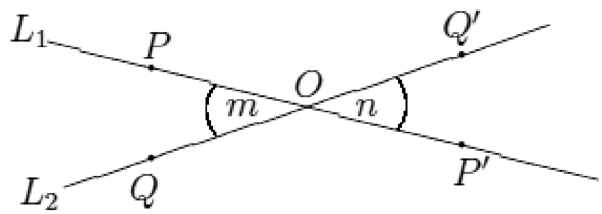
Lesson 6: Rotations of 180 Degrees

Classwork

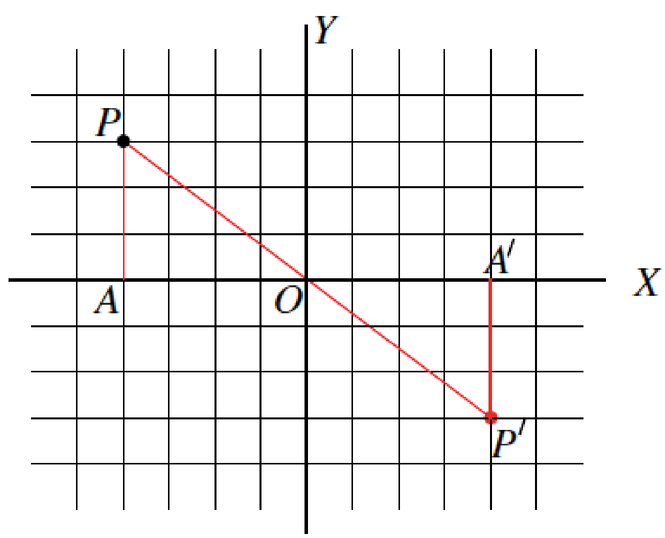
Example 1

The picture below shows what happens when there is a rotation of $180°$ around center O.



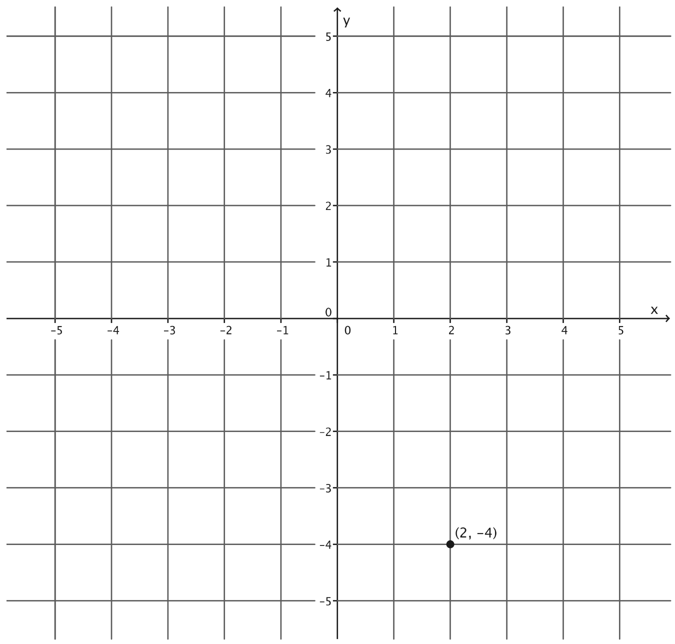
Example 2

The picture below shows what happens when there is a rotation of $180°$ around center O, the origin of the coordinate plane.

