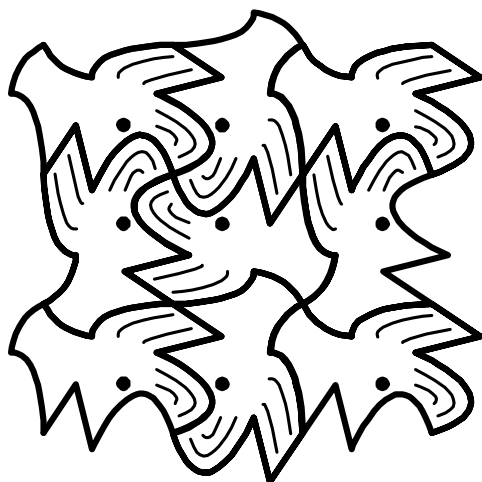


# Three Hour Exams and Final

## Geometric Structures Spring 2005

Jennifer Stone



Exam 1	Page 1
Exam 2	Page 5
Exam 3	Page 9
Final Exam	Page 14

Oklahoma State University  
June 2005

# MATH 3403 – Geometric Structures – Exam 1

February 2005

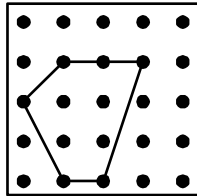
Name \_\_\_\_\_

1. (12 points) These are some ways that we have been finding areas of geoboard figures:

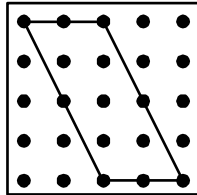
- Cut-Up
- Take-Away
- Julie's Way
- Base x height
- $\frac{1}{2}(\text{Base} \times \text{height})$

Three different geoboard figures are given below. You are to work out the area of each figure using a different method for each figure. Be sure to name each method and fully describe how you used the method for the figure. *Note: Be sure to use 3 different methods.*

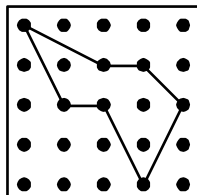
(a) Method 1  
Method Name:  
Show Method:



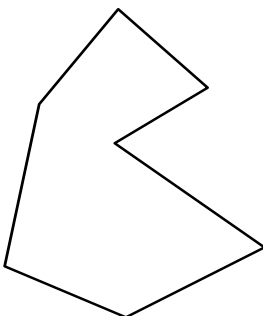
(b) Method 2  
Method Name:  
Show Method:



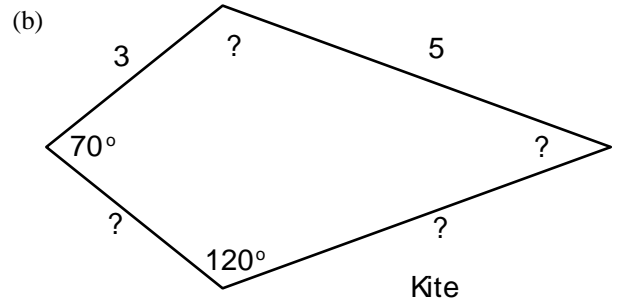
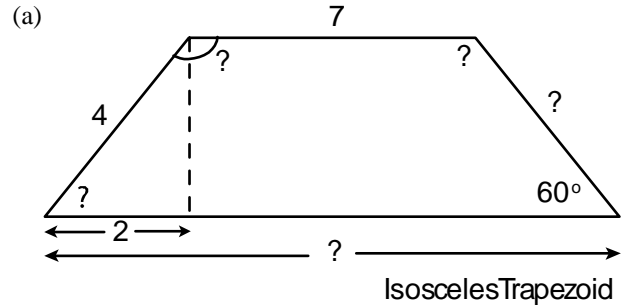
(c) Method 3  
Method Name:  
Show Method:



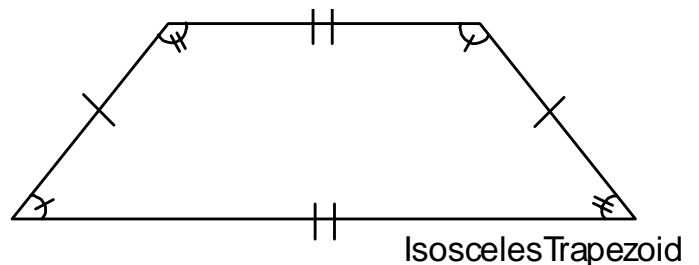
2. (6 points) What is the angle sum for the following polygon? *Show your reasoning.*



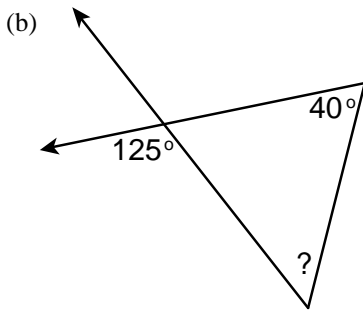
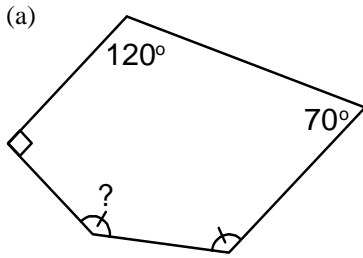
3. (9 points) Write in the values of each side and each angle of the given quadrilaterals.



