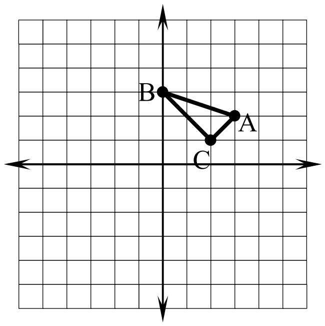
Geometry Connections
1.2.5 Supplemental Lesson Resource Page

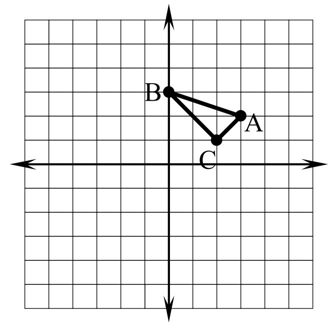
Transformations

1. Given ΔABC with coordinates A(3, 2), B(0, 3), and C(2, 1), perform the following transformations to make ΔA′B′C′. Label points A′, B′, and C′ on the new triangle.

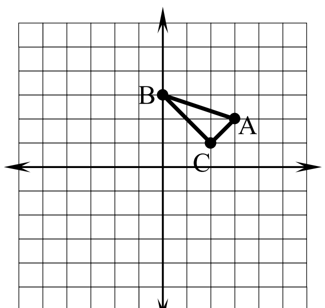
a. Translate ΔABC left 3 and down 5



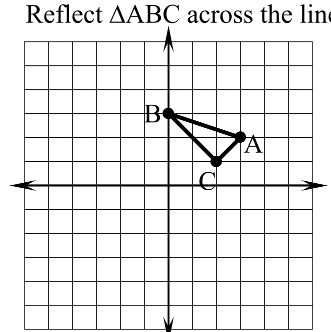
b. Reflect ΔABC across the x-axis



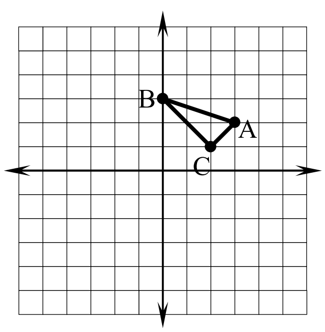
c. Reflect ΔABC across the y-axis



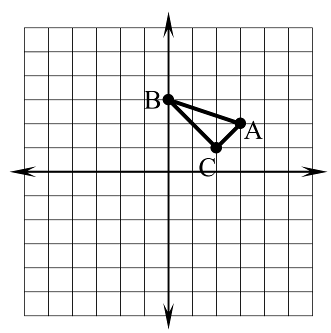
d. Reflect ΔABC across the line y = ±x



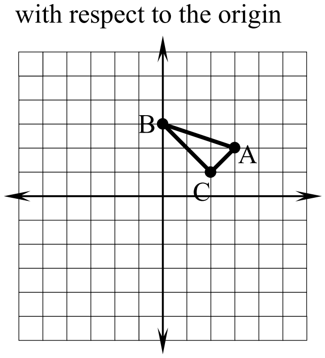
e. Rotate ΔABC 90^{o} clockwise about the origin



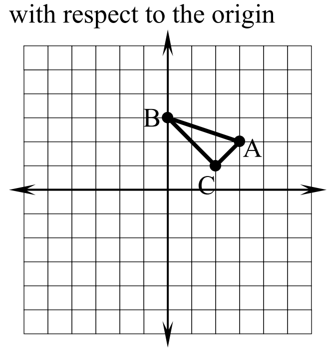
f. Rotate ΔABC 180^{o} counterclockwise about A



g. Dilate ΔABC by a factor of 2
with respect to the origin

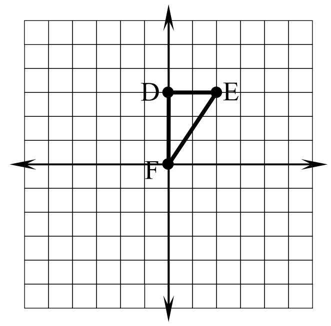


h. Dilate ΔABC by a factor of ½
with respect to the origin



Rotations

2. Rotate ΔDEF counterclockwise 90°, 180°, and 270° about the origin.



Point E (original) __________

Point E′ (after 90° ccw rotation) __________

Point E′′ (after 180° ccw rotation) __________

Point E′′′ (after 270° ccw rotation) __________

What do you notice about the coordinates as the point rotates?

