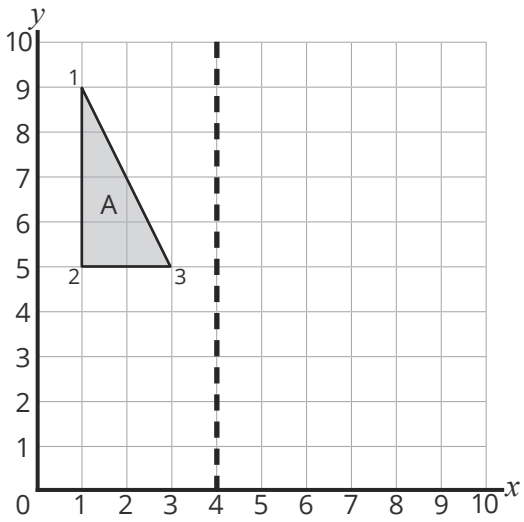
Transformations: Reflections

Prior Knowledge: Draw lines of $x = n$, $y = n$ and $y = x$.

Reflection is a **transformation** that results in a mirror image of a shape. To carry out a reflection, you need one piece of information: the **mirror line**. The most important thing when answering a reflection question is that every point on the new shape must be the same distance from the mirror line as the equivalent point on the original shape.

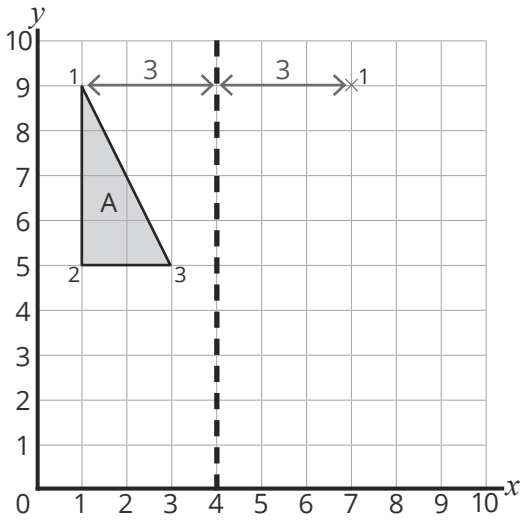
Example 1: Reflect shape A in the given mirror line. Label the new shape B



In this example, you have been given the mirror line. The corners of the shape have been labelled 1, 2 and 3.

Start with corner 1.

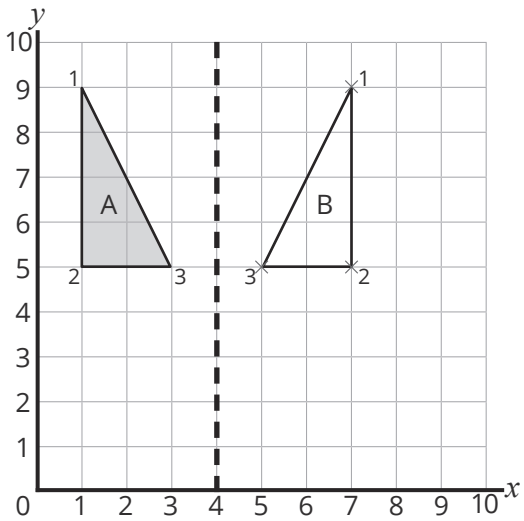
Count the number of spaces from the corner to the mirror line.



Because there are three squares between corner 1 and the mirror line, you plot corner 1 of shape B three squares on the other side of the mirror line.

Repeat the same process for the other corners.

Corner 2 is also three squares away from the mirror line. Corner 3 is only one square from the mirror line.

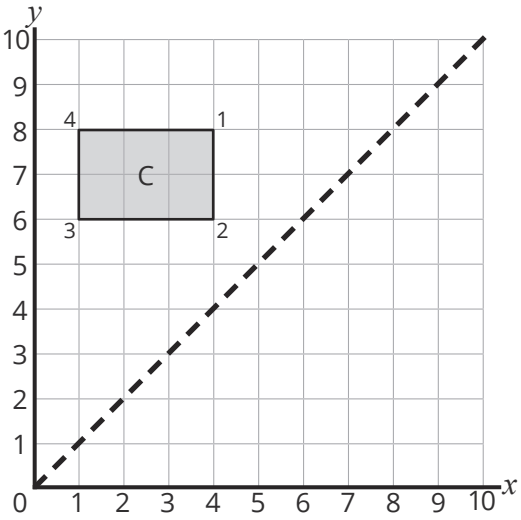


Finally, join up the three points and label them shape B.

