to determine the area of a parallelogram









Quadrilateral Area Record

NAME _____

NAME	ORIGINAL SHAPE	DIMENSIONS	AREA	NEW SHAPE	DIMENSIONS	AREA
A						
B						
C						
D						
E						

Name _____

Parallelogram Questions:

- State the area formula for a parallelogram. Draw and label a picture.

- What relationship is shared by parallelograms and rectangles that allow the same formula to be used to find the area of each?

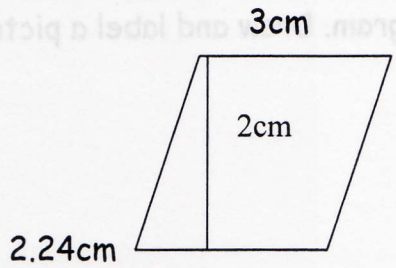
- Are there other methods to solve for the area of a parallelogram? Which is easier?

- When finding the area of a parallelogram, why multiply base times *height*, not *side?*

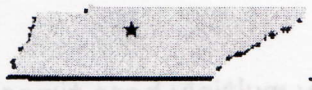
- Can the area formula for parallelograms be extended to rhombi? Why or why not?

Extension Problems:

1. Find the perimeter and area of the parallelogram.



2. A backyard is shaped like a parallelogram with a base of 7.9 yards and a height of 2.3 yards. What is the area of this backyard?

3.  Tennessee has an area of 42146 sq. miles. If the base of the state is 450 miles long, what is the height of the state, assuming Tennessee is a parallelogram?

4. Create a parallelogram with an area of 24 square centimeters. Make sure to label the length of the base and height.

AREA Day 3: Area of Triangles and Trapezoids

Purpose: Develop the formula for the area of a triangle and the area of a trapezoid by comparing those areas to the area of a related parallelogram.

Review:

- Recall the area formula for a general rectangle.
  - A = length * width = base * height
- Recall the area formula for a general parallelogram
  - A = base * height
- Draw the relationship between the parallelogram and the rectangle

FIRST....Using what we know about the area of parallelograms (including rectangles) .... We can solve for the area of a triangle.

***(discuss how to find the height & base of several triangles)

TRIANGLE AREA ACTIVITY

- go over questions and results

SECOND ... Using what we know about the area of a parallelogram...we can solve for the area of a trapezoid.

*** review definition of a trapezoid

***(discuss how to find the height & base of several trapezoids)

TRAPEZOID AREA ACTIVITY

- go over questions and results

EXTRA....Triangle & Trapezoid Worksheets

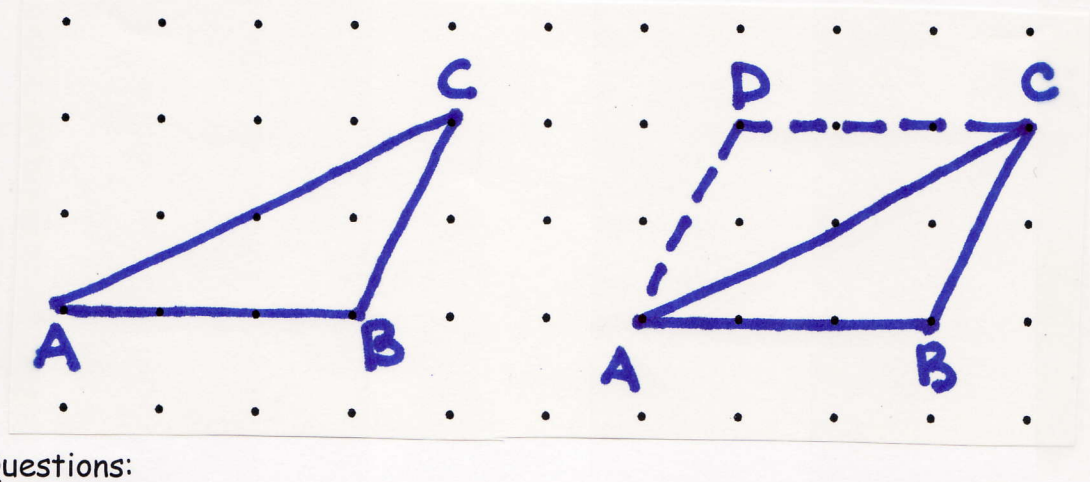
--Conclusion: review all formulas and relationships between shapes

Name _____

AREA OF TRIANGLES

Directions:

- Build Δ ABC on your dot paper.
- Construct a segment DC, parallel to AB, and with length equal to the measure of AB as shown.
- Draw the segment DA.



