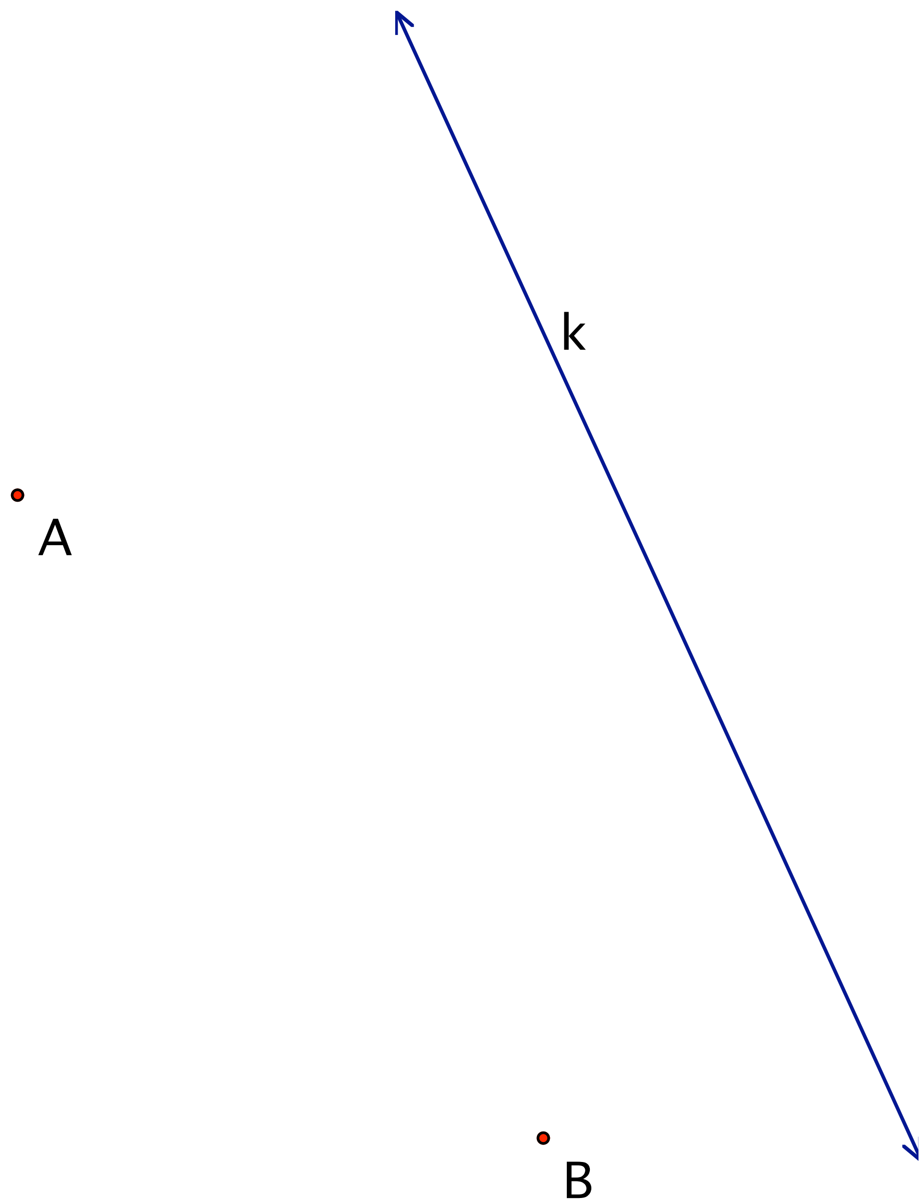
Construction Portfolio #4

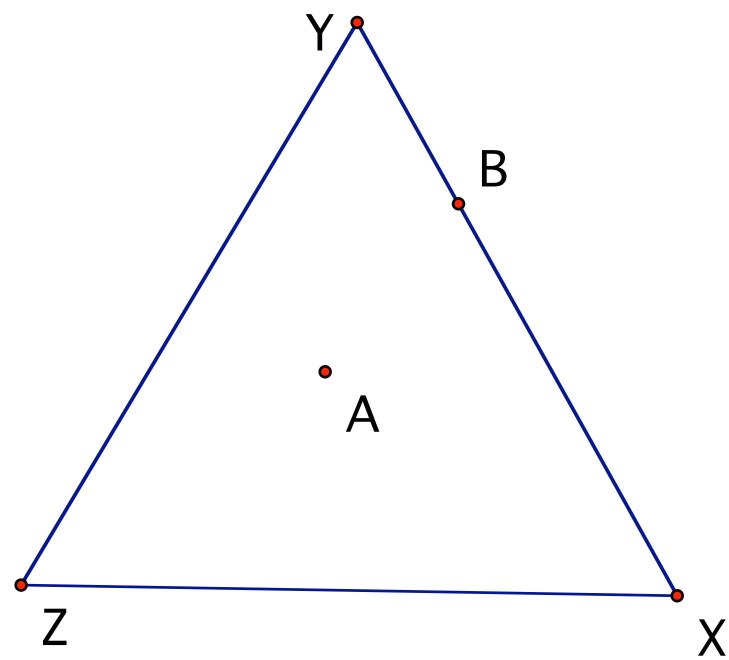
27. Light Path

Construct a point C on line k so that the path from A to C to B is the shortest possible. Specifically, the sum of lengths AC + CB should be smaller than for any other point C on k. This