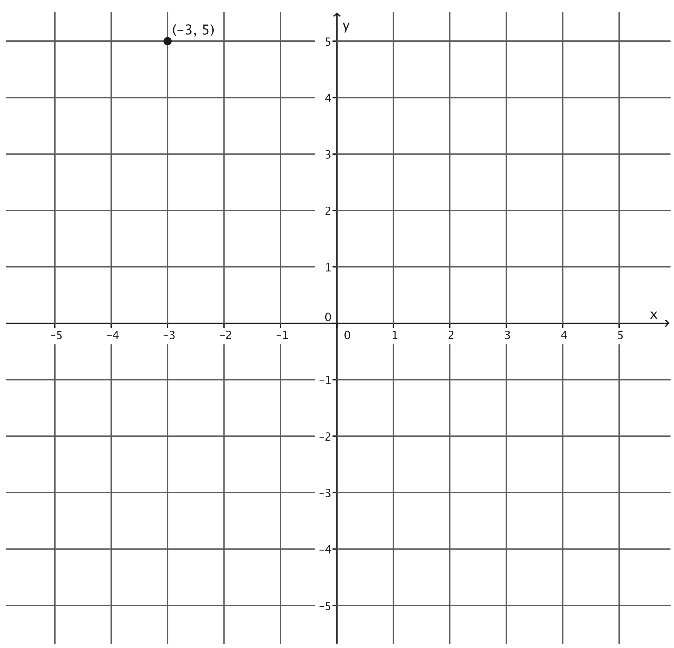


Exercises 1–9

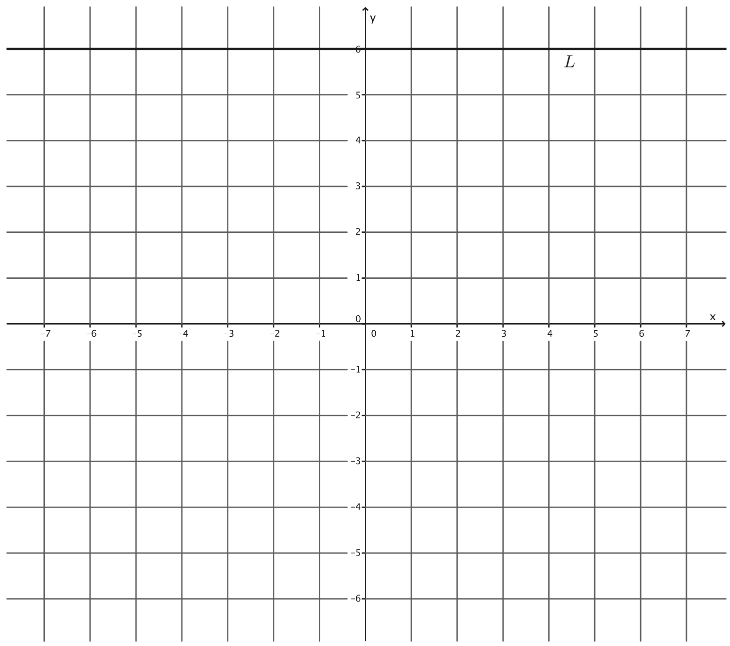
1. Using your transparency, rotate the plane 180 degrees, about the origin. Let this rotation be $Rotation_0$. What are the coordinates of $Rotation_0(2, -4)$?



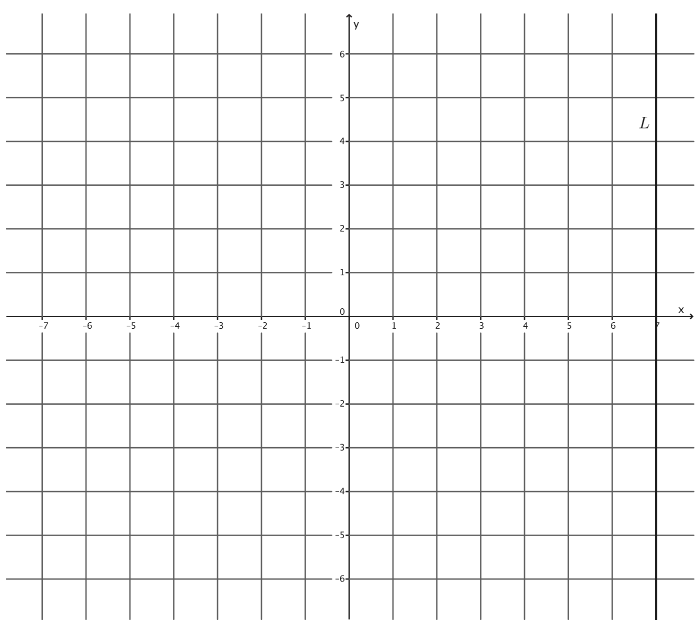
2. Let $Rotation_0$ be the rotation of the plane by 180 degrees, about the origin. <u>Without</u> using your transparency, find $Rotation_0(-3, 5)$.



