AVID Summer Bridge

Curriculum Sampler

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AVID Math
Summer Bridge Program

ALGEBRA READINESS

AVID Center

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UNIT 5:
Algebraic Concepts: Transformations and Expressions

Objectives: The Students Will...

- Use official math language (OML) to describe mathematical concepts and processes.
- Simplify algebraic expressions using the distributive property and like terms.
- Explore congruence and similarity through translations, rotations, reflections, and dilations.

Activities

- *Warm-Up* (15 min)
- *Transformation Exploration, Part 1* (40 min)
- *SLAP* (30 min)
- *Transformation Exploration, Part 2* (30 min)
- *Transformation Exploration: Card Sort and Summary* (20 min)
- *Expression-Problem Match* (15 min)
- *Substitution Crossword* (35 min)
- *See-Run-Do: Introduction to Algebra* (40 min)
- *Exit Ticket* (5 min)

Handouts

- *Warm-Up, Unit 5*
- *Transformation Exploration: Translations*
- *Transformation Exploration: Rotations*
- *SLAP Cards* (2 copies of 4 sets; located on curriculum CD)*
- *Transformation Exploration: Reflections*
- *Transformation Exploration: Dilation 1*
- *Transformation Exploration: Dilation 2*
- *Transformation Exploration Card Sort* (1 set per pair of students plus 1 set for the board)*
- *Expression-Problem Match*
- *Substitution Crossword*
- *See-Run-Do Equations* (1 set per group)*
- *See-Run-Do Poster* (1 per group and 1 per student)*
- *Exit Tickets* (use handout from Unit 1; 1 ticket per student)*

Resources and Supplies

- Markers, highlighters, pencils, scissors, sticky notes, glue sticks, adhesive tape, colored pencils
- 4" x 4" squares of patty paper or wax paper (5 per group)
- Envelopes (1 per pair of students)
- Cardstock
- Baggies (1 per group)
- Chart paper (optional)

Teacher Preparation

- Prepare the sets of *SLAP Cards* (template provided on curriculum CD) by copying them on cardstock and cutting them apart. The sets can be copied in color or black and white.
- Cut cards for *Transformation Exploration Card Sort* and place each set in an envelope.
- Copy *See-Run-Do Poster* (1 per group and 1 per student) and post the posters in separate locations for the activity.
- Copy and cut *See-Run-Do Equations* sets and place each set in a bag.
- Copy and cut *Exit Tickets* (if using handout from Unit 1 for activity).

WICOR Strategies

W - Reflect on learning
I - Analyze and reproduce algebraic problems
C - Collaborate on activities
O - Plan and organize using note-taking and Interactive Notebooks
R - Read and interpret math word problems

ELL Strategies

- Vocabulary building
- Peer collaboration
- Speaking and listening exercises in math
- Sentence frames
- Visuals and manipulatives

Alignment to Math Common Core State Standards: The Students Will…

- Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). (6.EE.2c)
- Apply the properties of operations to generate equivalent expressions. (6.EE.3)
- Verify experimentally the properties of rotations, reflections, and translations. (8.G.1)
- Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them. (8.G.2)
- Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. (8.G.3)
- Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them. (8.G.4)

Vocabulary

- algebraic expression
- congruent
- constant
- dilation
- reflection
- rotation
- scale factor
- similar figures
- simplify
- translation

Transformation Exploration, Part 1

INTRODUCTION

The *Transformation Exploration, Part 1* activity provides students with the opportunity to explore congruence and similarity through translations and rotations of plotted coordinates. Reflections and dilations will be explored in *Part 2*, after a *Brain Break* activity that will allow the students a mental break from the intense activity.

time

40 minutes

handouts

- *Transformation Exploration: Translations*
- *Transformation Exploration: Rotations*

supplies

- Colored pencils
- 4"x 4" squares of patty paper or wax paper (2 per group)
- Sticky notes or scratch paper (1 per group)

Teacher Directions

- Create groups of three students each. Allow them 4 minutes to discuss and write their group's definitions for the following terms on INB page 33. This should be done without referring to the vocabulary cards at the back of their INBs. Tell students to leave space between each definition to add the correct definition.

translation	*scale factor* (similar figures)
dilation	*polygon*
rotation	*similar*
reflection	*congruent*

