Transformations on the coordinate plane
Course: Math 8
Time Span: Five days
Tools utilized: Geometer's SketchPad
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Objectives of unit

New York State Standards:
- Describe and identify transformations in the plane, using proper function notation (rotations, reflections, translations, and dilations.)
- Draw the image of a figure under rotations of 90 and 180 degrees.
- Draw the image of a figure under a reflection over a given line.
- Draw the image of a figure under a translation.
- Draw the image of a figure under a dilation.
- Identify the properties preserved and not preserved under a reflection, rotation, translation, and dilation.

NCTM Standards:
- Describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, slides, and scaling.
- Examine the congruence, similarity, and line or rotational symmetry of objects using transformations.

Resources:

http://www.emsc.nysed.gov/3-8/gr8prepost.htm, New York State Education Department.


Materials:
- A computer lab with 20 computers each with Geometer's SketchPad.
- A SmartBoard connected to one teacher's computer via an LCD projector.
- Glencoe Mathematics: Applications and Connections Course Three.
- Graph paper and rulers for students.
Overview of the Transformations on the coordinate plane.

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<td>Translate an object over the coordinate plane.</td>
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<td>Describe and identify transformations in the plane, using proper function notation.</td>
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<td>transformations</td>
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<td>Describe and identify transformations in the plane, using proper function notation.</td>
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Day 1

Subject: Mathematics

Grade Level: Grade 8

Classroom description (e.g., specify if any students have disabilities): The classes will consist of 15 to 20 students. There will be four different classes of Mathematics 8 with one being an inclusion class with seven special education students. The class will be taught in the computer lab with 25 computers in it. There will be one computer in the classroom connected to an LCD projector that displays on a Smartboard.

Topic: Translations on the coordinate plane.

Amount of Time to Complete Lesson: 40 minutes.

New York State Learning Standard(s):
Mathematics Standards for grade 8: 8G7 and 8G10.

Objectives:
• Students will translate shapes on the coordinate plane.
• Know that a translation is a slide.
• Describe and identify transformations in the plane, using proper function notation.

Materials required: Mathematics Application and Connections Course 3 book. Computer lab with 25 computers each with Geometer's SketchPad on it. Students will need a ruler and graph paper.

Motivation: Tell me what a translation is? What happens to the labels to a shape when you transform a shape on the coordinate plane?

Introduction: Have students plot triangle A(1,2), B(6,2) and C(4,8). The class will then transform this triangle by a translation of (4,-2) on GSP by plotting the points. Students will then be shown how to transform by selecting the shape and using the transform function of GSP, The class will be asked, what happened to the shape? The class will go through the process of translating the x and y values together using proper notation and then plot the new translated triangle.

Procedure: Students will be asked what do they notice and to describe the translation? Students will then translate rectangle R(2,-2) E(2,4) C(-2,4) and T(-2, -2) by a translation of (-3, 4) using GSP. Students will then translate triangle def by hand and then on GSP and show results to the teacher. Students will then be shown how to label objects and their translations. D(-3,-4) E(-6,-5) and F(-8,-8) by a translation of (5, 6).

Integration of computer technology: Students will be using GSP to translate shapes on the coordinate plane.
Special accommodation(s) for at-risk, special education, gifted: There are no gifted students in these classes. Modifications for special education students will be made by special education teacher. Students who do not do well on the class work will receive remediation.

Assessment:
- Class work
- Homework

Closure: Think of something or someplace where you would experience translations?

Transition to next lesson: Students will reflect objects on the coordinate plane.

Extensions/homework: pg. 458(4-6) in Course 3 book. 5-10 minutes to start.
Day 2

Subject: Mathematics

Grade Level: Grade 8

Classroom description (e.g., specify if any students have disabilities): The classes will consist of 15 to 20 students. There will be four different classes of Mathematics 8 with one being an inclusion class with seven special education students. The class will be taught in the computer lab with 25 computers in it. There will be one computer in the classroom connected to an LCD projector that displays on a Smartboard.

Topic: Reflections on the coordinate plane.

Amount of Time to Complete Lesson: 40 minutes.

New York State Learning Standard(s):
Mathematics Standards for grade 8: 8G7 and 8G9.