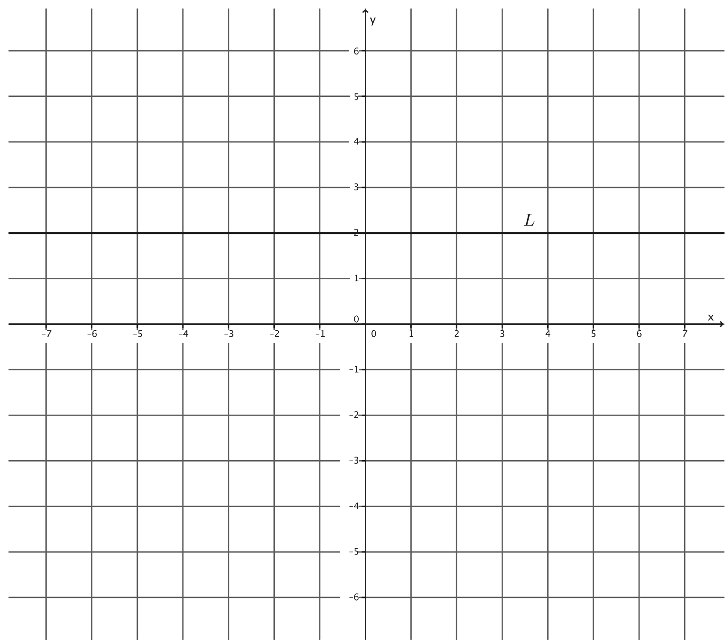
3. Let $Rotation_0$ be the rotation of 180 degrees around the origin. Let L be the line passing through $(-6, 6)$ parallel to the x-axis. Find $Rotation_0(L)$. Use your transparency if needed.



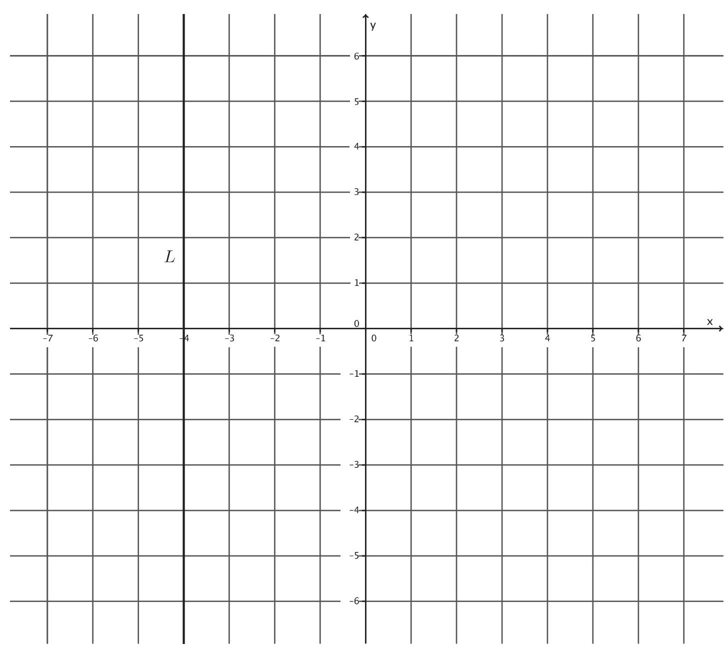
4. Let $Rotation_0$ be the rotation of 180 degrees around the origin. Let L be the line passing through $(7,0)$ parallel to the y-axis. Find $Rotation_0(L)$. Use your transparency if needed.