- After the groups' definitions have been written, ask students to record the actual definition of each word from the *Vocabulary Cards* (Appendix I). You may want to ask volunteers to explain each of the terms to the class.
- **ELL Note:** Include the more social language of "turn or spin" (for rotation), "flip" (for reflection), "slide or move" (for translation), "same size, same shape" (congruent or rigid), "same shape, different size," (similar) and "enlarged or shrunk" (for dilation).
- Each student will complete the first two *Transformation Exploration* pages (*Translations* and *Rotations*) during Part 1 of this activity. The next two *Transformation Exploration* pages (*Reflections* and *Dilation 1*) will be completed in Part 2, and the fifth page (*Dilation 2*) is to be used as an extension for early finishers.
- On a sticky note or scrap piece of paper, have each group select and write the coordinates of one point within the region $0 \le x \le 5$ and $0 \le y \le 8$. Collect the papers with the selected points and randomly choose five points for the students to plot.
- Have each group record the points in their tables as you call them out, and plot the points on their graph paper. These five points are to be used for the starting image on all of the *Transformation Exploration* pages.

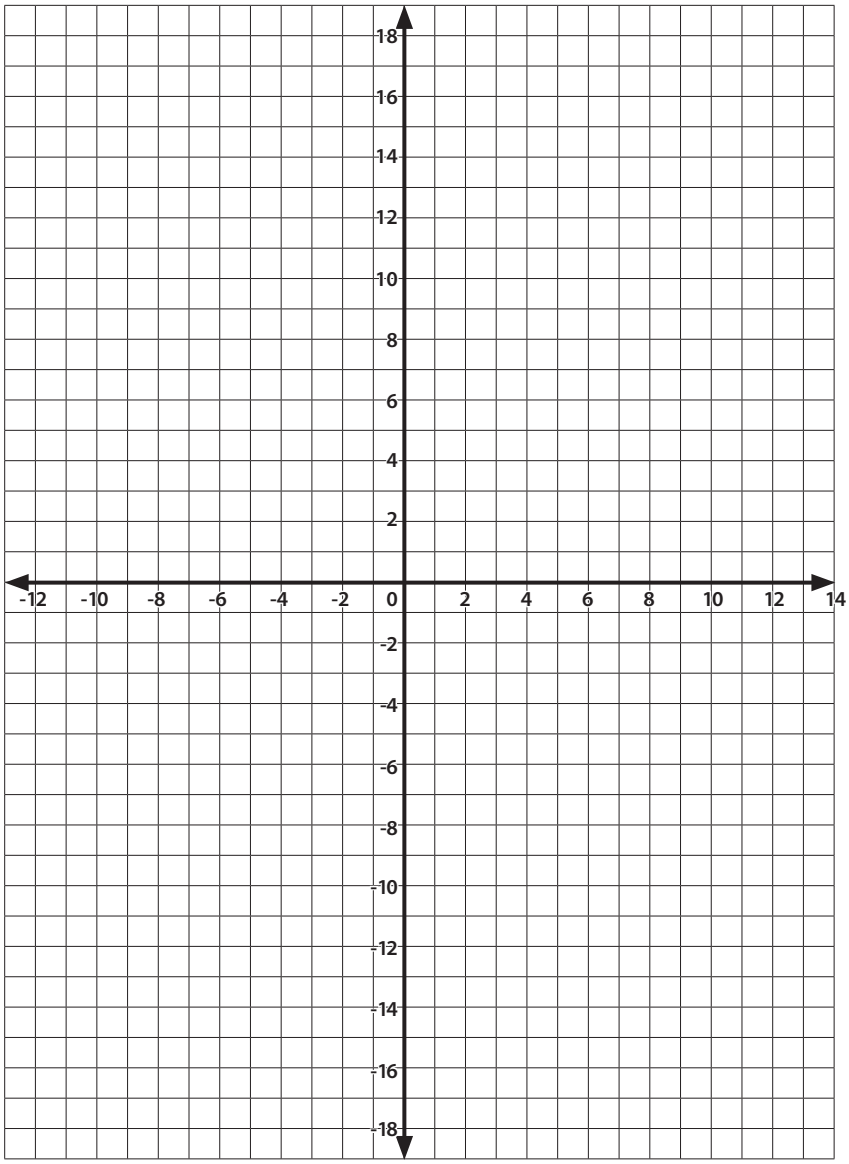
- After all points have been plotted, instruct students to connect the points using a colored pencil to form a polygon.
- Direct the groups to trace their polygons onto a sheet of patty paper with one corner of the paper at the origin and the two adjoining sides following the *x*-axis and *y*-axis of the first quadrant.
- Before students begin the activity, review the use of the "prime" notation for the transformed values. If your district/state uses the subscript notation, you may want to have students change the prime designations to the subscript notation.
- Allow the groups about 20 minutes to complete the first two *Transformation Exploration* pages (INB pages 34 and 35).
- Students may have difficulty interpreting the algebraic representations of the transformations [e.g., translating from (x, y) to $(-x, -y)$] or answering some of the questions on the page.
- Monitor each group during this process to make sure they are on the right track. Be mindful of the students' math backgrounds and their need for support in completing the activity.
- **Teacher Note:** Maintaining students' accountability during a group activity like this can be difficult, so be sure to communicate to all students that a random member from each group will be selected to present their group's findings at the end of the activity to the class. Encourage each group to make sure everyone in their group feels comfortable talking about what they did and what they learned from the exploration.
- Since the *Transformation Exploration* activity is long and rather intense, a fun activity is inserted between Parts 1 and 2.
- The debrief of the entire activity will take place after Part 2.