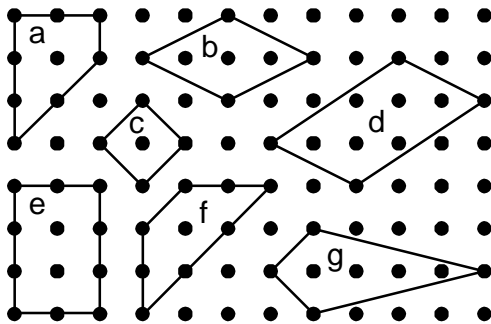
4. (5 points) Describe what is wrong with the markings on this figure. *Look carefully!*



5. (8 points) In the two figures below, give the value of the angles marked with a question mark “?”. *Be sure to show your work!*

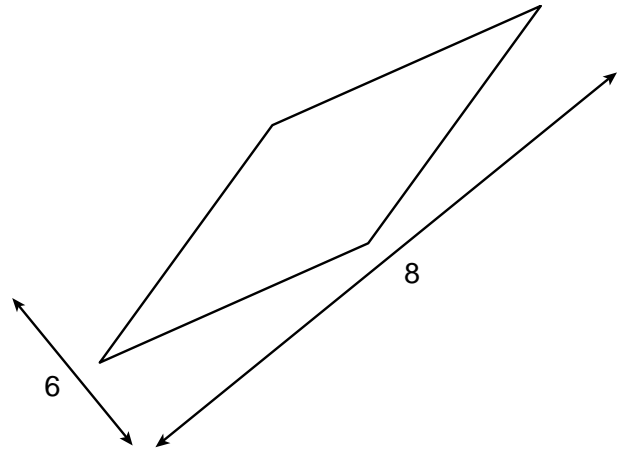


6. (10 points) For each of the properties given below, write the letters of the shapes that have that property.



- (a) Opposite angles are congruent.
- (b) At least one diagonal is a line of symmetry.
- (c) The diagonals bisect the vertex angles.

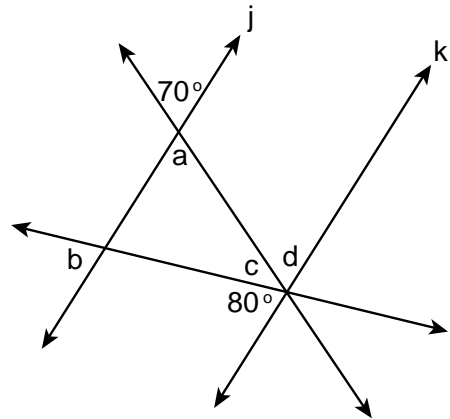
7. (10 points) Find the area of this rhombus. The lengths of the diagonals are marked. *Show your work!*



8. (11 points) In the figure below, line  $j$  and line  $k$  are parallel. For each angle marked with a letter, find (i) the value of the angle and (ii) give a reason.

Acceptable reasons include:

- “alternate interior angle to something”
- “corresponding angle to something”
- “vertical angle to something”
- “supplementary angle to something”
- “angle sum is something” (straight line or polygon)



- (a) The value of  $a$  is:  
The reason is:
- (b) The value of  $b$  is:  
The reason is:
- (c) The value of  $c$  is:  
The reason is:
- (d) The value of  $d$  is:  
The reason is:

9. (10 points) Redbeard the Pirate found a treasure map to the famed sunken ship, the Black Pearl. The only problem is that his pet monkey got hungry and ate part of the map. Redbeard locates the area on the map hoping to find some clues. He finds three islands in the area and from artifacts found on the three islands, Redbeard thinks that the treasure is located underwater at a point equidistant from the three islands. If he is correct, using paper folding, how should he go about locating the point on the map where the treasure is located? (*Hint: Sketch a picture*)

10. (9 points) For each of the following statements, decide if it is possible or not.

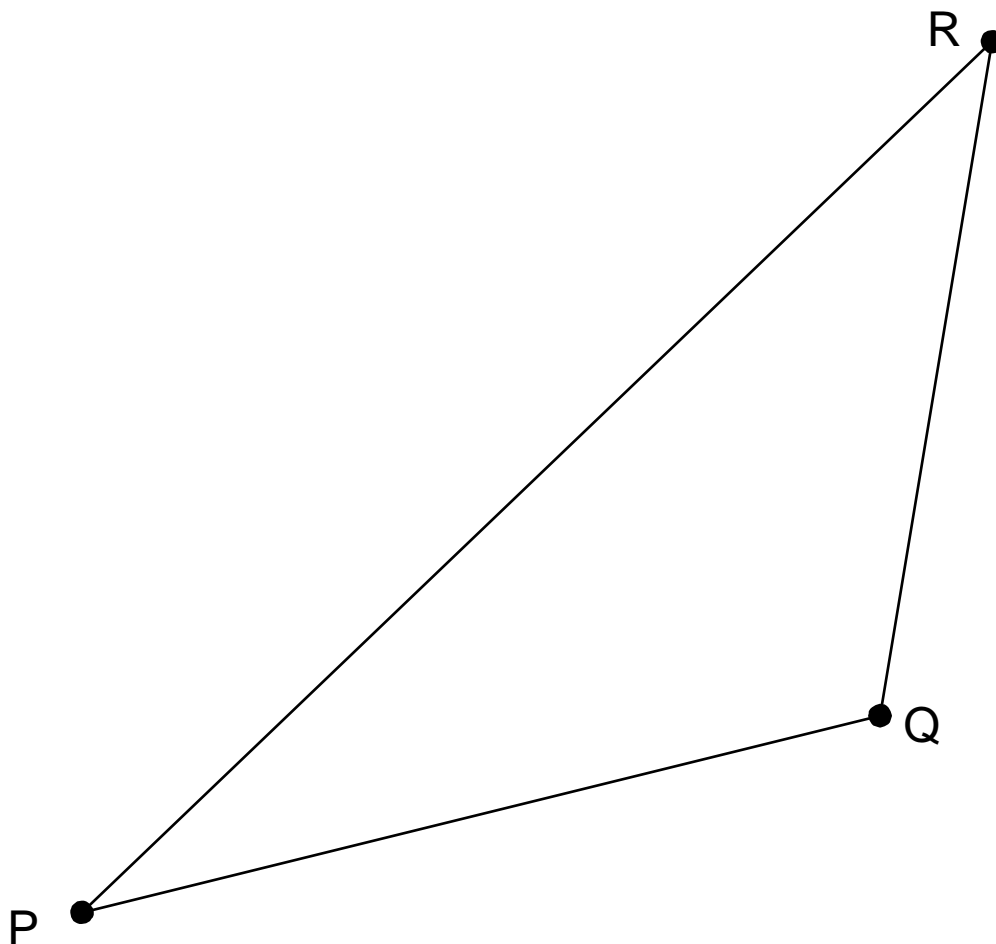
- If possible, write POSSIBLE, and draw a picture.
- If it is not possible, write NOT and give a reason.