Geometry Connections
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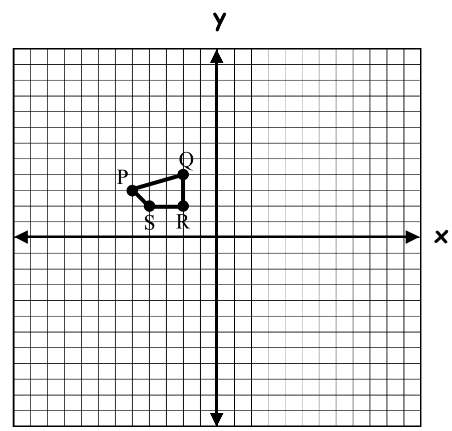
3. Coordinate Rule Example

Here is an example of a coordinate rule: (x, y) → (-2y, -2x)



To use the coordinate rule above, first find the coordinates of point P and write them down as shown below.

P(-5, 3) → (____, ____)

Next use the x and y coordinates of point P to calculate the x and y coordinates of the new point, P′:

<u>To find the new x</u>: the coordinate rule tells us that the new x coordinate is -2y, and we know that in the original point P y = 3, so the new x is -2(3) = -6.

<u>To find the new y</u>: the coordinate rule tells us that the new x coordinate is -2x, and we know that in the original point P x = -5, so the new x is -2(-5) = 10.

Add the new x and y values to the coordinate rule:

P(-5, 3) → (-6, 10)

Repeat the process for each point in the figure, then graph the four new points on the graph. Label the points P′, Q′, R′, and S′.

P(____, ____) → P′(____, ____)

Q(____, ____) → Q′(____, ____)

R(____, ____) → R′(____, ____)

S(____, ____) → S′(____, ____)

Coordinate Rules

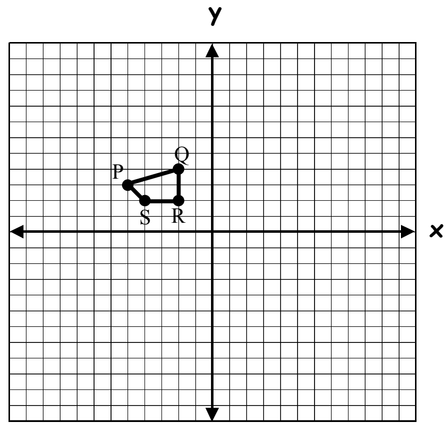
a. (x, y) → (-x, y)

P(-5, 3) → ___________

Q(-2, 4) → ___________

R(-2, 2) → ___________

S(-4, 2) → ___________



Transformation for
(x, y) → (-x, y)

---

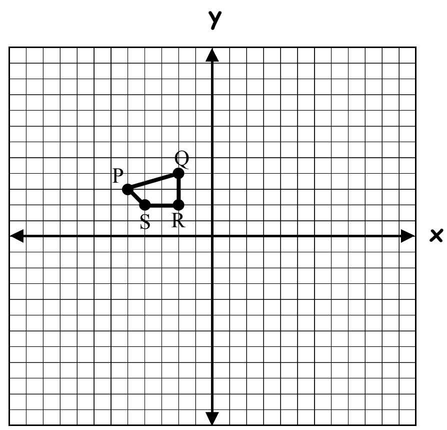
b. (x, y) → (x, -y)

P(-5, 3) → ___________

Q(-2, 4) → ___________

R(-2, 2) → ___________

S(-4, 2) → ___________



Transformation for
(x, y) → (x, -y)

