MT 2

DEPARTMENT OF MATHEMATICS
UNIVERSITY OF MANITOBA

FA/MATH 1020 Math In Art
Mid-Term Exam, 28 Feb 2008

Time 10:00 AM to 11:15 AM

Examiners
Dr. R. Padmanabhan
Dr. Michelle Davidson

LAST NAME: (Print in ink) _____

FIRST NAME; (Print in ink)_____

STUDENT NUMBER: _____

FACULTY: School of Art _____ University One _____

SIGNATURE:_____

(I understand that cheating is a serious offence)

Please show your work clearly.

You may use calculators and drawing instruments like the ruler and the compass,. However, show all the intermediate steps and calculations.

In the construction problems, do not erase the intermediate lines.

Cell phones or other aids are not allowed.

The exam has a total of 6 pages (including this title page) and two blank sheets for rough work. Please check that you have all the pages.

There are 7 questions and each question carries 10 points. The total value of all question is 70.

Please do not write in this column	
1.	_____/10
2.	_____/10
3.	_____/10
4.	_____/10
5.	_____/10
6.	_____/10
7.	_____/10
Total	_____/70

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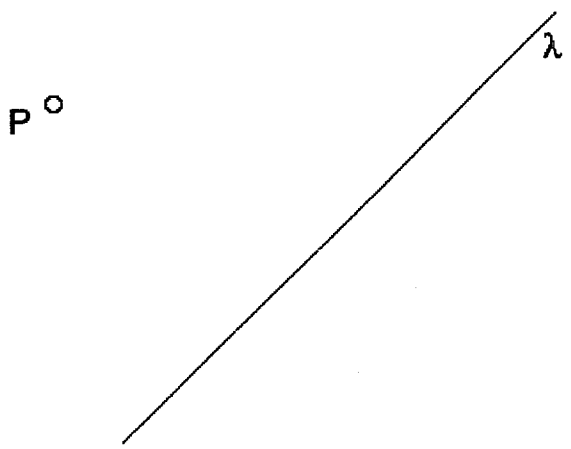
1. You are given a line λ and a point P not on λ. Using ruler and compass, draw a line m through P and parallel to the given line λ.
   Give a brief description of your method of constructing the parallel line.
   How many such lines m one can be drawn through P?



2. Recall that two geometric figures are *similar* if they have the same shape (i.e. corresponding sides are proportional), but not necessarily the same size. They are congruent if they are similar and of same size as well. Indicate whether the geometric figures described below are always, sometimes, or never similar (similarly for "being congruent")

	Always congruent	Always similar
(a) Two squares		
(b) Two obtuse golden triangles		
(c) Two triangles of same area		
(d) Two rectangles of same area		
(e) A regular pentagon and a hexagon		

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3. Draw a 8-15-17 triangle ΔABC where $AB = 8$, $BC = 15$ and $AC = 17$.
   Find the value of the angle $\angle B$ using a protractor.
   What is the exact value of the angle? Why? Give reasons for your answers.

4. You are commissioned to construct an obtuse golden triangle using copper wire. If the total length of the wire supplied is 9,045 feet, what is the base of the largest golden triangle that you can construct?
   Draw an illustrative diagram to explain your answer.

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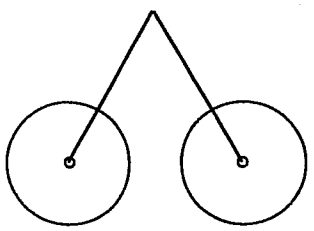
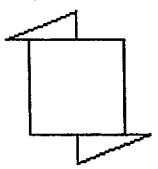
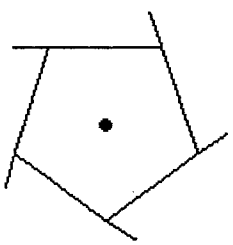
5. List the symmetries of each of the following designs. Use the notation refl l (for the mirror reflection about the line l) and rot(C, t) (for the rotational symmetry with centre C with t as the angle of rotation measured counter-clockwise). Mention the total number of symmetries in each case.

Design	symmetries	total number of symmetries
		
		
		

Give an example of a design D having ***exactly three*** symmetries.
Describe all the symmetries of your design.

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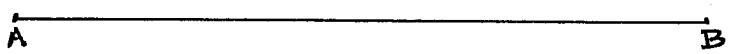
6. If ABCD is a *golden rectangle* with the shorter side AB = 5 inches, what is the approximate length of the longer side CD? Draw such a golden rectangle in the space given below. Using the technique of drawing circular arcs, draw a smooth golden spiral within the rectangle ABCD.



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7. Study the algorithm given by the first two stages of a fractal design given below and draw the next two stages of the fractal. Demonstrate the self-similarity property of the fractal by circling a portion of your final sketch that is similar to the entire design of the *previous* stage.