(a) A polygon with an angle sum equal to  $560^\circ$ .

(b) A rhombus with an angle of  $60^\circ$  and another angle of  $110^\circ$ .

(c) A rectangle with a line of symmetry.

11. CD Problem: By paper folding, find the balance point, or center of gravity, of the triangle.  
(10 points) Remember to complete *both* the construction and write your detailed description of the steps that you followed.

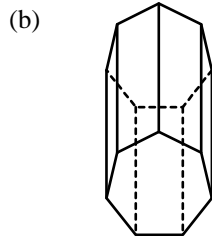
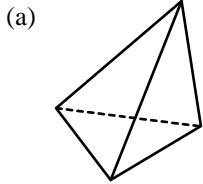


# MATH 3403 – Geometric Structures – Exam 2

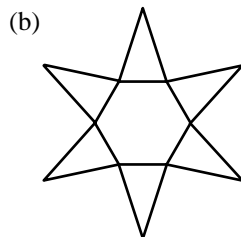
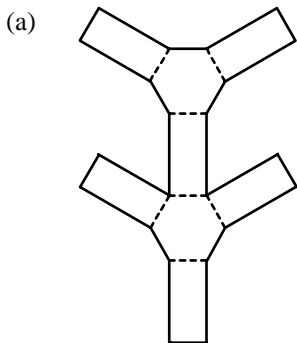
March 2005

Name \_\_\_\_\_

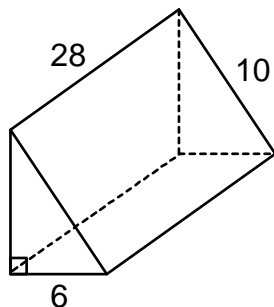
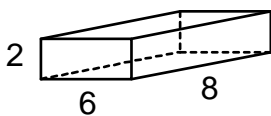
1. (4 points) How could you name the following polyhedra?



2. (4 points) What would you name the 3-D shapes formed by these nets?



3. (10 points) Below are two prisms with measurements marked. How many rectangular prisms could fit into the triangular prism? In other words, if we filled the rectangular prism up with sand and poured it into the triangular prism, how many times would we have to do this until the triangular prism was full? (*Hint: Start with volume, BE CAREFUL!!*)



4. (12 points) Here are some ways that we have been calculating areas of geoboard figures:

i)  $\text{Area} = (\text{Inside pegs}) + 1$

ii)  $\text{Area} = (\text{Inside pegs}) + 2$

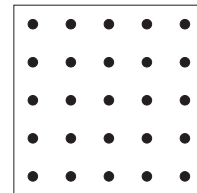
iii)  $\text{Area} = \frac{(\text{EdgePegs})}{2} - 1$

iv)  $\text{Area} = \frac{(\text{EdgePegs})}{2}$

v)  $\text{Area} = (\text{InsidePegs}) + \frac{(\text{EdgePegs})}{2} - 1$

Choose one of these methods and (a) illustrate the method with an example, (b) describe the conditions where the method works, and finally (c) give an example where the method does NOT work.

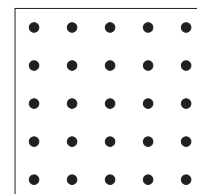
(a) Make up an example on the geoboard below and show how the method works.



(b) What conditions on a geoboard figure are needed in order for this method to work?

**Describe:**

(c) Give an example below where the method does NOT work. Your example:

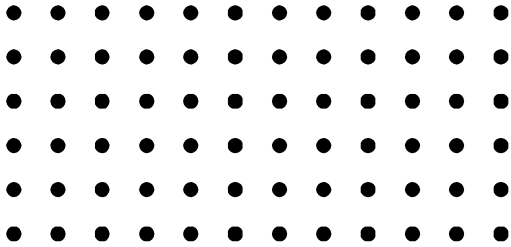


5. (6 points) On dot paper, draw and label 3 lines with the following slopes.

