Coordinate Geometry
Lessons 2 & 3 Notes

Honors Geometry

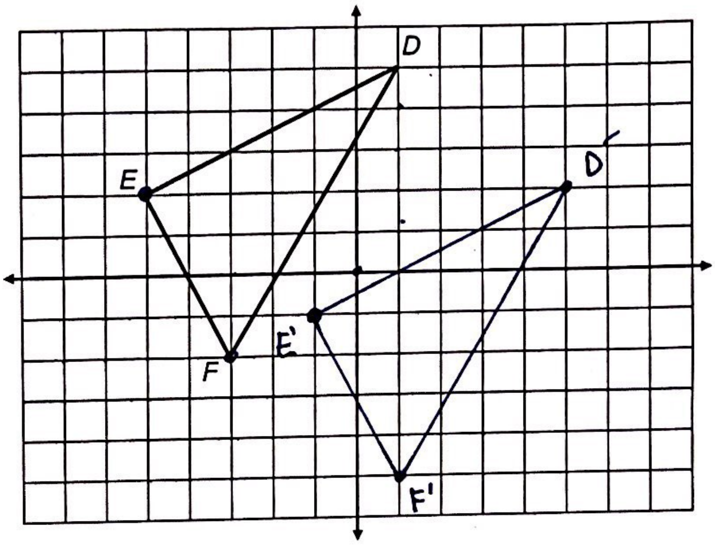
Name: Answer Key

Coordinate Geometry 2: Coordinate Properties of Transformations

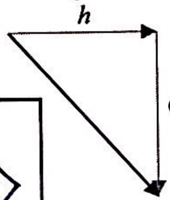
Translations on the Coordinate Plane:

- use an order pair rule (using addition and subtraction)
- example:

$$(x, y) \rightarrow (x+4, y-3)$$



Vector Notation:



Vector:

$\langle h, k \rangle$

- example:

translation vector: ⟨4, -3⟩

F(-3,-2) → F′(1,-5)
E(-5,2) → E′(-1,-1)
D(1,5) → D′(5,2)

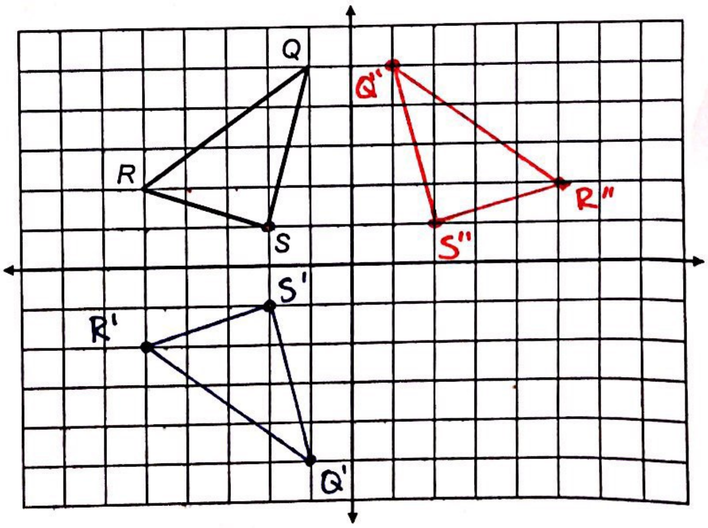
Reflections on the Coordinate Plane:

- using the x-axis as the reflecting line:

$r_{x\text{-axis}}(x, y) \rightarrow$ (X , -Y)

- using the y-axis as the reflecting line:

$r_{y\text{-axis}}(x, y) \rightarrow$ (-X , Y)



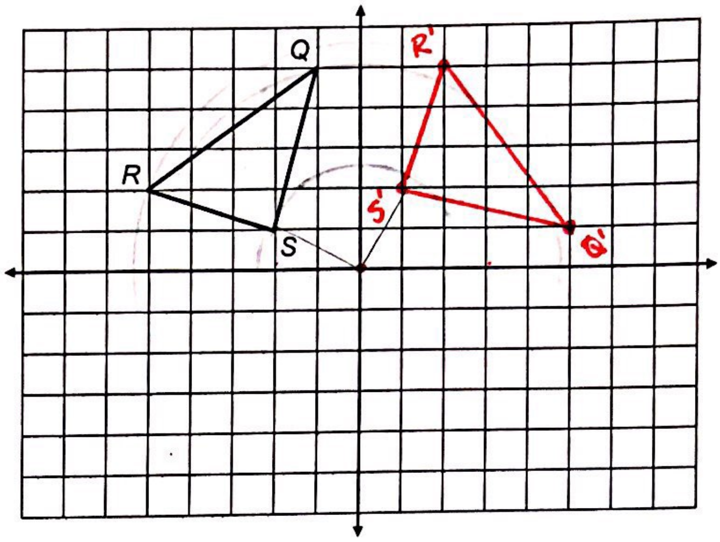
Rotations on the Coordinate Plane:

- example:

$(x, y) \rightarrow (y, -x)$

- Describe the transformation:

