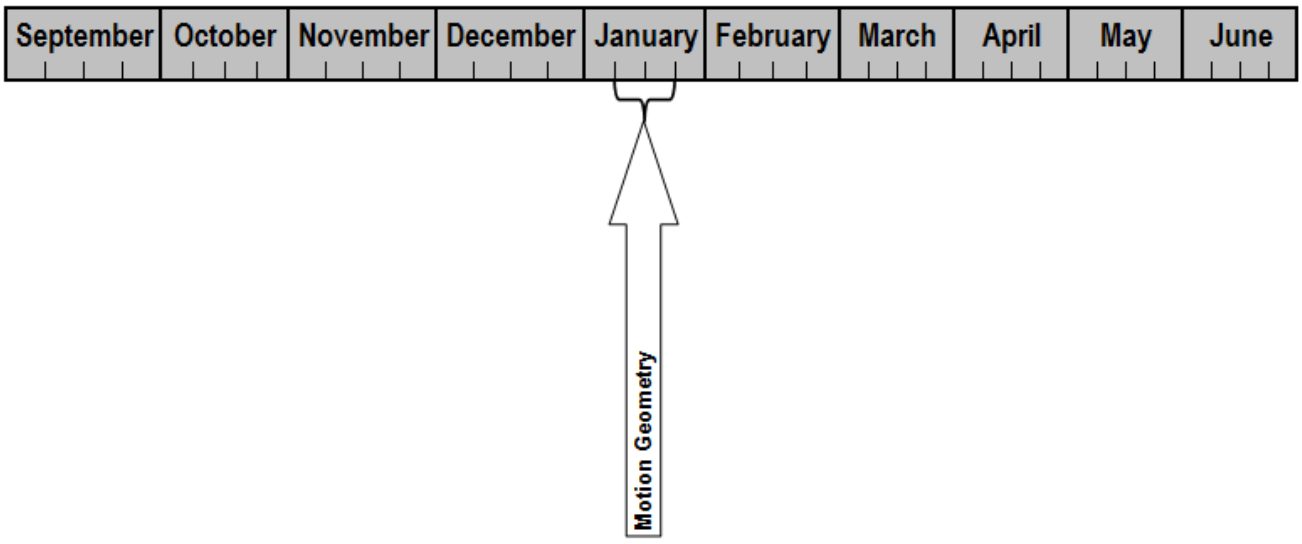
Motion Geometry

Suggested Time: 2 Weeks



Unit Overview

Focus and Context

As students work through activities involving motion geometry, they will have opportunities to use their understanding of transformations to identify, perform, and describe these transformations and use these to solve problems. The focus for students is on the ability to visualize, perform and describe the positional change of the vertices for single and successive transformations in the first quadrant of a Cartesian plane. This unit builds on students' knowledge of plotting ordered pairs, as was introduced in previous work on Data Relationships. Transformational geometry was introduced in Grade 5, where students worked with single transformations. In Grade 6, students will be introduced to combining transformations in the first quadrant of the Cartesian plane. It is important to make use of manipulatives such as pattern blocks, Miras, overhead projectors, and grid paper. If available, use of the interactive white board and interactive websites can be very effective in helping students visualize the various transformations.

Math Connects

Geometry is an important aspect of the mathematics curriculum as it helps students relate to their physical surroundings. The activities and concepts in this unit will help students further develop their spatial sense, including the ability to mentally visualize objects and spatial relationships. Being able to visualize the orientation and movement of shapes is important as we use it in everyday life when driving, rearranging furniture, and map reading. Developing geometric thinking students will improve knowledge of geometric forms and help develop an appreciation for art, nature and architecture. Skills in describing and predicting location will help develop spatial sense which is also a necessary component in many career paths such as engineering, design, and carpentry.