(a)  $\frac{5}{4}$

(b)  $-80\%$

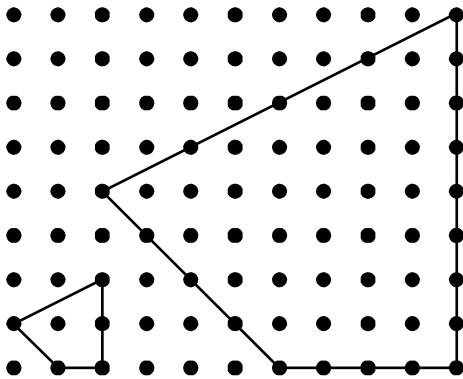
(c)  $0.25$



6. (4 points) For each of the following statements, name one polyhedron that satisfies the given requirements.

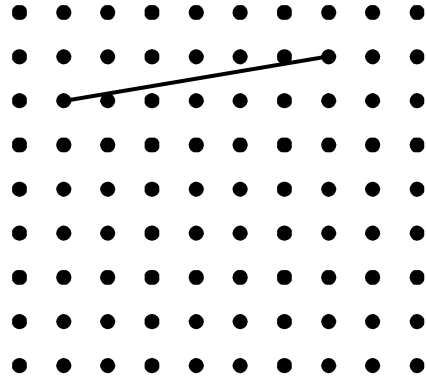
- (a) A polyhedron with 7 faces and 12 edges.
- (b) A polyhedron with two congruent parallel bases and 21 edges.

7. (12 points) The two figures drawn below are similar. Inside each figure, write the area.



- a) What is the scale factor going from smaller figure to the larger?
- b) What is the area factor going from the smaller figure to the larger?
- c) Describe how the scale factor and the area factor are related. **Your description:**

8. (6 points) Circle two dots which would make corners of a square with the given side below.



9. (9 points) For each of the following statements, decide if it is possible or not.

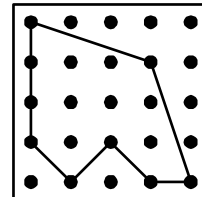
- If possible, write POSSIBLE, and draw a picture.
- If it is not possible, write NOT and give a reason.

(a) A 45-45-90 triangle with sides 3, 4, and 5.

(b) A skew figure which is also a tile shape.

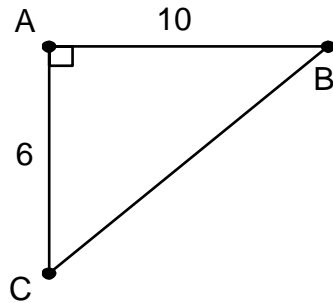
(c) A prism with 9 edges.

10. (5 points) Find the perimeter of the following figure. Express your answer in two ways.



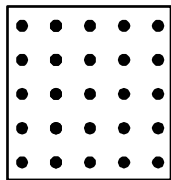
- (a) The perimeter as a sum of square roots.
- (b) The perimeter as a decimal.

11. (8 points) Assume you are driving from point C to point B. Approximately how much further do you have to drive if you go from C to A and then from A to B than if you go directly from C to B? (Triangle ABC is a right triangle.)



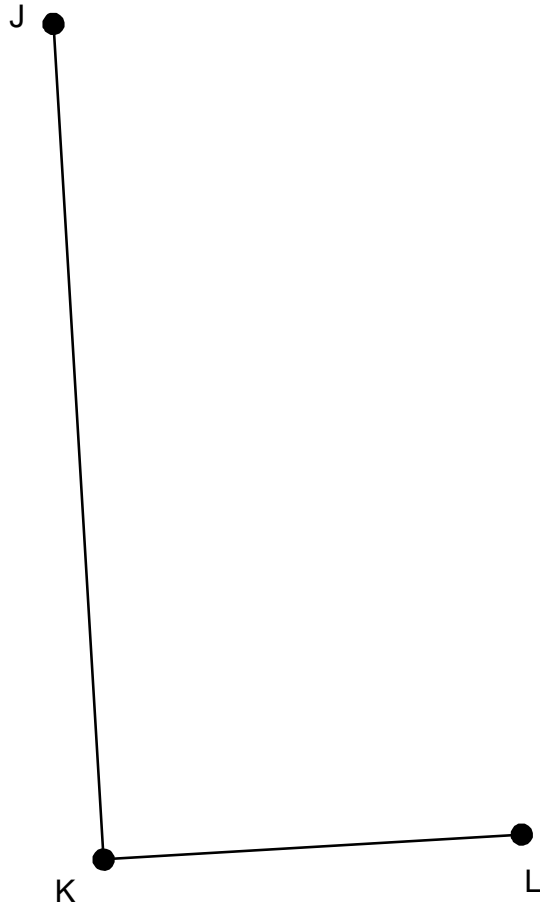
12. (6 points) Abigail just bought a new TV with dimensions of 34 in x 40 in. Her old TV was  $1/16^{\text{th}}$  the area of this new TV. What were the dimensions of her old TV (length and width)?

13. (4 points) Make up a polygon with perimeter  $2\sqrt{2} + 2\sqrt{5} + 4$





14. (10 points) CD Problem: Using a compass and straight edge, construct a rectangle with JK and KL as two of the sides. Describe the steps which you followed:



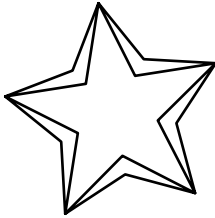
# MATH 3403 – Geometric Structures – Exam 3

April 2005

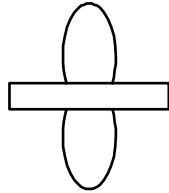
Name \_\_\_\_\_

1. (5 points) Using a mira, for each figure below, find *all* of the lines of symmetry.

