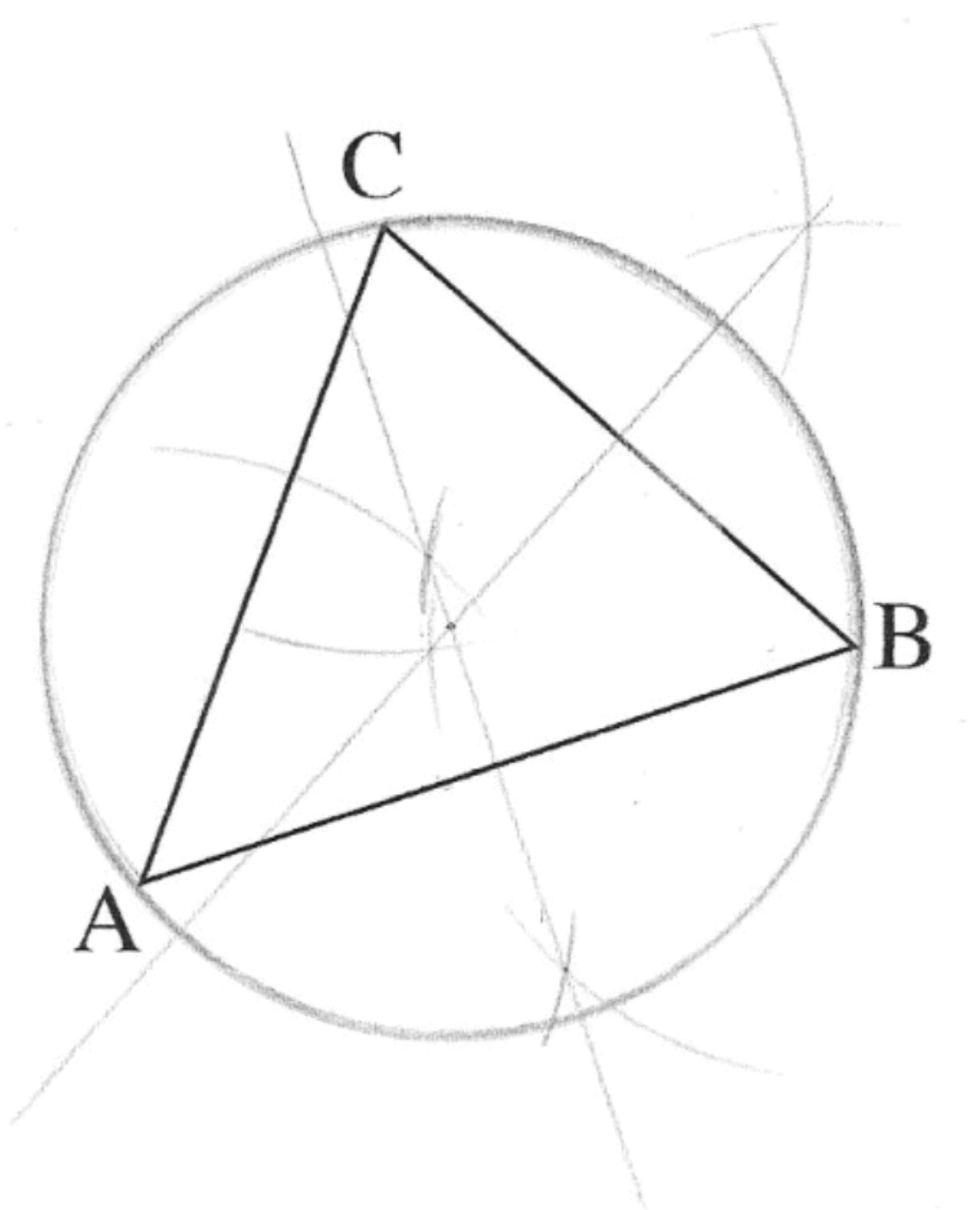
1a 3

1. 8 – Marks

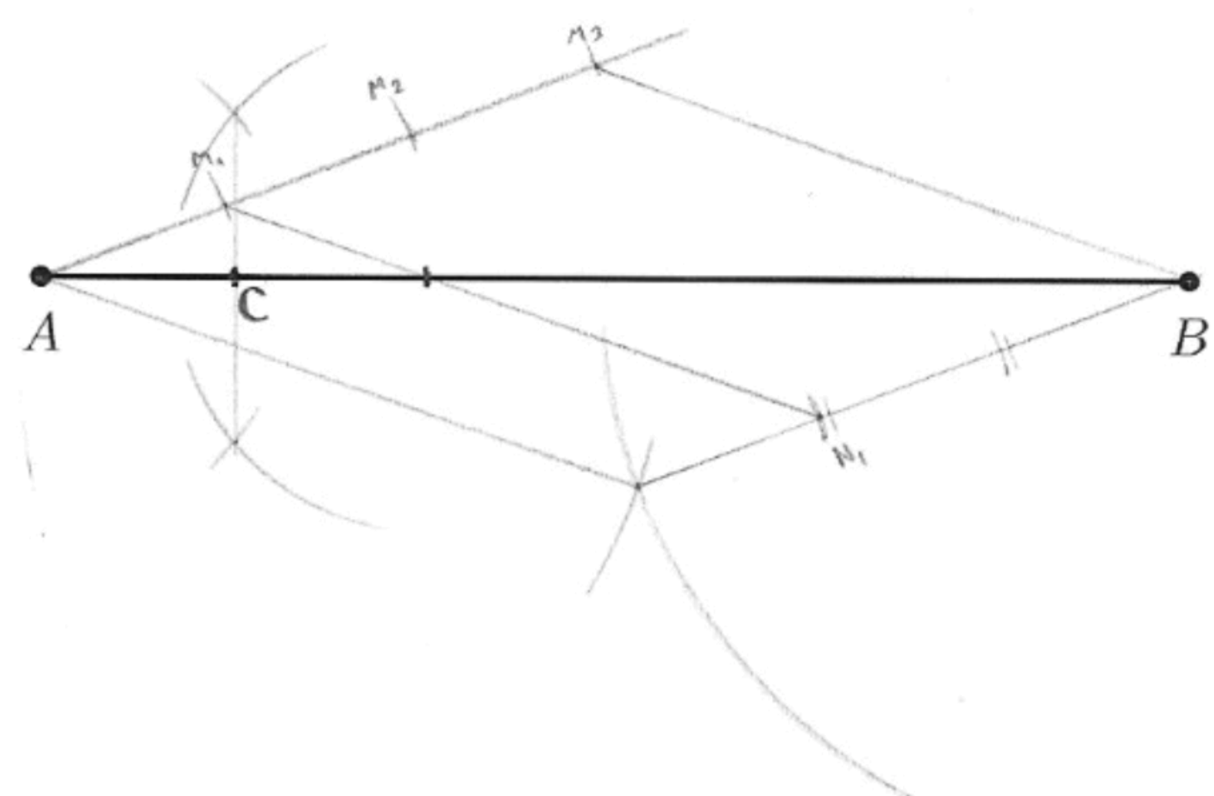
[3] (a) Construct the circle passing through the corners of the triangle ABC.



Steps: trace 2 lines: one perpendicular to CB, and the other to AB. Use point of intersection to trace circle.

[5] (b) Construct the point C between points A and B so that $AB = 6AC$.

Steps: "Trisected" line segment by using a parallelogram. Then divided a third so as to obtain a sixth.