R (-5, 2) ⟶ R'(2, 5)
Q (-1, 5) ⟶ Q'(5, 1)
S (-2, 1) ⟶ S'(1, 2)



Use the remaining coordinate planes to determine the properties of the given transformations, and complete the blanks in the following conjecture:

Coordinate Transformations Conjecture:

- The ordered pair rule $(x, y) \rightarrow (-x, y)$ is a reflection across y-axis
- The ordered pair rule $(x, y) \rightarrow (x, -y)$ is a reflection across x-axis
- The ordered pair rule $(x, y) \rightarrow (-x, -y)$ is a rotation 180° about the origin
- The ordered pair rule $(x, y) \rightarrow (y, x)$ is a reflection across the line y=x
- The ordered pair rule $(x, y) \rightarrow (y, -x)$ is a rotation 90° about the origin clockwise
- The ordered pair rule $(x, y) \rightarrow (-y, x)$ is a rotation 90° about the origin counterclockwise
- The ordered pair rule $(x, y) \rightarrow (-y, -x)$ is a reflection across the line y=-x

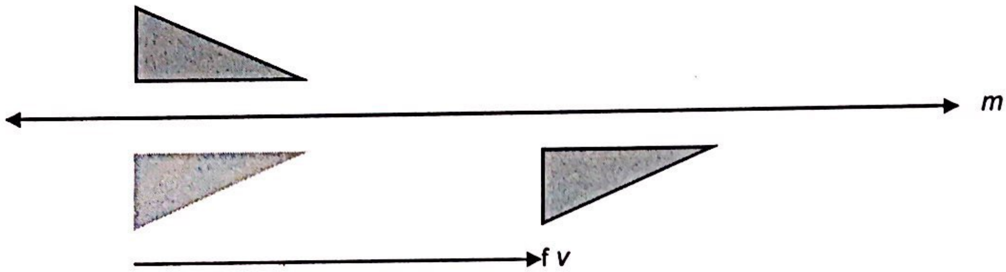
Coordinate Geometry 3: Compositions of Transformations in the Coordinate Plane

Compositions of Transformations

Definition: A *composition of transformations* occurs when one isometry is applied to a pre-image, then another isometry is applied to that image to create a final image

Example: ***Glide Reflection***: (the fourth and final isometry!)

- the composition of a reflection and a translation



Notation: if $\mathbf{r}_m$ is a reflection over line m, and $\mathbf{T}$ is a translation, the glide reflection is given by: $T \cdot r_m$.

second Isometry "following" 1st isometry

Equivalent ***Isometries***:

- when a single isometry yields the same final image as a composition of other isometries.

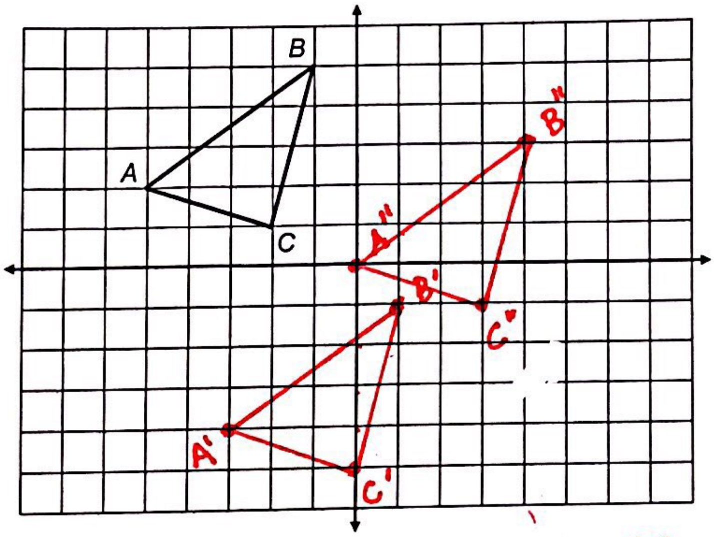
Example 1:

- Perform the following translation on ΔABC to get $\Delta A'B'C'$:
  $(x, y) \rightarrow (x+2, y-6)$

- Perform the following translation on $\Delta A'B'C'$ to get $\Delta A''B''C''$:
  $(x, y) \rightarrow (x+3, y+4)$

- Is the composite image still an isometry? Which one?
  yes, rigid isometry

- Describe the equivalent isometry that moves ΔABC to $\Delta A''B''C''$?
  single translation
  $\langle x+5, y-2 \rangle$



A(-5,2) → A'(-3,-4) → A''(0, 6)
B(-1,5) → B'(1,-1) → B''(4, +3)
C(-2,1) → C'(0,-5) → C''(3, -1)

Example 2:

- Perform the following translation on ΔDEF to get $\Delta D'E'F'$:
  $r_{x\text{-axis}}(x, y)$

- Perform the following translation on $\Delta R'Q'S'$ to get $\Delta D''E''F''$:
  $r_{y\text{-axis}}(x, y)$

- Is the composite image still an isometry? Which one?
  yes, rigid isometry

- Describe the equivalent isometry that moves ΔDEF to $\Delta D''E''F''$?

single rotation → toward 1st axis to the 2nd