Combining Transformations

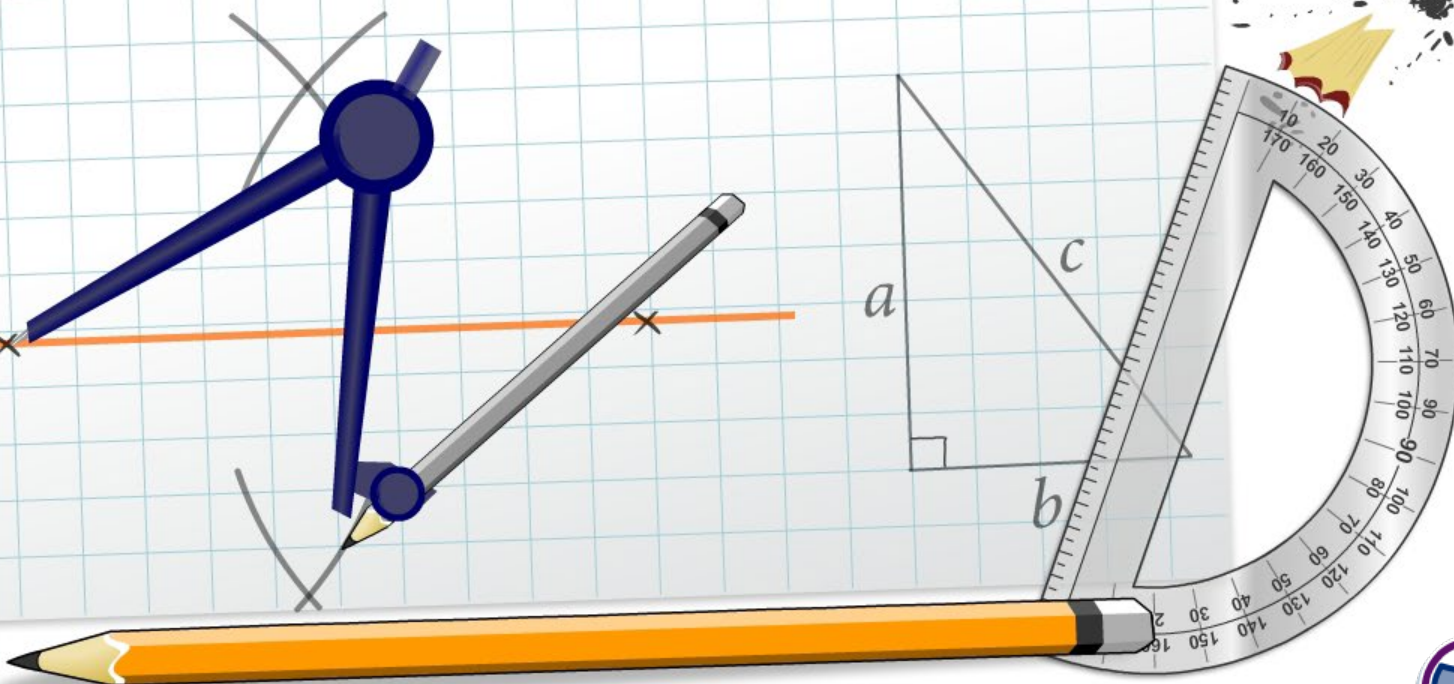# Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

MODELING

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) **Make sense of problems and persevere in solving them.**

