

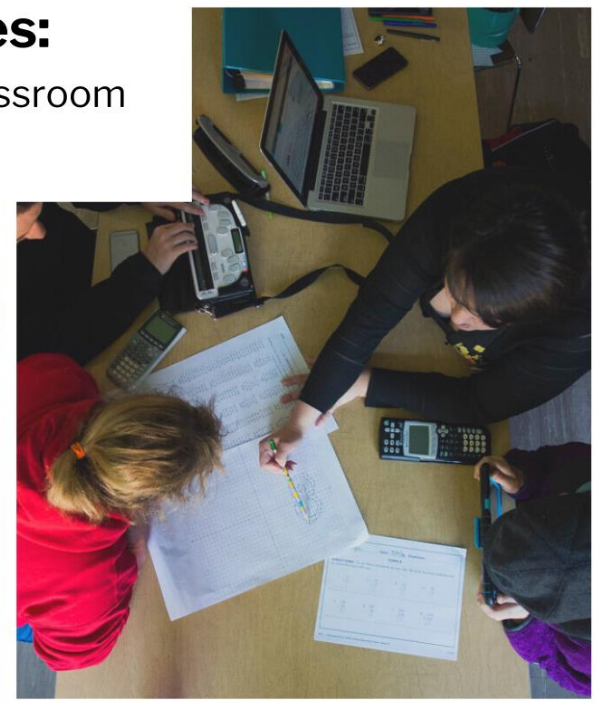
Kentucky Department of
EDUCATION

Writing Across Discplines:

An Expansion of Composition in the Classroom

Fall 2023





What is Writing Across Disciplines?

What does "Writing Across Disciplines" mean?

Defining "Writing Across Disciplines" requires clarity around the terms "Writing" and "Across Disciplines." Most simply, writing is communicating. Student writers communicate with themselves, peers, teachers and others. Writing in the classroom can have many purposes and audiences and may be formal or informal. In the academic setting, writing can serve as a tool to promote student learning, to allow students to demonstrate their thinking and understanding of the content and/or concepts taught, and/or to share with others in a real-world setting. These types of writing are called Writing to Learn, Writing to Demonstrate Learning and Writing for Publication. "Across Disciplines" refers to using the types of writing—as defined here—in English/language arts as well as other disciplines, such as social studies, science, math and visual and performing arts.

What is Writing Across Disciplines, and what is its purpose?

Writing Across Disciplines is an expansion of *Composition in the Classroom*, a resource developed by reading and writing teachers to help Kentucky educators provide students with opportunities to develop into confident, independent and proficient writers. *Composition in the Classroom* and its expansions support teachers implementing existing High-Quality Instructional Resources (HQIRs) adopted by school districts as well as educators teaching in districts that have not yet adopted a primary HQIR in reading and writing. The tips, suggestions and tasks in *Composition in the Classroom* and its expansions should not replace adopted HQIR but should serve to supplement instruction towards the full depth and rigor of the *Kentucky Academic Standards*. For more information regarding high-quality literacy curricula, districts and school leaders may access The Reading and Writing Instructional Resources Consumer Guide, a tool for evaluating and selecting instructional resources for alignment to the *Kentucky Academic Standards (KAS) for Reading and Writing*.

Composition in the Classroom is organized around three modes of writing in the *Kentucky Academic Standards (KAS) for Reading and Writing,* including information regarding standards instruction through Writing to Learn, Writing to Demonstrate Learning and Writing for Publication. *Writing Across Disciplines*, however, contains sample discipline-specific writing tasks, organized by each of the three types of writing mentioned above. This resource is grounded in the *KAS for Reading and Writing,* which includes the Interdisciplinary Literacy Practices as well as each discipline's content specific standards. The ten Interdisciplinary Literacy Practices are part of the *KAS for Reading and Writing*, appearing on every page of the standards document but **should not be confused as additional standards**. They should guide teachers in providing intentional opportunities for students to engage in deeper learning by practicing the behaviors of a literate citizen. The student practices serve as the overarching goals for literacy instruction for each student across the state. These practices are further clarified by possible teacher and student actions. These actions do not define curriculum, but rather they demonstrate how teachers can provide opportunities for students to experience the literacy practices and how students will apply these practices, so they may become an innate part of life across the disciplines and beyond school. This resource aims to bring more clarity around what these practices look like in action.