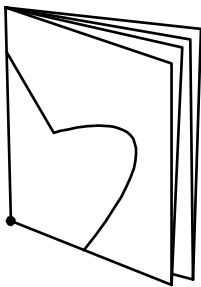
(a)



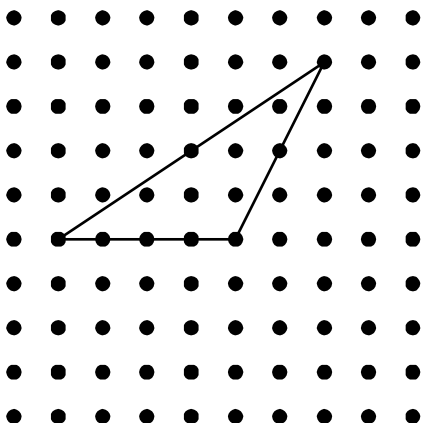
(b)



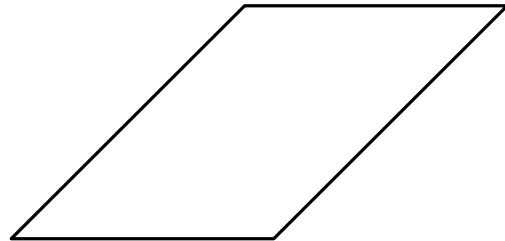
2. (5 points) For the picture given below, draw what you think the shape will look like when it is cut out.



3. (8 points) Find the orthocenter of the obtuse triangle.  
(Hint: point where the altitudes meet).



4. (6 points) For the given parallelogram, use a mira to find two altitudes which cross each other.

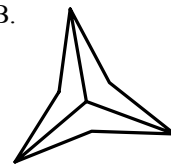


5. (12 points) Several figures are given below:

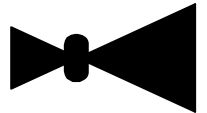
A.



B.



C.



D.



E.

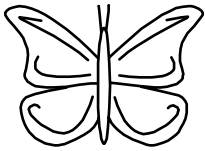


F.



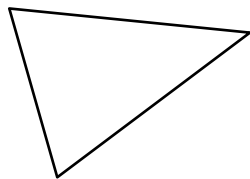
- Which figures are symmetric?
- Which figures have bilateral symmetry?
- Which figures are fold and cut?
- Which figures are double fold and cut?

6. (4 points) Using a mira, find the line of reflection for the given figure and its image.

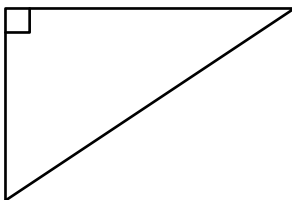


7. (12 points) For each of the following triangles, describe where the circumcenter is located, and sketch a picture for each (does NOT need to be exact). Make sure it is clear what method you think should be used to find the circumcenter.

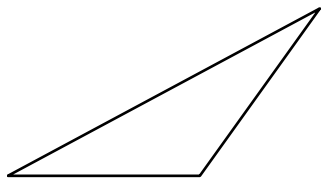
(a) Acute triangle



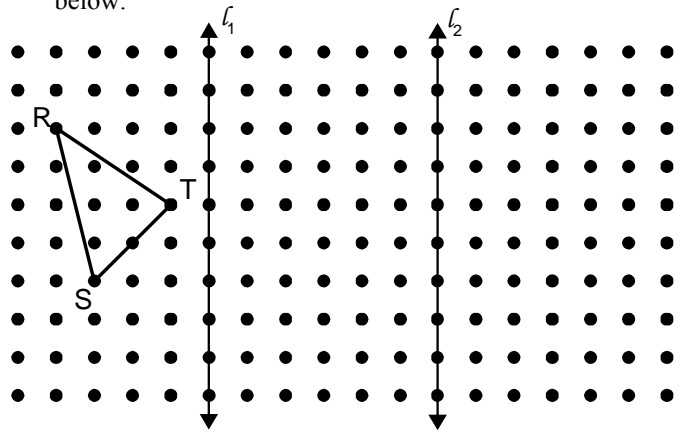
(b) Right triangle



(c) Obtuse triangle



8. (10 points) A triangle RST is shown on the dotpaper below.



- (a) Carry out the following construction:
- Reflect RST across line  $l_1$ . Label the reflection as  $R' S' T'$  where  $R'$  is the reflection of R,  $S'$  is the reflection of S, etc.
  - Reflect the new triangle  $R' S' T'$  over line  $l_2$ . Label this third triangle  $R'' S'' T''$ .

(b) How are RST and  $R'' S'' T''$  related? (Reflection, translation, glide reflection, or rotation.)

(c) Draw the point image segments  $RR''$ ,  $SS''$ , and  $TT''$ . How long is each of these segments?

(d) How far apart are lines  $l_1$  and  $l_2$ ?