Questions:

1. Polygon ABCD is what type of quadrilateral?

2. What is the area of quadrilateral ABCD?

3. The area of Δ ABC is what fractional part of the area of the quadrilateral ABCD?

4. What is the area of Δ ABC?

Now, construct five additional triangles on your dot paper, then construct the related parallelogram as shown above.

1. For each new triangle, what is the relationship between the area of the triangle and the area of the related parallelogram?

2. What is the formula for finding the area of a parallelogram?

3. Knowing the relationship between the area of a triangle and the area of a related parallelogram, write a rule to determine the area of a triangle.

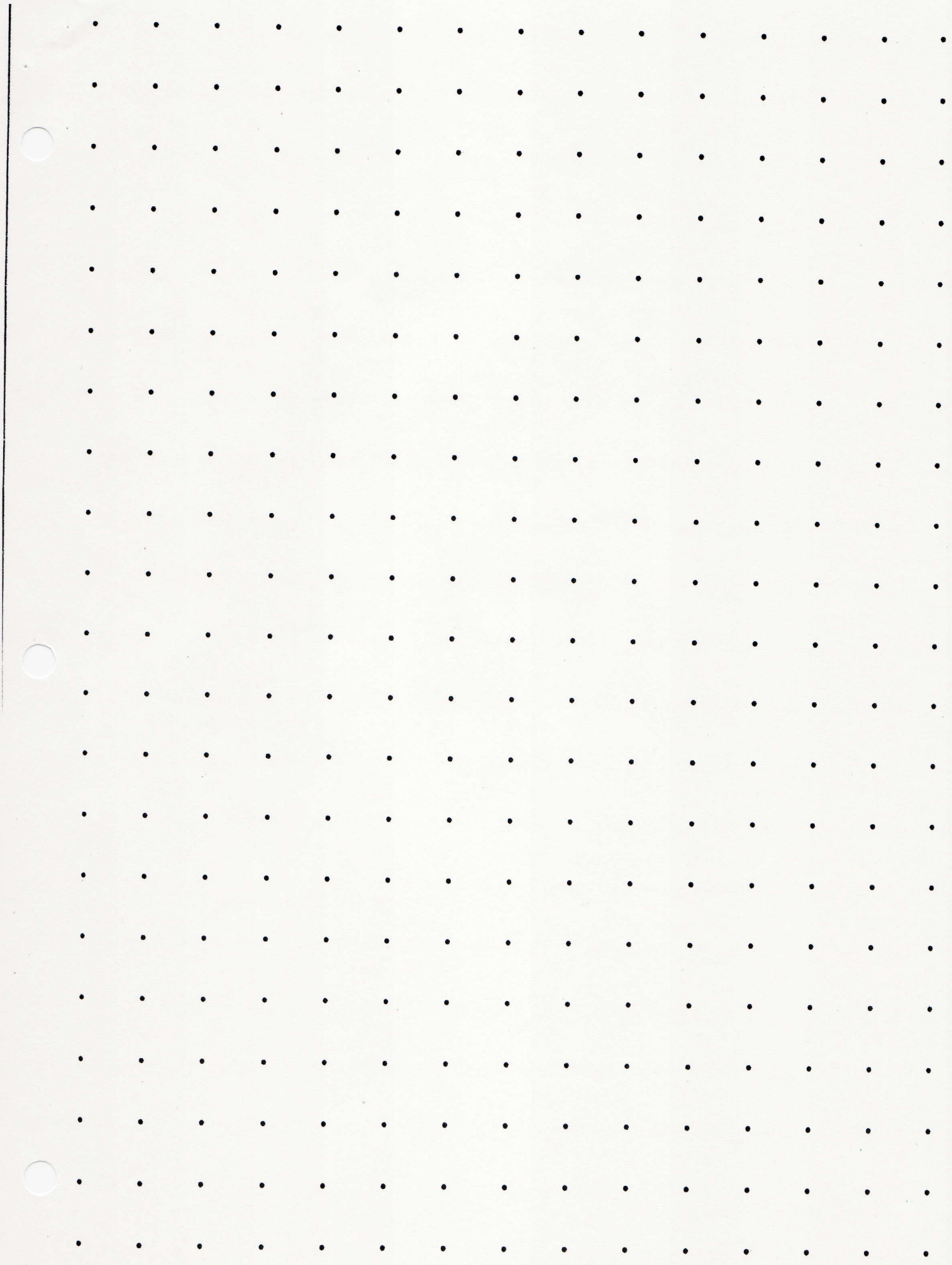
4. Solve for the area of your 5 triangles, drawing and labeling a small diagram.