While *Composition in the Classroom* primarily serves English/language arts teachers and their students, *Writing Across Disciplines* attends to the needs of all teachers and their students. Because of its widespread classroom use already, the developers chose to begin the expansion with a focus on Writing to Learn, a professional learning space that will hopefully both affirm and stretch educators' practices. The second release added Writing to Demonstrate Learning and the final release will include Writing for Publication.

Writing Across Disciplines is created to provide what *Composition in the Classroom*, alone, does not. While *Composition in the Classroom* provides general characteristics of each type of writing (Writing to Learn, Writing to Demonstrate Learning and Writing for Publication) and examples of strategies teachers can implement to engage students in each of the types of writing, this expansion includes a more disciplinary, or specialized, look at writing. *Writing Across Disciplines* intends to show more precisely how to ensure opportunities for students to engage in discipline-specific literacies or learning that uses reading and writing skills specific to each field to teach or demonstrate content knowledge and for publication purposes as well. The sample tasks in *Writing Across Disciplines* represent some of the types of reading and writing experts in each field (e.g., economists, biologists, literary scholars, mathematicians, etc.) might authentically engage in to deepen their own expertise.

Writing TO DEMONSTRATE LEARNING Across Disciplines

Writing to Demonstrate Learning, as previously described, is necessary in every classroom for teachers to ascertain how well students are understanding the content, skills or concepts taught. Teachers use this type of writing to provide students opportunities for applying and demonstrating the skills they have learned in class and for assessing students' understanding of the subjects they are studying.

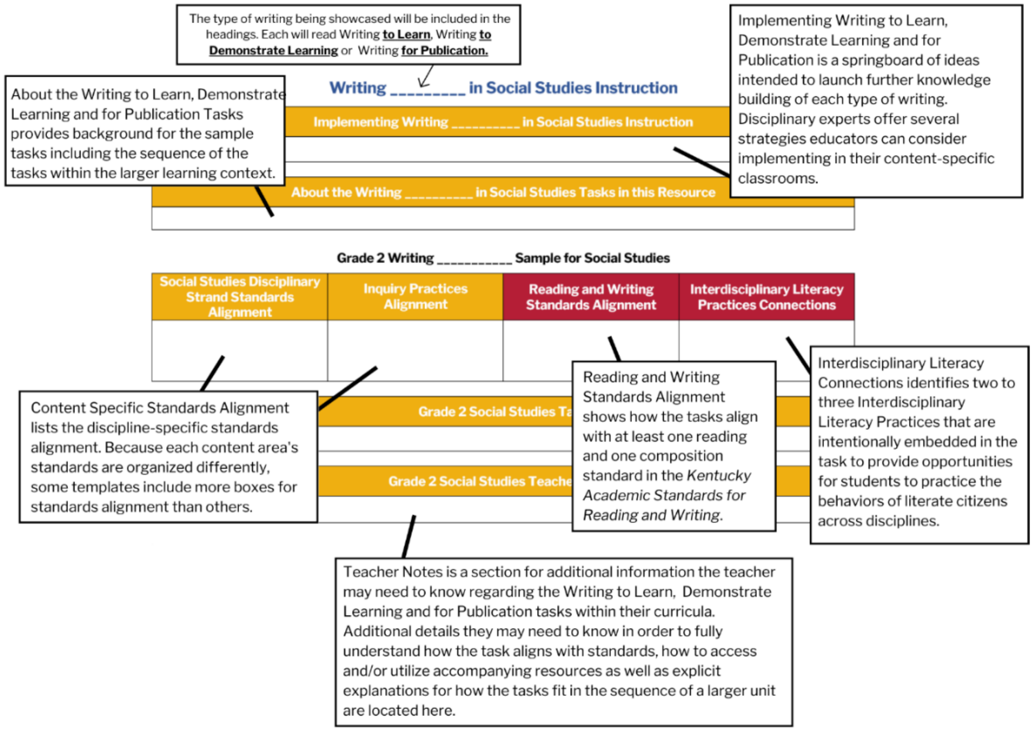
Regularly asking students to think and write about text at the higher levels of Bloom's Taxonomy (i.e., analysis, synthesis, evaluation) can help students not only think through the content but also reveal the depth of their knowledge. Though this kind of writing certainly can promote learning, it is especially used to help teachers understand how well students are learning. Typically, Writing to Demonstrate Learning takes the form of an academic exercise with the teacher as the primary audience and, thus, would not be suitable for publication. When students Write to Demonstrate Learning, their responses will be graded, marked or scored with a rubric to provide feedback to both the teacher and the student on their progress towards mastery. While feedback may focus on compositional or technical skills as a writer, teacher feedback usually focuses on content and conceptual understandings. Most simply stated, Writing to Demonstrate Learning is any composition intended to serve as a measurement of the student's depth of learning.