You should check your answer. Your new shape should be **congruent** to your old shape (exactly the same proportions and exactly the same size, but mirrored). It should also be exactly the same distance from the mirror line as your original shape.

This next example is a little trickier because the mirror line is diagonal, but the principal is the same.

Example 2: Reflect shape C in the mirror line. Label the new shape D.

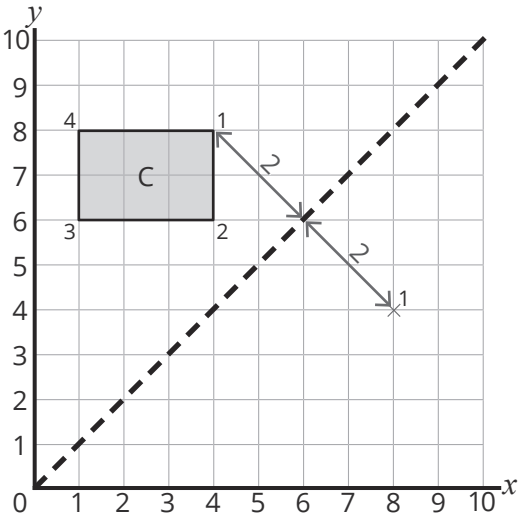


Again, we already have the mirror line.

Start with point 1. Count the squares diagonally to the mirror line.

As before, point 1 of shape B will be exactly the same distance on the other side of the mirror line.

Repeat the process with the other three corners.

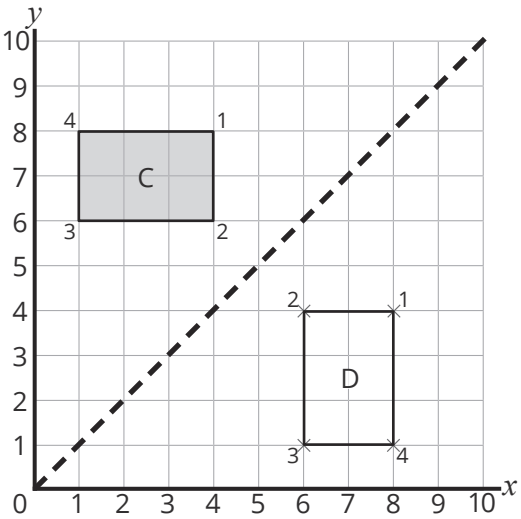


We need to be careful with corner 3 and corner 4.

Corner 3 is $2\frac{1}{2}$ diagonal squares from the mirror line so the new corner 3 will also be $2\frac{1}{2}$ squares from the mirror line.

Corner 4 is $3\frac{1}{2}$ diagonal squares from the mirror line so the new corner 3 will also be $3\frac{1}{2}$ from the mirror line.

Join up your points and label the new shape D.



Notice that your new shape seems to have been rotated.

That is because it has been reflected in a diagonal mirror line.

It is important to reflect each corner of a shape individually. It is very easy to make mistakes if you try to reflect an object by eye.

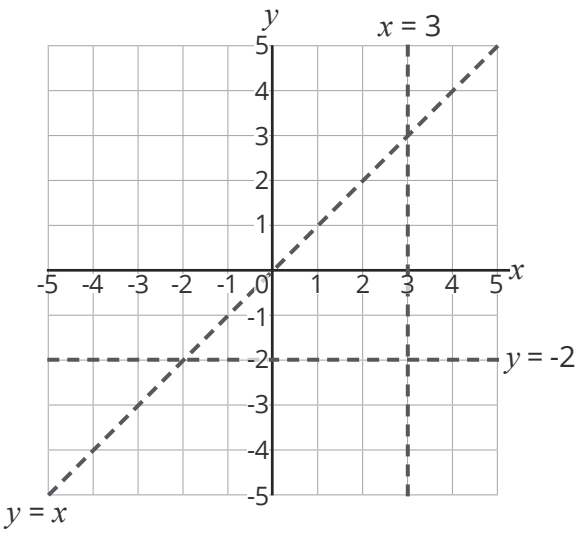
As before, shapes C and D are congruent and they remain the same distance from the mirror line.