Transformation Exploration: Translations

- Record the coordinates of your original polygon in the table.
- Graph the polygon on the coordinate plane.
- Translate the polygon by (-6, 4) in the table.
- Graph the translation in a different color on the coordinate plane.

Point	Original (x, y)	New Point	Translation $(x - 6, y + 4)$
A		*A'*	
B		*B'*	
C		*C'*	
D		*D'*	
E		*E'*	

Answer the following questions by using your table, graph, and patty paper.



Does the translation change the size? Does it change the shape? In your own words, how does a translation affect the graph of a polygon?

How do the coordinates change? How does this change show up on the graph?

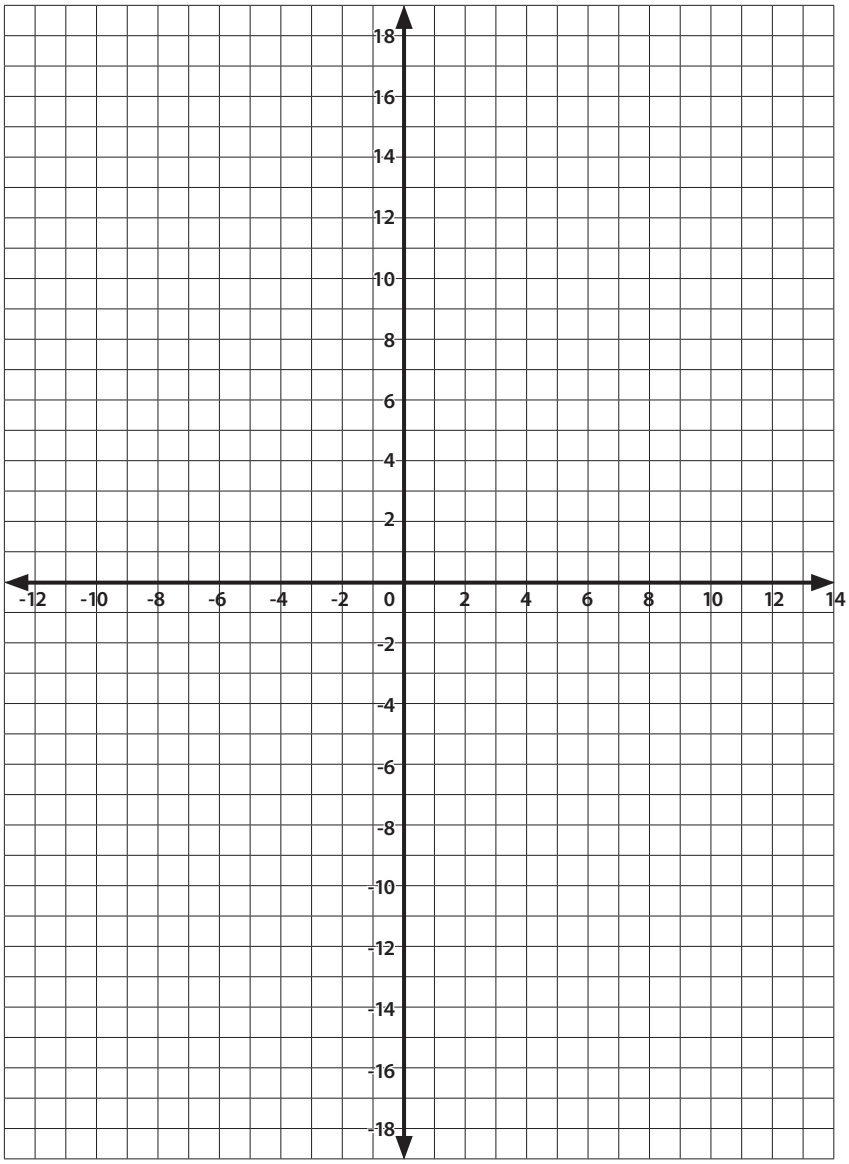
Would you describe the translated polygon as similar or congruent? How do you know? (Hint: use your definitions and patty paper to check.)