---

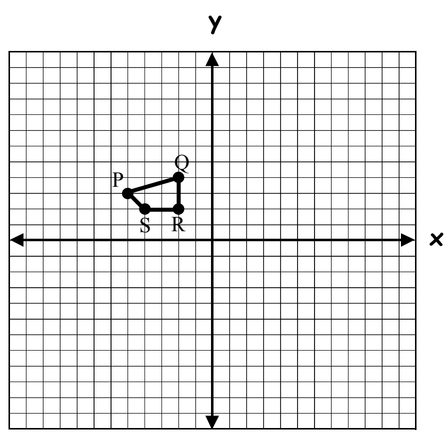
c. (x, y) → (-y, x)

P(-5, 3) → ___________

Q(-2, 4) → ___________

R(-2, 2) → ___________

S(-4, 2) → ___________



Transformation for
(x, y) → (-y, x)

Coordinate Rules

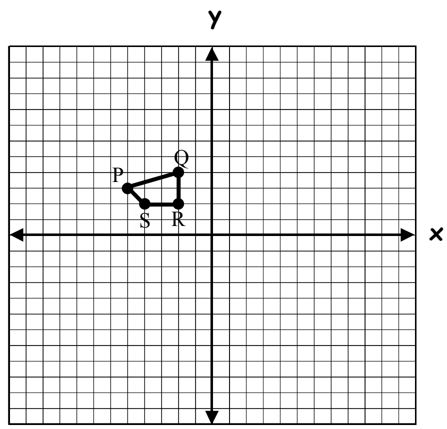
d. (x, y) → (-x, -y)

P(-5, 3) → ___________

Q(-2, 4) → ___________

R(-2, 2) → ___________

S(-4, 2) → ___________



Transformation for (x, y) → (-x, -y)

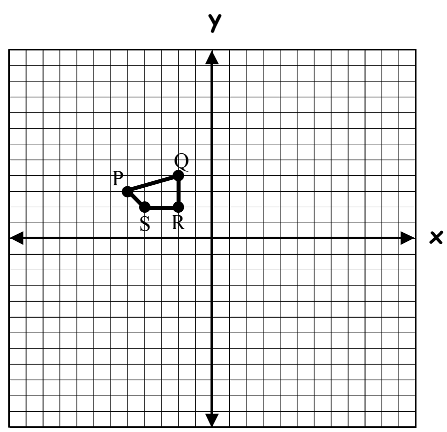
e. (x, y) → (y, -x)

P(-5, 3) → ___________

Q(-2, 4) → ___________

R(-2, 2) → ___________

S(-4, 2) → ___________



Transformation for (x, y) → (y, -x)

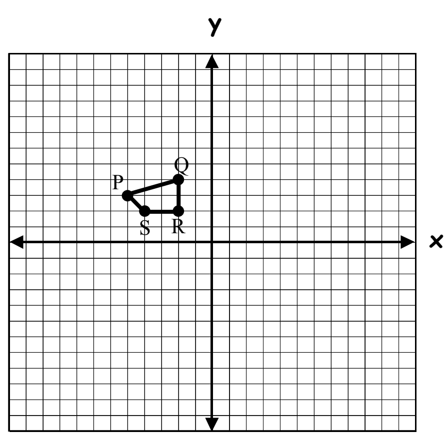
f. (x, y) → (y, x)

P(-5, 3) → ___________

Q(-2, 4) → ___________

R(-2, 2) → ___________

S(-4, 2) → ___________



Transformation for (x, y) → (y, x)