Process Standards Key

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[ME]	Mental Mathematics and Estimation	[T]	Technology
		[V]	Visualization

Curriculum Outcomes

STRAND	OUTCOME	PROCESS STANDARDS
Shape and Space (Transformations)	6SS6 Perform a combination of translations, rotations and/or reflections on a single 2-D shape, with and without technology, and draw and describe the image.	[C, CN, PS, T, V]
Shape and Space (Transformations)	6SS7 Perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations.	[C, CN, T, V]
Shape and Space (Transformations)	6SS9 Perform and describe single transformations of a 2-D shape in the first quadrant of a Cartesian plane (limited to whole number vertices).	[C, CN, PS, T, V]

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS9 Perform and describe single transformations of a 2-D shape in the first quadrant of a Cartesian plane (limited to whole number vertices).

[C, CN, PS, T, V]

Achievement Indicator:

6SS9.1 Identify the coordinates of the vertices of a given 2-D shape (limited to the first quadrant of a Cartesian plane).

Elaborations—Strategies for Learning and Teaching

In Grade 5, students described and performed single translations, reflections and rotations. In Grade 6, students will continue this work but identify the coordinates of the vertices of a 2-D shape in the first quadrant of a Cartesian plane and describe the positional change in the vertices as a result of a transformation. **Work on plotting points in the first quadrant of the Cartesian plane was done in the Data Relationships unit. This knowledge base will be important as students learn about transformations. If this topic has not been introduced previously, it would be necessary to cover the material before starting work on this particular outcome.**

Students will have greater success if they are able to visualize the transformations before they perform them. To encourage this, ask students to predict the location of the transformed image before they perform the transformation.

Generate a discussion about orientation and how it is affected by each of the three transformations. (E.g., In a translation, the shape moves without rotating or resizing. Every point of the shape moves the same distance and in the same direction. It's orientation does not change). When focusing on translations, discuss key words such as horizontal, vertical, diagonal, etc. Note that the terms up, down and across are equally acceptable.

Students may find it helpful when performing transformations to use tracing paper, a small piece of overhead plastic and dry-erase marker or a traced and cut out image of the shape they are transforming to help perform each transformation.

As students begin working on various transformations, they will benefit from working with 'hands on' materials such as pattern blocks or attribute blocks to physically manipulate each block as indicated by the transformation. When using symmetrical shapes to apply transformations, it may be a good idea to highlight or mark one of the vertices so students can indicate the orientation of the image. Students should also be given ample opportunities to work with less symmetrical shapes where it is easier to identify the effect of the transformations. Students will begin their study of transformations by learning about translations. A translation is a slide where the shape being translated does not change its direction or orientation. Students should already be familiar with key terms such as coordinate plane, ordered pairs, origin, x-axis (horizontal axis), y-axis (vertical axis), x-coordinates and y-coordinates from previous work on data relationships. Continued use of this terminology is very important.

(continued)

General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Performance

- Provide a 2-D shape on grid paper and ask students to translate the shape according to specific instructions. E.g., 4 units left and 1 unit down. Ask students to identify the vertices of the image.

(6SS9.1, 6SS9.2)

Resources/Notes

Math Focus 6

Lesson 1: Translating Shapes

6SS9

TG pp. 13 – 17

Additional Reading:

Small, Marian (2008), *Making Math Meaningful to Canadian Students* K-8. pp. 342 - 350

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS9 Continued

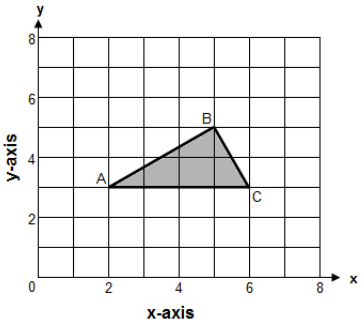
Achievement Indicators:

6SS9.1 Continued

6SS9.2 Perform a transformation on a given 2-D shape, and identify the coordinates of the vertices of the image (limited to the first quadrant).

Elaborations—Strategies for Learning and Teaching

Model plotting and identifying the coordinate points corresponding to the vertices of a given 2-D shape. Students are expected to identify the coordinates of the vertices of shapes drawn on a coordinate plane. Identify the coordinates of vertex A. Vertex A is named by (2,3).



A common error when identifying and plotting points is to reverse the order of the x-coordinate and the y-coordinate. Encourage students to always label the x- and y- axes of a Cartesian plane to avoid making this mistake. Remind students that ordered pairs are communicated in alphabetical order (x, y).