is the path a beam of light would take from A to B if reflected off a mirror k.



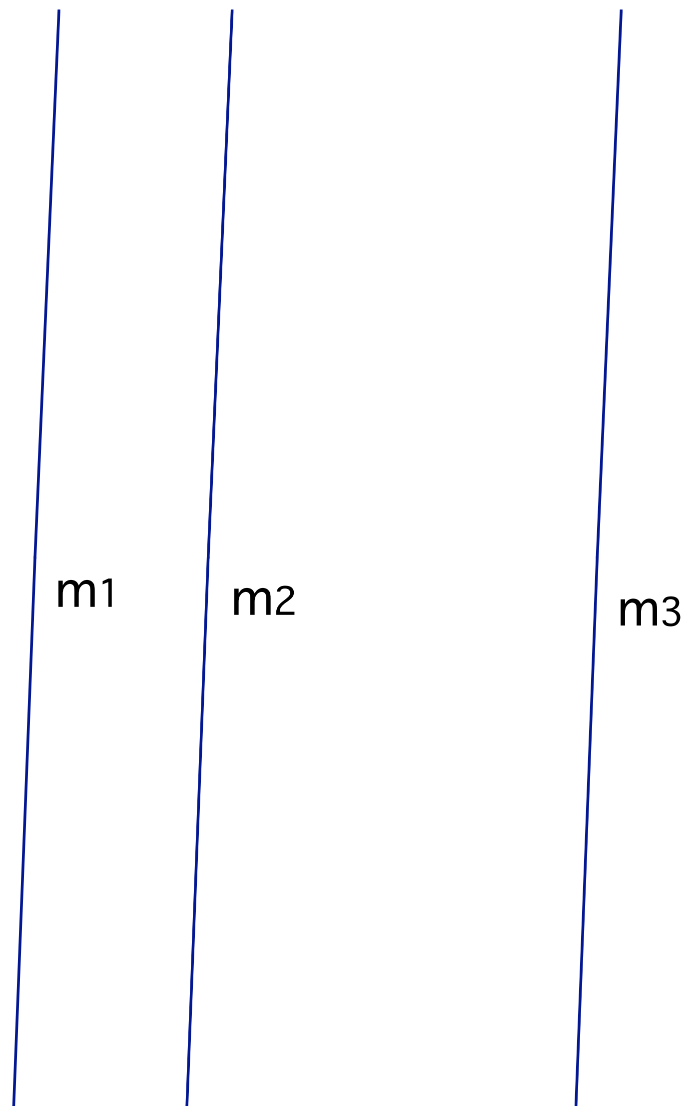
28. Triangular Billiards

Imagine that XYZ is a triangular billiard table. Construct the path of a billiard ball that is banked first off side XZ and then off side YZ before it reaches B.



