Unit 5: Transformations in the Coordinate Plane

Lesson 3: Rotations

Subject: Coordinate Algebra/Coordinate Algebra Support

Grade Level: 9th

Duration: 105 minutes/1 class period

Goals:
Each student will understand the concept of rotations on the coordinate plane. Students will use the guided notes to discover patterns and rules of rotations by angles that are multiples of 90 degrees.

Objectives:
Each student will use the dynamic software Geometer’s Sketchpad to explore and learn about rotations on the coordinate plane. Students will learn how to plot and label points, rotate by a given angle and direction, and find the coordinates of the new points. By analyzing each set of pre-image and image coordinates, students will discover patterns and create rules for different angles of rotation.

Standards:
MCC9-12.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
MCC9-12.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

MCC9-12.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

**Materials Needed:**

Guided notes

Computer/iPad

**Previous Knowledge:**

Students will have already learned how to perform translations, reflections, and glide reflections on the coordinate grid using pencil and graph paper. Students are also familiar with the vocabulary associated with this unit, i.e. isometry, translation, reflection, glide reflection, rotation, dilation, composition, vector, vector notation, coordinate mapping, scale factor, angle of rotation, line of reflection, etc.

**Motivation (approx. 20 minutes):**

In the computer lab, students will open Geometer’s Sketchpad and be given verbal instructions to create a coordinate grid and plot three points to form a triangle (the teacher will do this on the projector to help students follow along). Students will be asked to find the coordinates of the points and reflect this figure over the y-axis. They will then find the coordinates of the new figure. They will then create a figure of their own and reflect it over the x-axis. This will
acclimate students to the program and give them a review of the material taught the day before. Students will explore the program as the teacher helps students who are having difficulties.

**Lesson Procedure (approx. 45 minutes):**

1. Students will be given a worksheet of guided notes to help walk them through the process of rotating a figure on the coordinate plane.

2. Students will answer questions that force students to analyze their findings when rotating a triangle 90 degrees, 180 degrees, and 270 degrees.

3. Students will rotate both clockwise and counterclockwise and compare rotations.

4. Students will use their findings to observe patterns in coordinates and write rules regarding the rotation of a figure by a given degree and direction.

**Closure (approx. 15 minutes):**

As a class, students will discuss their findings and patterns that they observed. For those that struggle to fill in the coordinate mapping, we will discuss and explain how to transfer their findings into the coordinate mapping. Students will discuss any other discoveries they found while exploring the Geometer’s Sketchpad program.

**Extension:**

With any leftover time in class, students will be given time to start their homework assignment. Students that enjoyed using GSP may use the program to replicate their homework problems and find the solutions using the software. They may also use additional time to practice/explore translations, reflections, or glide reflections using the software.