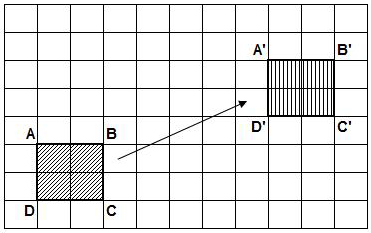
Ask students to play a Hide and Seek game where they draw a shape on their Cartesian plane and hide it from their partner. In turn, each student will say a coordinate trying to find the vertices of the shape. The player to find all vertices, wins.

When identifying a translation remind students that:

- the 2-D shape and its image are congruent

- the 2-D shape and its image have the same orientation (the vertices of the translated image will be in the same relative position as the original image.

Remind students to label the vertices of the shape (e.g. A, B, C, D) and the corresponding vertices of the reflected image (A', B', C', D'). A' is read as A prime.



General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Performance

- Provide students with a Cartesian plane. Ask them to draw a three sided figure on the plane. Tell them to choose another coordinate in the plane that the image is not already on. Tell them this new point is now a vertex of the translated image. Ask them to show and explain how they would know what the other coordinates of their translated image would be just by knowing one of the vertices. Ask students to describe the positional change of the vertices after the translation.

(6SS9.2, 6SS9.3)

Resources/Notes

Math Focus 6

Lesson 1 (Cont'd): Translating Shapes

6SS9

TG pp. 13 – 17

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS9 Continued

Achievement Indicators:

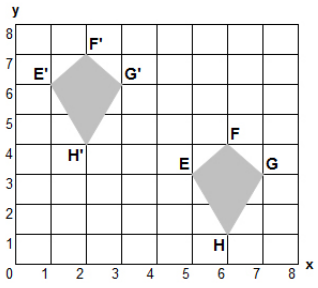
6SS9.3 Describe the positional change of the vertices of a given 2-D shape to the corresponding vertices of its image as a result of a transformation (limited to the first quadrant).

Elaborations—Strategies for Learning and Teaching

When describing the positional change of the vertices of a given 2-D shape to the corresponding vertices of its image as a result of a translation, students should keep in mind the following:

- the shape and its image will have the same orientation
- all vertices move together
- each vertex moves the same way
- if the translation is:
    - to the left, the x- coordinate will decrease
    - to the right, the x- coordinate will increase
    - downward, the y- coordinate will decrease
    - upward, the y- coordinate will increase

Based on the transformation shown here, students should be able to answer questions such as the following:



"Describe the translation."

- Left 4, up 3

"Describe the change in the x-coordinates of the vertices."

- They decreased. They are 4 less.

"Describe the change in the y-coordinates of the vertices."

- They increased by 3.

Use masking tape to create the x- and y-axis of the first quadrant coordinate grid on the classroom floor (use floor tiles as the grid if applicable). Label the x- and y-coordinates for each axis on the masking tape. Ask students to create a shape by standing on the vertices of the shape. To create the sides of the figure have the first student hold the end of a ball of yarn and toss it to the next student and so on, until the shape is complete. Give students a transformation rule and ask students to predict their new position on the grid. Finally, ask students to who are not part of the shape direct the students to where their new position should be. The students can now move or another group of students can move onto the grid to form the image.

General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Journal

- Ask students to describe how the translation rule can help them identify the positional change of the vertices. (6SS9.3)

Resources/Notes

Math Focus 6

Lesson 1 (Cont'd): Translating Shapes

6SS9

TG pp. 13 – 17

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS9 Continued

Achievement Indicators:

6SS9.2 Continued

6SS9.3 Continued

Elaborations—Strategies for Learning and Teaching

Students will continue their study of transformations by learning bout reflections. Students have had prior experience reflecting images in Grade 5. At this point, reflections should now be performed in the first quadrant of the Cartesian plane. Ask students to reflect a shape over four different lines (up, down, left and right) and ask them to compare and contrast the four different images created. Students should see that no matter where the shape is in relation to the line of reflection, the image is always the same distance from the line as the original shape. Some students may think that a reflection can only be horizontal or vertical. They may not recognize that a reflection can also be diagonal. It is important to use illustrations of other reflections as the topic is being discussed.

