UNIVERSITY OF MANITOBA

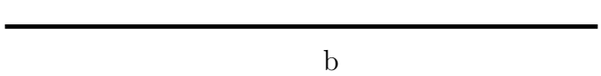
DATE: February, 2009 — PRACTICE MIDTERM

COURSE: MATH 1020 — TIME: 70 minutes

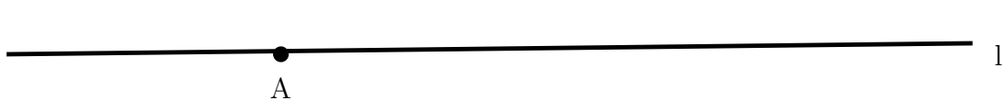
EXAMINATION: Math in Art — EXAMINER: M. Davidson

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.

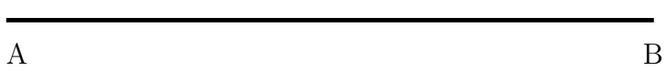
1. (a) On b given below, construct an equilateral triangle. Then bisect one of the angles.



(b) Using the above, construct a line through A which intersect l at an angle of $30°$.



2. (a) Given the line AB, construct C, the golden cut.

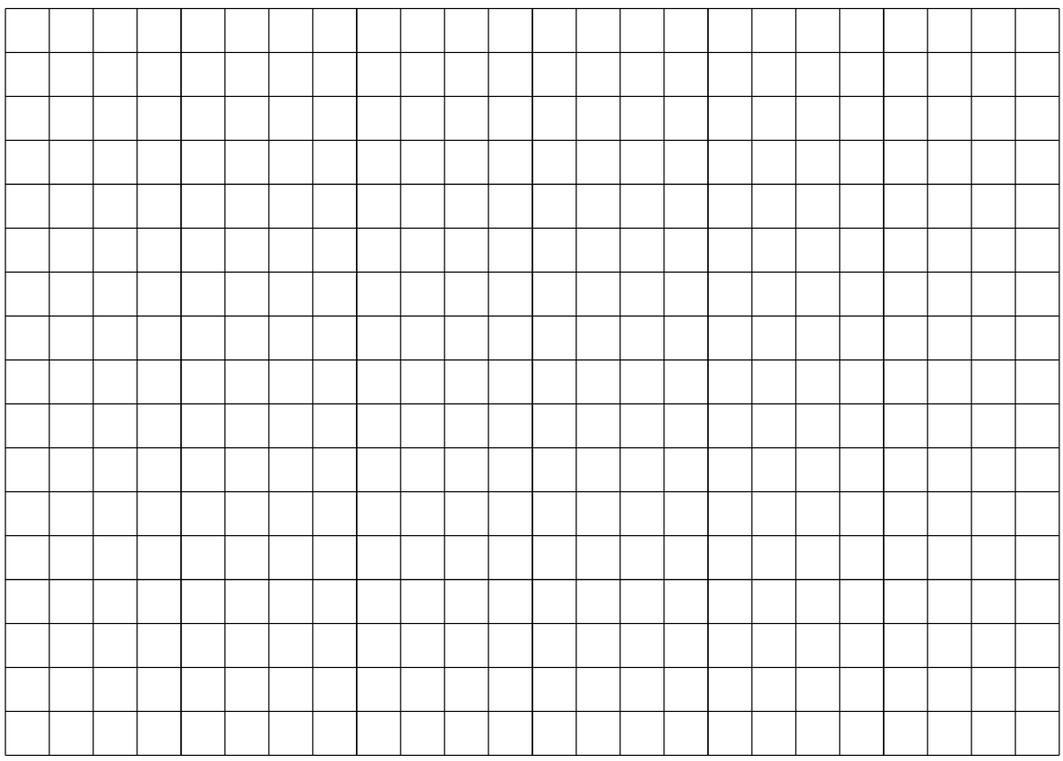


(b) The golden ratio occurs twice in part (a). Use each to construct two different sized golden obtuse triangles. On the larger of these two triangles, add precisely one line that divides this triangle into two smaller golden triangles, one acute and one obtuse.

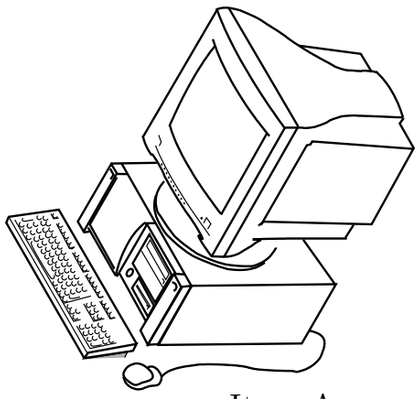
---

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

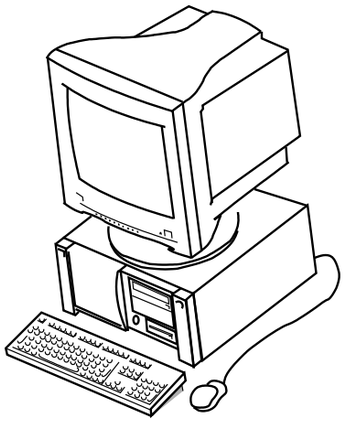
(b) In the following grid, construct an approximation to a golden spiral using at least the first 6 Fibonacci numbers.



4. Item B is the image of Item A under a rotation. Construct the center and angle of rotation. (The angle should be indicated, not measured.)



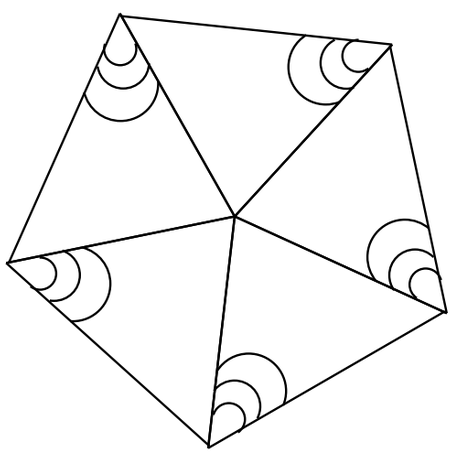
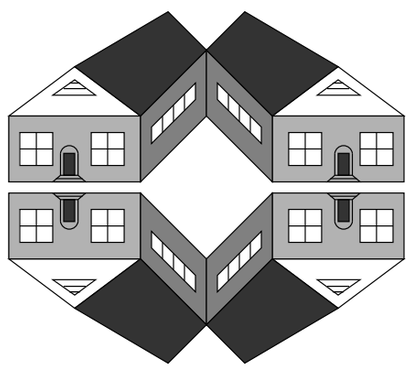
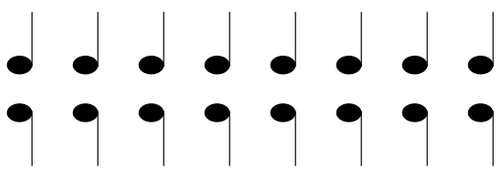
Item A



Item B

---

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

---

6. In the following diagram, the point $f(A)$ (resp. $f(B)$) is the image of the point A (resp. B) under a central similarity. Find the center of the similarity and find the image of the point C.