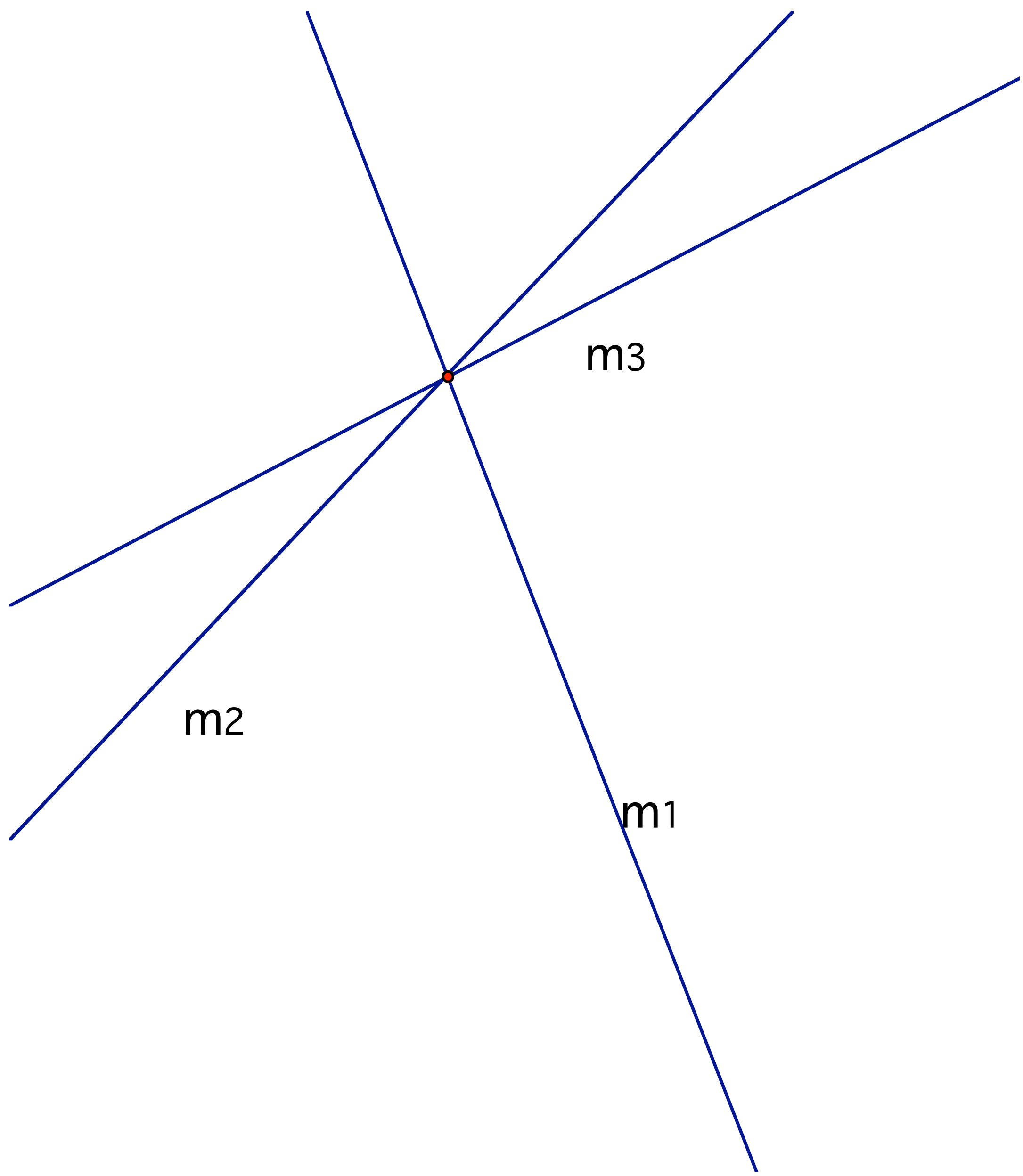
29. Triple Line Reflection (parallels)

Let reflection in parallel lines m1, m2, m3 be M1, M2, M3. Construct a line n so that reflection in n is the same transformation as the composition M3 M2 M1.