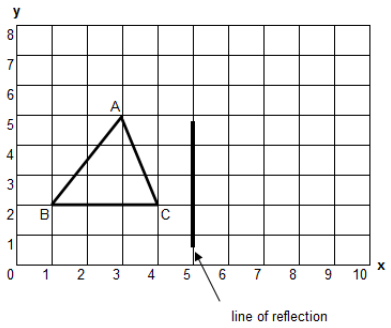
Providing students with 'hands on' activities where they actually manipulate objects to reflect them will help students visualize the effect of this type of transformation on the object. Using pattern blocks, model the act of reflecting the object by 'flipping it' on the line of reflection. Students can trace these objects and the resulting image. The use of Miras can also be helpful to students when performing reflections, especially when working with diagonal reflections. Review Mira use with students as they should already be familiar with them, modelling how a reflected image can be produced. As students reflect images, they must label each of the vertices of the image and be able to name the ordered pair for each.

General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Performance

- Ask students to reflect ABC using the given line of reflection. Ask them to describe the position and orientation of the reflected image and justify why it is correct.



(6SS9.2, 6SS9.3)

- Tell students that △ABC with coordinates A(1,5), B(0,2) and C(4,0) is reflected. The resulting image has vertices (6, 2), (4, 6) and (1, 5). Ask students to determine where the line of reflection is located and to write the coordinates of 2 different points on the line of reflection. (6SS9.3)

Resources/Notes

Math Focus 6

Lesson 2: Reflecting Shapes

6SS9

TG pp. 18 – 21

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS9 Continued

Achievement Indicators:

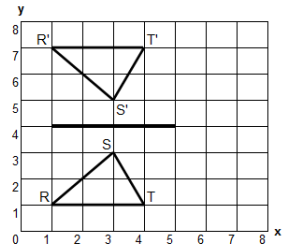
6SS9.2 Continued

6SS9.3 Continued

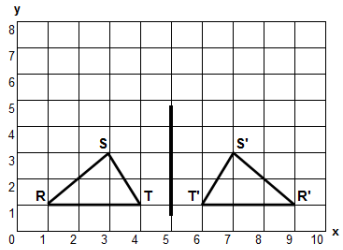
Elaborations—Strategies for Learning and Teaching

When describing the positional change of the vertices of a given 2-D shape to the corresponding vertices of its image as a result of a reflection, remind students that:

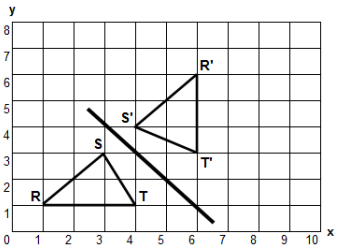
- the shape and its image are of opposite orientation
- a 2-D shape and its image are congruent
- there is an equal distance from the mirror line to both the 2-D shape and its reflected image
- when reflecting a 2-D shape across a horizontal line of reflection, the x-coordinates of the vertices do not change, but the y-coordinates do.



- when reflecting a shape across a vertical line of reflection, the y-coordinates of the vertices do not change, but the x coordinates do.



- when reflecting a 2-D shape across a diagonal line of reflection, both the x- and y-coordinates of the vertices change.

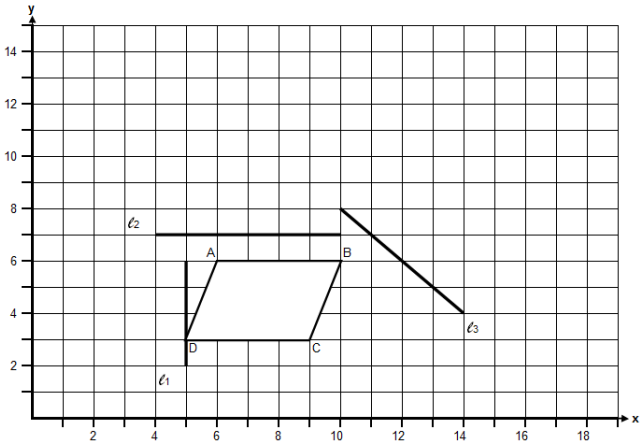


General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Pencil and Paper

- Parallelogram Reflection - Students can work in pairs. Provide them with a similar copy of a coordinate grid and a table for recording vertices.



