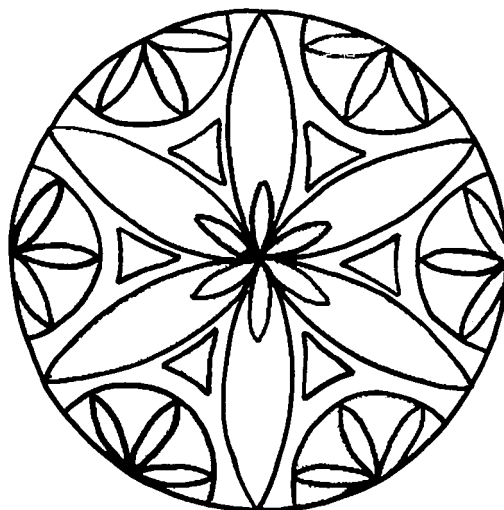

**Hour Exams and Final
Math 3403 – Fall 1999**

Version A

John Wolfe



Final page 2
Exam III page 10
Exam II page 16
Exam I page 20

File: E99f.tex

MATH 3403 – Geometric Structures – Final Exam – A

December 1999

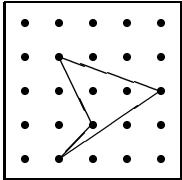
Name: _____

Honor Code

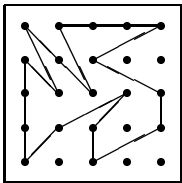
IMPORTANT: There are multiple sections of this course. Although different versions of the exams are given in each section, there are enough similarities that sharing information about the exam could influence a student's grade.

You are on your honor to not discuss this exam with students in other sections until after all sections have taken the test.

1. (A13 points) Figure out the area of the two geoboard figures given below. Be sure to describe the process that you use and show your work.

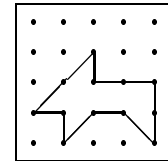
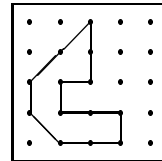
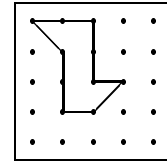
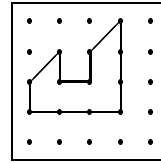


Your Process:



Your Process:

2. (A6 points) Figure out the area of the 4 geoZAGs given below.



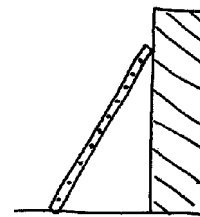
Describe the relationship between the area and the number of edge pegs for a geoZAG.

Your Description:

3. (A5 points) Circle the names of the quadrilaterals given below which have the property that their diagonals are the same length.

Square	Rectangle
Rhombus	Kite
Trapezoid	Isosceles Trapezoid
Parallelogram	

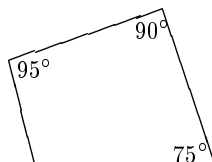
4. (A7 points) The base of an 8-foot ladder is placed 2 feet away from the wall.



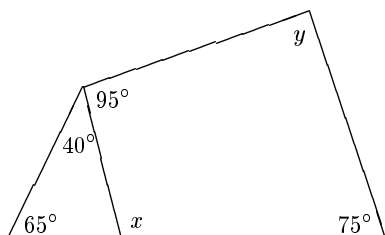
How far up the wall does the ladder reach?

Express your answer two ways: as a square root and as a decimal.

5. (A6 points) Figure out the measures of all of the unknown angles.



6. (A9 points) Consider this figure.



- (a) What is the measure of the angle marked x ? Show your reasoning!

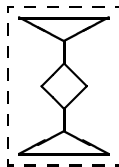
- (b) What is the measure of the angle marked y ? Show your reasoning!

7. (A4 points) An article titled “Reflections of the Past” appeared in *The Daily O’Collegian* on November 30, 1999. Part of the headline for this article included two copies of the word “Reflections” similar to that given here:

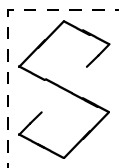
Reflections
Reflections

For this problem you are to indicate by which of the four types of symmetry the two copies are related.

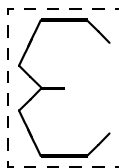
8. (A9 points) Three generating rectangles for border patterns are given below. Imagine that each is repeated many times on both sides forming three different borders. By each of the generating rectangles, indicate what type of border will be generated. The border code table is given below for your information.



a)



b)



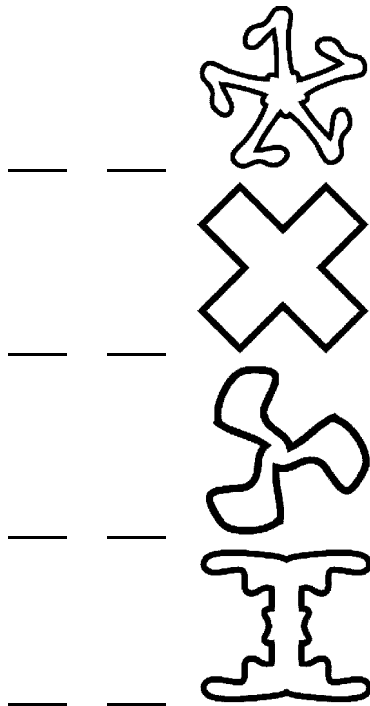
c)

Code for Border Patterns

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

9. (A18 points) Four figures are provided below. In the first column before each figure write a “1” or a “2” to indicate if the figure is one or two sided. In the second column write the mandala type for the figure. Be sure to answer the question after the Mandala Table.