In harder questions, you will not be given the mirror line, but will have to plot it yourself.

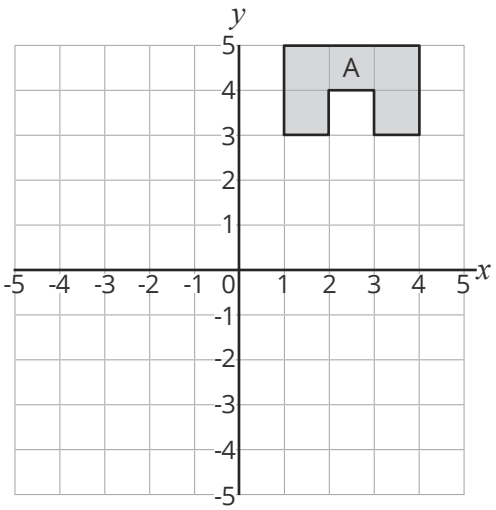
When drawing a straight line like $x = 3$, every point on the line will have an x-coordinate of 3. This means the line will cross straight through the x-axis at (3, 0).

When drawing a line like $y = -2$, every point will have a y-coordinate of -2 and the line will cross straight through the y-axis at point (0, -2).

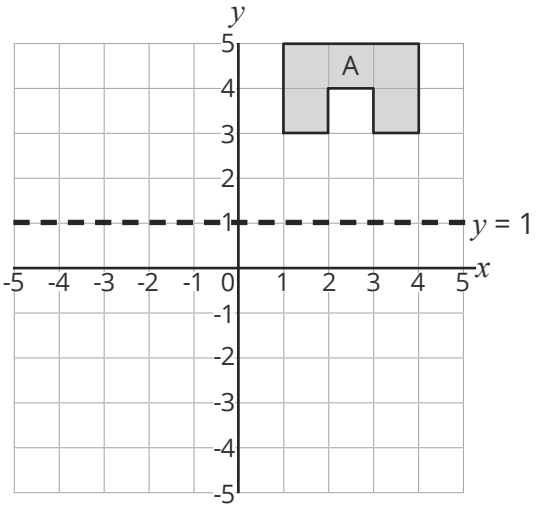
When drawing a line like $y = x$ or $x = y$, both coordinates will be the same. This gives you a diagonal line crossing through the point (0, 0).



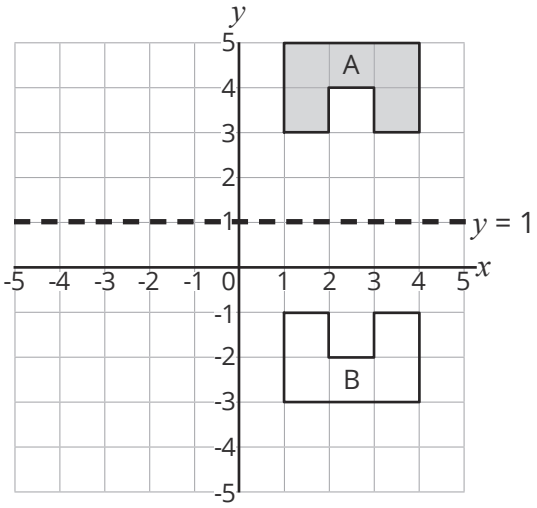
Example 3: Reflect shape A in the line $y = 1$. Label the new shape B



Start by drawing the line $y = 1$.