While students may demonstrate their learning through paragraphs or essays, at all ages, student composition should not be limited to traditional formats or restricted to writing on paper or drafting in a word processing document. Instead, students should have numerous opportunities to use digital resources to create, publish, research and update individual or shared products and to take advantage of technology's capacity to link to other information and to display information flexibly and dynamically. This may even require students to incorporate a variety of communication methods into one Writing to Demonstrate Learning composition.

Like Writing to Learn, Writing to Demonstrate Learning Across Disciplines refers to using Writing to Demonstrate Learning in English/language arts as well as other disciplines such as math, science, social studies, and visual and performing arts. The first section of this expansion, Writing to Learn Across Disciplines, provides samples of Writing to Learn tasks for each discipline. The Writing to Demonstrate Learning section is the second of three sections that will make up the complete expansion and provides samples of Writing to Demonstrate Learning. Explicit reading-writing connections are intentionally present throughout the sample tasks, requiring students to read and think deeply about text, or "anything that communicates a message," as defined by the *KAS for Reading and Writing*. Throughout the sample tasks, readers engage in passages, videos, graphs, data sets, experiments or other forms of communication while processing and documenting their learning through Writing to Demonstrate Learning.

How to Read the Writing Across Disciplines Templates

Each content area template begins broadly with a compilation of possible Writing to Learn, Writing to Demonstrate Learning and Writing for Publication strategies that experts in the field deem especially applicable to learning that discipline's content. The remainder of each template provides authentic content-specific sample tasks, organized into elementary and secondary levels. These sample tasks can help educators recognize the presence or absence of Writing to Learn, Writing to Demonstrate Learning or Writing for Publication instructional strategies within their adopted high-quality instructional resource (HQIR), equipping them with the knowledge to identify when the curriculum does not include adequate opportunities for students to engage in both types of writing. Because the types of texts involved in reading and writing vary across disciplines, each sample contains discipline-specific approaches each type of writing.



Writing to Demonstrate Learning in Mathematics Instruction

Implementing Writing to Demonstrate Learning in Mathematics Instruction

Writing to Demonstrate Learning in the mathematics classroom should be a regular occurrence. This type of writing provides opportunities for students to employ critical thinking, analytical skills and logical reasoning to reveal the depth of their knowledge.

Writing to Demonstrate Learning can cultivate opportunities for students to analyze situations by breaking them into cases or looking for generalizations, using counterexamples and clarifying misconceptions when appropriate. Writing to Demonstrate Learning in mathematics may invite students to explain or analyze a process. For example, the four-step investigative process students experience in middle school provides a foundation for students as they continue to model increasingly complex real-world situations with mathematics. When making mathematical models, students can use technology to visualize the results of varying assumptions, explore consequences and compare predictions with data. Writing to Demonstrate Learning may invite students to justify their conclusions, communicate them to others and critique the conclusions of others.