One Side or Two	Mandala Type
-----------------------	-----------------



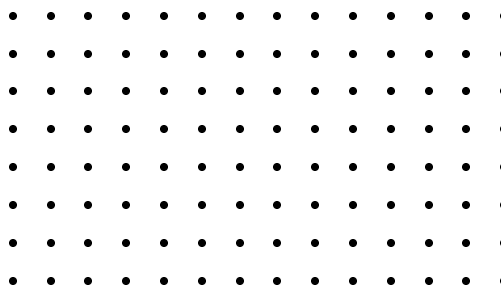
Code for Mandalas

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

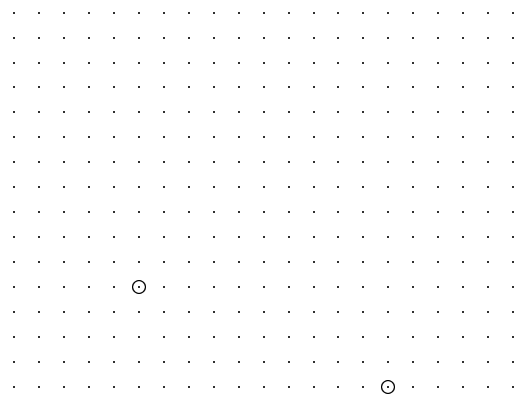
Question: What relationship do you see between the mandala type and whether the figure is one-sided or two-sided? Describe the relationship:

10. (A9 points) On the dotpaper below, draw and label a line which

- (a) has a slope of $-\frac{2}{5}$,
- (b) has a slope of 1.2,
- (c) has a slope of 20%.



11. (A7 points) Two dots are circled in the grid below. Circle a third dot so that the resulting 3 dots are the corners of an isosceles right triangle where the line joining the two given dots is a leg.

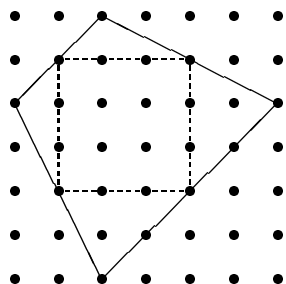


Describe clearly how you determined the third dot completing the triangle:

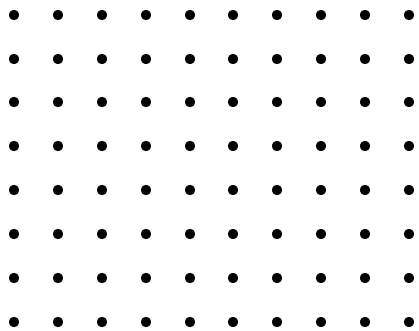
12. (A7 points) The class was talking about inscribed quadrilaterals. As we have seen, an inscribed quadrilateral is formed by joining adjacent midpoints of the sides of a quadrilateral. Several students noticed that the area outside of the inscribed quadrilateral (but inside the beginning quadrilateral) consists of four triangles.

Sara claimed that “the area of the inscribed quadrilateral is the same as the combined area of the four outside triangles”.

- (a) For the example below check if Sara’s idea is true. Clearly show your calculations and also show how your results confirm Sara’s idea.



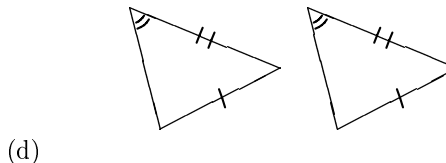
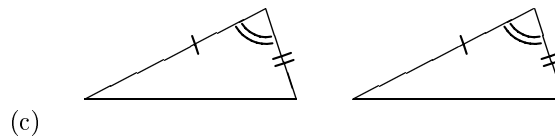
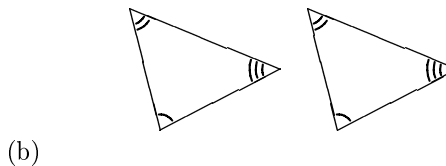
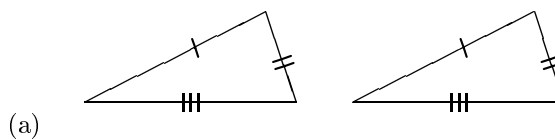
- (b) On the dotpaper below make up a different example of a quadrilateral where you can check Sara’s idea. Again, clearly show your calculations and also show how your results confirm Sara’s idea.



13. (A6 points) What would be a congruence condition for a right triangle, i.e., just enough information to specify the figure?

14. (A6 points) Pairs of figures, which look to be congruent, are given below. Additional information about the figures is indicated using the standard markings.

After each pair write *CC* if there is enough information marked to guaranteed the triangles actually are congruent. Write *Not CC* if there is not enough information marked.



Definitions to Properties – Four Step Model

Name: _____

15. (A5 points)

Official Definition: A rectangle is a quadrilateral with opposite sides the same length and all angles right angles.

Property: For an official rectangle, the two diagonals are the same length (SAS).

Step 1

Step 2

Step 3

Step 4

Four Step Model

Step 1: Draw and mark figure of officially defined term.
Step 2: Draw and identify apparently congruent triangles.
Step 3: Cite and fully apply CC to triangles.
Step 4: Apply CPCT for results needed for the property.