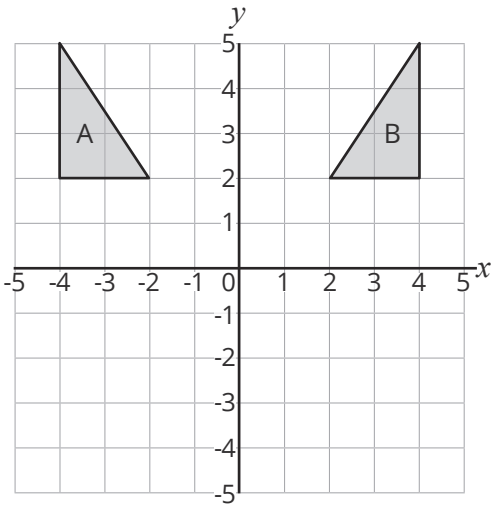
Then, reflect the shape as usual. Count the distance from each corner to the mirror line and make sure the corners of the new shape are the same distance from the mirror line.



Finally, label the new shape B and check your answer. (Is it **congruent**? Is it the same distance from the mirror line?)

You will also be asked to describe a reflection that has already been carried out.

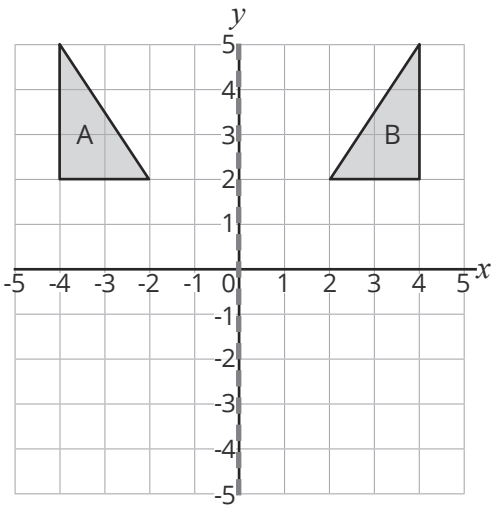
Example 4: Fully describe the transformation that maps shape A onto shape B.



This question is asking you to describe what transformation (reflection, rotation, enlargement or translation) changes shape A to look like shape B, and how to carry out that transformation.

In this case, you are describing a reflection. To fully describe a reflection, you only need one piece of information – the location of the mirror line.

Start by drawing this line. It should be exactly between the two shapes. Remember: every point on shape A must be the same distance from the line as the corresponding point on shape B.



In this case, the mirror line is the y-axis.

The y-axis crosses through the x-axis at 0 so the formula of the line is $x = 0$.

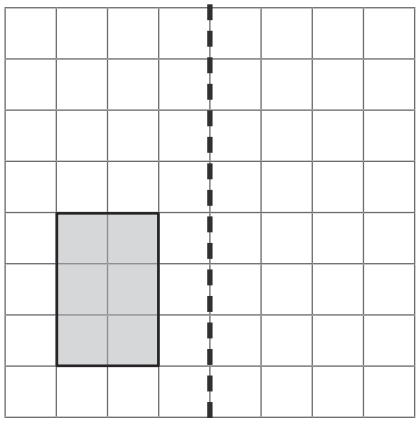
Therefore, the answer to the question is:

A reflection in the line $x = 0$.

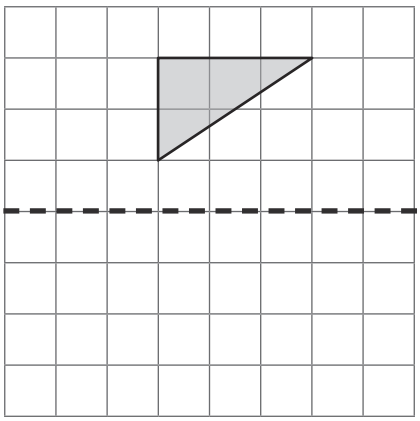
Your turn:

1. Reflect each shape in the mirror line:

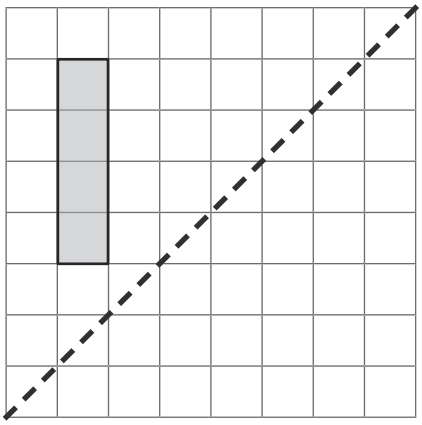
a.