Shape	Image		
	Vertical Reflection	Horizontal Reflection	Diagonal Reflection
A (_, _)	A' (_, _)	A' (_, _)	A' (_, _)
B (_, _)	B' (_, _)	B' (_, _)	B' (_, _)
C (_, _)	C' (_, _)	C' (_, _)	C' (_, _)
D (_, _)	D' (_, _)	D' (_, _)	D' (_, _)

Ask students to do the following:

(i) Reflect Parallelogram ABCD using each reflection line and draw the image each time.

(ii) Label the vertices of each image and record them in the table

(iii) Describe the distance of the image from the line of reflection.

(iv) Describe the orientation.

(v) Examine the table and describe any changes in the vertices when comparing the original shape to each image.

(6SS.9.1, 6SS9.2, 6SS9.3)

Resources/Notes

Math Focus 6

Lesson 2 (Cont'd): Reflecting Shapes

6SS9

TG pp. 18 – 21

Strand: Shape and Space (Transformations)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to	
6SS9 Continued	The next transformation students will be studying is rotation. When students describe a rotation, their description should include the amount of rotation, the direction of turn and the center of rotation. Rotations can be described in terms of degrees (E.g., 90˚ turn and 180˚ turn) or fractions (E.g., $\frac{1}{4}$ turn and $\frac{1}{2}$ turn). When describing the direction of rotation students should be using the terms clockwise and counter clockwise. To help students solidify their understanding of rotations, ask them to use their own bodies to explore turns. A half turn (180º) means turning from front to back. A quarter turn (90º) means turning right or left. Placing a large wooden protractor on the floor may also help students rotate accordingly.
Achievement Indicators:	
6SS9.2 Continued	In Grade 5, students rotated shapes about a vertex of that shape. **In Grade 6, students will rotate images about a centre of rotation on a vertex, outside the shape and within the shape.** Students need a lot of 'hands on' experiences performing rotations to become comfortable with this particular transformation as they will later use these skills to combine various transformations on a given shape. Using tracing paper or overhead transparencies, ask students to trace the shape on the paper and place a dot on the point of rotation. Place the tip of a pencil on the point of rotation and turn tracing paper the indicated direction and amount for that particular rotation to see the position of the rotated image. Students can then transfer the traced shape on the grid.
6SS9.3 Continued	When describing the positional change of the vertices of a given 2-D shape to the corresponding vertices of its image as a result of a rotation, students should keep in mind the following: - all vertices move together $\frac{1}{4}$ (90º), $\frac{1}{2}$ (180º) , or $\frac{3}{4}$ (270º) of a turn in the same direction, either clockwise or counter clockwise - the shape and its resulting image are congruent - the orientation of the shape and its image are different

General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Paper and Pencil

- Provide students with coordinate grid paper and colored pencils.

  On the grid paper ask students to draw trapezoid ABCD with vertices A(2, 4), B(9, 4), C(9, 8) and D(4, 8).

  Ask students to draw the image of the trapezoid each time and color it as indicated.

  Rotate trapezoid ABCD $\frac{1}{4}$ (90º) turn clockwise about C(9, 8) and color the image blue.

  Rotate trapezoid ABCD $\frac{1}{2}$ (180º) turn about a point at (11, 9) and color the image red.

  Rotate trapezoid ABCD $\frac{3}{4}$ (270º) turn counter clockwise about a point at (10, 4) and color the image yellow.

  Ask students to write the coordinates of the vertices of each rotated image. Ask them to describe if the centre of rotation has an effect on the location of the image. (6SS9.1, 6SS9.2, 6SS9.3)

Student-Teacher Dialogue

- Provide students with a variety of completed transformations. Ask them to identify the type of transformation and explain how they know. Ask them to describe a transformation required to produce the image by discussing the positional change of the vertices. (6SS9.3)

Resources/Notes

Math Focus 6

Lesson 3: Rotating Shapes

6SS9

TG pp. 22 – 26

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS6 Perform a combination of translations, rotations and/or reflections on a single 2-D shape, with and without technology, and draw and describe the image.