1. 2.

3. 4.

5.

5. Do two triangles with the same height have the same area? Why or why not? (give an example)

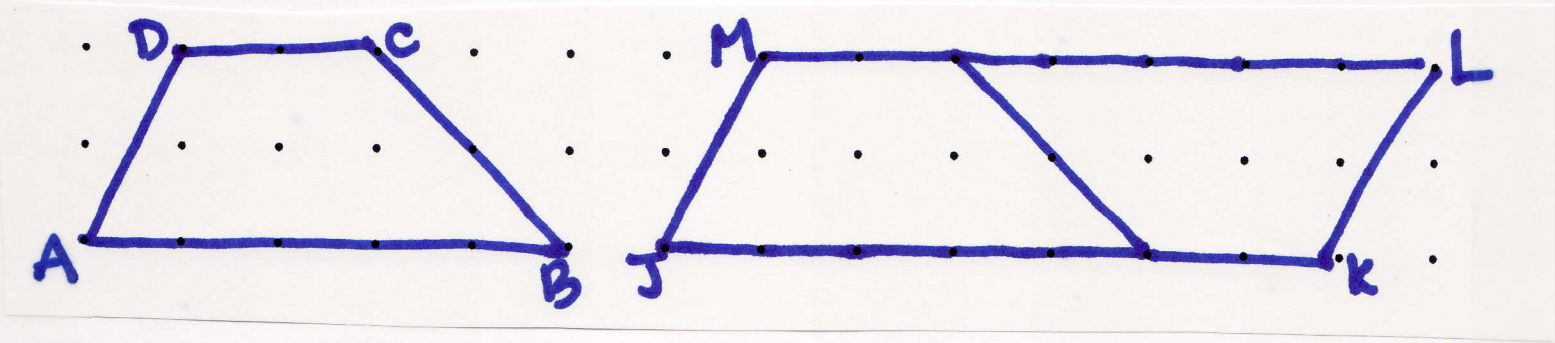


Name _____

AREA OF TRAPEZOIDS

Directions:

- Construct a trapezoid on your dot paper as shown. Duplicate the trapezoid, flip it over, and slide it to the right and match the vertices with the original trapezoid as shown.



Questions:

1. Polygon JKLM is what type of quadrilateral?

2. What is the area of quadrilateral JKLM?

3. What is the relationship between the area of trapezoid ABCD and the area of the quadrilateral JKLM?

4. What is the area of trapezoid ABCD?

Construct five additional trapezoids on your dot paper, and then construct the related parallelogram.

1. For each trapezoid, what is the relationship between the area of the trapezoid and the area of the related parallelogram?

2. What is the relationship between the measure of the base of the parallelogram and the measures of the two bases of the trapezoid?

3. Knowing the relationship between the area of the trapezoid and the area of a related parallelogram, write a rule to determine the area of a trapezoid.