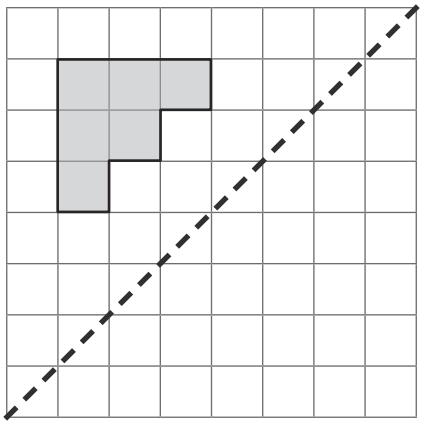
b.



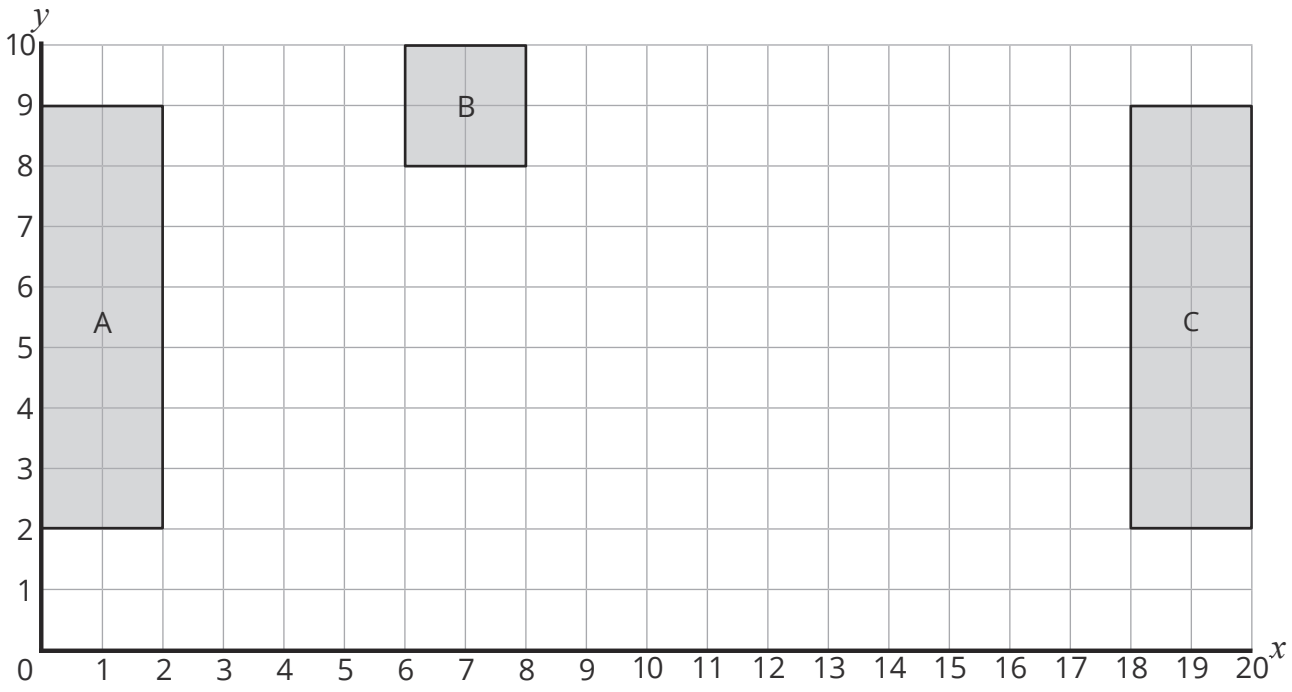
c.



d.

