Rotations on the Coordinate Plane

Do Now:
Fill in the table below to identify the characteristics and types of rigid motions being applied to create $\Delta A'B'C'$, the image of $\Delta ABC$.

<table>
<thead>
<tr>
<th>Type of Rigid Motion:</th>
<th>Is size preserved?</th>
<th>Is orientation preserved?</th>
<th>Which type of isometry?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Important Vocabulary:

A rotation is a rigid motion that turns a figure about a fixed point called the center of rotation.

The angle of rotation is the number of degrees the figure rotates. We often rotate a figure in increments of 90°. The center of rotation on a graph is usually the origin. A positive angle of rotation turns the figure counterclockwise (a negative angle of rotation can be used for clockwise rotations).

A look at rotation angles:
Example 1)

Take the point (4, 2) and rotate it as stated. Plot the new point and state its coordinates.

<table>
<thead>
<tr>
<th>Rotation of 90°</th>
<th>Rotation of 180°</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Coordinates of the New Point: ____________

<table>
<thead>
<tr>
<th>Rotation of 270°</th>
<th>Rotation of 360°</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://via.placeholder.com/150" alt="Diagram" /></td>
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</tr>
</tbody>
</table>

Coordinates of the New Point: ____________

Summary of the Rules:

\[
\begin{align*}
R_{90°} \quad (x, y) &\rightarrow \text{___________} \\
R_{180°} \quad (x, y) &\rightarrow \text{___________} \\
R_{270°} \quad (x, y) &\rightarrow \text{___________} \\
R_{360°} \quad (x, y) &\rightarrow \text{___________}
\end{align*}
\]

Practice Examples: Complete the following using your rotation rules.

1) \( R_{90°} (7, -2) \) 
2) \( R_{270°} (2, -5) \) 
3) \( R_{-90°} (3, 7) \)

4) \( R_{180°} (9, 8) \) 
5) \( R_{360°} (2, 1) \) 
6) \( R_{-270°} (-4, 1) \)
Example 2)
Given ΔCOW with vertices C (-1, 2), O (-1, 5) and W (-3, 3).
a) Graph ΔCOW on the axes provided.
b) Graph and state the coordinates of ΔC'O'W',
   the image of ΔCOW after a rotation of 180°

c) What type of isometry is the image?

Example 3)
Given ΔTOY with vertices T (2,3), O (4,7) and Y (8,5).
a) Graph ΔTOY on the axes provided.
b) Graph and state the coordinates of ΔT'O'Y',
   the image of ΔTOY after a \( r_y \)-axis

c) Graph and state the coordinates of ΔT''O''Y'',
   the image of ΔT'O'Y' after a \( r_x \)-axis

d) This twice-reflected triangle is the same as which single transformation?
Example 4) – Challenge Problem.

We are now going to rotate an image around a point other than the origin. Given $\triangle ABC$ with vertices $A (2, 3)$, $B (0, 6)$ and $C (2, 6)$.

a) Graph $\triangle ABC$ on the axes provided below.
b) Graph and state the coordinates of $\triangle A'B'C'$, the image of $\triangle ABC$ after a rotation of $90^\circ$ about the point $(-1, 2)$.

Steps to rotate an image about a point other than the origin:

**Step 1:** Translate the rotation point to the origin.

**Step 2:** Translate the pre-image using the same translation.

**Step 3:** Rotate the image following the rules of rotations.

**Step 4:** Translate the image the opposite direction as the translation from Step 1.
Rotations on the Coordinate Plane HW

**Part 1:** Review Section

1) Which line is parallel to the line whose equation is $4x + 3y = 7$ and also passes through the point $(-5,2)$?
   - (1) $4x + 3y = -26$
   - (2) $4x + 3y = -14$
   - (3) $3x + 4y = -7$
   - (4) $3x + 4y = 14$

2) In $\triangle DEF$, $m\angle D = 3x + 5$, $m\angle E = 4x - 15$, and $m\angle F = 2x + 10$. Which statement is true?
   - (1) $DF = FE$
   - (2) $DE = FE$
   - (3) $m\angle E = m\angle F$
   - (4) $m\angle D = m\angle F$

3) In the diagram below, lines $n$ and $m$ are cut by transversals $p$ and $q$.
   Which value of $x$ would make lines $n$ and $m$ parallel?
   - (1) 110
   - (2) 80
   - (3) 70
   - (4) 50

**Part 2:** Complete the following using your rotation rules.

- $R_{90}$ $(-1, 3)$
- $R_{270}$ $(-11, 15)$
- $R_{180}$ $(3, 6)$
- $R_{-180}$ $(18, -16)$
- $R_{270}$ $(-41, -3)$
- $R_{360}$ $(8, -12)$

**Part 3: Identify the following transformations as a Line Reflection, Translation or Rotation.**

- 10) ________________
- 11) ________________
- 12) ________________
- 13) ________________
- 14) ________________
- 15) ________________
Part 4: Complete each question in the space provided. Show all work necessary.

16) Given ΔLOU with vertices L (-1, 5), O (-3, 1) and U (-2, -2).
   a) Graph ΔLOU on the axes provided.
   b) Graph and state the coordinates of ΔL'O'U',
      the image of ΔLOU after a $R_{0,270^\circ}$.

   c) Graph and state the coordinates of ΔL'O''U''
      the image of ΔL'O'U', after a $r_x-\text{axis}$

   d) Which type of isometry is the image in part c?
      Explain your answer.

   e) Which single transformation would transform ΔLOU to become ΔL'O''U''?
      Explain your answer.