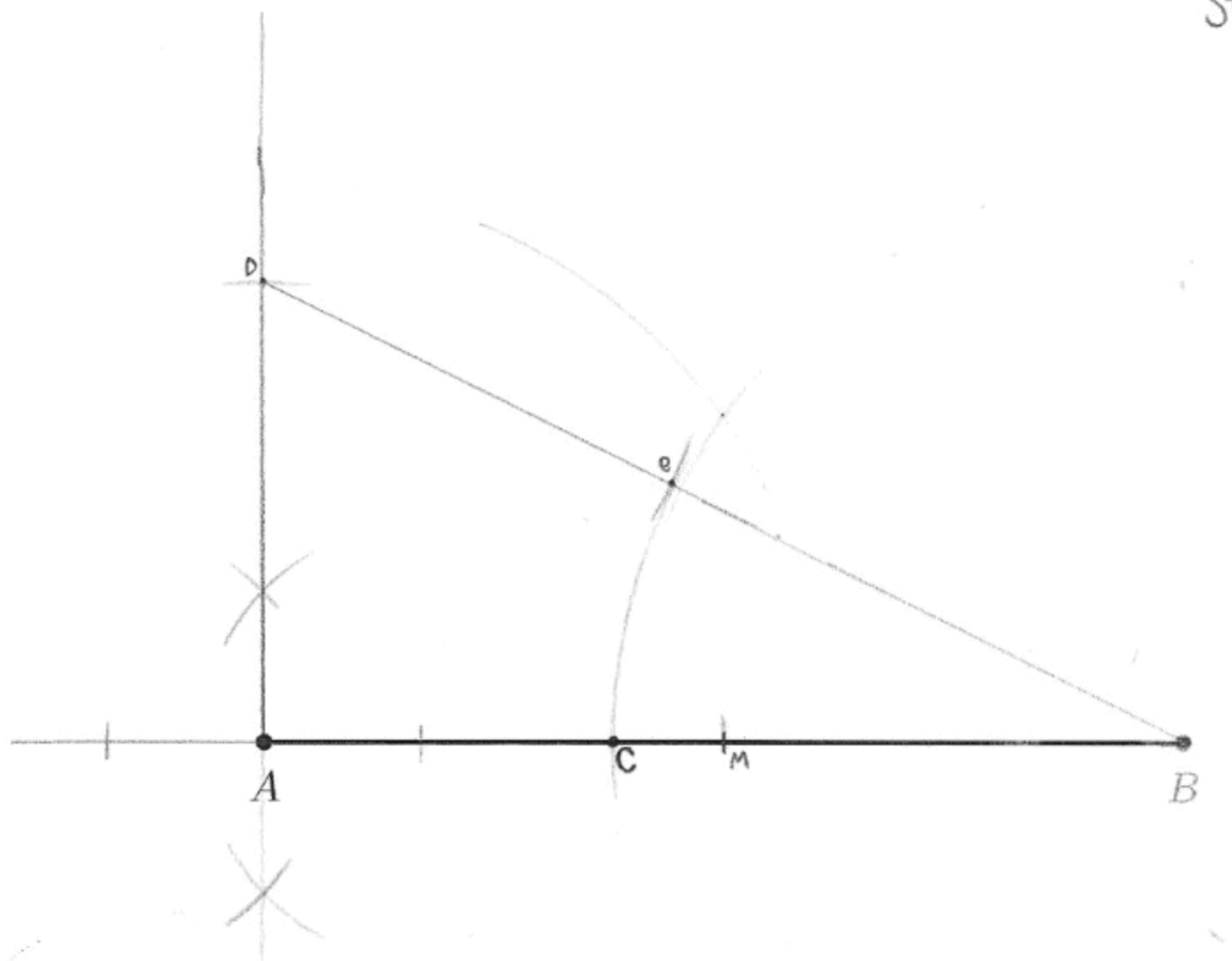


2a 4

2. 7 – Marks

[4] (a) Construct a $\boxed{\text{point } C}$ between A and B such that $\frac{AB}{CB} = \frac{CB}{AC} = \phi$, where ϕ is the golden ratio. Note that C is closer to A than to B.

Steps: found the middle (M), then constructed a line perpendicular to A. Measured $\overline{AM}$ to find point D, and then made a circle from D. I then traced a line from D to B, and named the intersection "e". From there I measured $\overline{Be}$ to find C using a circle.



[3] (b) We know that the 25^{th} Fibonacci number is 75025 , and the 27^{th} Fibonacci number is 196418 . Find the 24^{th} Fibonacci number by solving equations. Show your work.