CD Problem – Straight Edge and Compass

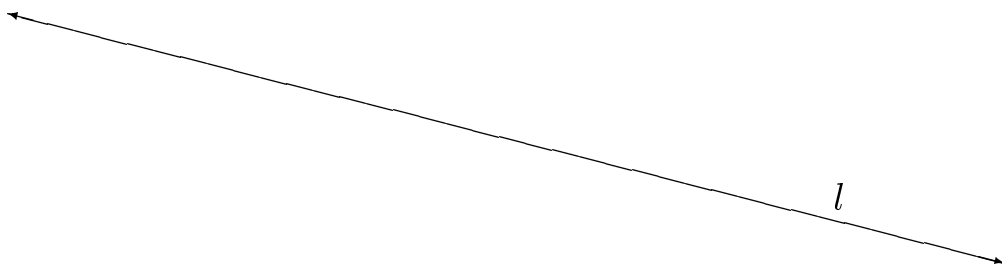
Name: _____

16. (A11 points) Using a straight edge and compass, find the line which is parallel to the line l and passes through the point P .

Note: Do the construction and then clearly describe the process that you used.

Describe:

P •

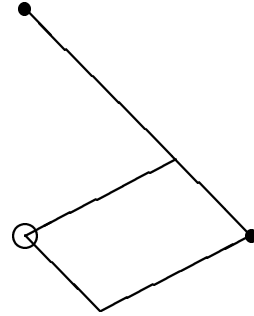
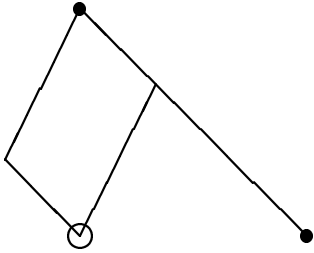


CD Problem – Mira

Name: _____

17. (A11 points) Notice that the two figures given below have opposite orientations. Therefore they must be related by a glide reflection (since plane reflection does not seem to work). Using a mira, find the glide reflection line which takes one of the figures to the other.

Describe the process that you used in this problem.



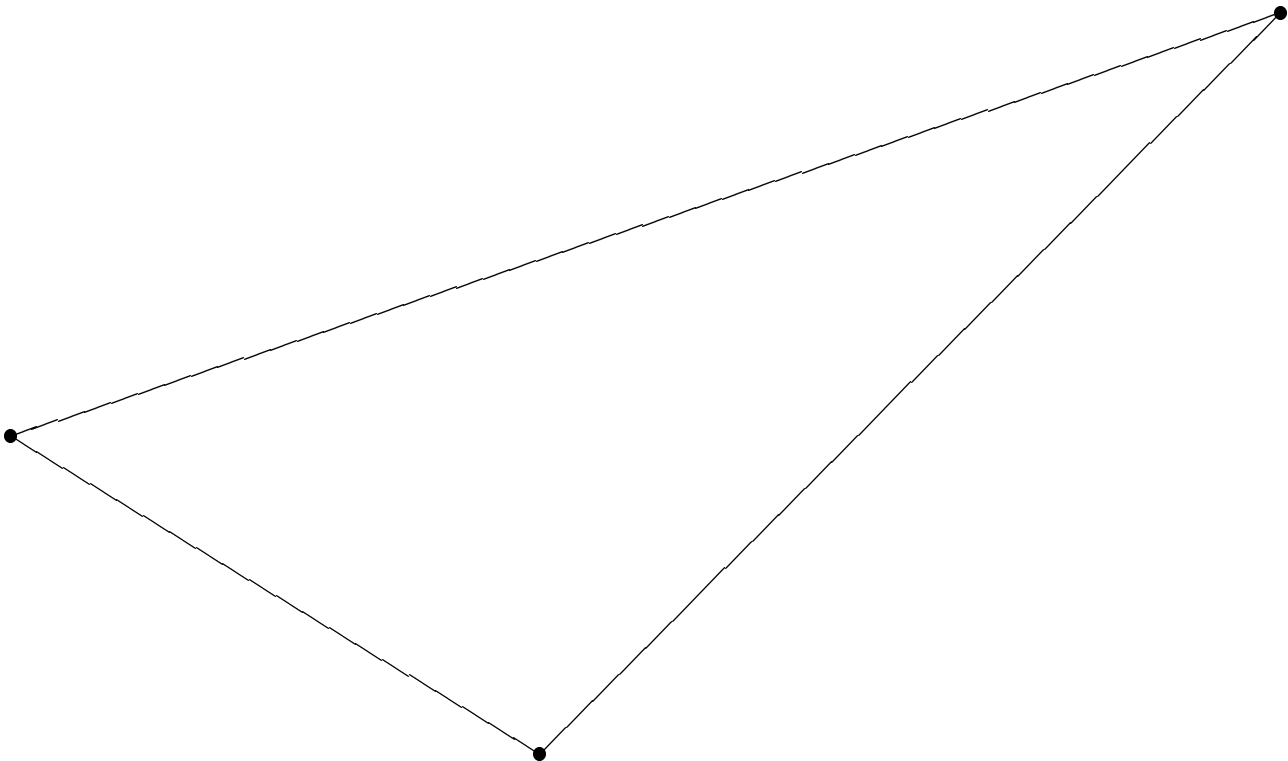
CD Problem – Paper Folding

Name: _____

18. (A11 points) On the triangle below, use paper folding to find the balance point or center of gravity.

Describe the process that you used to find the balance point.