4. Determine the area of your 5 trapezoids, drawing and labeling a small diagram.

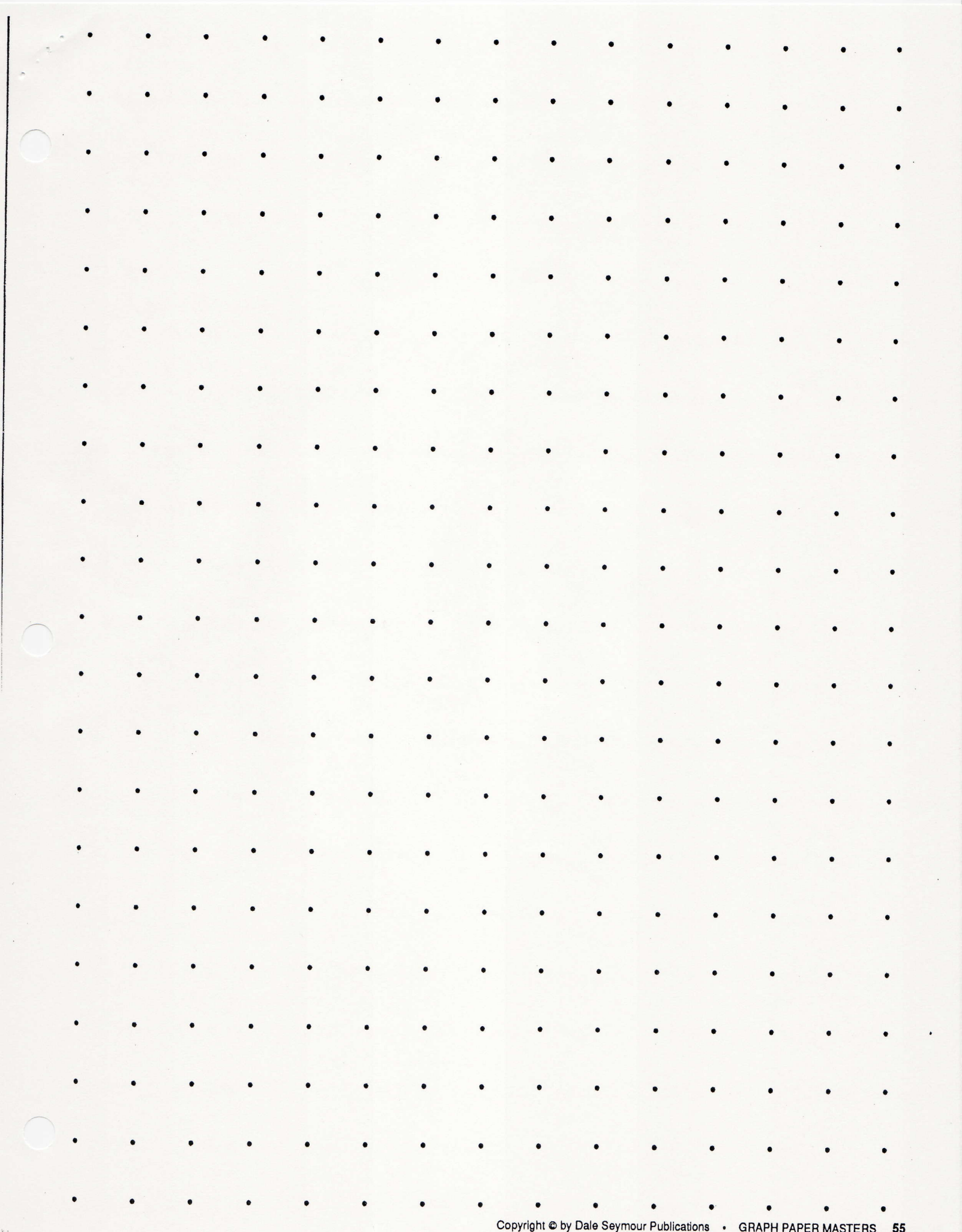
1.

2.

3.

4.

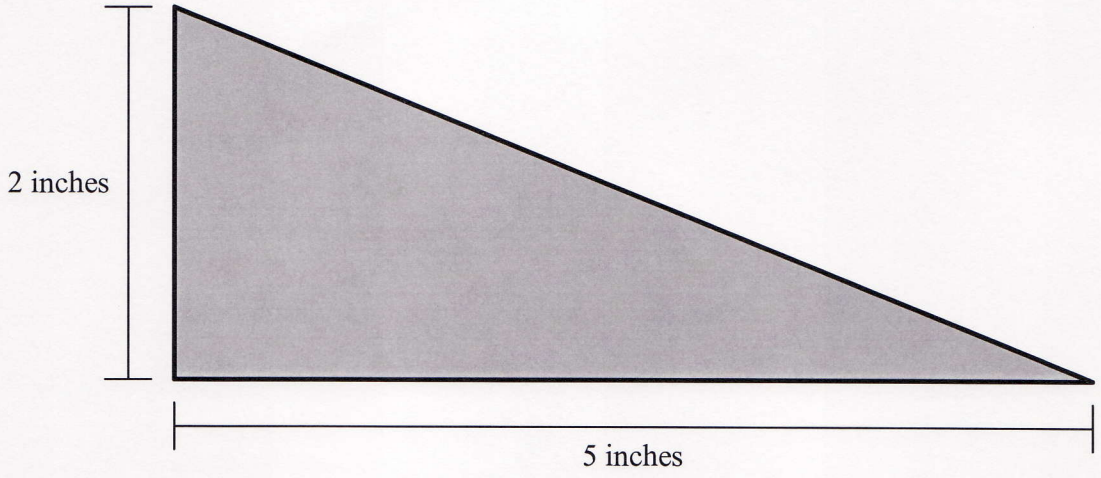
5.