$f_{25} = 75\ 025$

$f_{27} = 196\ 418$

$f_{24} = x$

$f_{26} = y$

$f_{25} + f_{26} = f_{27}$ $\quad$ $f_{24} + f_{25} = f_{26}$

$75\ 025 + y = 196\ 418$ $\quad$ $x + 75\ 025 = y$

$y = 196\ 418 - 75\ 025$ $\quad$ $x + 75\ 025 = 121\ 393$

$y = 121\ 393$ $\quad$ $x = 121\ 393 - 75\ 025$

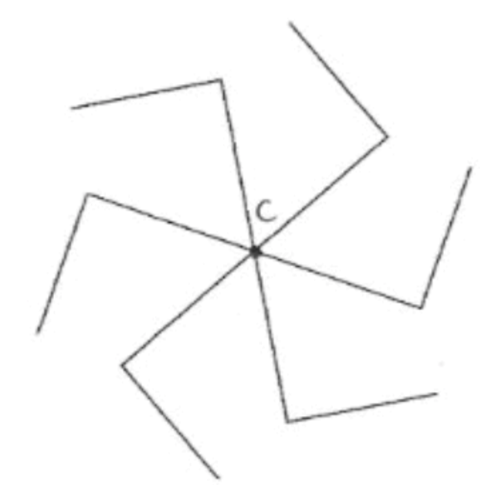
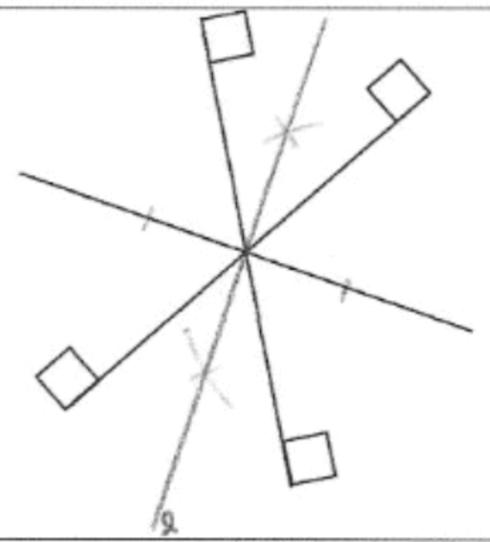
$x = 46\ 368$

$\boxed{f_{24} = 46\ 368}$

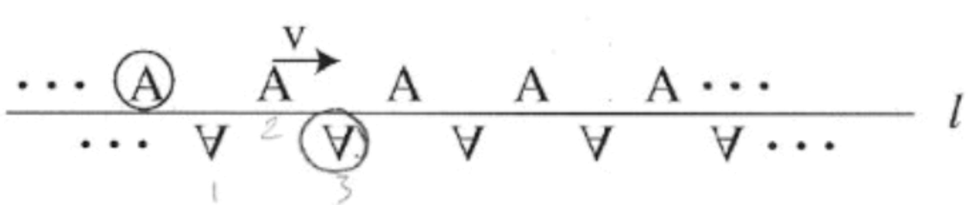
3a 4

3. 10 – Marks

Find the group of symmetries of the two objects shown below. If you claim a rotational symmetry, indicate the center of the rotation and the angle of rotation. If there are reflections, show the line of reflection.

OBJECT	THE GROUP OF SYMMETRIES
	(a) [4] $\{id, rot(C,60^\circ), rot(C,120^\circ), rot(C,180^\circ), rot(C,240^\circ), rot(C,300^\circ)\}$
	(b) [3] $\{id, ref_l\}$

[3] (c) The frieze pattern shown below consists only of $A-s$ and upside-down $A-s$; the circle, the line l, and the vector v are not parts of it. Let f be the glide reflection $ref_l \circ trans_v$. Find the image of the circled A under the symmetry $f \circ f \circ f$. You only need to draw freehand a circle around an A or around an upside-down A that you think is the image of the circled A. No justification is required.