Objectives:

• Students will reflect a shape on the coordinate plane.
• Know that a reflection is a mirror image.
• Describe and identify transformations in the plane, using proper function notation.

Materials required: Mathematics Application and Connections Course 3 book. Computer lab with 25 computers each with GSP on it. Students will need a ruler and graph paper.

Motivation: Have students describe what a reflection is? What happens to a shape when it is reflected?

Introduction: Have students plot triangle A(1,2), B(6,2) and C(4,8) using GSP. Students will mark each axis as a mirror. The class will then transform this triangle by a reflection over the x-axis and then over the y-axis. Students will then be asked what do you notice about the original and reflected triangles?

Procedure: Students will then reflect rectangle R(2,-2) E(2,4) C(-2,4) and T(-2, -2) over both axes using GSP. Students will then use their own rules to show what happens to the coordinates of a shape when it is reflected over either axis. Students will then reflect triangle def by hand and then on GSP over both axes. D(-3,-4) E(-6,-5) and F(-8, -8). Students will then be shown how to label objects and their reflections. Students may use GSP to start their homework.

Integration of computer technology: Students will use GSP to graph and reflect shapes over the x and y-axis.
**Special accommodation(s) for at-risk, special education, gifted:** There are no gifted students in these classes. Modifications for special education students will be made by special education teacher.

**Assessment:**
- Homework
- Teacher observation

**Closure:** Is there a way to translate and reflect the same object so the translated and reflected shape land in the same place. Try GSP to answer this question. Also what happens to a point when it is on the line of reflection?

**Transition to next lesson:** Students will rotate objects on the coordinate plane.

**Extensions/homework:** pg. 463(10-13) in Course 3 book. Time will be given to allow students to start homework.
Day 3

Subject: Mathematics

Grade Level: Grade 8

Classroom description (e.g., specify if any students have disabilities): The classes will consist of 15 to 20 students. There will be four different classes of Mathematics 8 with one being an inclusion class with seven special education students. The class will be taught in the computer lab with 25 computers in it. There will be one computer in the classroom connected to an lcd projector that displays on a Smartboard.

Topic: Rotations on the coordinate plane.

Amount of Time to Complete Lesson: 40 minutes.

New York State Learning Standard(s):
Mathematics Standards for grade 8: 8G7 and 8G8.

Objectives:
• Students will rotate an object on the coordinate plane.
• Know that a rotation is a turn.
• Describe and identify transformations in the plane, using proper function notation.

Materials required: Mathematics Application and Connections Course 3 book. Computer lab with 25 computers each with Geometer's SketchPad on it. Students will need a ruler and graph paper.

Motivation: Have students describe what a rotation is? Also what happens to a shape’s location when it is rotated about the origin?

Introduction: Talk about rotations. Only rotate 90, 180 and 360 degrees clockwise and counter-clockwise.

Procedure: Have students plot triangle A(1,2), B(6,2) and C(4,8) which could be saved from the previous two days. The class will then transform this triangle by a rotating it 90 and 180 degrees counter-clockwise. Students will graph the original and learn how to plot the rotated triangles on graph paper also. Students will then be shown how to label objects and their rotations. Students will be asked for their observations. Students will then plot the above triangle in GSP and rotate the object 90 and 180 degrees counter-clockwise. Students will check their work. Students will then plot triangle D(2,3), E(8,3) and F(5,-2) and rotate 90 and 180 degrees counter-clockwise by hand and by GSP and show their results to the teacher.

Integration of computer technology: Students will use GSP to explore what happens to a shape after it is rotated.
Special accommodation(s) for at-risk, special education, gifted: There are no gifted students in these classes. Modifications for special education students will be made by special education teacher.

Assessment:
• Homework
• Class work

Closure: Can a triangle be rotated and reflected to get the transformed triangle in the same location?

Transition to next lesson: Dilations

Extensions/homework: pg. 467(10-13) in Course 3 book. Allow time at the end of class to be utilized or homework questions.
Day 4

Subject: Mathematics

Grade Level: Grade 8

Classroom description (e.g., specify if any students have disabilities): The classes will consist of 15 to 20 students. There will be four different classes of Mathematics 8 with one being an inclusion class with seven special education students. The class will be taught in the computer lab with 25 computers in it. There will be one computer in the classroom connected to an lcd projector that displays on a Smartboard.