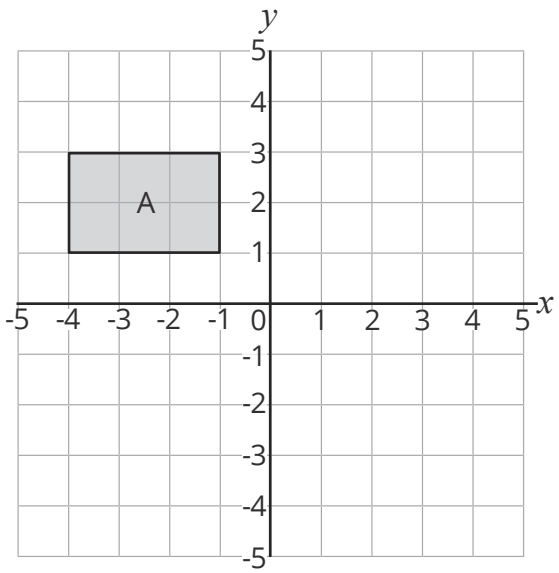


2. Reflect shape A in the line $x = 3$. Label your new shape D.
   Reflect shape B in the line $y = 7$. Label your new shape E.
   Reflect shape C in the line $x = 16$. Label your new shape F.
   Reflect shape D in the line $x = 7$. Label your new shape G.

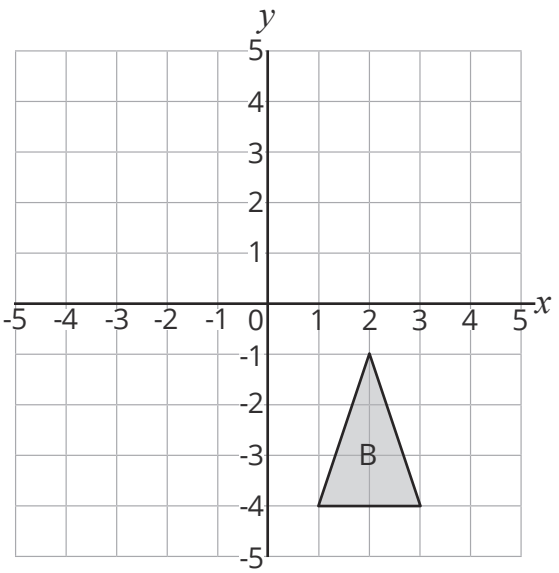


3.

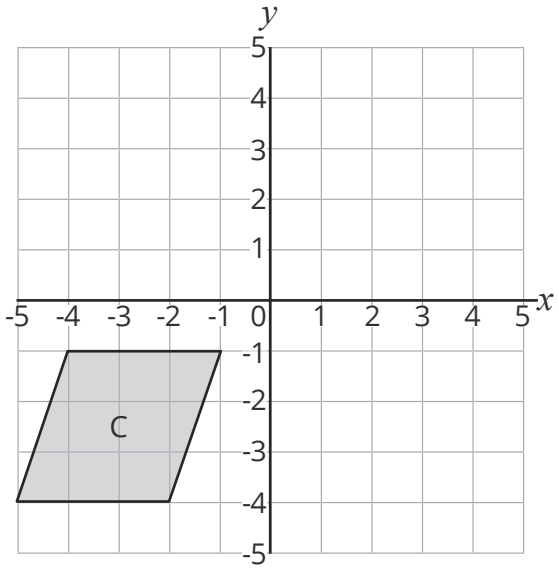
a. Reflect shape A in the line $y = -1$.
Label the new shape A′.



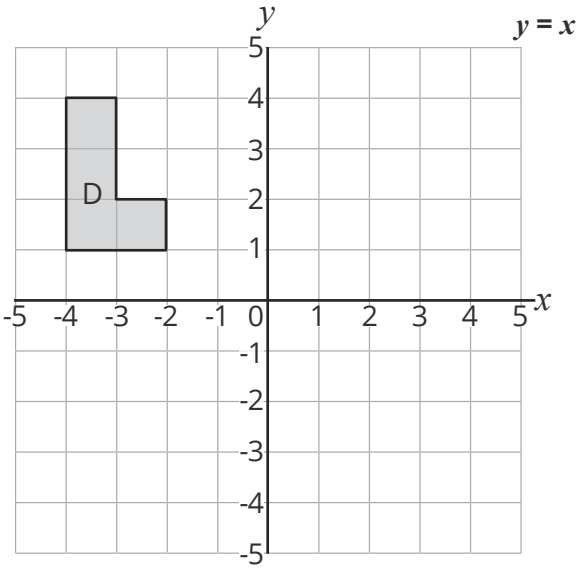
b. Reflect shape B in the line $y = 0$.
Label the new shape B′.