Describe:



MATH 3403 – Geometric Structures – Exam III–A

November 1999

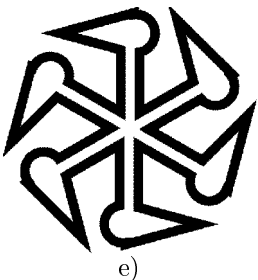
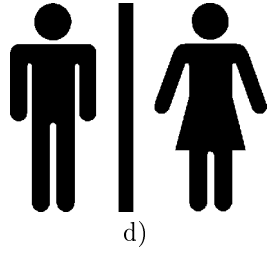
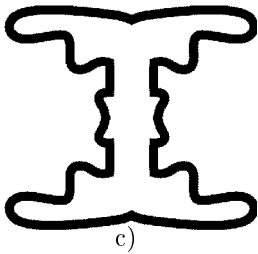
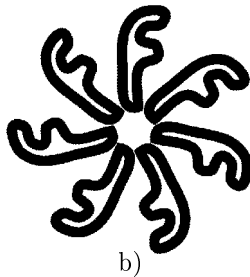
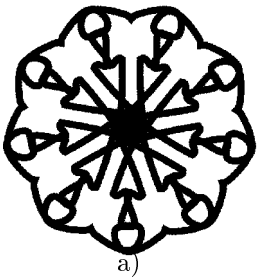
Name: _____

Honor Code

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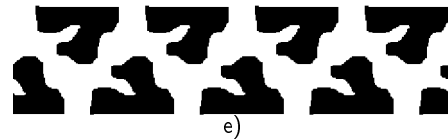
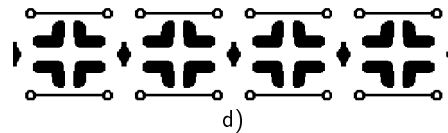
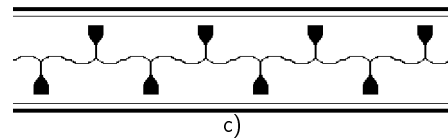
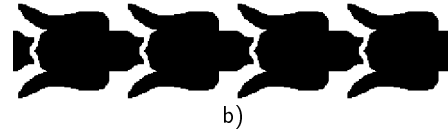
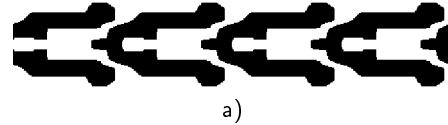
1. (A18 points) Using the code table below, identify the symmetry type of the following mandalas.



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

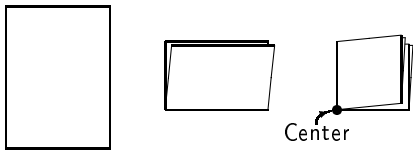
2. (A15 points) Using the codetable below, identify the symmetry type of these borders.



Code for Border Patterns

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

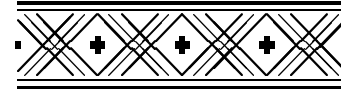
3. (A4 points) Suppose that you were to double fold in half a sheet of paper as pictured.



Now you hold the paper by the center point and cut out a figure. The result will be a sort of mandala. What will the type of this mandala be?

4. (A5 points) What is one example of just enough information to specify a parallelogram, i. e., give a congruence condition for a parallelogram.

5. (A7 points) Jane is confused about classifying the border pattern below. She can see that the border has half turn symmetry since it can be rotated about the center “cross” or “plus sign” shape. Because of this symmetry, she thinks that it is of type **m2**.

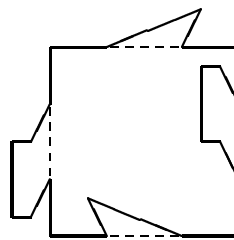


But **m2** is not the correct type.

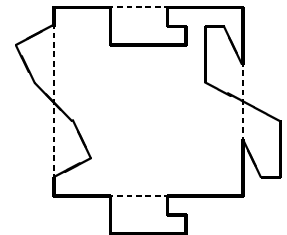
- (a) What is the correct type for this border?
- (b) Give an explanation for Jane about how to do these kinds of borders.

Your explanation:

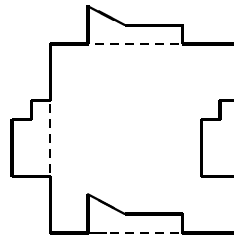
6. (A12 points) For each of the Escher style prototiles given below, identify the Heesch type.



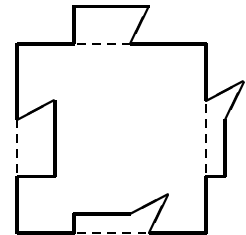
a)



b)

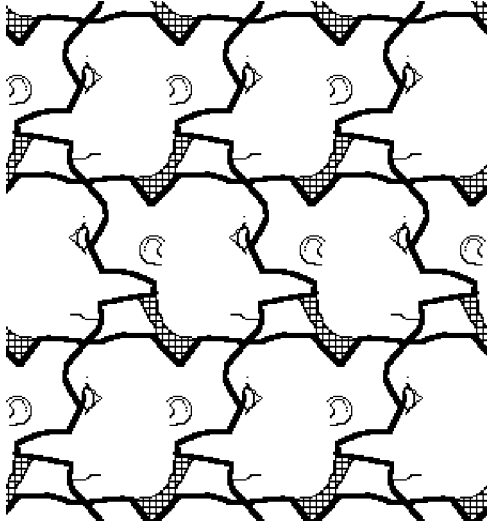


c)