2) **Reason abstractly and quantitatively.**

3) **Construct viable arguments and critique the reasoning of others.**

4) **Model with mathematics.**

5) **Use appropriate tools strategically.**

6) **Attend to precision.**

7) **Look for and make use of structure.**

8) **Look for and express regularity in repeated reasoning.**

This icon indicates that the slide contains activities created in Flash. These activities are not editable.
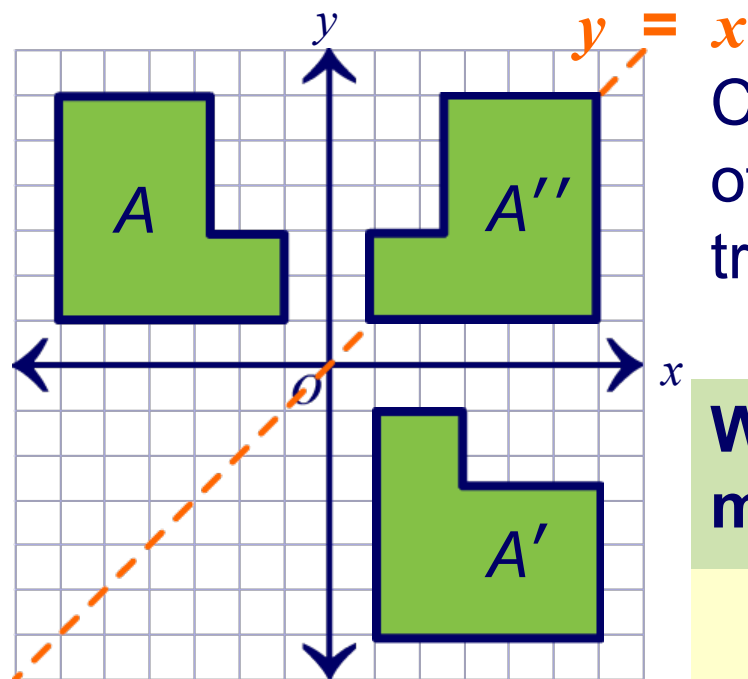
This icon indicates teacher's notes in the Notes field.

Shape A is reflected across the line $y = x$ to give its image A'.
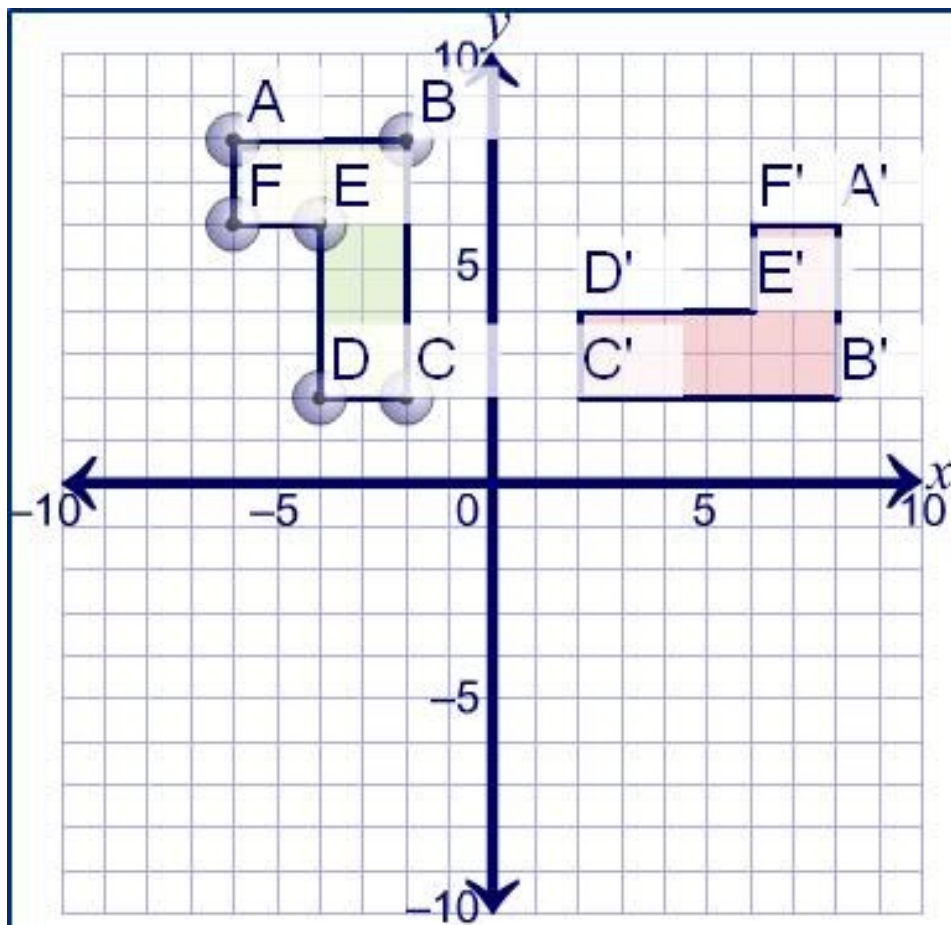
A' is rotated 90° about the origin to give the image A''.