Transformation Exploration: Rotations

- Record the coordinates of your original polygon in the table.
- Graph the polygon on the coordinate plane.
- Translate the polygon by (*-x, -y*) in the table.
- Graph the rotation in a different color on the coordinate plane.

Point	Original (*x, y*)	New Point	Translation (*-x, -y*)
A		*A'*	
B		*B'*	
C		*C'*	
D		*D'*	
E		*E'*	

Answer the following questions by using your table, graph, and patty paper.



In your own words, how does a rotation affect the graph of a polygon?

How do the coordinates change? How does this change show up on the graph?

Would you describe the rotated polygon as similar or congruent? How do you know? (Hint: use your definitions and patty paper to check.)

What's Your Fav?

INTRODUCTION

The *What's Your Fav?* activity requires that students develop an algebraic equation from a multi-step word problem and use the process of substitution to solve the equation. Students may need support in working through the steps of these processes.

time

35 minutes

handout

- *What's Your Fav?*

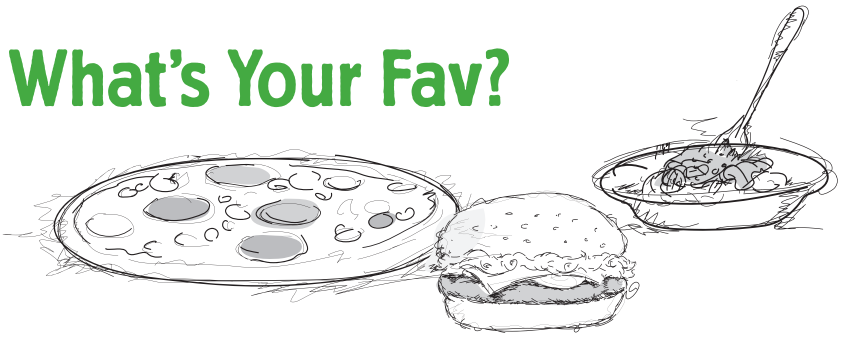
supplies

- None

Teacher Directions

- Depending on the skill of the students in using substitution in an algebraic equation, you may want to provide a few practice problems, such as the ones below, on defining a variable and translating a verbal expression to an algebraic expression. Students can write the examples on page 49 in their INBs.
    - Team A scored one-third as many points as Team B.
    - Keisha has eight more than three times as many books as Patrick.
    - Ava received two fewer than half as many points as Nahal.
- Ask students turn to *What's Your Fav?* on INB page 50 and have a student volunteer read the problem aloud.
- Identify the key words or amounts as a whole class. Ask students to highlight or underline the key words or amounts.
- Guide students in a discussion of defining the variable in the problem and identifying what algebraic expressions they will need to solve the problem.
- Allow students about 10 minutes to work in groups of two or three on writing the equation for Part 1. Monitor and, as necessary, redirect students' work on writing the equation.
- Once the equations are written, have students determine the number of votes that each food choice received.
- About 5 minutes before the time for the activity is over, ask for a volunteer to work the Part 2 problem on the board and explain the steps in the solution. Remind all students to check their work and correct it, if needed, as the problem is discussed.
- Instruct students to list in their INBs the steps they took to solve the problem. Remind them to use official math language. You may need to review with them the OML they might use in their explanation (e.g., variable, like terms, distributive property, simplify).
- If desired, award guild points for correct calculations.
- Close the activity with one of the energizers from Appendix III (e.g., Standing "O," Power Whoosh, or AVID Clap) as recognition of a job well done.

What's Your Fav?



Students at Happy Times Middle School held a vote on their favorite lunch item. There were three options: pizza, spaghetti, and cheeseburgers. There were 750 students at Happy Times Middle School, and each student voted only once.

Pizza received five fewer than four times as many votes as cheeseburgers.

Spaghetti received 15 fewer than twice as many votes as cheeseburgers.

Part 1: Write an equation that could be used to find out how many votes each food received.
Let ***x*** represent the number of votes that were received for cheeseburgers.

Part 2: Using the process of substitution, calculate the number of votes that each food choice received.