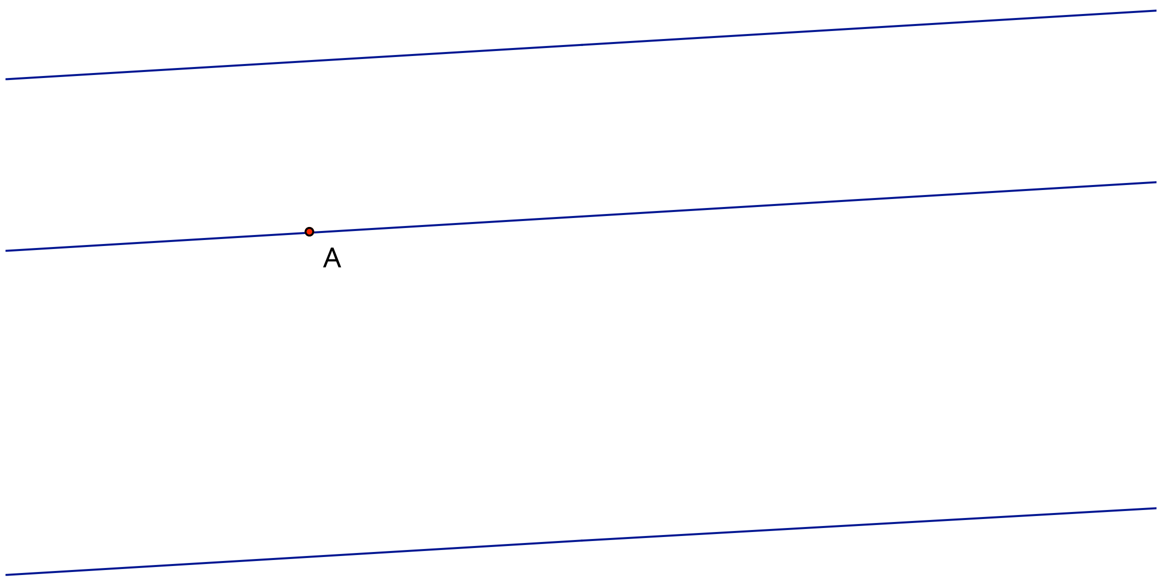
30. Triple Line Reflection (concurrent)

Let reflection in concurrent lines m1, m2, m3 be M1, M2, M3. Construct a line n so that reflection in n is the same transformation as the composition M3 M2 M1.