[C, CN, PS, T, V]

Achievement Indicators:

6SS6.1 Model a given set of successive translations, successive rotations or successive reflections of a 2-D shape.

Elaborations—Strategies for Learning and Teaching

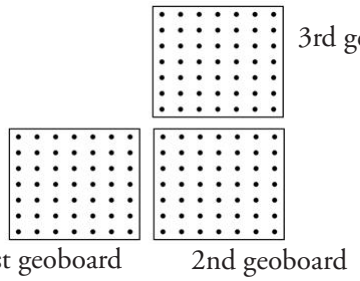
Combining transformations is a new concept for Grade 6 students. After working with each of the three transformations, combining transformations of the same type should become a natural progression for students.

When students are given a combination of transformations, they should focus on one transformation at a time and recognize that each transformation in succession would be applied to the image resulting from the previous transformation.

Students should investigate combining transformations each time, trying to visualize the result in order to make a prediction before actually carrying out the transformations.

At this point students will combine only like transformations.

Place three geoboards as shown here.



Students work in groups of threes. Ask one student to make a scalene triangle on the first geoboard. Ask another student to construct on the second geoboard the image of this triangle if the right side of the first geoboard is used as a mirror line. Ask another student to construct on the third geoboard the image of the triangle on the second geoboard if the top of the second geoboard is used as the mirror line. Repeat this activity using other shapes and/or other transformations.

General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Performance

- Ask students to create a triangle, then locate the image of △ABC after a reflection in line 1 followed by a reflection in line 2 and indicate the coordinates of the final image. Ask them what single transformation of △ABC would have the same result. (6SS6.1, 6SS6.5)

Resources/Notes

Math Focus 6

Lesson 4: Combining Transformations of the Same Kind

6SS6

TG pp. 31 – 35

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS6 Continued

Achievement Indicator:

6SS6.2 Describe the transformations performed on a 2-D shape to produce a given image.

Elaborations—Strategies for Learning and Teaching

Students have been describing successive like transformations. Now they will describe successive transformations of all three types. When describing the transformations performed on a shape, students should be encouraged to use appropriate math language. Review with students the appropriate description for each type of transformation.

Some students may be able to describe combinations of differing transformations and can quickly move on to identifying these combinations.

Students but may describe any number of combinations of transformations. Students may present differing ways to identify how an image was obtained; a specific number of transformations used cannot always be determined or, in fact, if a combination was used.

Investigate questions such as:

- If a shape undergoes 2 translations, does it matter in which order they take place?
- Could this image have been obtained by a single transformation?

Students have worked on single transformations and performing a combination of like transformations. Now, focus is on performing a combination of different transformations on a shape. Combinations should include:

- a reflection followed by a translation
- two translations
- two reflections
- a translation followed by a rotation
- two rotations

Remind students when performing a combination of transformations to focus on only one transformation at a time where each new transformation is applied to the previous transformed image. Each new image should be labelled with an additional prime symbol at each vertex.

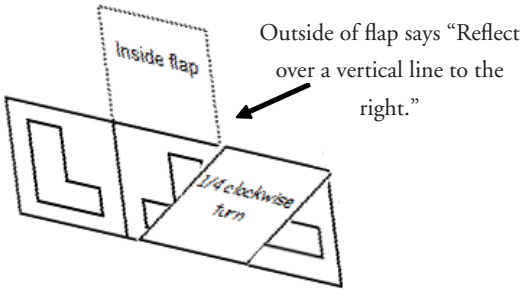
General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Performance

- Motion Commotion- Provide students with a sheet of 8 $\frac{1}{2}$ by 14 inch paper to fold and cut according to the diagram below. Students must cut along the dotted edge so that the top half of the strip has flaps that can be folded over to cover the images. Place one figure in the first (lower left-hand) box of the strip. Students must perform a transformation and write on the flap a description of the movement performed. Students should continue performing successive transformations until all blocks have been filled. This activity shows students the orientation of each image, not the position in reference to the shape undergoing the transformation. Students can exchange strips and predict the shape they will see before they raise each flap. It provides a great opportunity for students to make predictions.