$y = x$

Combinations of transformations can often be described as one transformation.

What single transformation will map shape A onto A''?

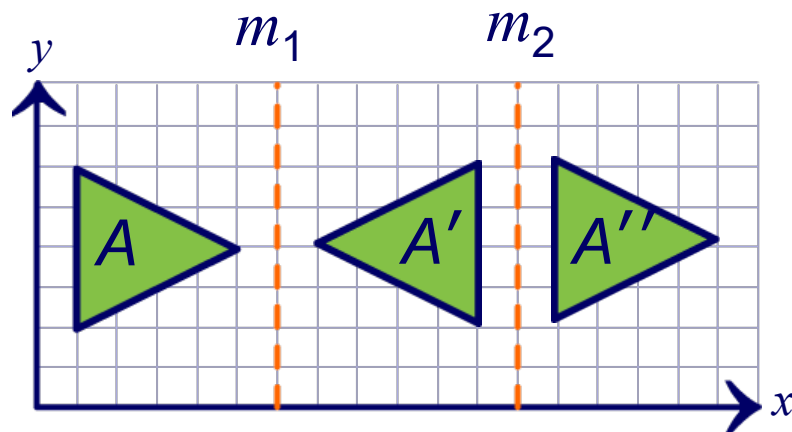Reflection of A across the y-axis.

Combining transformations

M reflect across x-axis

N reflect across y-axis

P reflect across $y = x$

Q reflect across $x = 1$

R rotate 90° about (0, 3)

S rotate 90° about (0, 0)

T translate by $\langle 2, -1 \rangle$

U translate by $\langle -3, 2 \rangle$

V dilation −1 about (0, 0)

N followed by P   Go

Lines of reflection m_1 and m_2 are parallel.

Reflect shape A across m_1 to produce the image A'.

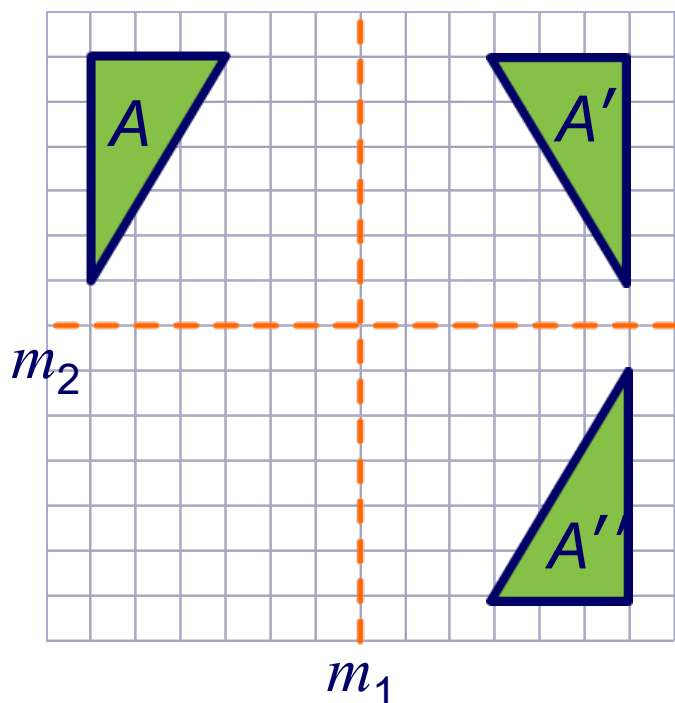Then reflect shape A' across m_2 to produce the image A''.

How can we map A onto A'' in a single transformation?

Translate A 12 units along the x-axis.

Reflecting an object in two parallel lines of reflection is equivalent to a single translation.

Lines of reflection m_1 and m_2 are perpendicular.

Reflect shape A across m_1 to produce the image A'.