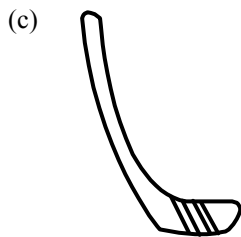
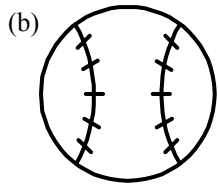
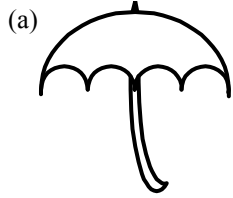
(e) What is the relationship between the answers you found in part c and the answer you found in part d? **Describe this relationship.**

9. (3 points) For the following statement, decide if it is possible or not.

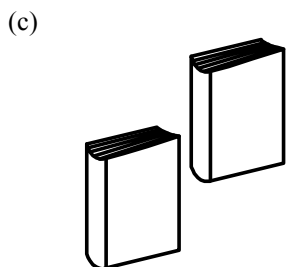
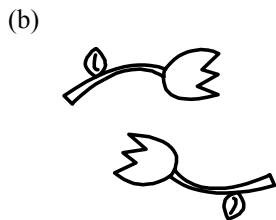
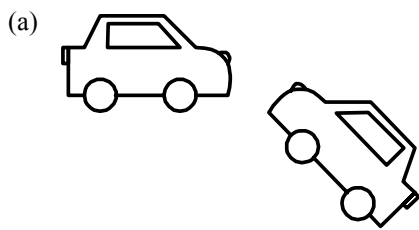
- If possible, write POSSIBLE, and draw a picture.
- If it is not possible, write NOT and give a reason.

→ A triangle where the foot of an altitude is the same as a vertex.

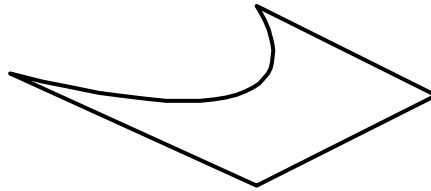
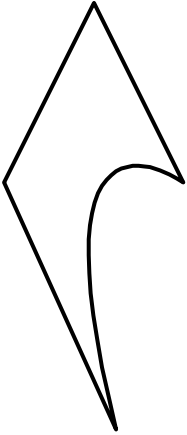
10. (6 points) Indicate if the following figures are one or two sided by writing a "1" or "2" beside each figure.



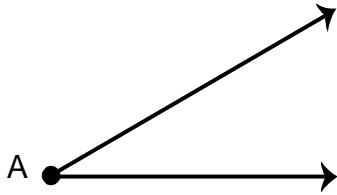
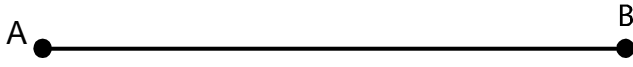
11. (9 points) Below are pairs of congruent figures. For each pair, indicate by which of the four types of transformations the copies are related (translation, rotation, reflection, or glide reflection).



12. (10 points) **CD Problem:** The two congruent figures below are related by either a glide reflection or a rotation. Decide which relationship is true. Using a mira, if it is a rotation, find the center, and if it is a glide reflection, find the glide reflection line. Describe you steps:



13. (10 points) **CD Problem:** Using a *compass and straightedge*, create a triangle which has two sides and the included angle copied from those given below. Be sure the ends marked A of the two line segments meet at the angle A. Describe your steps:



# MATH 3403 – Geometric Structures – Final Exam

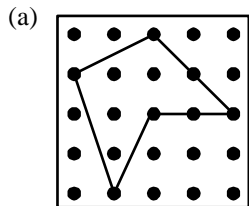
May 2005

Name \_\_\_\_\_

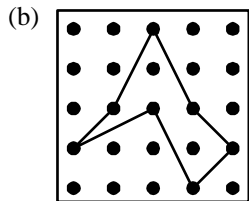
1. (12 points) These are some ways that we use to find areas of geoboard figures.

- Cut-Up
- Take-Away
- Julie's Way
- Base x height
- $\frac{1}{2}$  (Base x height)
- Pick's Formula

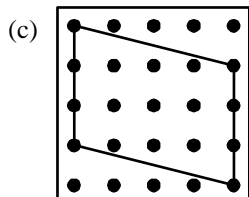
Three different geoboard figures are given below. You are to work out the area of each figure using a different method for each figure. Be sure to **name** each method and **describe how** you used the method for the figure.



Name:  
Description:

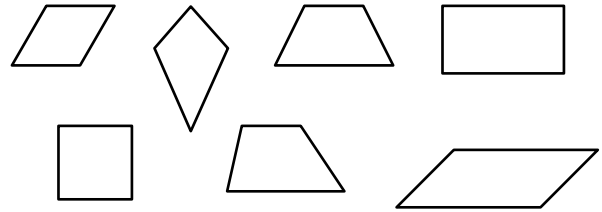


Name:  
Description:



Name:  
Description:

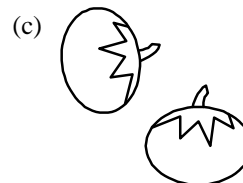
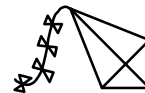
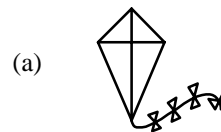
2. (9 points) The seven types of quadrilaterals we have been working with are drawn below.



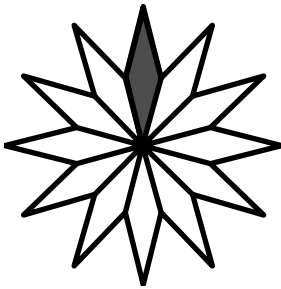
For each of the following descriptions, write down all of the names of the quadrilaterals which satisfy the description. There may be more than one answer for each.