These and other Writing to Demonstrate Learning opportunities help teachers understand how well students are learning. In mathematics, Writing to Demonstrate Learning opportunities might assist teachers in determining whether students can explain correspondences between equations, verbal descriptions, tables and graphs, or draw diagrams of important features and relationships, graph data and search for regularity or trends. This type of writing may also be used to evaluate students' abilities to apply the mathematics they know to solve problems that arise in everyday life, including providing opportunities for students to routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Some additional examples of Writing to Demonstrate Learning in the mathematics classroom could include, but are not limited to, the following:

- **Which One Doesn't Belong** or **Would You Rather Math** prompts which engage students in explaining their approach to a problem, critiquing the solutions of others and comparing the different approaches in terms of whether they are accurate and efficient.
- **Mathematical Language Routines**, such as:
  - **Stronger and Clearer Each Time:** Students write individually about a response and slowly refine their writing through conversation and questioning. Subsequent drafts should show evidence of incorporating new evidence or reasoning to demonstrate learning in communicative precision as well as mathematical concepts.
  - **Convince Yourself, a Friend, a Skeptic:** Students demonstrate learning by writing three versions of a mathematical argument or justification for three different audiences.

Teachers are also encouraged to leverage writing as a tool for deeper learning using Writing to Learn tasks described in Writing to Learn in Mathematics.

About the Writing to Demonstrate Learning in Mathematics Tasks in this Resource

These Writing to Demonstrate learning sample tasks engage students in Standard for Mathematical Practice 3, construct viable arguments and critique the reasoning of others. These tasks also teach content in the Grade 3 domain “Number and Operations – Fractions” and in the high school conceptual category “Functions.” Each sample shows how Writing to Demonstrate Learning can be a tool to assess student mastery by inviting students to justify their conclusions, communicate them to others and respond to the arguments of others. Mathematically proficient students also compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in an argument—explain what it is.

Elementary students engage in Writing to Demonstrate Learning when they construct arguments using concrete referents such as objects, drawings, diagrams and actions. This can be seen in part B of the Fractions and Rectangles task. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Students at all grades can listen to or read the arguments of others, decide whether they make sense and ask useful questions to clarify or improve the arguments.

As high school students build on middle school understanding about functions, students might analyze cases to look for generalizations to determine the effects of transformations on the graph of a function. Within the What’s My Transformation Desmos activity, students use technology to explore how changing the value of a constant impacts the graph of the function and use graphical representations to create plausible arguments about the effects of transformations, instead of relying on computational rules.

The purpose of these Writing to Demonstrate Learning tasks is to give students an opportunity to apply conceptual understanding to demonstrate mastery, ultimately receiving more formal feedback about long term growth towards mastery of mathematics.

In both sample tasks, the instructional emphasis remains on the content and practice standards within the *KAS for Mathematics*. The *KAS for Mathematics* differs from previous standards in that they intentionally integrate content and practices in such a way that every Kentucky student will benefit mathematically. Put simply, the Standards for Mathematical Content define **what** students should understand and be able to do. Standards for Mathematical Practice define **how** students engage in mathematical thinking.