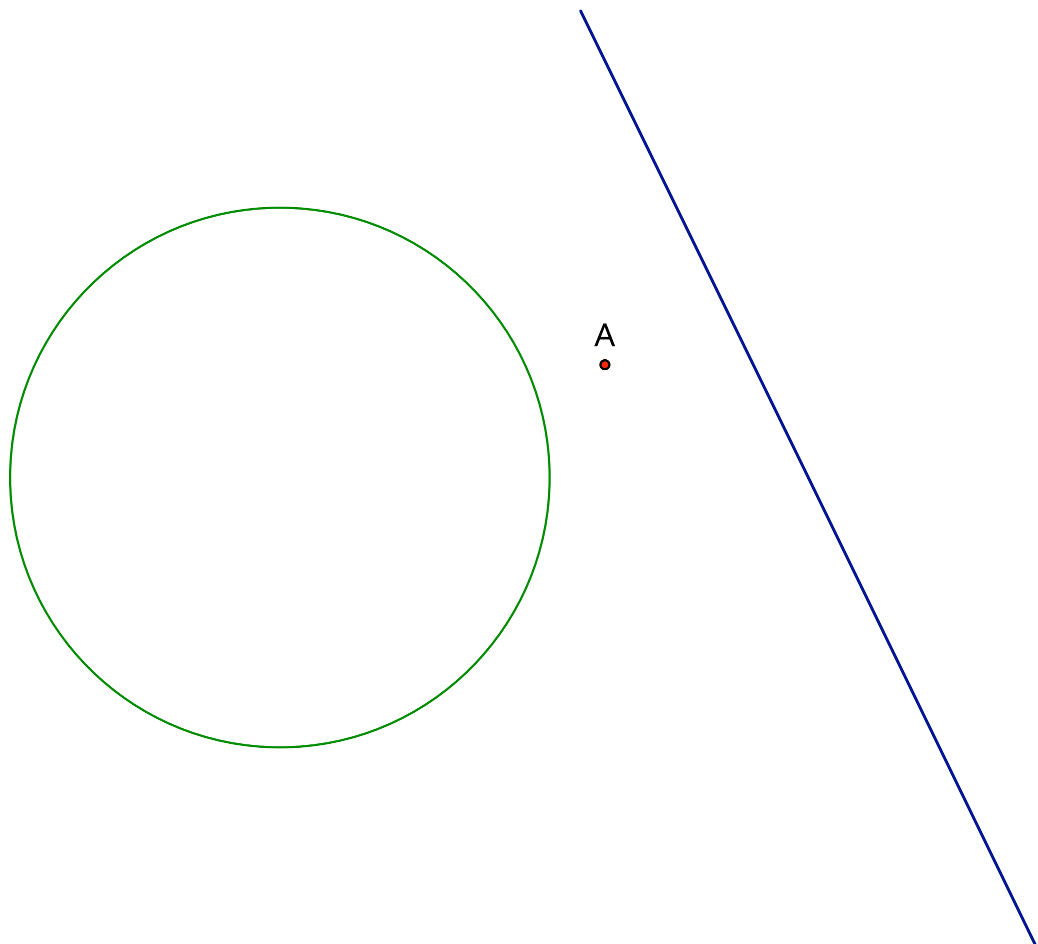
31. Constructions using transformations: equilateral triangle

Construct points B and C so that ABC is an equilateral triangle with one vertex on each of the 3 parallel lines.



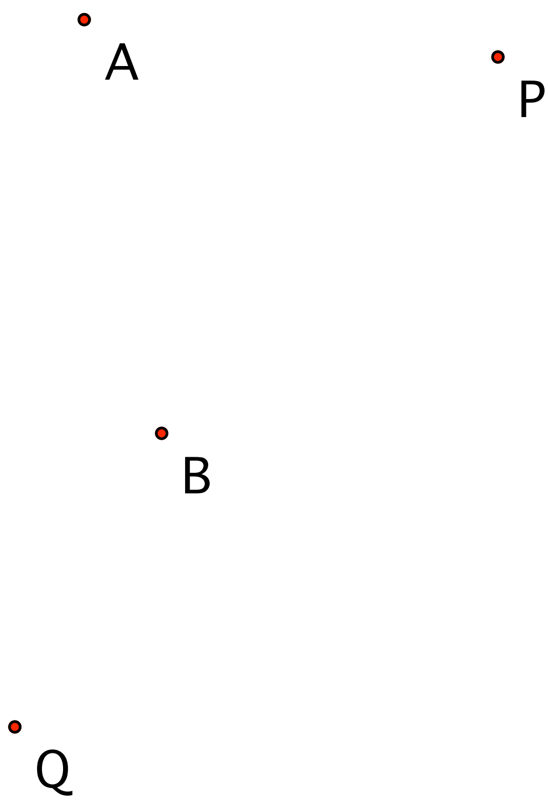
32. Constructions using transformations: segments with given midpoint

Construct ALL segments PQ so that P is on the line, Q is on the circle, and A is the midpoint of PQ.



33. Composition of two point symmetries

Given the points A and B, let H_A and H_B denote the point reflections with centers A and B. Let S be the composition $H_B H_A$. Construct points P' = S(P) and Q' = S(Q). Note: You are not required to construct H_A and H_B of any points unless you find it necessary.

