UNIVERSITY OF MANITOBA

DATE: October 21, 2010 — MIDTERM TITLE PAGE

COURSE: MATH 1020 — TIME: 70 minutes

EXAMINATION: Math in Art — EXAMINER: M. Davidson

FAMILY NAME: (Print in ink) _____

GIVEN NAME(S): (Print in ink) _____

STUDENT NUMBER: _____

SIGNATURE: (in ink) _____

(I understand that cheating is a serious offense)

INSTRUCTIONS TO STUDENTS:

This is a 70 minute exam. **Please show your work clearly.**

A compass and straight edge (ruler) are required for this exam.

No texts, notes, or other similar aids are permitted. There are no calculators, cellphones or electronic translators permitted.

This exam has a title page and 5 pages of questions. Please check that you have all the pages.

The value of each question is indicated in the lefthand margin beside the statement of the question. The total value of all questions is 50 points.

Answer all questions on the exam paper in the space provided beneath the question. If you need more room, you may continue your work on the reverse side of the page, but CLEARLY INDICATE that your work is continued.

Question	Points	Score
1	10	
2	10	
3	8	
4	12	
5	10	
Total:	50	

UNIVERSITY OF MANITOBA

DATE: October 21, 2010 — MIDTERM

COURSE: MATH 1020 — TIME: 70 minutes

EXAMINATION: Math in Art — EXAMINER: M. Davidson

Important: "Construct" means "construct using an unmarked ruler and compass." The phrase "unmarked ruler" stands for any ruler that may be used only as a straight edge to draw straight line segments. When you use a compass, show the (intermediate) circular arcs you draw in your constructions (do not erase them). Use words to describe **BRIEFLY** what you have done.

[5] 1. (a) Construct the division of the following line segment ℓ into 3 segments of equal length.

ℓ

[5] (b) On the following line, construct an isocelese triangle having an angle of 45 degrees in each corner.

---

[7] 2. (a) Construct the golden cut of the following line segment.

---

[3] (b) Using the above, construct a golden acute triangle.

---

[3] 3. (a) What are the Fibonacci numbers? (Give a definition)

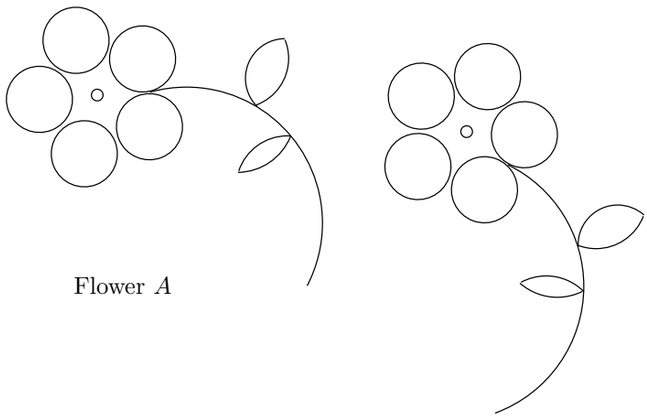
[5] (b) We define a sequence of numbers, which we will call the midonacci numbers as follows:

$M_1 = 3$, $M_2 = 4$, and for $n \geq 1$, $M_{n+2} = M_{n+1} + M_n$.

It is known that $M_{17} = 5778$ and $M_{14} = 1364$. Find M_{15} and M_{16}.

---

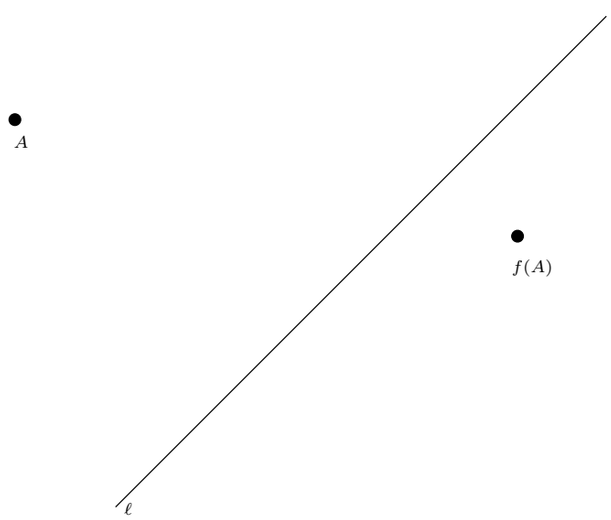
[6] 4. (a) In the diagram, if flower B is the image of flower A under a rotation, find the center (label it C) and angle (label it θ) of this rotation .



Flower A

Flower B

[6] (b) Recall that a dilative reflection is a composition of a central similarity followed by a reflection with respect to a line passing through the center of the central similarity. Given that f is a dilative reflection, (where ℓ is the line of reflection), find C, the center of the central similarity.



---

[10] 5. Find the group of symmetries for each of the three objects shown below. Be sure to indicate **in the object** any **centers of rotation**, **lines of reflection** or **vectors of translation**. If you are indicating a rotation, be sure to include to **angle of rotation**.

OBJECT	SYMMETRIES