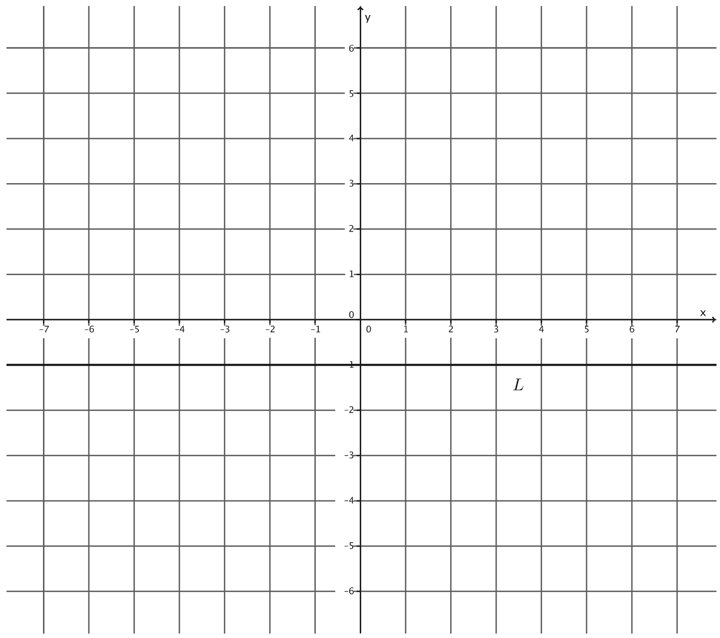
5. Let $Rotation_0$ be the rotation of 180 degrees around the origin. Let L be the line passing through $(0,2)$ parallel to the x-axis. Is L parallel to $Rotation_0(L)$?



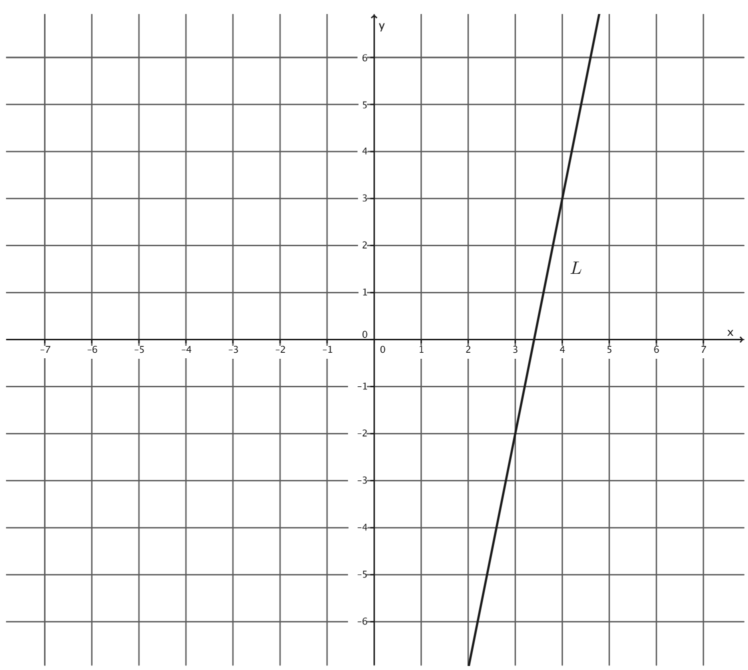
6. Let $Rotation_0$ be the rotation of 180 degrees around the origin. Let L be the line passing through $(4,0)$ parallel to the y-axis. Is L parallel to $Rotation_0(L)$?



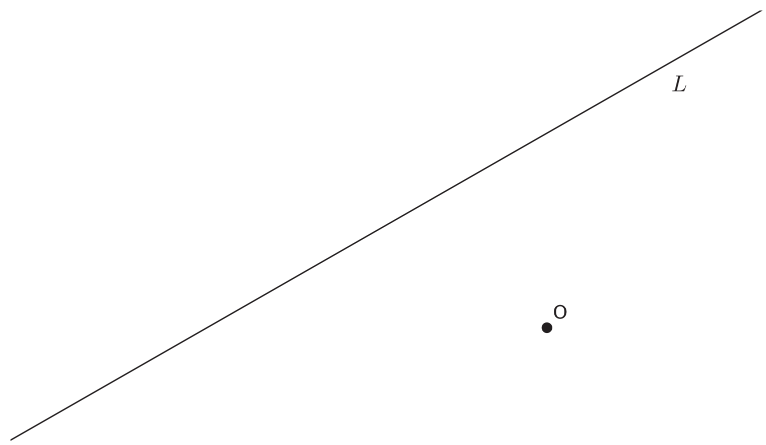
7. Let $Rotation_0$ be the rotation of 180 degrees around the origin. Let L be the line passing through $(0, -1)$ parallel to the x-axis. Is L parallel to $Rotation_0(L)$?