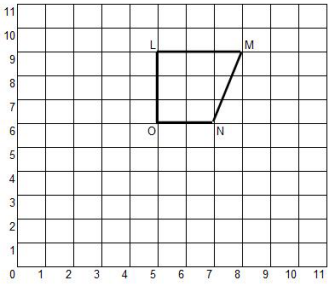
  (6SS6.4, 6SS6.5, 6SS6.2, 6SS6.6, 6SS6.7)



Source: Navigating Through Geometry (Grades 3 – 5)

Paper and Pencil

- Provide students with a coordinate grid and figure as shown:



  Ask students to translate the figure 1 square left and 5 squares down. Rotate the translated image $\frac{1}{4}$ turn counter clockwise about (4, 1). Write the coordinates of the final image. What do you notice about this final image? (S66.5, 6SS6.2, 6SS6.6, 6SS6.7)

Resources/Notes

Math Focus 6

Lesson 5: Combining Transformations of Different Kinds

6SS6

TG pp. 36 - 40

Lessons 5 and 6 may be combined.

Lesson 6: Communicating About Transformations

6SS6

6SS7

TG pp. 45 – 48

Curious Math: Single Transformations or Multiple Transformations

6SS6

TG pp. 41 - 42

Math Game:

Wei-Chi

6SS8

TG pp. 43 - 44

Capturing Squares

TG pp. 43 - 44

Additional Reading:

Van de Walle, John and Lovin, LouAnn.(2006) *Teaching Student–Centered Mathematics*. Grades 3-5

"Motion Man" activity – p. 233

Tessellations – p. 237-239

Strand: Shape and Space (Transformations)

Outcomes	Elaborations—Strategies for Learning and Teaching
Students will be expected to **6SS6 Continued** **Achievement Indicators:**	
6SS6.3 Demonstrate that a 2-D shape and its transformation image are congruent.	Demonstrate congruency to students, using pattern blocks. Choose two pattern blocks, such as the triangle and the trapezoid, and place them side by side. Have the students choose a combination of 2 transformations. Perform these combinations to create a pattern with the blocks. Ask students if the image in the pattern is congruent. Ask students to check an image's congruency by tracing it and overlaying it on the initial shape. Students will see that the size and shape is maintained. If not, this is an indication that there is an error in their creation of the image or they have performed the transformation incorrectly. Students will discover that the images are congruent because the transformations do not change the size or form of the shape.
6SS6.4 Model a given combination of two different types of transformations of a 2-D shape.	During modelling, place an emphasis on which image is being transformed. **Students must be aware that when performing a combination of transformations the second transformation is performed on the first image, not on the original shape.** As students begin working on modelling and performing given combinations of different types of transformations, it is suggested that they limit their work to combining two different transformations only. Generally students will require practice in this area in order to successfully model a combination of transformations on their own. Using an overhead projector or interactive white board, ask a student to give a single transformation direction where another student would perform this transformation on the overhead/interactive white board. Invite other students to provide different directions to transform the resulting image. Once three or four combinations of different transformations have been used, invite students to brainstorm other transformations that could be used to get the original shape to its final image. Repeat this activity using two other transformations.
6SS6.5 Draw and describe a 2-D shape and its image, given a combination of transformations.	Students have had practice drawing and describing single and combined like transformations and now will apply these skills and strategies to drawing and describing a 2-D shape when given a combination of different transformations. When students are drawing combined transformations encourage them to appropriately label their images. For example, when transforming ΔABC, its image after the first transformation should be labelled ΔA'B'C'. The second image should be labelled ΔA''B''C'', and so on.

General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Journal

- Present students with two congruent shapes on grid paper (the first and the third shapes after two transformations were performed.) Ask students to write in their journals:

  (i) What two transformations do you predict were performed? Explain your reasoning.
  (ii) Draw the second image
  (iii) Could this have been done more than one way?
  (iv) Could this have been done by a single transformation?