Coordinate Rules

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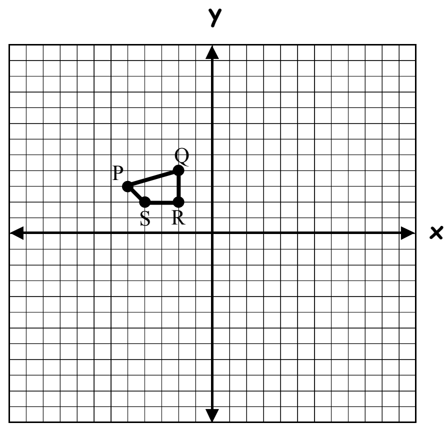
g. $(x, y) \rightarrow (x + 3, y - 5)$

P(-5, 3) $\rightarrow$ ___________

Q(-2, 4) $\rightarrow$ ___________

R(-2, 2) $\rightarrow$ ___________

S(-4, 2) $\rightarrow$ ___________



Transformation for
$(x, y) \rightarrow (x + 3, y - 5)$

---

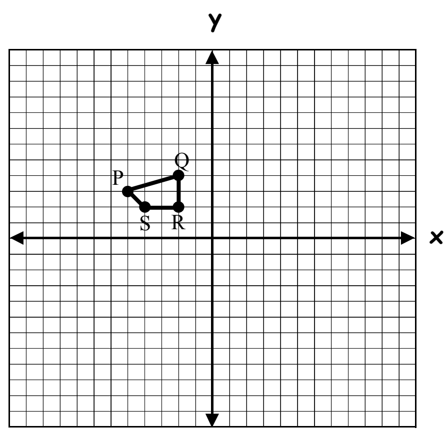
h. $(x, y) \rightarrow (2x, 2y)$

P(-5, 3) $\rightarrow$ ___________

Q(-2, 4) $\rightarrow$ ___________

R(-2, 2) $\rightarrow$ ___________

S(-4, 2) $\rightarrow$ ___________



Transformation for
$(x, y) \rightarrow (2x, 2y)$

---

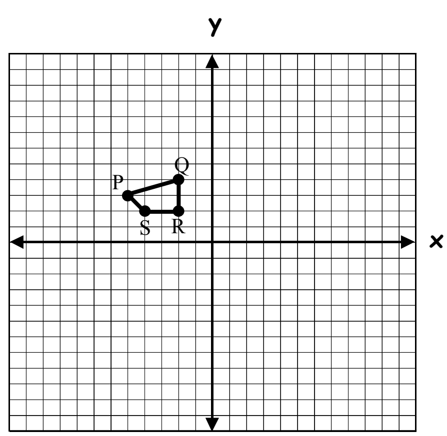
i. $(x, y) \rightarrow (2x + 3, 2y - 5)$