- (a) Opposite sides are congruent.
- (b) There is at least one line of symmetry.
- (c) The diagonals bisect each other.

3. (9 points) Below are pairs of congruent figures. For each pair, indicate by which of the four types of transformations the copies are related (translation, rotation, reflection, or glide reflection).

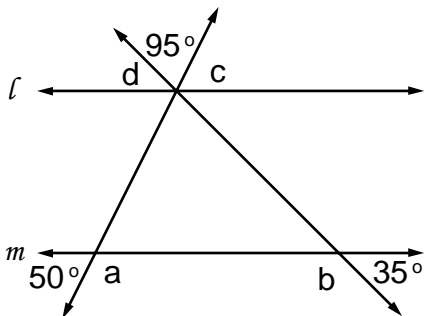


4. (6 points) Since a piece of the shape is shaded, the following figure is a type  $D_1$  mandala. Shade more pieces so that the figure becomes a type  $D_4$  mandala.



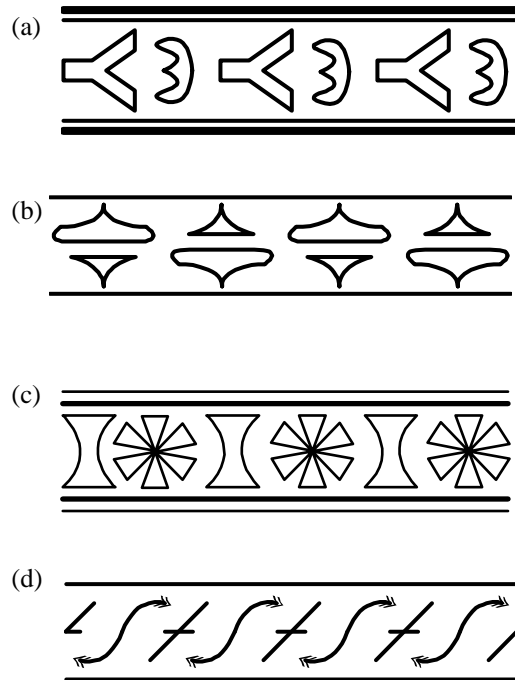
5. (8 points) In the figure below, line  $l$  and line  $m$  are parallel. For each angle marked with a letter, find the value of the angle and give a reason.

Acceptable reasons include:  
 “alternate interior angle to something”  
 “corresponding angle to something”  
 “vertical angle to something”  
 “supplementary angle to something”  
 “angle sum is something” (straight line or polygon)



- (a) The value of  $a$  is:  
The reason is:
- (b) The value of  $b$  is:  
The reason is:
- (c) The value of  $c$  is:  
The reason is:
- (d) The value of  $d$  is:  
The reason is:

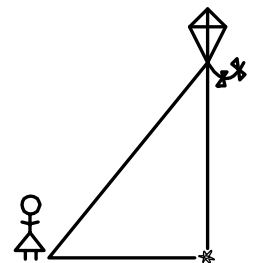
6. (12 points) Using the code table below, identify the symmetry types of these borders.



Code for Border Patterns

First	Second
m crossline symmetry	m centerline symmetry
1 no crossline sym.	g glide reflectional sym.
	2 half-turn symmetry
	1 no additional sym.

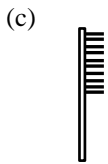
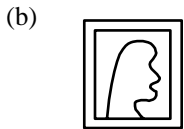
7. (7 points) Abigail is flying a kite and is curious about how high the kite is above the ground. She measures the length of the string and finds it to be 32 feet. Her kite is directly above a flower which is 11 feet away from her. How high is her kite flying?



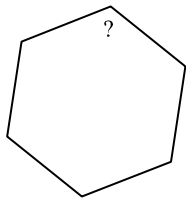


8. (7 points) The minute hand on Ray's watch is 8 mm long. He knows that the clock on his wall is 36 times the area of his watch. How long is the minute hand of his clock?

9. (6 points) Indicate if the following figures are one or two sided by writing a "1" or "2" beside each figure.

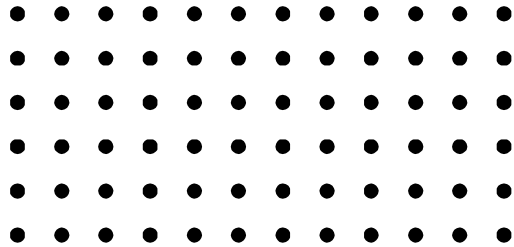


10. (6 points) Find the angle measurement marked for the regular hexagon. *Show your work!!*