Grade 4 Writing to Demonstrate Learning Sample for Mathematics

Mathematics Content Standards Alignment	Standards for Mathematical Practice Alignment	Reading and Writing Standards Alignment	Interdisciplinary Literacy Practices Connections
Cluster: Extend understanding of fraction equivalence and ordering. **KY.4.NF.1** Understand and generate equivalent fractions. a. Use visual fraction models to recognize and generate equivalent fractions that have different numerators/ denominators even though they are the same size. b. Explain why a fraction $\frac{a}{b}$ is equivalent to a fraction $\frac{n \times a}{n \times b}$. **Target of the standard**: Conceptual Understanding For additional insight on standard KY.4.NF.1, access the Annotated Breaking Down a Standard Protocol.	**MP.3 Construct viable arguments and critique the reasoning of others.** Students engage with MP.3 by critiquing the reasoning of Laura and justifying why she is correct. **MP.6 Attend to precision.** Students have to attend to precision in the way they partition and see that $\frac{3}{12}$ is equivalent to $\frac{1}{4}$. .	**RI.4.8** Explain how an author uses reasons and evidence to support particular claims the author makes in a text. **C.4.2** Compose informative and/or explanatory texts, using writing and digital resources, to examine a topic and convey ideas and information clearly. *See Teacher Notes for an explanation of the *KAS for Reading and Writing* reading strand and clarification of RI.4.8.	**ILP 1:** Recognize that text is anything that communicates a message. **ILP 8:** Engage in specialized, discipline-specific literacy practices.

Grade 4 Mathematics Task

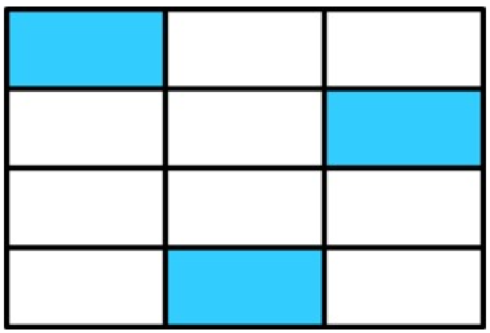
Task: Fractions and Rectangles By: Illustrative Mathematics

Student View

Task

a.

What fraction of the rectangle below is shaded?



b. Laura says that $\frac{1}{4}$ of the rectangle is shaded. Do you think she is correct? Explain why or why not by using the picture.

Grade 4 Mathematics Teacher Notes

A note about the *Kentucky Academic Standards for Reading and Writing*: RI.4.8 states students will explain how an “author” uses reasons and evidence to support particular claims the author makes in a text. In this task, the author is Laura, the individual – assumed peer – who says that $\frac{1}{4}$ of the rectangle is shaded. The text is the task, including the image in part A of the shaded rectangle and the statement in part B that says Laura claims the shaded portion is equivalent to $\frac{1}{4}$ of the rectangle.

Part A of the task addresses the conceptual understanding of equivalent fractions that KY.4.NF.1 calls for. This task builds conceptual understanding allowing students to connect prior knowledge to new ideas and concepts from KY.3.NF.3. Students conceptually see fraction equivalence by subdividing the whole into smaller equal-sized pieces, or $\frac{1}{12}$ pieces as seen in the area model. Students realize the shaded amount that represents the fraction has not changed. Students conceptually recognize the equivalencies by seeing the three pieces of the fraction model partitioned into fourths. This task helps students on the path of understanding that if they divide the numerator and denominator by the same whole number, they get an equivalent fraction. KY.4.NF.1 uses a rectangle model to show the equivalent fractions, just like this task. This is not the only model, but there are lots of connections between the fraction progression and using the area model with rectangles. We can see this by simply re-arranging the shaded parts of the rectangle to form a single row. To clarify, three $\frac{1}{12}$ pieces is the same amount of the whole as one row of the whole. Since it takes four rows to complete the whole, one row is $\frac{1}{4}$ of the whole rectangle.

Part B allows students to engage with MP.3 intentionally to justify why Laura is correct using the picture to explain. Mathematically proficient students understand and use stated assumptions, definitions and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases or looking for generalizations, using counterexamples and clarifying misconceptions when appropriate. They justify their conclusions, communicate them to others and respond to the arguments of others. They reason inductively about data, making plausible arguments that consider the context from which the data arose. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Students at all grades can listen to or read the arguments of others, decide whether they make sense and ask useful questions to clarify or improve the arguments.