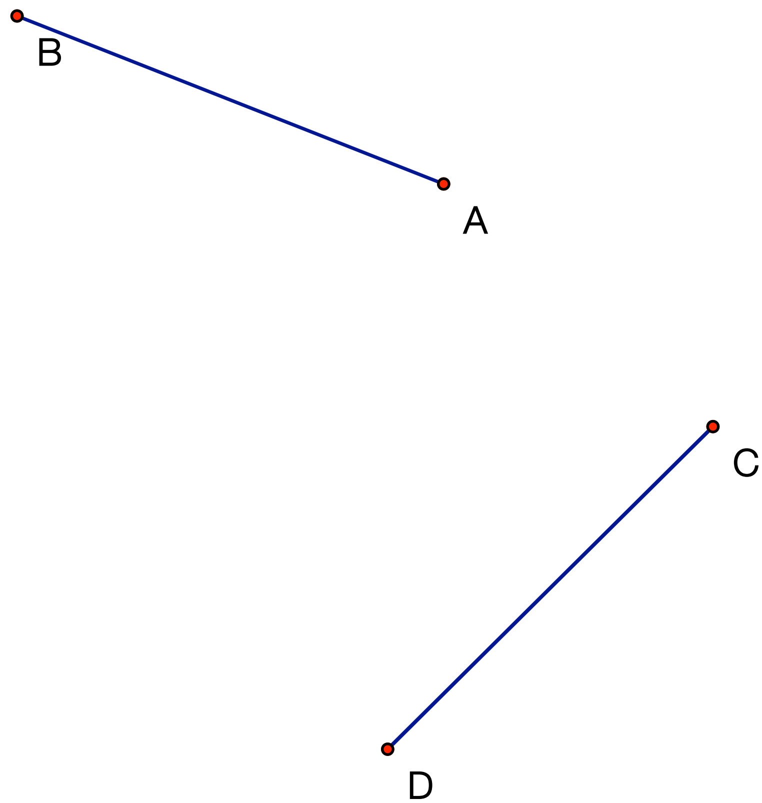


34. Center of a Rotation or Invariant Line of a GR

(1) Construct the center O of the rotation that takes A to C and B to D.

(2) Construct the invariant line g of the glide reflection that takes A to C and B to D

Be sure to label O and g very clearly as well as showing construction steps.



35. Center of a Product of Rotations

Given the points A and B below; let S be rotation with center A by 60 degrees and let T be rotation with center B by 180 degrees.