Then reflect shape A' across m_2 to produce the image A''.
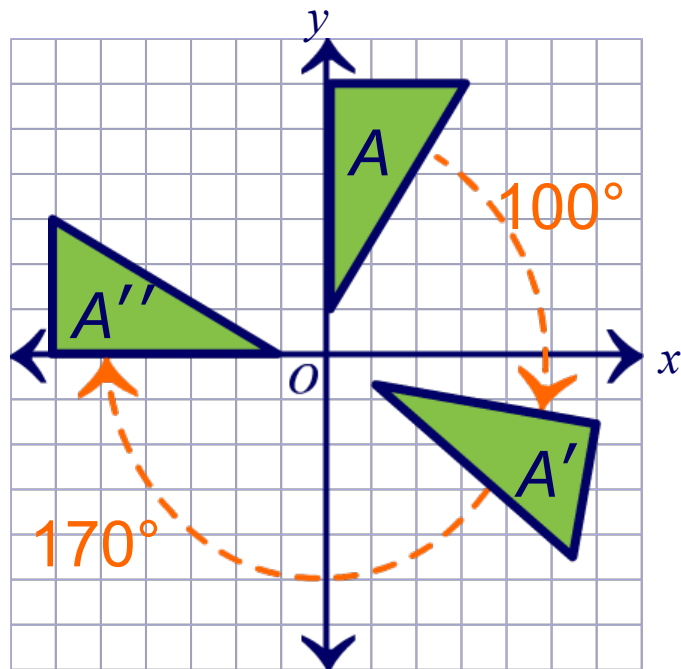
How can we map A onto A'' in a single transformation?

Rotate A 180° about the point of intersection of m_1 and m_2 to produce the image A''.

Reflection in two perpendicular lines is equivalent to a single rotation of 180° about the point of intersection.

Rotate shape A through 100° clockwise about point O to produce the image A'.

Then rotate shape A' through 170° clockwise about the origin to produce the image A''.
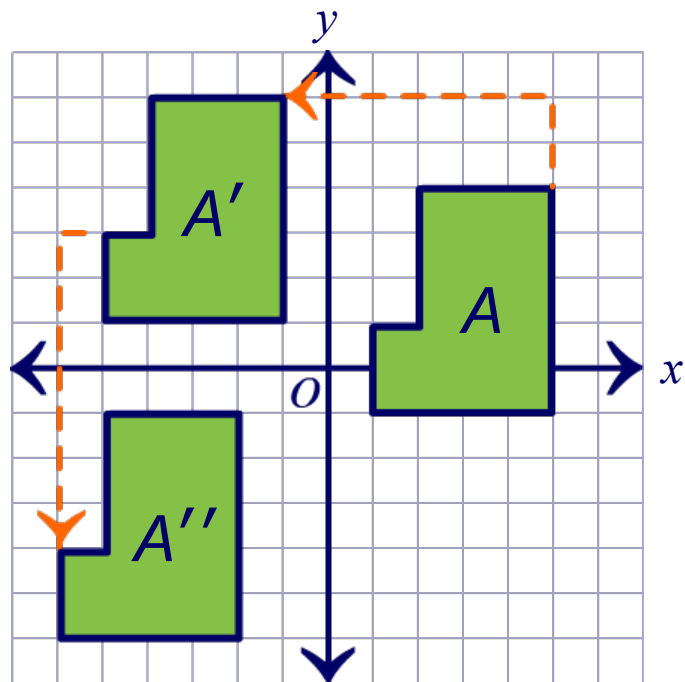
How can we map A onto A'' in a single transformation?

Rotate shape A 270° clockwise or 90° counterclockwise.

Two rotations about the same center are equivalent to a single rotation about the same center.

Translate shape A by the vector $\langle -6, 2 \rangle$.

Then translate A' by the vector $\langle -1, -7 \rangle$ to give A''.

How can we map A onto A'' in a single transformation?

The vectors can be added together to find the overall translation. Map A onto A'' by translating it by $\langle -7, -5 \rangle$.

Two or more consecutive translations are equivalent to a single translation.