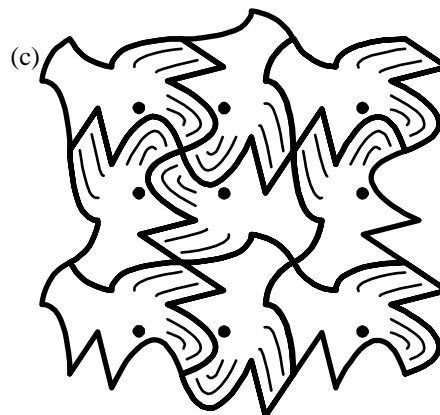
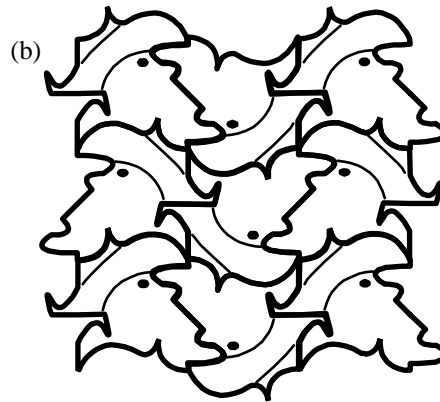
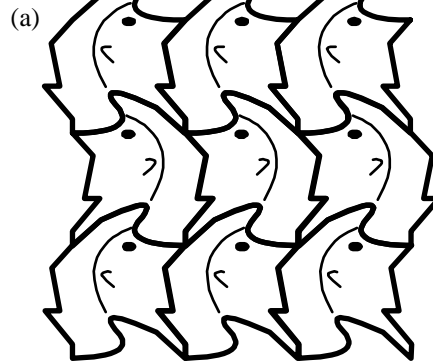


11. (6 points) On the dot paper below, draw and label two lines with the following slopes.

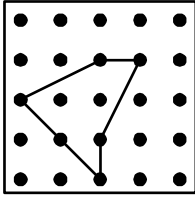
- a)  $-0.75$       b)  $60\%$



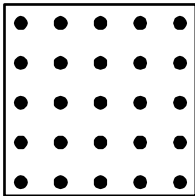
12. (9 points) For each of the tessellations, identify the Heesch type.



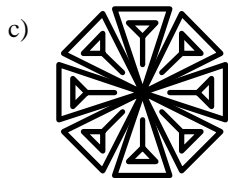
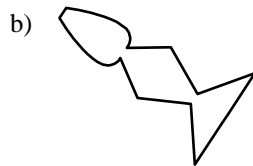
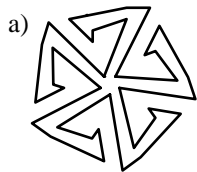
13. (6 points) Find the perimeter of the following geoboard figure. Express your answer in two ways.



- (a) The perimeter as a sum of square roots.
- (b) The perimeter as a decimal.
- (c) Now, create your own geoboard figure that is different from the given figure, but has the same perimeter.



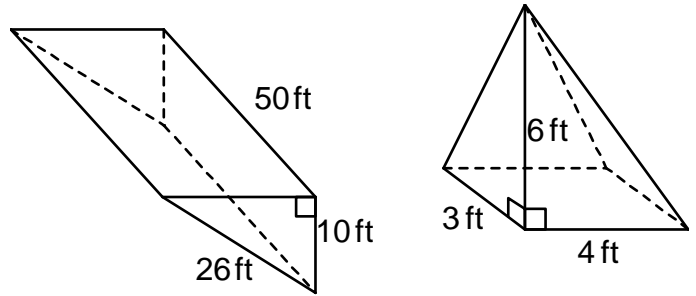
14. (9 points) Using the code table below, identify the types of the following mandalas.



**Code for Mandalas**

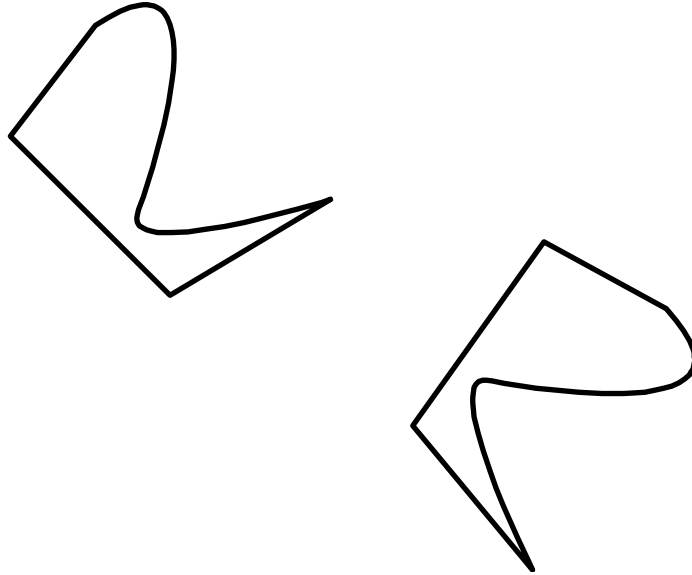
$C_n$	n-fold rotational symmetry (no reflectional symmetry)
$D_n$	reflectional symmetry and n-fold rotational symmetry
D or $D_1$	Bilateral symmetry only
N or $C_1$	No symmetry

15. (8 points) Use the polyhedra to answer the following questions.



- (a) How would you name **each** of the above polyhedra?
- (b) Choose either the prism or pyramid and calculate its volume. State which polyhedra you choose. *Show your calculations.*

16. (10 points) **CD Problem – Mira:** The two congruent figures below are related by either a glide reflection or a rotation. Decide which relationship is true. Using a mira, if it is a rotation, find the center, and if it is a glide reflection, find the glide reflection line. Describe your steps:



17. (10 points) **CD Problem – Compass and Straightedge:** Using a Compass and Straightedge, locate point R so that triangle PQR is an equilateral triangle.



18. (10 points) **CD Problem – Paper Folding:** Using Paper Folding, locate the center of the inscribed circle for triangle PQR. Use a compass to draw the inscribed circle.