  (6SS6.2)

Performance

- Provide each student with grid paper marked with a coordinate grid and three pattern blocks of the same type. Ask students to place one block on the grid so that one of its vertices is at (4, 3). Ask them to place a second block so that it would be the image of the first block under a vertical translation of 10 units up. Then ask them to place the third block so that it is the image of the second block under a reflection in the vertical line through the point (11, 10). Ask them to compare the first and third blocks. (6SS6.4)

Resources/Notes

Math Focus 6

Lesson 5 (Cont'd): Combining Transformations of Different Kinds

6SS6

TG pp. 36 - 40

Lessons 5 and 6 may be combined.

Lesson 6 (Cont'd): Communicating About Transformations

6SS6

6SS7

TG pp. 45 – 48

Strand: Shape and Space (Transformations)

Outcomes

Students will be expected to

6SS6 Continued

Achievement Indicators:

6SS6.6 Model a given set of successive transformations (translations, rotations and/or reflections) of a 2-D shape.

6SS6.7 Perform and record one or more transformations of a 2-D shape that will result in a given image.

6SS7 Perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations.

[C, CN, T, V]

6SS7.1 Analyze a given design created by transforming one or more 2-D shapes, and identify the original shape(s) and the transformations used to create the design.

6SS7.2 Create a design using one or more 2-D shapes, and describe the transformations used.

Elaborations—Strategies for Learning and Teaching

Rotations can be challenging. It may be a good practice to leave a rotation in a set of combined transformations as the final transformation in the set. This would ensure that in assessment students could model their understanding of combining transformations without making a rotational error at the beginning that would continue that error throughout.

Provide each student with a coordinate grid and pattern blocks. Ask each student to carry out two transformations of their choice on the grid and leave only the first and third blocks in place. Ask them to exchange grids with a partner and predict the two transformations that took place. Share their predictions and actual transformations.

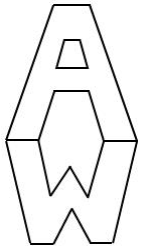
Demonstrate a design that could be created using a combination of transformations. Discuss the various transformations that could have been applied to create this design. Initiate a class discussion about how transformations can be used to create various designs, such as company logos and symbols.

Model some examples of creative tessellations. M.C. Escher (graphic artist) is well known for his tessellations which often take the shape of various objects. Explain that these designs are created by using transformations or by combining compatible polygons. Invite students to create their own tessellation designs. This particular activity can help students see that math can be used in other areas such as art.

Create a design using pattern blocks (preferably on the overhead or board) for all students to see. Ask students to analyze the pattern to identify and describe the transformations used to create the design.

Ask students to draw their initials in a block letter symbol.

Ask them to perform a combination of two different transformations on their symbol. Repeat these transformations to create a design with their symbol. Ask students to exchange symbols with a partner and have the partners describe which combinations of transformations got them to form the design.



General Outcome: Describe and Analyze Position and Motion of Objects and Shapes

Suggested Assessment Strategies

Performance

- Ask students to create a design using 3-5 pattern blocks (there must be at least 3 different shapes). Using a sheet of grid paper they will move their design from the top-left corner of the page to the bottom-right corner. The design should be in its original orientation when finally in the bottom right corner. Each move must be a reflection, a rotation or a translation. Encourage students to use more rotations and reflections than translations. Students should note how many moves were needed and draw each move on a piece of paper (or use additional blocks) to show what their design looks like. Extension: Students can complete the task again in fewer moves and describe the strategies used. (6SS7.1, 6SS7.2)

- Ask students to create a tessellation design using a combination of one type of transformation. (6SS7.2)

Presentation

- Ask students to choose from preselected company logos or symbols that illustrate different combinations of transformations. E.g., the recycling symbol, Pepsi symbol, etc. Ask them to present the logo/symbol to the class explaining the transformations that have taken place. (6SS7.1)

Resources/Notes

Math Focus 6

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6SS6

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6SS6

6SS7

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