Transformations on a coordinate grid

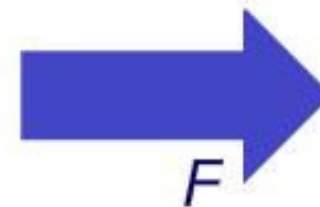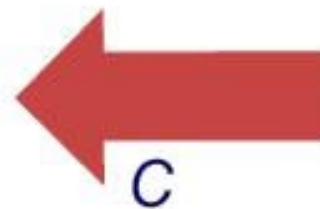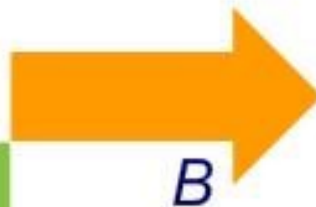Press the buttons to see these combinations of transformations and equivalent single transformations.

multiple rotations	**multiple translations**
reflections across perpendicular lines	**reflections across parallel lines**

Tranformations

A

B

C

D

E

F

G

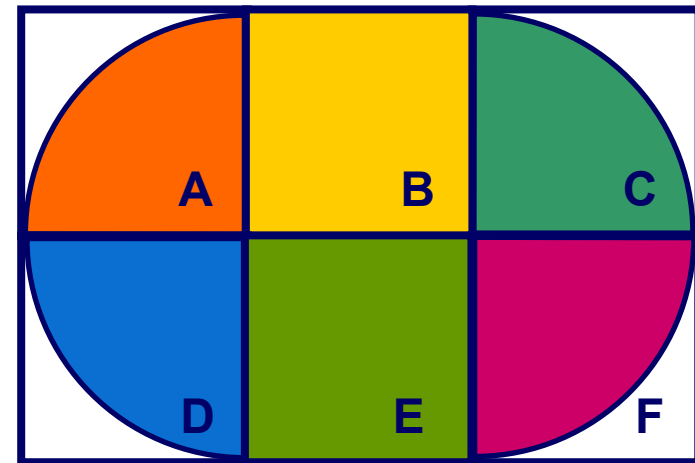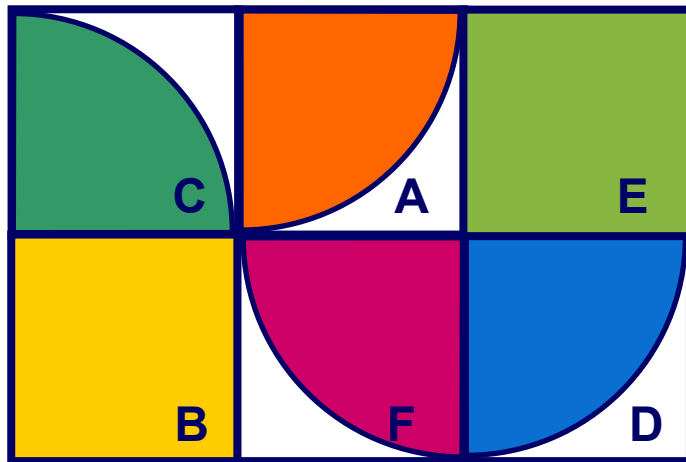**Question 1/5: Select arrow _B_ and its possible translation.**

This pattern for a stained glass window is based on a 3 by 2 grid. Each tile is labeled A-F.

Describe possible transformations (translation, rotation, reflection) for each square to make the design on the right from the layout on the left.

