Part 2. Make Conclusions

Group members will need to work together in order to answer the questions that will inform a precise definition of Rotation.
**Make Conclusions Based Upon Your Work.**

For definiteness, we first deal with the case where $0 \leq t \leq 180$.  
*P* is any point of the pre-image.  
Look specifically at exercises A and C.3. What is the location of points A and U, respectively, relative to the origin?

What is the location of $A'$ and $U'$, respectively, again relative to the origin?

What is the observed effect of rotating such a point, for any value of $t^\circ$, around the origin?

Based upon these two observations, complete the general rule.

\[
\text{If } P = O, \text{ then by definition, } Ro(O) = __. 
\]

Look at any points in any of the exercises other than points A and U just considered, are the points distinct or non-distinct from the origin? Why?

When rotated, where are the images in relation to their respective pre-images?
In contrast to the preceding rule,

**MULTI FILL-IN-THE-BLANK**

If $P$ is distinct from $O$, then by definition, $Ro(P)$ is the point $Q$ on the

(1) _______________ with (2) _____________ $O$ and (3) _______________ $|OP|$ such

that $|m\angle QOP| = t^\circ$ and such that $Q$ is in the

(4) ___________________________ direction of the point $P$.

*circle / radius / diameter / angle / degree / clockwise / counterclockwise / center*

Looking at any point of any geometric image rotated in this investigation, does the mapping result in a single image or multiple images?

**MULTIPLE CHOICE**

Thus, one may claim that the mapping is _______________ (i.e., there cannot be

more than one such image $Q$).

*unique / ambiguous / congruent / unambiguous*
Look at exercises B.2 and C.2, where geometric figures are rotated $180^\circ$ around the origin, if each pair of pre-image/image points (e.g., $H$ and $H'$) are treated as endpoints of a segment, what special chord of a circle does each pre-image/image pair create?

**MULTIPLE CHOICE**

If $t = 180$, then $Q$ is the point on the circle so that $PQ$ is a ______________ of the circle.

secant / diameter /

Look at exercises C.4 and C.6, where geometric figures are rotated $0^\circ$ around the origin, describe the result of the mapping.

**MULTIPLE CHOICE**

If $t = 0$, then $Q = P$; and $Ro$ is the ______________ transformation of the plane.

reciprocal / identity / non-rigid / inverse
Now, consider the case when $t < 0$.

MULTIPLE CHOICE

Hence, if $0 < t < 180$, then all the $Q$'s in the ________________ direction of the point $P$ with the property $0 < |m\angle QOP| < 180^\circ$ lie in the fixed half-plane of $\overrightarrow{OP}$ that contains $Q$.

clockwise / counterclockwise / circumference

Thus, $Ro$ is well-defined, in the sense that the mapping is unambiguous.

MULTIPLE FILL-IN-THE-BLANK

By definition, we rotate the given point $P$ ________________ on the circle that is ________________ at $O$ with ________________ $|OP|$. Everything remains the same except that the point $Q$ is now the point on the circle so that $|m\angle QOP| = |t|\degree$ and $Q$ is in the ________________ direction of $P$.

circle / radius / diameter / angle / degrees / clockwise / counterclockwise / center

Thus, we define $Ro(P) = Q$. 