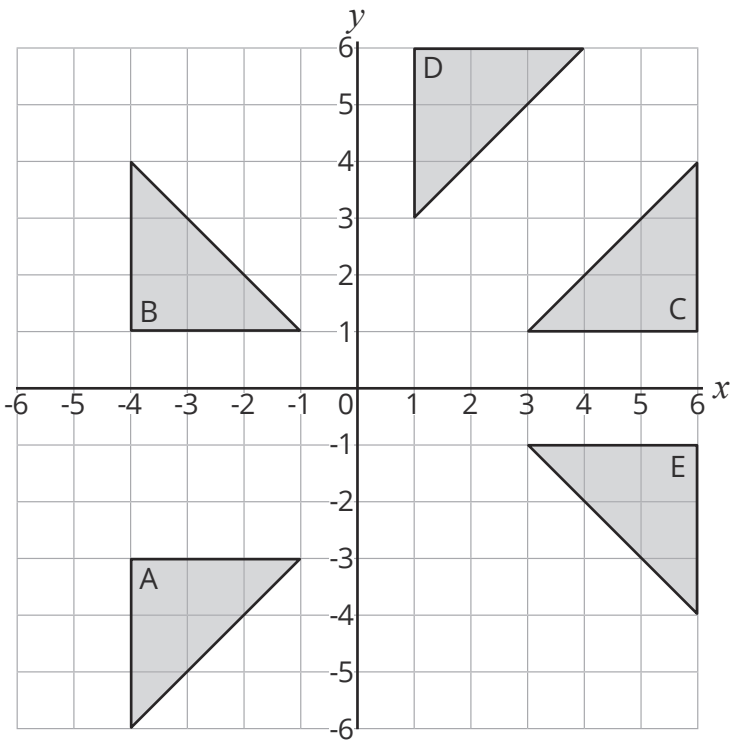
c. Reflect shape C in the line $x = -1$.
Label the new shape C′.



d. Reflect shape D in the line $y = x$.
Label the new shape D′.



4. Fully describe the reflection that maps:



a. Shape A onto shape B

b. Shape B onto shape C

c. Shape C onto shape D

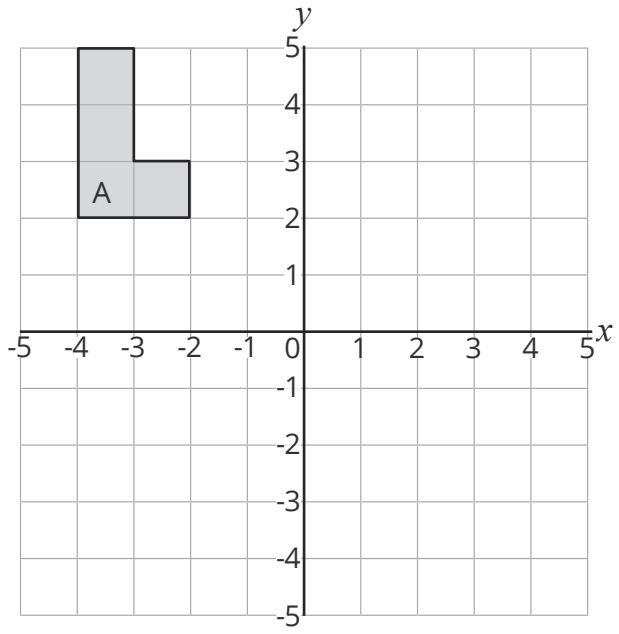
d. Shape C onto shape E

Challenge:

Shape A is reflected in the line $y = x$ to produce shape B.

Shape B is reflected in the line $x = 0$ to produce shape C.

Shape C is reflected in the line $y = -x$ to produce shape D.



Fully describe the single transformation that maps shape D onto shape A.