For additional insight around the alignment of the selected task to the *KAS for Mathematics*, access the Annotated Assignment Review Protocol. Designed to guide educators through the process of reviewing a single task/assignment by examining the alignment with the Mathematical Content alignment, engagement in the Mathematical Practices, attention to Relevance and analyzing Student Performance, the Assignment Review Protocol is intended to help teachers, leaders and other stakeholders answer the question, “Does this task give students the opportunity to meaningfully engage in worthwhile grade-appropriate content?”

High School Functions Writing to Demonstrate Learning Sample

Mathematics Content Standards Alignment	Standards for Mathematical Practice Alignment	Reading and Writing Standards Alignment	Interdisciplinary Literacy Practices Connections
Cluster: Build new functions from existing functions. **KY.HS.F.8** Understand the effects of transformations on the graph of a function. a. Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx) and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. b. Experiment with cases and illustrate an explanation of the effects on the graph using technology. **Target of the Standard:** Conceptual Understanding For additional insight on standard KY.HS.F.8, access the Annotated Breaking Down a Standard Sample.	**MP.3 Construct viable arguments and critique the reasoning of others.** Students can make conjectures and build a logical progression of statements to explore the truth of their conjectures. Students are able to generalize and formalize arguments. **MP.5 Use appropriate tools strategically.** Students are able to use technological tools to explore and deepen their understanding of concepts. **MP.8 Look for and express regularity in repeated reasoning.** Students notice if calculations are repeated and look both for general methods and shortcuts.	**RI.9-10.8** Evaluate the argument, specific claims and evidence in a text, assessing the validity, reasoning, relevancy and sufficiency of the evidence; identify false statements and fallacious reasoning. **C.9-10.2** Compose informative and/or explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization and analysis of content.	**ILP 1:** Recognize that text is anything that communicates a message. **ILP 7:** Utilize digital resources to learn and share with others.

High School Functions Task

Task: What's My Transformation Desmos Activity

In this activity, students explore the idea that all lines are related to each other, as are all parabolas. They extend this idea to a new function type and manipulate it to gain skill with symbolic representations of function transformations. Students are given a series of fourteen screens, each showing transformations (described below). The final screens, screens 13 and 14, expect students to demonstrate their learning through writing.

Description of Screens leading up to the Writing to Demonstrate Learning Task:
Screens 1-7 offer students the opportunity to engage with visual representations of a variety of functions, beginning with lines (screen 1), parabolas (screen 2) and parangulas (screen 3) before entering a more focused exploration of a variety of transformations of a specific parangula. Students interact with the graphical representations of the transformations before shifting to look at the algebraic representations using function notation on screen 6.

On screen 7, students look for and express regularity in repeated reasoning by using symbols to move the parangula, paying careful attention to the vertex of the parangula and how that will be evident in the symbolic representation. The graph shows several parangulas: a red one with vertex at (3, 0), an orange one with vertex at (-4, 0), a green one with vertex at (0, -4) and a blue one with vertex at (-6, 0). Students use symbols to match each of the remaining parangulas.

Graph	Function
Red	
Orange	
Green	
Blue	

Sample student responses might be:

- Red: $f(x-3)$
- Orange: $f(x+4)$
- Green: $f(x)-4$
- Blue: $f(x)+6$

Students are asked to summarize their thoughts about how to transform the graph of a function f(x) using symbols instead of movable points on screen 8. A sample student response might be: To move a function left or right, subtract a number from x inside the function definition. To move it up or down, add a number outside the parentheses. So, $f(x-1)$moves it to the right one unit (subtracting positive one). But $f(x)-1$ moves the function down one unit (adding a negative one).

High School Functions Task

On screens 9-11, students look for and express regularity in repeated reasoning by using symbols to stretch the parangula. Students interact with the graphical representations of the transformations before shifting to look at the algebraic representations using function notation on screens 10 and 11. In a manner similar to screen 7, the graph shows several parangulas, each with vertex at (0, 0). The black parangula's elbow is at (-1, 1). The red parangula's elbow is at (-1, 3), the orange parangula's elbow is at (-1, 0.5), and the blue parangula's elbow is at (-4, 1). Students use symbols to match each of the remaining parangulas.