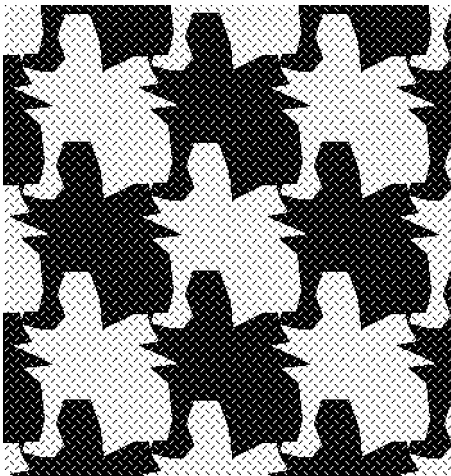


d)

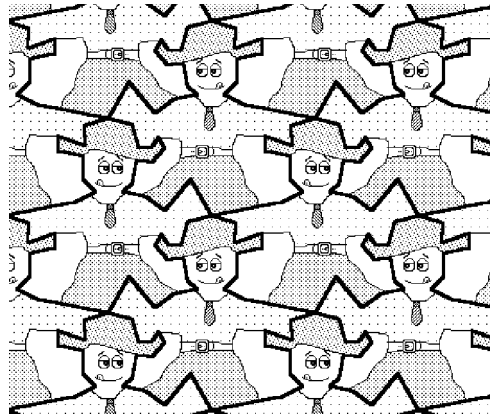
7. (A14 points) Analyze each of the Escher style tessellations given below. For each design, indicate the Heesch type.



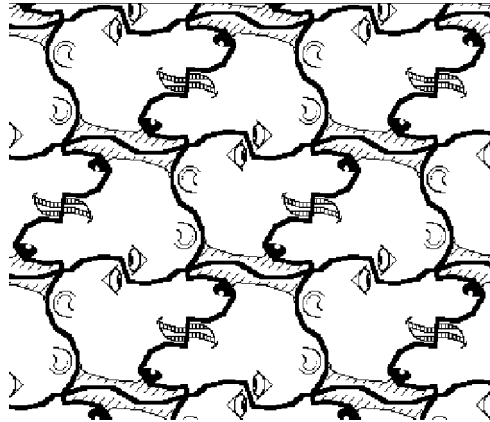
a)



b)

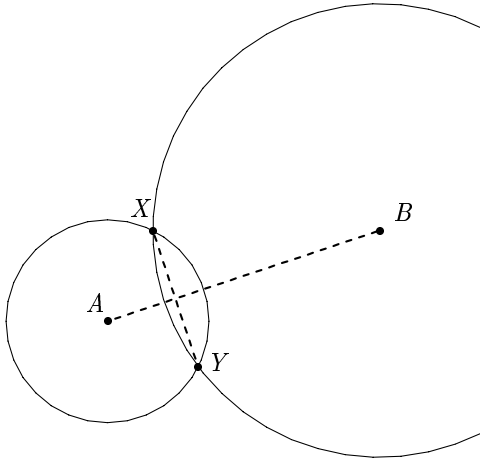


c)



d)

8. (A5 points) Check out the diagram given below.



This figure was made by putting the compass point at A and drawing a circle and then putting the compass point at B and drawing a circle. The two circles cross at X and Y .

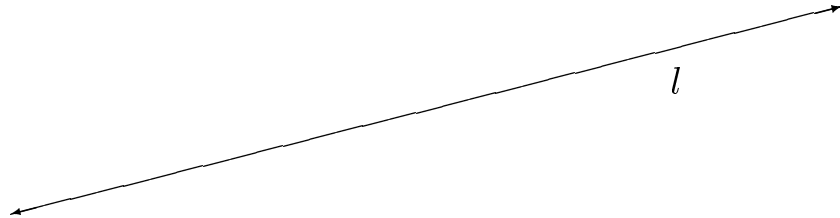
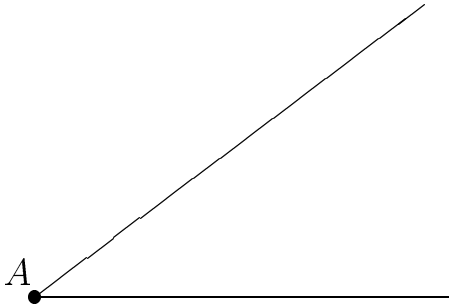
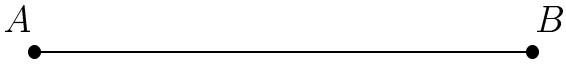
Give the best reasoning you can come up with for why the two dotted lines AB and XY are perpendicular.

Your reasoning:

CD Problem – Straight Edge and Compass

Name: _____

9. (A10 points) Use a straight edge and compass to construct a rhombus with sides of length \overline{AB} and one angle as shown. Put one side on the line l .



Describe the process that you used in this problem.

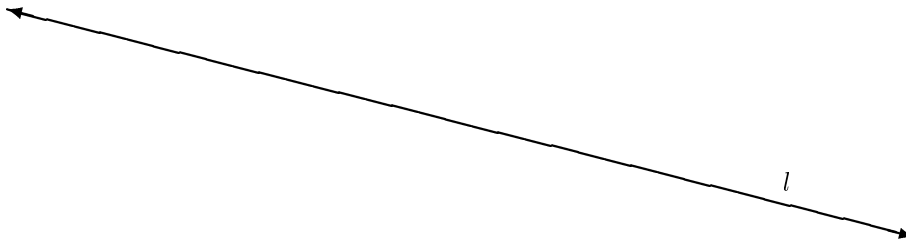
CD Problem – Straight Edge and Compass

Name: _____

10. (A10 points) Three lengths or sides are given below. Using a straight edge and compass, make a triangle out of the given information. Begin by copying segment AB onto line l below.