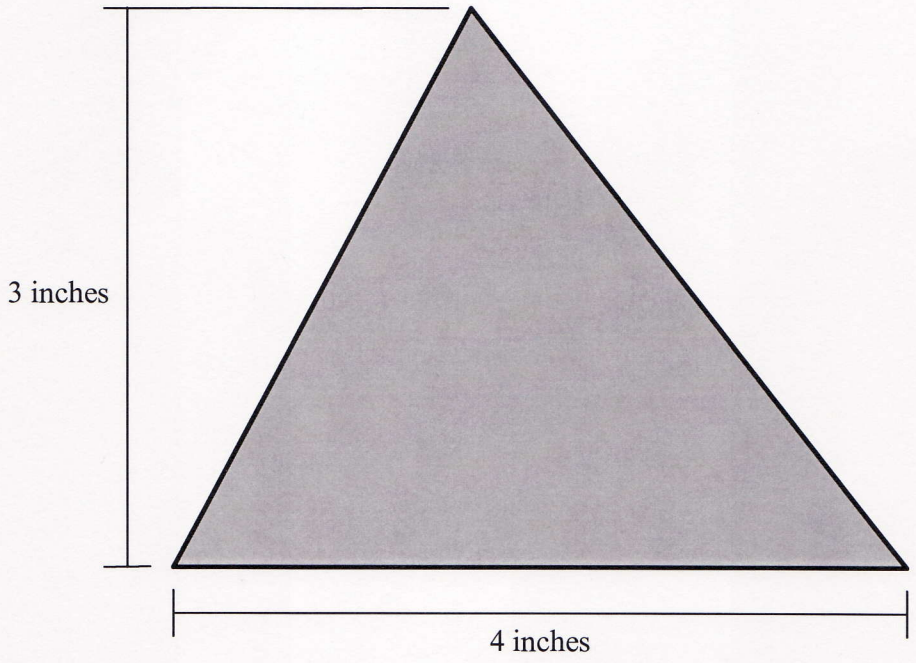


Unknown Triangles

NAME _____

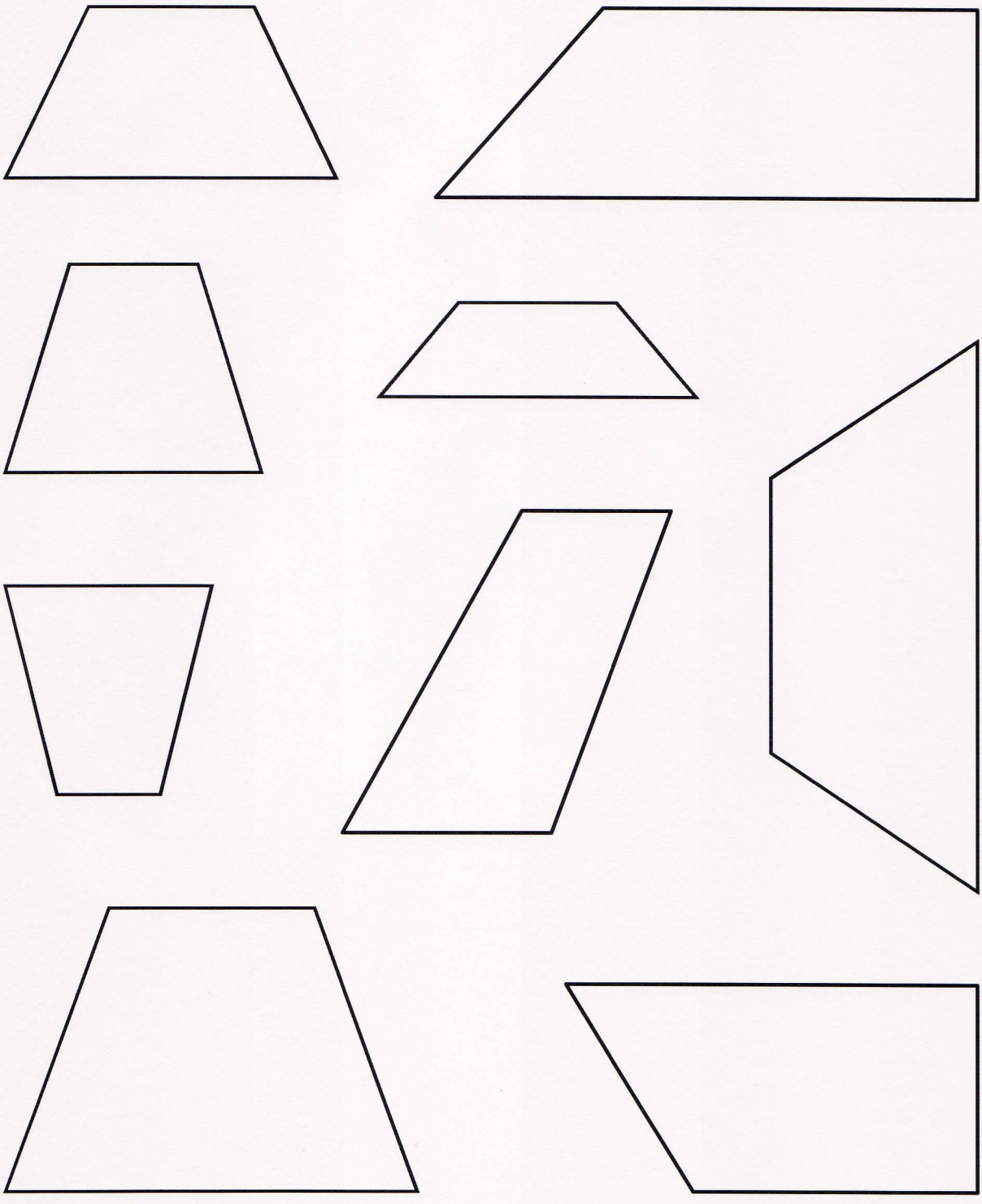
Determine the area of the triangles below, using any method you choose.