Graph	Function
Red	
Orange	
Blue	

Sample student responses might be:

- Red: $3 \times f(x)$
- Orange: $\frac{1}{2} f(x)$
- Blue: $f\left(\frac{1}{4}x\right)$

Students are asked to summarize their thoughts about how to transform the graph of a function f(x) using symbols instead of movable points on screen 12. A sample student response might be: To stretch a function vertically, multiply the whole function by a constant, such as $2 \times f(x)$ or $\frac{1}{10} f(x)$. To stretch it horizontally, multiply the x inside the function definition by a constant, such as $f(2x)$ or $f\left(\frac{1}{10}x\right)$.

Students are "putting together" their conceptual understandings on screen 13. The graph shows several parangulas. The black parangula has vertex at (0, 0) and elbow at (-1, 1). The red parangula has vertex at (-0.5, 3) and elbow at (-1, 4). The orange parangula has vertex at (5, 0) and elbow at (4, 0.5). The blue parangula has vertex at (-6, -3) and elbow at (-7, -4). Students are instructed to use their summaries about moving (Screen 8) or stretching (Screen 12) functions using symbols to match each of the parangulas on this screen.

Graph	Function
Red	
Orange	
Blue	

Sample student responses might be:

- Red: $f(2x + 1) + 3$
- Orange: $\frac{1}{2} f(x - 5)$
- Blue: $-1 \times f(x + 6) - 3$

High School Functions Task

Students are given one last transformation to look at on screen 14. The graph shows two parangulas, each with vertex at (0, 0). The black parangula's elbow is at (-1, 1), while the blue parangula's elbow is at (-1, -1). They have symmetry across the horizontal axis. Malcolm says that the blue parangula is a reflection over the x-axis. Jamal says that the blue parangula is a vertical stretch using 1 as the multiplier. Who is correct?

Students are given the option to select Malcolm, Jamal, Both or Neither. Once students select one of the choices, they are asked to "Explain your thinking." A sample student response might be: Both are correct. I can see the reflection over the x-axis visually. I also notice that multiplying each of the y-coordinates of the black parangula by -1 gives me the corresponding y-coordinates of the blue parangula. Therefore, the blue parangula is a vertical stretch using -1 as the multiplier.

High School Functions Teacher Notes

Writing to Demonstrate Learning helps teachers understand how well students are learning. Within this task, screens 8 and 12 offer opportunities for students to engage with Writing to Learn before demonstrating their learning on frames 13 and 14.

This task emphasizes building the understanding that while familiar families of functions may help students get a sense for the transformations, it is important that students understand the ideas for any function.

Throughout the activity teachers can pause the class and lead discussion around whether it is possible to match all the functions on the screen and which is most challenging. During discussion teachers may ask students to describe the necessary transformations in words. Start with informal math language and reasoning, then help them to move towards more formal responses. As teachers use the dashboard to monitor student progress, they can identify and address any typographical errors.

On screens 8, 12, 13 and 14, students formalize their ideas. Consider using teacher pacing to have everyone linger here for a minute or two. Students may find the horizontal translations counterintuitive. When the classes are exploring together, look for strategies that might elevate unique perspectives, such as when students are finding ways to shift the parangula to the left some may use F(x−−4) to match the orange parangula.

The Teacher Guide provided with the activity offers recommendations for ensuring student success.

For additional insight around the alignment of the selected task to the *KAS for Mathematics,* access the Annotated Assignment Review Protocol. Designed to guide educators through the process of reviewing a single task/assignment by examining the alignment with the Mathematical Content alignment, engagement in the Mathematical Practices, attention to Relevance and analyzing Student Performance, the Assignment Review Protocol is intended to help teachers, leaders, and other stakeholders answer the question, "Does this task give students the opportunity to meaningfully engage in worthwhile grade-appropriate content?"