8. Let $Rotation_0$ be the rotation of 180 degrees around the origin. Is L parallel to $Rotation_0(L)$? Use your transparency if needed.



9. Let $Rotation_0$ be the rotation of 180 degrees around the center O. Is L parallel to $Rotation_0(L)$? Use your transparency if needed.



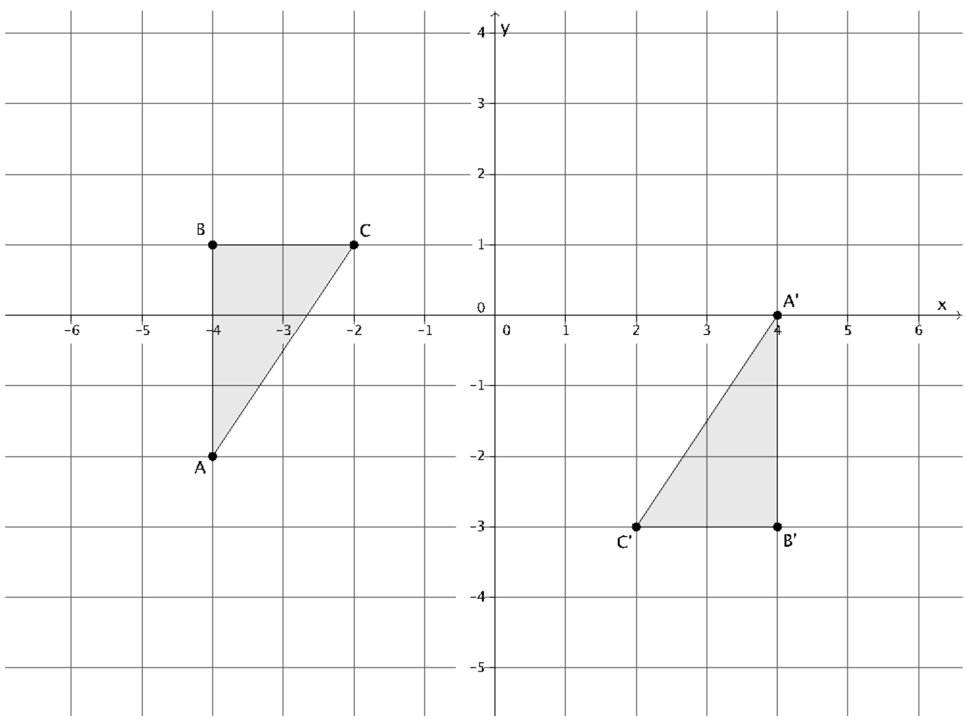
Lesson Summary

- A rotation of 180 degrees around O is the rigid motion so that if P is any point in the plane, P, O, and $Rotation(P)$ are *collinear* (i.e., lie on the same line).
- Given a 180-degree rotation around the origin O of a coordinate system, R_0, and a point P with coordinates (a, b), it is generally said that $R_0(P)$ is the point with coordinates $(-a, -b)$.

THEOREM: Let O be a point not lying on a given line L. Then, the 180-degree rotation around O maps L to a line parallel to L.

Problem Set

Use the following diagram for Problems 1–5. Use your transparency as needed.



1. Looking only at segment BC, is it possible that a $180°$ rotation would map segment BC onto segment $B'C'$? Why or why not?

2. Looking only at segment AB, is it possible that a $180°$ rotation would map segment AB onto segment $A'B'$? Why or why not?

3. Looking only at segment AC, is it possible that a $180°$ rotation would map segment AC onto segment $A'C'$? Why or why not?

4. Connect point B to point B', point C to point C', and point A to point A'. What do you notice? What do you think that point is?

5. Would a rotation map triangle ABC onto triangle $A'B'C'$? If so, define the rotation (i.e., degree and center). If not, explain why not.

6. The picture below shows right triangles ABC and $A'B'C'$, where the right angles are at B and B'. Given that $AB = A'B' = 1$, and $BC = B'C' = 2$, and that $\overline{AB}$ is not parallel to $\overline{A'B'}$, is there a $180°$ rotation that would map $\triangle ABC$ onto $\triangle A'B'C'$? Explain.