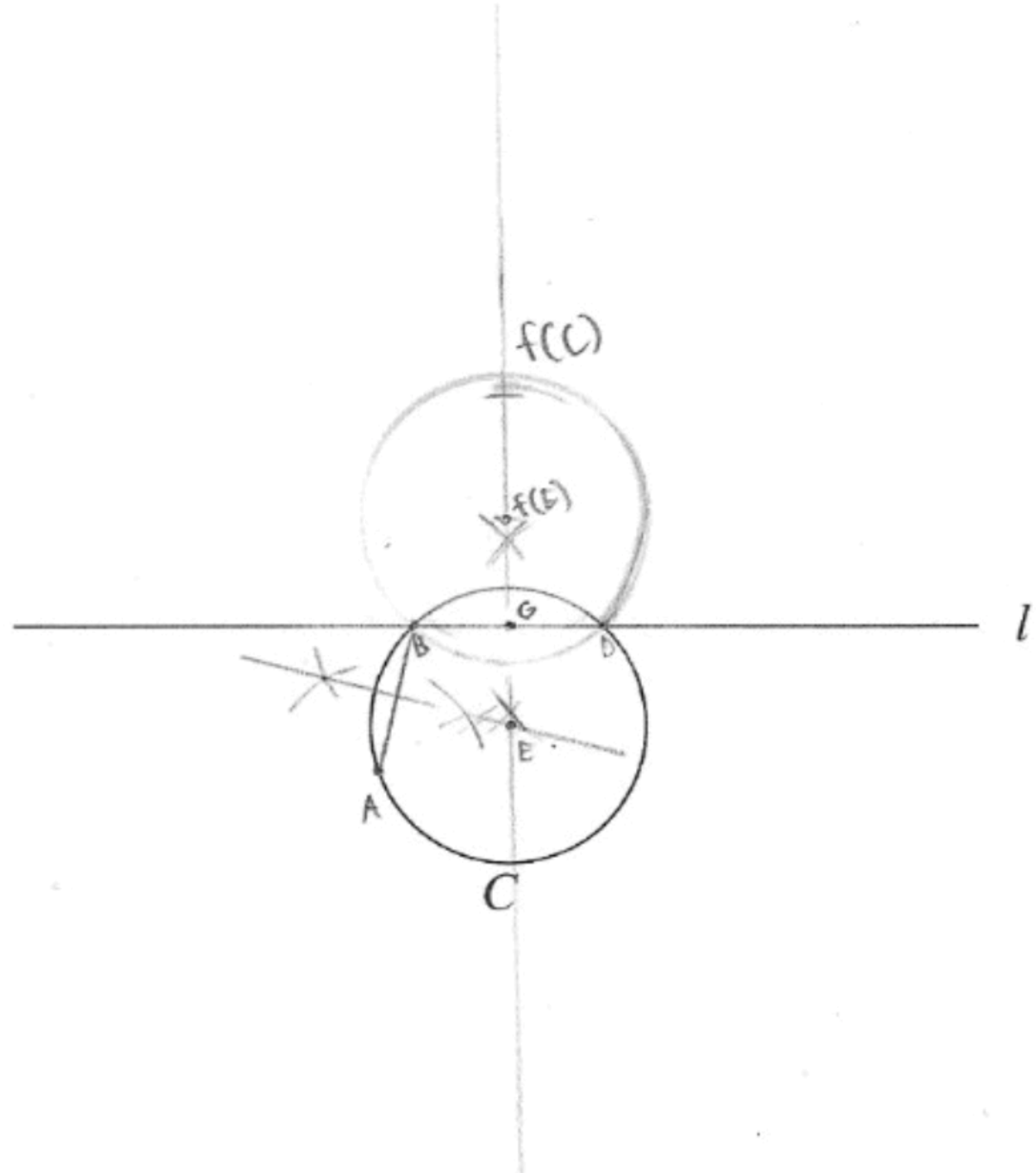


4a 3

4. 7 – Marks

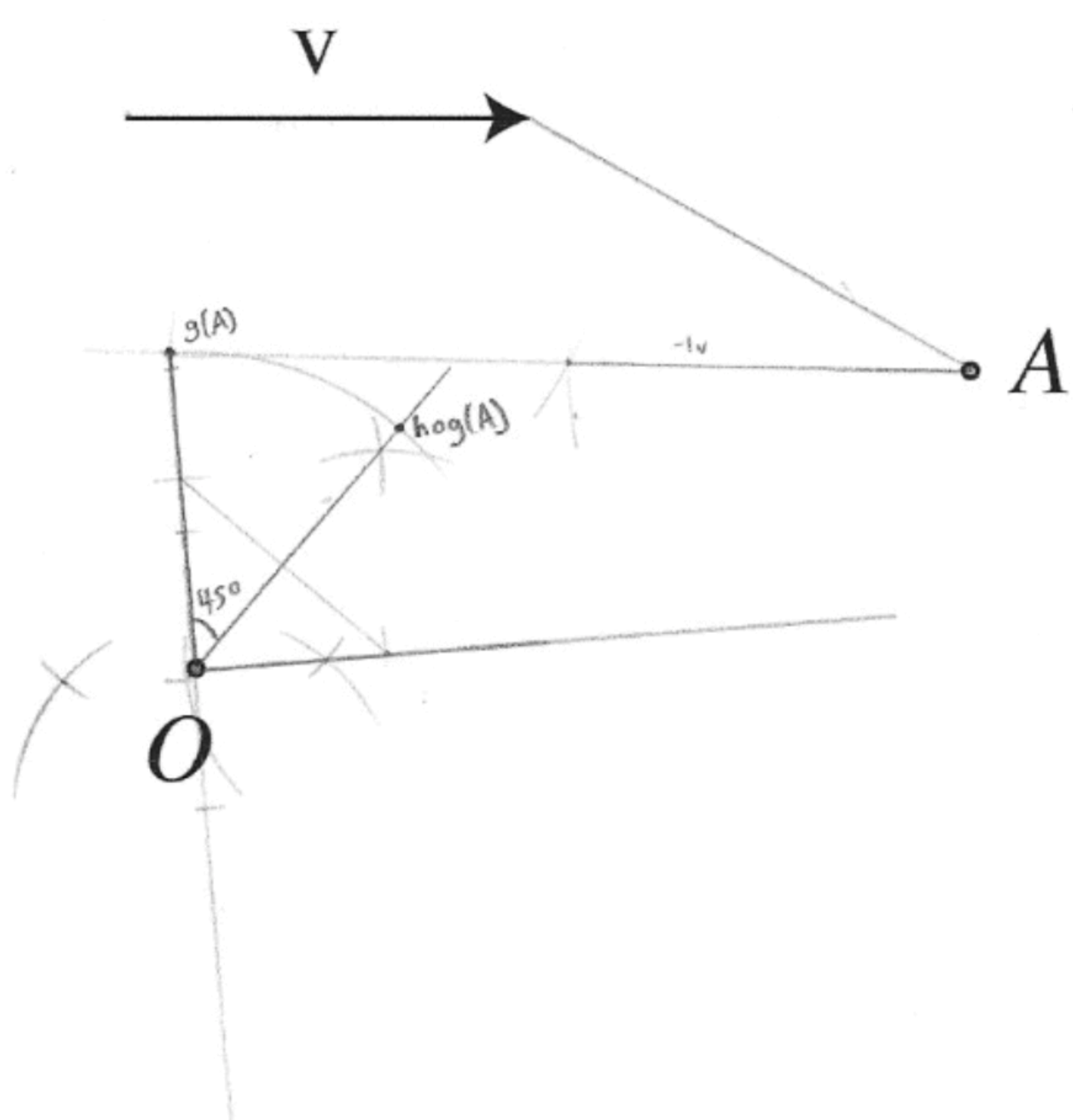
[3] (a) Let f be the reflection with respect to the line l. Construct the image $f(C)$ of the circle C.

Steps: Used perpendicular lines to find the center, then measured $\overline{EG}$ to find $f(E)$, then measured $\overline{ED}$ to trace $f(C)$



[4] (b) Let g be the translation along the vector $-2\mathbf{v}$, and let h stand for the rotation $rot(O, -45°)$. Construct $\underset{2}{h} \circ \underset{1}{g}\,(A)$.

Steps: use parallelogram to find $-v$ from A, then double it to finish f. Then create perpendicular from O to get 90° angle, and bisect it. move A and done!

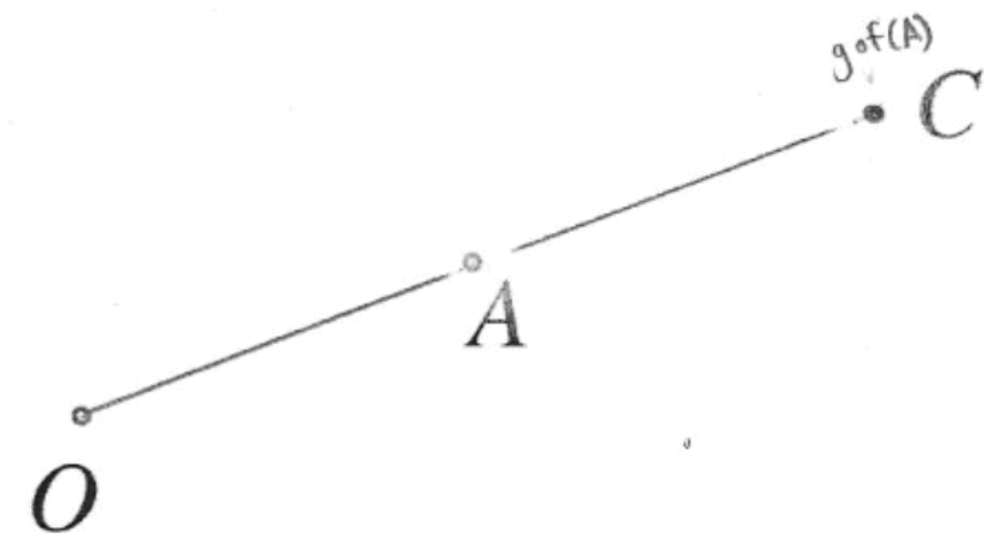


5a 3

~~5.~~ 7 – Marks

[3] (a) Denote by f the central similarity centered at O and of stretching factor $\alpha = 2$, and denote by g the central similarity centered at C and of stretching factor $\alpha = 1.3$. The point A is the midpoint of the line segment OC. Construct $g \circ f(A)$.

Steps: A is at the midpoint, which means f(A) is directly on point C, which means g∘f(A) is equal to C.



[4] (b) We are given the points O, A, $f(A)$ and B (see below) where f is a central similarity centered at O. Construct $f(B)$.

Steps: Constructed and extended parallelogram.