P(-5, 3) $\rightarrow$ ___________

Q(-2, 4) $\rightarrow$ ___________

R(-2, 2) $\rightarrow$ ___________

S(-4, 2) $\rightarrow$ ___________



Transformations for
$(x, y) \rightarrow (2x + 3, 2y - 5)$

Coordinate Rules

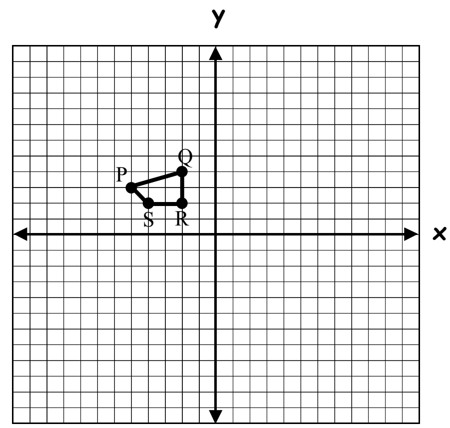
j. $(x, y) \rightarrow (2y, 2x)$

P(-5, 3) $\rightarrow$ ___________

Q(-2, 4) $\rightarrow$ ___________

R(-2, 2) $\rightarrow$ ___________

S(-4, 2) $\rightarrow$ ___________



Transformations for
$(x, y) \rightarrow (2y, 2x)$

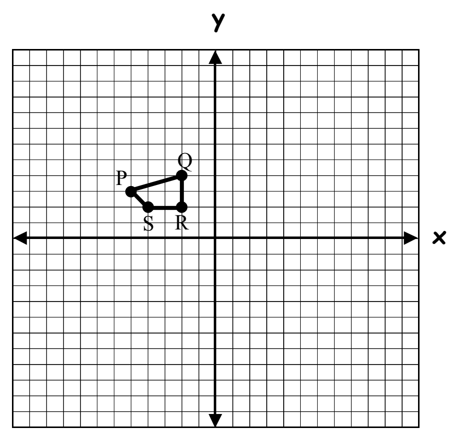
k. $(x, y) \rightarrow (2y + 3, 2x – 5)$

P(-5, 3) $\rightarrow$ ___________

Q(-2, 4) $\rightarrow$ ___________

R(-2, 2) $\rightarrow$ ___________

S(-4, 2) $\rightarrow$ ___________



Transformations for
$(x, y) \rightarrow (2y + 3, 2x – 5)$

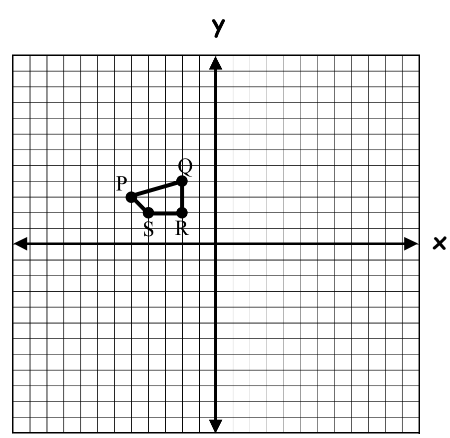
l. $(x, y) \rightarrow (2y + 3, -2x + 5)$

P(-5, 3) $\rightarrow$ ___________

Q(-2, 4) $\rightarrow$ ___________

R(-2, 2) $\rightarrow$ ___________

S(-4, 2) $\rightarrow$ ___________



Transformations for
$(x, y) \rightarrow (2y + 3, -2x + 5)$

4. Match each description with its coordinate rule.

a.	Translate (shift) *a* horizontal units and *b* vertical units	1.	$(x, y) \rightarrow (-x, y)$
b.	Reflect across the x-axis	2.	$(x, y) \rightarrow (x, -y)$
c.	Reflect across the y-axis	3.	$(x, y) \rightarrow (y, -x)$
d.	Reflect across the line y = x	4.	$(x, y) \rightarrow (-y, x)$
e.	Rotate 90^{o} counterclockwise (or 270^{o} clockwise) about the origin	5.	$(x, y) \rightarrow (-x, -y)$
f.	Rotate 180^{o} counterclockwise (or 180^{o} clockwise) about the origin	6.	$(x, y) \rightarrow (x + a, y + b)$
g.	Rotate 270^{o} counterclockwise (or 90^{o} clockwise) about the origin	7.	$(x, y) \rightarrow (cx, cy)$
h.	Dilate with respect to the origin by a factor of *c*	8.	$(x, y) \rightarrow (y, x)$

5. Without looking at your notes, describe the transformation(s) that would occur for each of the following coordinate rules.

a. $(x, y) \rightarrow (-x, y)$ b. $(x, y) \rightarrow (3x, 3y)$ c. $(x, y) \rightarrow (\frac{1}{4}y, \frac{1}{4}x)$

6. Write the coordinate rule for each transformation or set of transformations.

a. Reflect across the x-axis

b. Translate right 8 and up 3

c. Dilate by a factor of 10

d. Reflect across the line y = x and dilate by a factor of 7

e. Dilate by a factor of 3 and translate down 5 and left 1

7. What does the coordinate rule $(x, y) \rightarrow (-y, -x)$ do? Use one of the figures from this lesson or make up your own figure to test your conjecture by using the rule.

8. Write a coordinate rule that would transform Figure XYZ into Figure X′Y′Z′, and name the transformation(s).