Topic: Dilations on the coordinate plane.

Amount of Time to Complete Lesson: 40 minutes.

New York State Learning Standard(s):
Mathematics Standards for grade 8: 8G7 and 8G11.

Objective:
• Students will dilate a shape on the coordinate plane.
• Dilate points on a coordinate plane by a scale factor.
• Describe and identify transformations in the plane, using proper function notation.

Computer lab with 25 computers each with Geometer’ SketchPad.

Introduction: Students will view the gizmo math site below to view what happens to a shape when it is dilated on the coordinate plane if possible. If not have students partner up and look in each other's eyes and turn off and on light to see eyes dilate. Also talk about an over head projector and moving the projector closer and farther away from a will

Procedure: Students will then graph the following shapes on the coordinate plane by using GSP.
M(-1, -1) A(1,-1) T(1,1), H(-1,1)
D(8,-2) E(3, 5) F(11,5)
Each student will then let the functions of GSP to dilate the shape by a scale factor of two and –3. Students will observe what happens to the coordinates and come up with an explanation of what happens when you dilate a shape by a scale factor. Students will then bring up triangles ABC and DEF from previous days. Students will dilate the two shapes by two different scale factors of their choice. Students will then be shown how to label objects and their dilations. Students will then graph any polygon of their choosing and dilate it by a scale factor of 4 and ½ and record their results on a separate sheet of paper using proper notation.

Web site name(s): Explore Learning.com Dilations
Web site address(es):

Integration of computer technology: Students will view a gizmo to see what happens to a shape when it is dilated. Students will use GSP to view the changes in the coordinates to a dilated shape.

Special accommodation(s) for at-risk, special education, gifted: There are no gifted students in these classes. Modifications for special education students will be made by special education teacher.

Assessment:
• Class discussion
• Homework

Closure: What do you think happens to the perimeter of a dilated shape? How about the area?

Transition to next lesson: Students will investigate properties preserved and not preserved under transformations.

Extensions/homework: pg. 372(8-13) in Course 3 book. Time will be given to have students ask questions on homework questions.
Day 5

Subject: Mathematics

Grade Level: Grade 8

Classroom description (e.g., specify if any students have disabilities): The classes will consist of 15 to 20 students. There will be four different classes of Mathematics 8 with one being an inclusion class with seven special education students. The class will be taught in the computer lab with 25 computers in it. There will be one computer in the classroom connected to an lcd projector that displays on a Smartboard.

Topic: Properties of transformations.

Amount of Time to Complete Lesson: 40 minutes.

New York State Learning Standard(s):
Mathematics Standards for grade 8: 8G7 and 8G12.

Objective:
- Identify the properties preserved and not preserved under a reflection, rotation, translation, and dilation.
- Describe and identify transformations in the plane, using proper function notation.


Motivation: Have students review in pairs how to find area and perimeter for different types of polygons. Then bring class together and discuss how you find each.

Introduction: Using GSP, have students draw a rectangle M(-1, -5) A(1,-1) T(1,1), H(-1,-5) on the coordinate plane. Have students find area and perimeter by using GSP. Show students how to construct quadrilateral interior and then how to find the area and perimeter. Students will also be shown how to find the measurement of an angle or length of a line segment.

Procedure: Using the rectangle from above, students will rotate the shape 90 and 180 degrees. Students will then compare the area and perimeter of all three quadrilaterals. They will be also asked to compare angles and sides, to see what has changed and what stayed the same.
Students will repeat with reflections over the x-axis and the y-axis.
Students will translate rectangle MATH by translation of (-3, 5) and compare the dimension of the original rectangle and the translated rectangle.
Students will then dilate MATH by a scale factor of ½ and by a scale factor of 2. students will again compare the three rectangles.
Students will then be asked, What changed to the rectangle when a dilation, rotation, reflection or translation was done to rectangle MATH? What stayed the same?

**Integration of computer technology:** Students will be looking at area and perimeter of similar polygons.

**Special accommodation(s) for at-risk, special education, gifted:** There are no gifted students in these classes. Modifications for special education students will be made by special education teacher.

**Assessment:**
- Class discussion

**Closure:** What do you think would happen if we compared volume of cubes if one edge was twice as big as the other?

**Transition to next lesson:** End of unit.