First carry out your construction. Then write out a step by step description of the process that you use.

A _____ B



MATH 3403 – Geometric Structures – Exam II – A

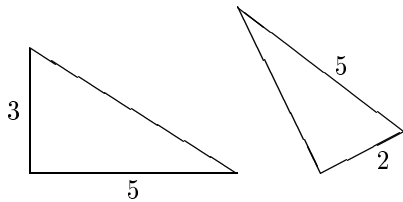
October 1999

Honor Code

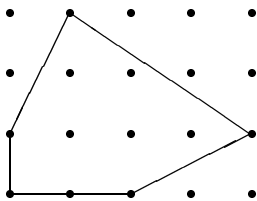
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1. (A12 points) Figure the lengths of the unmarked sides of these right triangles. Give your answer two ways: as a square root and as a decimal.



2. (A10 points) Calculate the perimeter of the following figure.

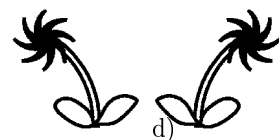
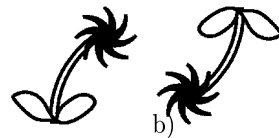
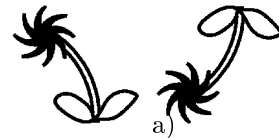


Give your answer two ways: as a square root and as a decimal.

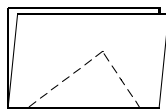
- Name: _____
 3. (A8 points) Write a 1 or a 2 beside each of the following figures to indicate if they are 1-sided or 2-sided.



4. (A8 points) For each of the following pairs of congruent figures indicate if they are related by translation, rotation, reflection or glide reflection.

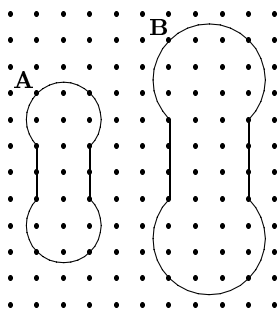


5. (A7 points) Fold a sheet of paper in half. Then make two straight line cuts starting and ending on the foldline as pictured. (There are many ways to do these two cuts.)



After unfolding, what kind of shapes will you always have?

6. (A7 points) What is the area factor going from figure A to figure B?

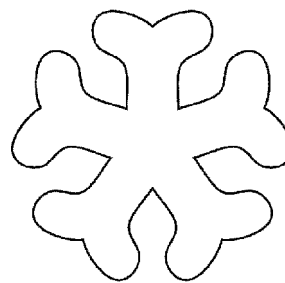


Describe your reasoning:

7. (A7 points) A square has area 81. What is the length of a diagonal?

8. (A7 points) Julie is planning a large party. She knows that her living room holds 15 people comfortably. She expects to have 135 people and needs to rent a conference room to hold her guests. How much bigger than her living room would the length and width of the conference room need to be?

9. (A10 points) Take a blank sheet of paper and, using fold & cut, make a copy of this “five pointed dog bone”. When you are done, put your name on your cutout and turn it in with your test.

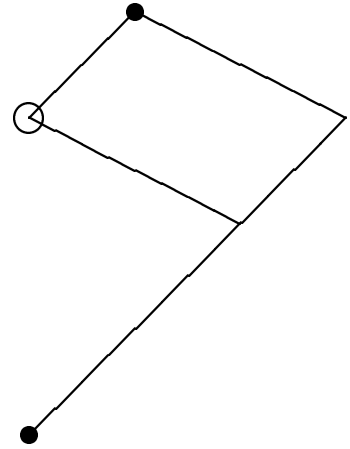
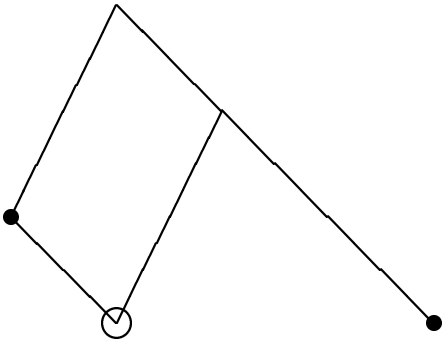


CD Problem – Mira

Name: _____

10. (A12 points) Notice that the two figures given below have the same orientation. Therefore they must be related by a rotation (since translation does not seem to work). Using a mira, find the center of rotation which takes one of the figures to the other.

Describe the process that you used in this problem.