Combining transformations

Shape A is reflected across the y-axis, then the x-axis, then rotated 67°. What one transformation maps shape A onto the final image?
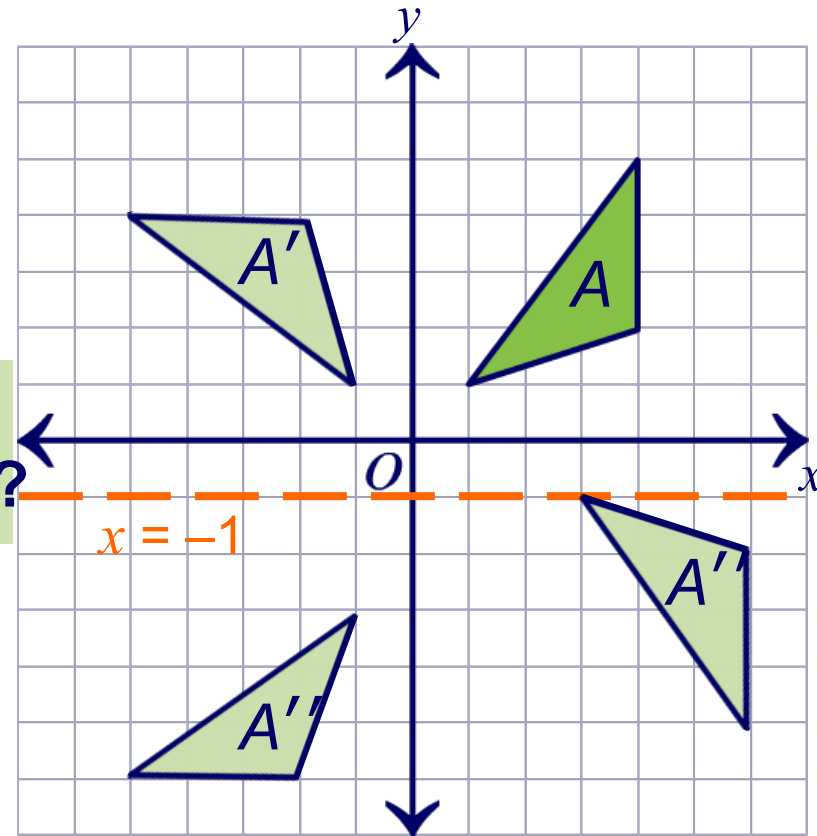
Press **play** to start.
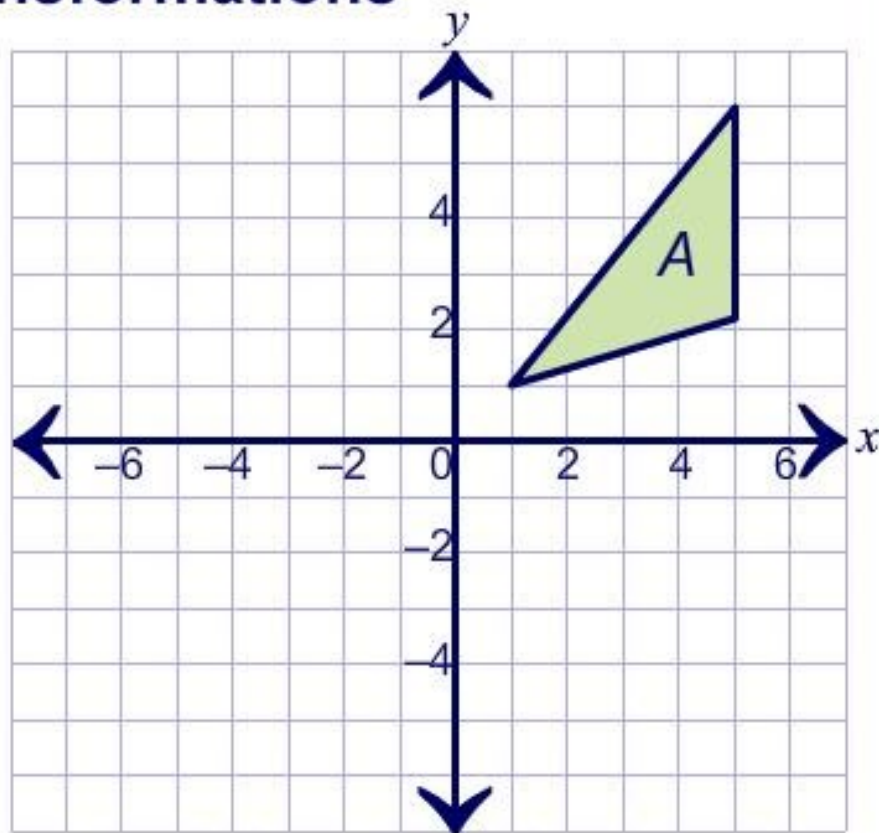
Rotate A 90° clockwise around the origin to create A'.

Then A' is reflected to create A'' with the coordinates (–1, –3), (–2, –6) and (–5, –6).

What is the equation of the line of reflection between A' and A''?

Then A'' is rotated to give A''' coordinates of (3, –1), (6, –2) and (6, –5).

$x = -1$

What is the degree of rotation between A'' and A''' ?

90°

Match the transformations

Match the combination of transformations with the single transformation that maps the object onto the final image.

Press the **"info"** button to see graphs of the transformations.

Press **"start"** to begin.

start