Trapezoids

NAME _____



AREA DAY 4: PRACTICE SOLVING FOR AREA

- There are several worksheets to use for practice.
- Also, use this as time to catch up on the previous lesson if needed.

Name _____ Date _____

Area of Parallelograms, Triangles, & Trapezoids

1. Find the area of the trapezoid whose vertices are (0, 6), (8, 2), (4, 6), and (0, 2)	2. Find the area of the trapezoid whose vertices are (9, 4), (0, 4), (0, 0), and (3, 0)
3. Find the area of the trapezoid whose vertices are (-6, 6), (3, 6), (-2, 1), and (3, 1)	4. Find the area of the trapezoid whose vertices are (0, 1), (-3, 6), (-3, 1), and (4, 6)
5. Find the area of the parallelogram whose vertices are (0, -6), (4, -2), (5, -6), and (-1, -2)	6. Find the area of the parallelogram whose vertices are (-10, 5), (-1, 0), (-2, 5), and (-9, 0)
7. Find the area of the parallelogram whose vertices are (3, 0), (4, 3), (8, 0), and (9, 3)	8. Find the area of the parallelogram whose vertices are (7, 1), (-5, -2), (0, 1), and (2, -2)
9. Find the area of the triangle whose vertices are (1, 4), (4, -1), and (-2, -1)	10. Find the area of the triangle whose vertices are (4, 4), (4, 1), and (-3, 1)
11. Find the area of the triangle whose vertices are (-3, -2), (-4, -5), and (-6, -5)	12. Find the area of the triangle whose vertices are (-3, -6), (-1, -3), and (-5, -6)

Comparing Area and Perimeter Name:_____

On grid paper create as many rectangles as you can having a perimeter 24 units. Record your findings in the chart provided.

Length	Width	Perimeter	Area

If the perimeter is constant which rectangle will produce the largest area?

If the perimeter is constant which rectangle will produce the smallest area?

On grid paper create as many rectangles as you can having an area of 36 units^2. Record your findings in the chart provided.

Length	Width	Area	Perimeter

If the area is constant which rectangle produces the largest perimeter?

If the area is constant which rectangle produces the smallest perimeter?

Suppose you wanted to help a friend build a rectangular pen for her pot-bellied pig, Elroy. You have 24 yards of fencing in 1-yard sections. Which rectangular shape would be best for Elroy? Explain why this shape is best.

Length	Width	Area	Perimeter

The National Parks Service decided that storm shelters were needed on the trails at Natural Bridge. Storm shelters are required to have 24 square meters of floor space. Suppose that the walls are made of sections that are one meter wide and cost $150 each. Which rectangular shape would be the best to build? Explain why.

Length	Width	Area	Perimeter	Cost