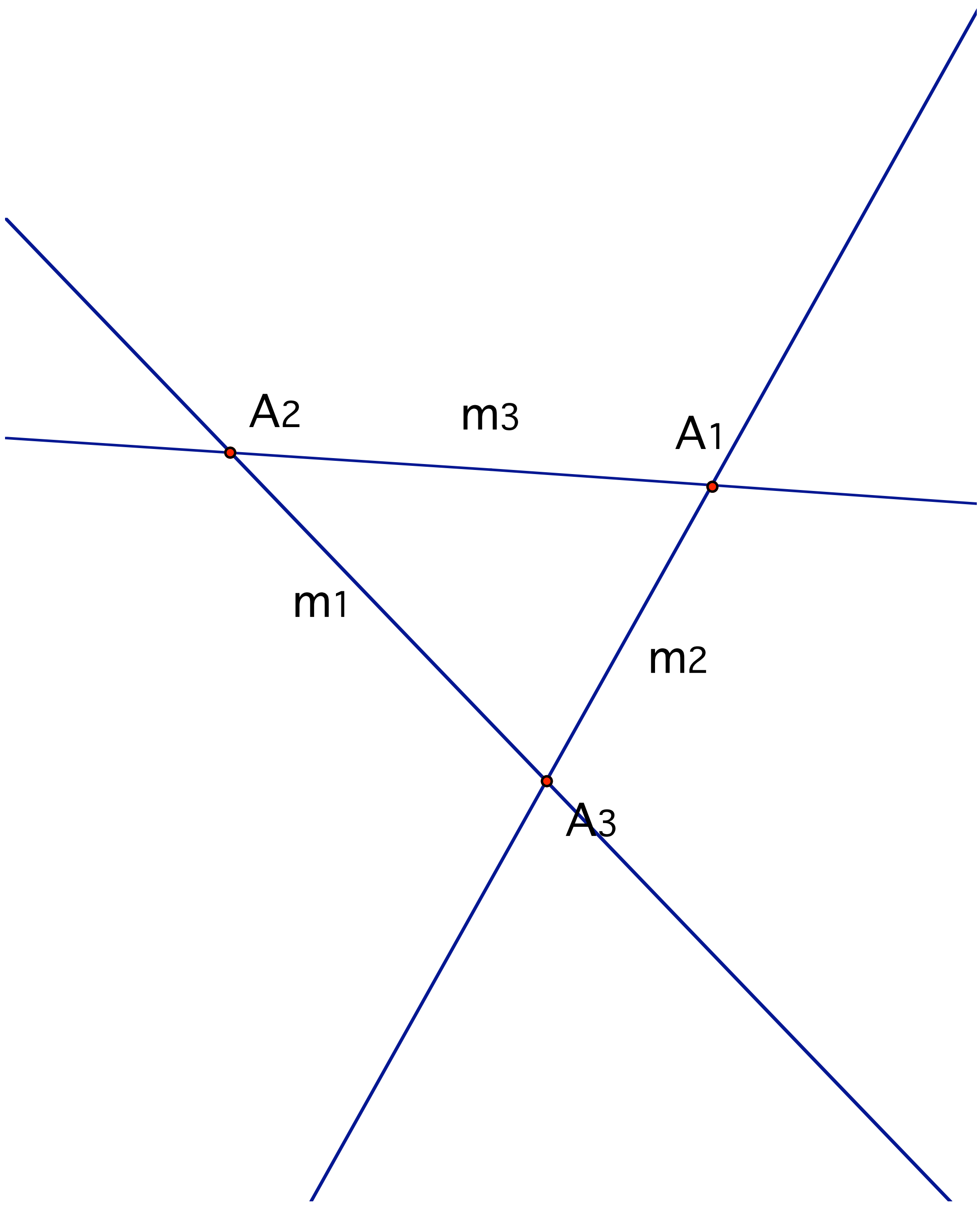
a) Construct the center C of the rotation U = ST. Write down the angle of rotation.

b) Construct the center D of the rotation V = TS. Write down the angle of rotation.

36. Glide Reflection as product of 3 Line Reflections

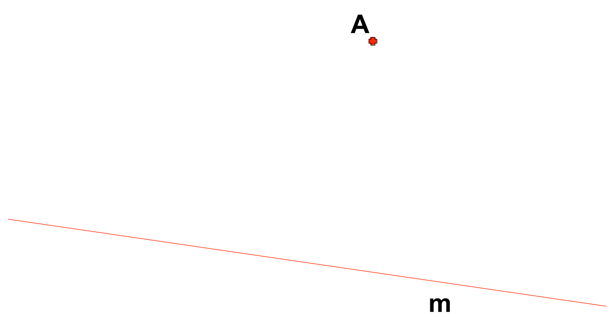
Let M_1, M_2, M_3 be line reflections in the lines m_1, m_2, m_3 below. Let $N = M_1 M_2 M_3$ and let $P = M_3 M_2 M_1$.

a) Construct the invariant (special) line of the glide reflection N and also a glide vector XY.
b) Construct the invariant (special) line of the glide reflection P and also a glide vector UV. Question to Ponder: How are N and P related?



37. Product of a Rotation and a Line Reflection

Let E be rotation with center A and angle 90 degrees and let M be reflection in line m. Construct the geometric defining data of ME.



38. Image of an Isometry

In the figure are given congruent quadrilaterals ABCD and A'B'C'D'. There is a unique isometry T that takes ABCD to A'B'C'D', i.e., A'B'C'D' is T(ABCD), the image of ABCD.

Construct the quadrilateral A"B"C"D" that is T(A'B'C'D'), the T image of A'B'C'D'.