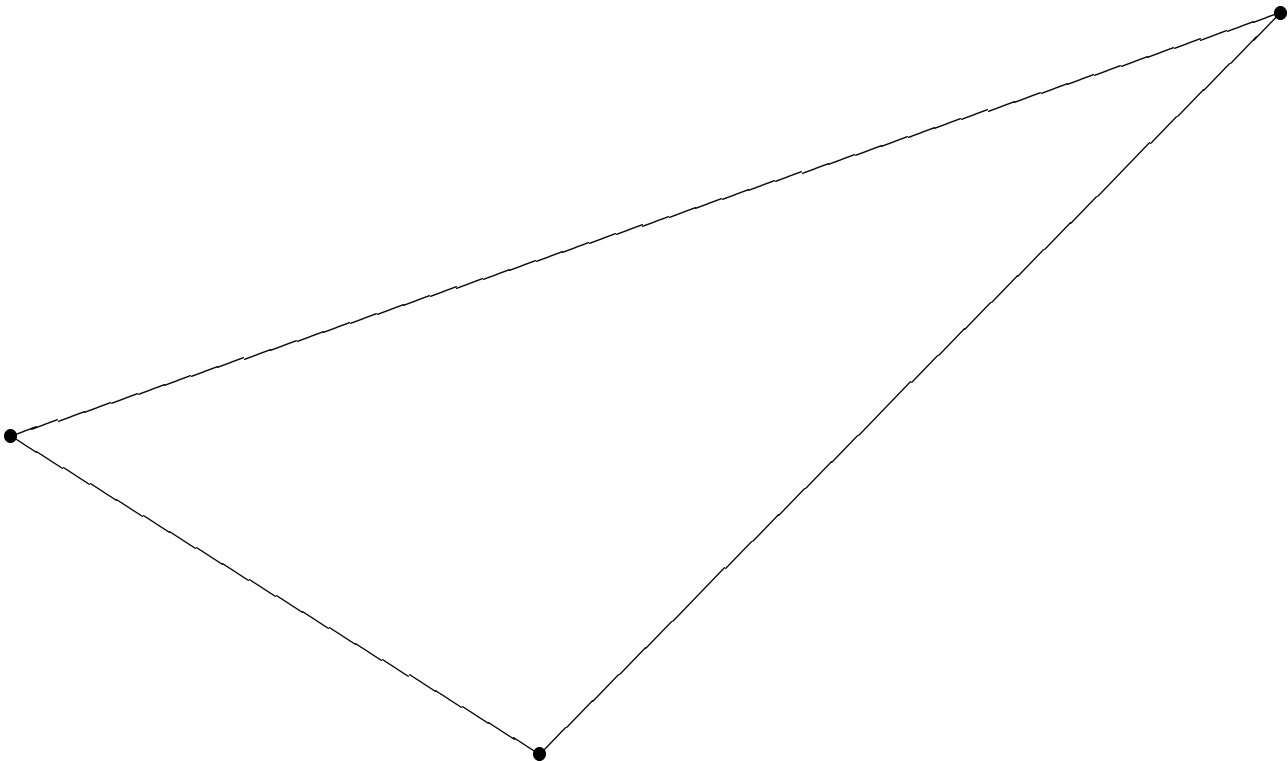
CD Problem – Mira

Name: _____

11. (A12 points) On the triangle below, use a mira to find the center of the inscribed circle. Use a compass to draw this circle.

Describe the process that you used to find the inscribed circle.

Describe:



MATH 3403 – Geometric Structures – Exam I – A

September 1999

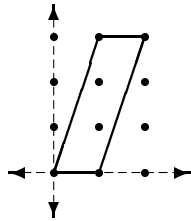
Honor Code

IMPORTANT: There are multiple sections of this course. Although different versions of the exams are given in each section, there are enough similarities that sharing information about the exam could influence a student's grade.

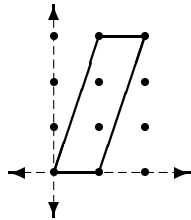
You are on your honor to not discuss this exam with students in other sections until after all sections have taken the test.

1. (A20 points) The figure below has area 3. In the space provided illustrate and describe 5 different ways to figure out this area.

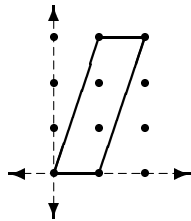
Method 1:



Method 2:

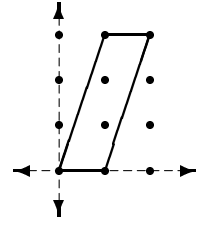


Method 3:

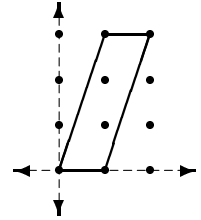


Name: _____

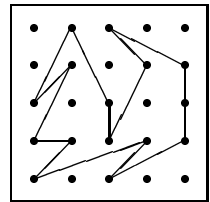
Method 4:



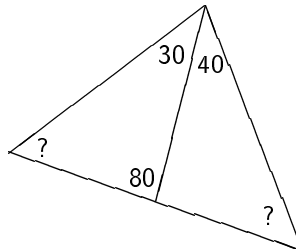
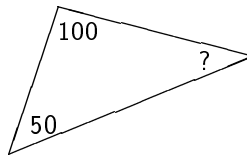
Method 5:



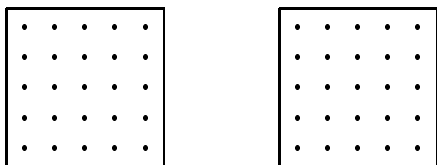
2. (A6 points) Figure the area of this geoboard shape. Show your work!



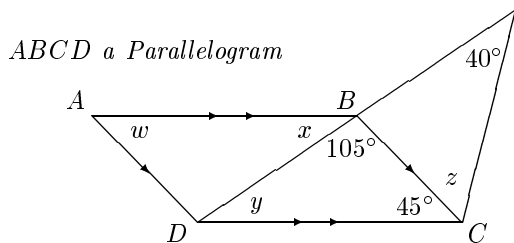
3. (A9 points) What are the measures of the angles marked with a “?”? Show your work!



4. (A7 points) Make up two different examples of geoboard figures which are skew quadrilaterals and which have area 5. Put your examples on the two geoboards given below.

