UNIVERSITY OF MANITOBA

DATE: February 24, 2014 — MIDTERM TITLE PAGE

COURSE: MATH 1020 — TIME: 90 minutes

EXAMINATION: Math in Art — EXAMINER: M. Davidson, S. Kalajdzievski

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FAMILY NAME: (Print in ink) _____

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

STUDENT NUMBER: _____

SIGNATURE: (in ink) _____

(I understand that cheating is a serious offense)

❑	A01	8:30–9:45	M. Davidson
❑	A02	11:30– 12:45	S. Kalajdzievski

INSTRUCTIONS TO STUDENTS:

This is a 90 minute exam. **Please show your work clearly.**

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

A simple non-programmable calculator is permitted. No texts, notes, or other similar aids are permitted. There are no 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	8	
2	9	
3	6	
4	6	
5	6	
6	5	
7	10	
Total:	50	

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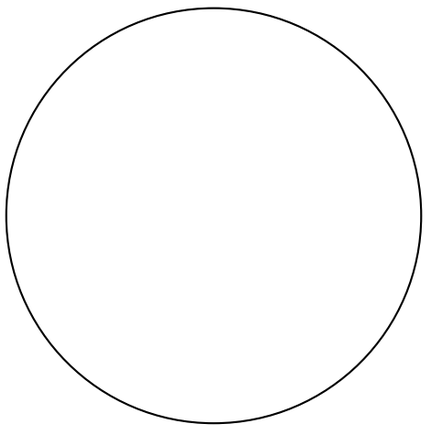
Important: "Construct" means "construct using an unmarked ruler and compass." The phrase "unmarked ruler" stands for any ruler that may be used only as a straight edge to draw straight line segments. When you use a compass, show the (intermediate) circular arcs you draw in your constructions (do not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

[4] 1. (a) Construct the centre of the given circle. Briefly describe your steps.



[4] (b) Construct the division of the following line segment into 3 segments of equal length. Briefly describe your steps.

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[7] 2. (a) Construct an acute golden triangle that has the entire given line segment as its base. Briefly describe the steps in this construction.

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[2] (b) What are the angles of the above triangle?

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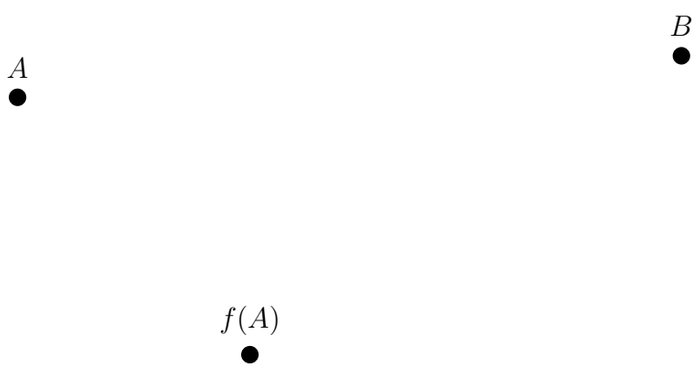
[3] 3. (a) What are the Fibonacci numbers? (Give a definition)

[3] (b) Given that $f_{20} = 6765$ and $f_{18} = 2584$ find f_{19}.

[6] 4. In the diagram, the point $f(A)$ is the image of A under the reflection with respect to a line ℓ. Construct ℓ, and find the image of B under the same reflection.



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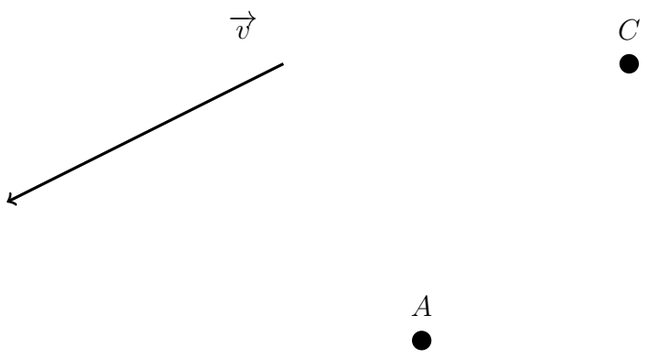
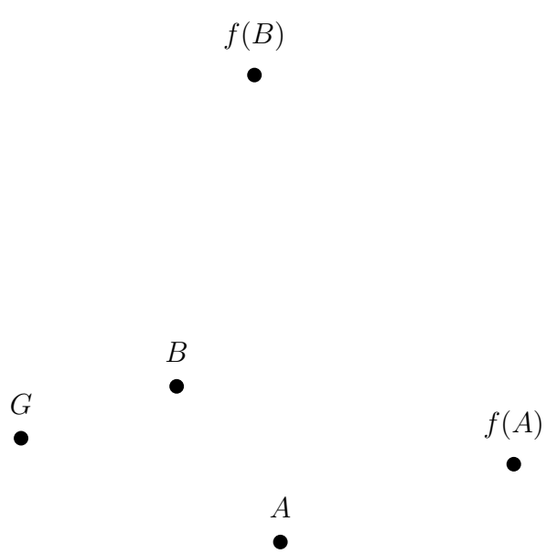
[6] 5. Construct the image of the point A under the composition of the symmetry $f_1 = \text{rot}(C, 60°)$, followed by $f_2 = \text{trans}(\overrightarrow{v})$.



[5] 6. In the following diagram, $f(A)$ is the image of the point A under a central similarity f, and $f(B)$ is the image of the point B under the same similarity.

(a) Find the centre of the central similarity.

(b) Find the image of the point G under the same central similarity.



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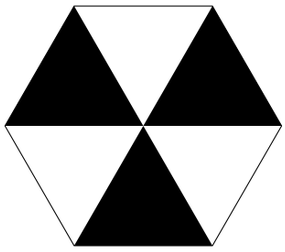
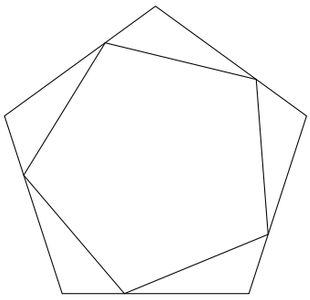
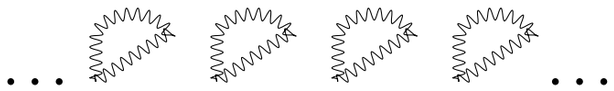
[10] 7. Find the group of symmetries for each of the three objects shown below. Be sure to indicate **in the object** any **centers of rotation**, **lines of reflection** or **vectors of translation**. If you are indicating a rotation, be sure to include to **angle of rotation**.

OBJECT	SYMMETRIES
	
	
 This is a Frieze pattern. It continues infinitely in both directions.	