Name Key Class Date

UNIT 4

Problem Solving Connections

COMMON CORE

CC.8.G.1
CC.8.G.2
CC.8.G.3
CC.8.G.4

Stitch Perfect Ellie is making a cross-stitch pattern for a butterfly. She uses translations, reflection, rotations, and dilations to design the parts of the butterfly. Perform the transformations as described. Then, draw the images on the final answer grid on the last page of the Problem Solving Connections.

1 Making the Body and Wings

A The coordinates of the vertices of the rectangle that represents the body of the butterfly are (−1, 7), (1, 7), (1, −7), (−1, −7). Draw the body on the final answer grid.

B What would the body of the butterfly look like if it were rotated clockwise by 180°?

It would look the same; A 180° rotation would align the original figure.

C Ellie draws one upper wing of the butterfly. The coordinates of the vertices of the wing are given in the table. Draw the wing on the final answer grid.

First Upper Wing	(−10, 9)	(−4, 9)	(−1, 5)	(−1, 0)	(−10, 2)
Image	(10, 9)	(4, 9)	(1, 5)	(1, 0)	(10, 2)

To find the coordinates of the other upper wing, perform a reflection across the *y*-axis. Draw the image of the first wing on the final answer grid.

D Ellie draws one lower wing of the butterfly. The coordinates of the vertices of the wing are given in the table. Draw the wing on the final answer grid.

First Lower Wing	(1, 0)	(5, 0)	(9, −2)	(10, −9)	(5, −9)	(1, −2)
Image	(−1, 0)	(−5, 0)	(−9, −2)	(−10, −9)	(−5, −9)	(−1, −2)

To find the coordinates of the other lower wing, perform a reflection across the *y*-axis. Draw the image of the first wing on the final answer grid.

E Is the first upper wing congruent to its image? Is the first lower wing congruent to its image? Explain how you know.

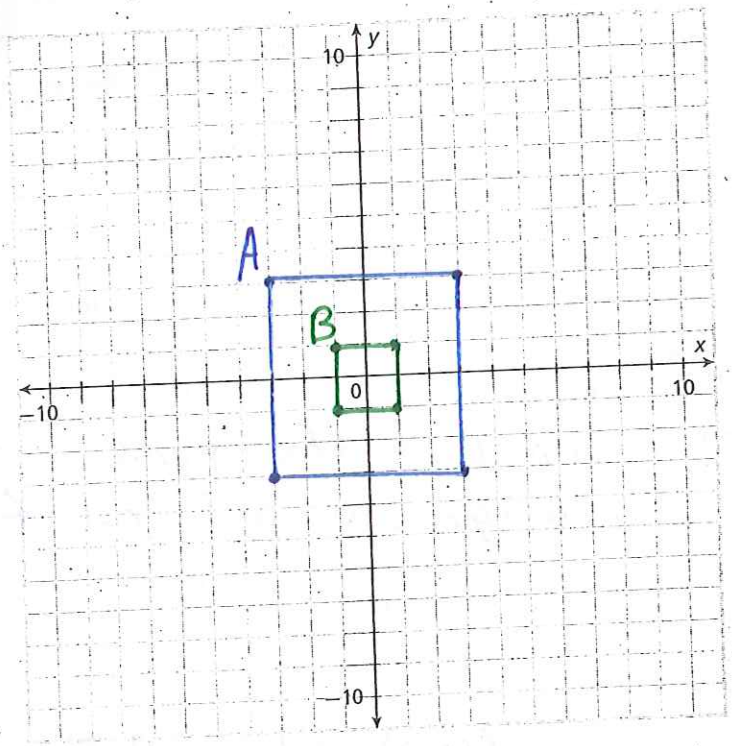
Yes; there is a sequence of transformations (reflecting across the y-axis) that would transform the first wing to its image.

2 Designing the Upper-Wing Pattern

A On the grid below, draw a square centered at the origin, with side lengths of 6 units.

B Ellie transforms the figure from **A** under the dilation $(x, y) \rightarrow \left(\frac{1}{3}x, \frac{1}{3}y\right)$. Write the coordinates of the image. Then, draw the image on the grid below.

(-1, 1), (1, 1), (1, -1), (-1, -1)



C Ellie transforms the figure from **B** under the translation $(x, y) \rightarrow (x + 5, y + 4)$. Write the coordinates of the image. Then, draw the image on the final answer grid.

(4, 5), (6, 5), (6, 3), (4, 3)

D Ellie transforms the figure from **C** by reflecting it across the y-axis. Write the coordinates of the image. Then, draw the image on the final answer grid.

(-4, 5), (-6, 5), (-6, -3), (-4, 3)

E On the final answer grid, there is a black square. Ellie reflects the square across the y-axis. Write the coordinates of the image. Then, draw the image on the final answer grid.