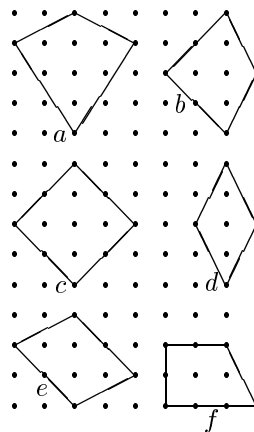


5. (A12 points) Figure $ABCD$ is a parallelogram in the picture below. Three of the angles are given.



- (a) What is angle y ? (Show your reasoning.)
- (b) What is angle w ? (Show your reasoning.)
- (c) What is angle x ? (Show your reasoning.)
- (d) What is angle z ? (Show your reasoning.)
6. (A6 points) Complete the following sentences with the name of just one of the seven types of quadrilaterals we have been discussing (square, rhombus, rectangle, parallelogram, kite, trapezoid, isosceles trapezoid).
- (a) If a rectangle has two adjacent sides which are equal then it will be a...
- (b) If a parallelogram has diagonals which bisect the corner angles then it will be a...
- (c) If a parallelogram has diagonals which bisect each other then it will be a...**BAD PROBLEM**

7. (A8 points) Six different figures are given below.



- (a) Give a definition of a kite so that only the first two, a and b , of the figures above are examples.
- (b) Give a definition of a kite so that only the first four, a , b , c and d , of the figures above are examples.
8. (A10 points) Each of the following types of figures may be possible or not possible. If possible, draw an example which shows how it is possible. If not possible state this and explain why.
- (a) A geoZAG with perimeter $4 + d$. (Here d is the diagonal of a unit square.) (*Explain why not possible or show picture.*)
-
- (b) A geoZAG whose area is $5\frac{3}{4}$. (*Explain why not possible or show picture.*)
-
- (c) A triangle where the inscribed circle touches the midpoint of exactly one of the three sides. (*Explain why not possible or show picture.*)

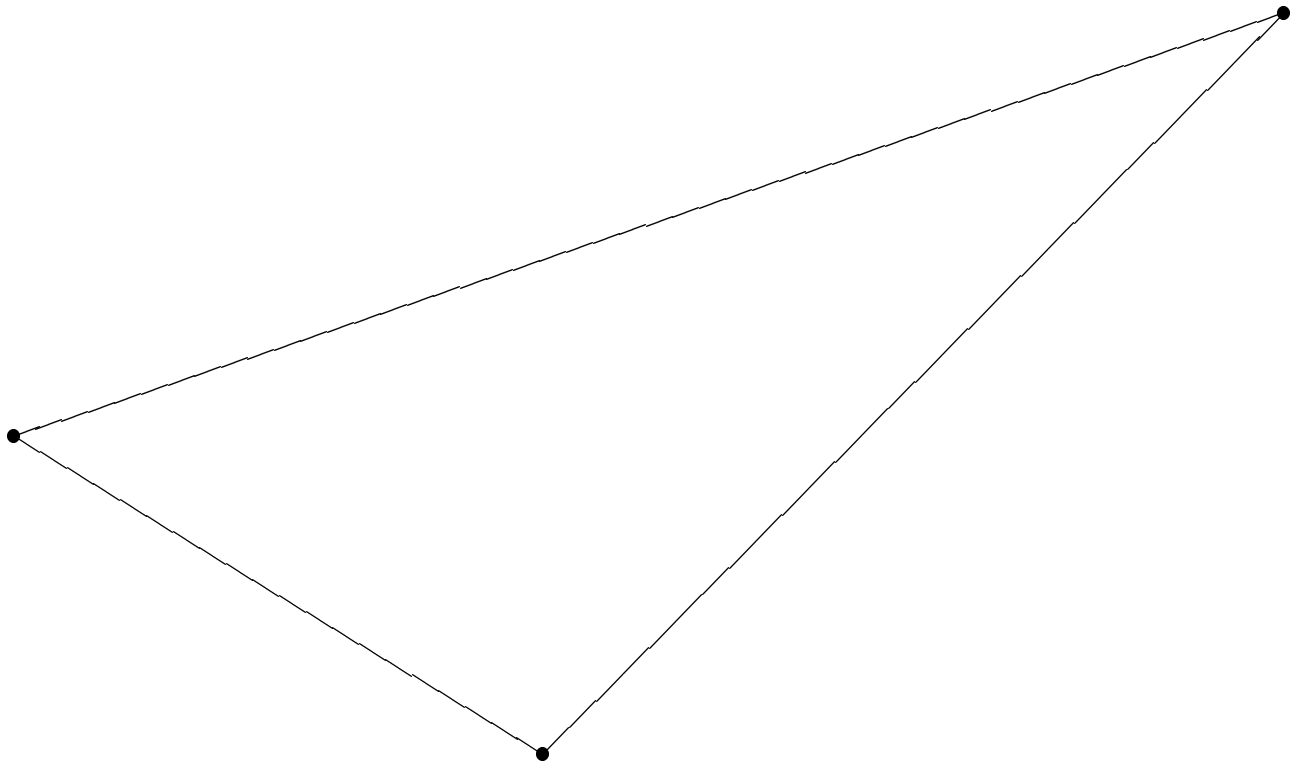
CD Problem – Paper Folding

Name: _____

9. (A11 points) On the triangle below, use paper folding to find the circumcenter. To check your work, using a compass, draw the circumscribed circle.

Describe the process that you used to find and draw the circumscribed circle.

Describe:



CD Problem – Paper Folding

Name: _____

10. (A11 points) Using paper folding, locate a point C so that the triangle ABC is equilateral.

Note: Do the construction and then clearly describe the process that you used.

Describe:

