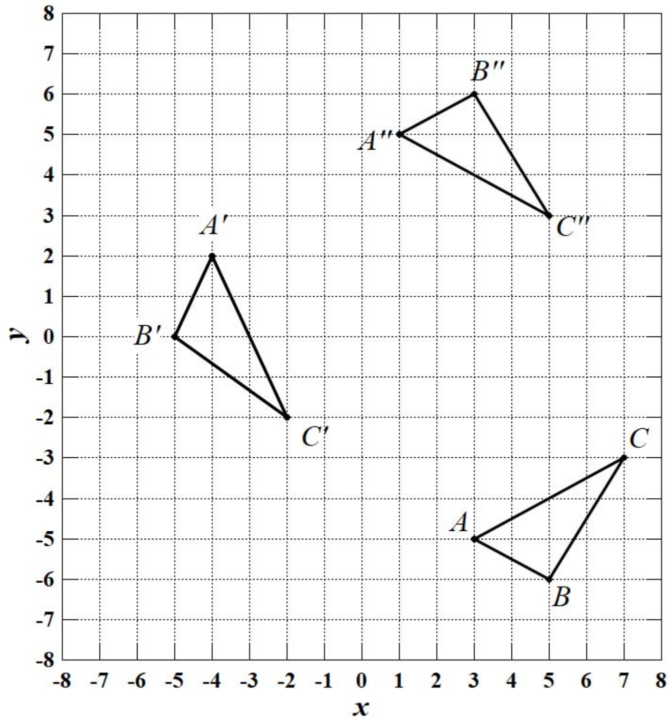
NANO 704-Crystallography & Structure of Nanomaterials

1. Transformations and Symmetry

Problems

1.1. Clearly emphasize the method of your solution, not just the answer.
Triangles $A'B'C'$ and ABC have direct congruence.
Triangles $A''B''C''$ and ABC have opposite congruence.



a) Find the translation vector $\vec{\mathbf{t}} = (t_x, t_y)$ to bring $A'B'C'$ into coincidence with ABC *after* a counter-clockwise rotation by 90° around each of the following points:
i) A', ii) C, ii) (0,0)

b) Repeat a) if the translation is instead performed *before* the rotation about the specified point.

c) Find an equation in the form $u \cdot x + v \cdot y = w$ for a line bisecting each of the following segments:
i) $A' - A$ ii) $B' - B$

d) Determine the Chasles center to transform $A'B'C' \rightarrow ABC$ by pure rotation.

e) Consider a line of reflection m_1 with equation $4x - y = 10$. Find the equation for a second line m_2, such that a reflection across m_1, followed by a reflection across m_2, transforms $A'B'C' \rightarrow ABC$.

f) For the glide transformation $A''B''C'' \rightarrow ABC$, find:
i) an equation for the glide line; ii) the translation component $\vec{\mathbf{t}}$.

g) Find the Chasles center to rotate $A''B''C'' \rightarrow ABC$ *after* a reflection across the line $x = 0$.