(-9, 8), (-6, 8), (-6, 5), (-9, 5)

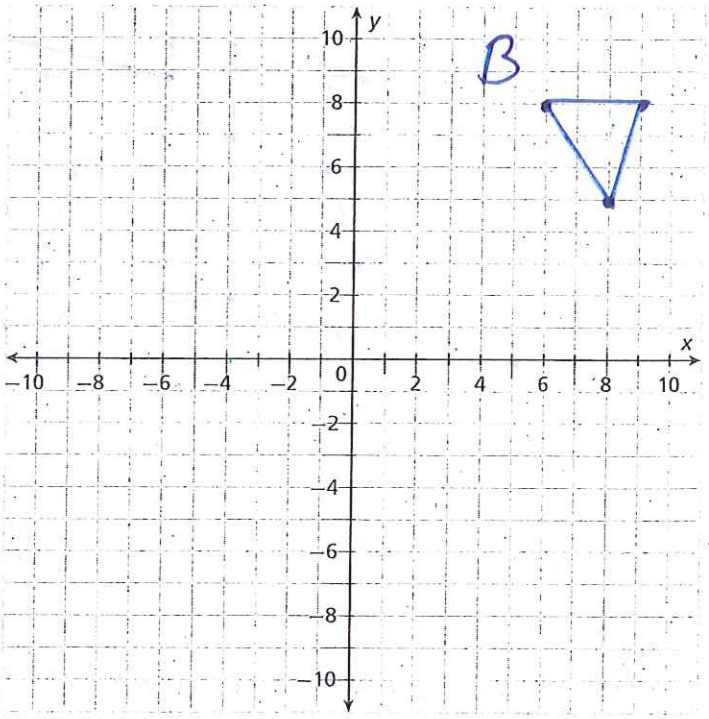
3 Designing the Lower-Wing Pattern

A On the final answer grid, there is a black triangle. Ellie reflects the triangle across the y-axis. Write the coordinates of the image. Then, draw the image on the final answer grid.

(8, -5), (9, -8), (6, -8)

B Ellie rotates the original triangle by 180° about the origin. Write the coordinates of the image. Then, draw the image on the grid below.

(8, 5), (9, 8), (6, 8)



C Ellie transforms the figure from B under the translation $(x, y) \rightarrow (x - 13, y - 11)$. Write the coordinates of the image. Then, draw the image on the final answer grid.

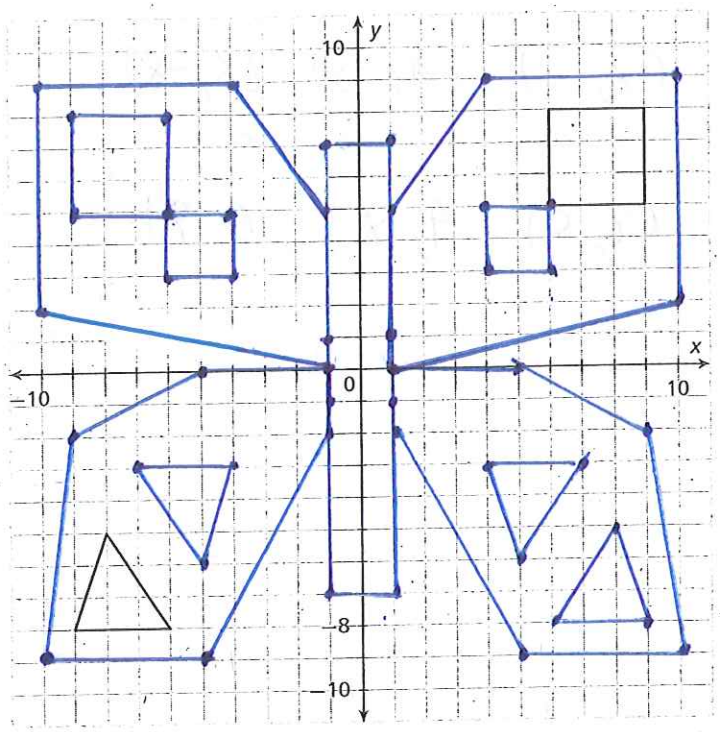
(-7, -3), (-5, -6), (-4, -3)

D Ellie transforms the figure from C by reflecting it across the y-axis. Write the coordinates of the image. Then, draw the image on the final answer grid.

(7, -3), (5, -6), (4, -3)

4 Final Answer Grid

Use this final answer grid to draw Ellie's completed butterfly design.



Are there any similar figures (that are not congruent) in Ellie's butterfly design? Use what you know about transformations and similarity to justify your answer. (If there are similar figures in the design, describe a sequence of transformations that would transform one of the similar figures to the other.)

Yes, the 2 squares in upper-right wing are similar. Translate the smaller square 5 units ← and 4 units ↓ so that it is centered at the origin. Then dilate the figure by a scale factor of $\frac{3}{2}$. Then translate the result 7.5 units → and 6.5 units ↑. There is a sequence of transformations that are applied to one figure to result in the other, so the squares are similar.