



## **Flags of Latin America: Culturally Relevant Learning Experiences With Technology to Enhance Geometry and Algebra Concepts**

**Kelly Wamser Remijan**

Illinois Mathematics and Science Academy – Statewide Educator Innovation

### **Abstract**

This article highlights flags from various Latin American countries as a springboard for implementing culturally relevant learning experiences within the mathematics curriculum. It provides middle school and high school math teachers, as well as college instructors, with examples of learning experiences to engage students in culturally relevant activities. These activities build a connection between geometry and algebra concepts while at the same time extending the knowledge of technology tools such as Google Sheets Pixel Art, Computer Numerical Control Machines, GeoGebra, and Desmos. Finally, discussing flags encourages dialog about different cultures and enhances global awareness and cultural competence.

### **Discussion And Reflection Enhancement (DARE) Pre-Reading Questions**

1. How might flags of Latin America be used to connect geometry and algebra concepts?
2. What technology can be utilized to integrate the use of flags to create culturally relevant learning experiences within the mathematics curriculum?
3. How can teachers use flags to promote global awareness within the mathematics curriculum?
4. What are benefits of engaging students in culturally relevant learning experiences?

**Kelly Wamser Remijan** ([wamser.remijan@yahoo.com](mailto:wamser.remijan@yahoo.com)) is Director-at-Large for the Illinois Council of Teachers of Mathematics (ICTM) and an active Board member of the Illinois Mathematics Teacher Educators (IMTE). Dr. Remijan is a former Professional Development and Curriculum Specialist with the Illinois Mathematics and Science Academy (IMSA) – Statewide Educator Innovation, former High School Mathematics Teacher in O'Fallon, IL, and former University Adjunct at McKendree University in Lebanon, IL. Dr. Remijan seeks to help students of all abilities and backgrounds learn and grow by sharing her knowledge, experience, and passion for mathematical connections with classroom teachers and teacher educators.

**Acknowledgments:** While most technology highlighted in this paper is free and available to those that have computer and internet access, a “school-friendly” Computer Numerical Control (CNC) Machine can cost up to \$3000. For this reason, it is important for math teachers to consider the technology resources available within one’s district or community. As such, I would like to acknowledge that the flag of Chile described in this paper was replicated using a CNC machine located within the Illinois Math and Science Academy (IMSA) Makerspace. I thank the IMSA Makerspace Coordinator, Grant Bell, who machined the flag of Chile using the G-code that I provided. Additionally, I acknowledge the assistance of Southwestern Illinois College (SWIC) on various math and machining projects in which we have collaborated. I thank SWIC Precision Machining Technology Instructors: Mark Bosworth, Jerry Bonifield, and David Berry who have helped me learn about machining throughout the years and have brought CNC machines on site to various schools where students have seen their designs machined in front of their eyes.

## **Flags of Latin America: Culturally Relevant Learning Experiences With Technology to Enhance Geometry and Algebra Concepts**

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Flags can allow students to explore and better understand the world around them. Through the exploration and discussion of the mathematics, symbolism, and history behind flag designs, flag-based learning experiences offer mathematics students the opportunity to make connections which aim to ignite student interest, increase global awareness, and build cultural competence. While global awareness involves having knowledge of geography, history, and culture (Werner & Case cited in Burnouf, 2004), 60 percent of *secondary students* believe that the understanding of various cultures is the “most important skill”, even more so than writing and math (Participate Learning, 2016). As global awareness is a critical element in building global competency in the 21<sup>st</sup> Century (NEA, 2010), culturally relevant pedagogy is a critical need (Jones, 2016) and guiding principle for “Dismantling Racism in Mathematics Instruction” (EquitableMath.org, 2021). Since culturally relevant pedagogy “uses student culture in order to maintain it and to transcend the negative effects of the dominant culture” with the negative effects occurring as a result of “not seeing one’s history, culture, or background represented in the textbook or curriculum or by seeing that history, culture or background distorted” (Ladson-Billings, 1994, p. 19), mathematics teachers should consider using flags within the mathematics curriculum as a means to engage students in culturally relevant learning experiences that

promote the discussion of history, geography, culture, and current issues.

Through the development and implementation of culturally relevant curricula and practices, cultural competence can improve when students are given the opportunity to “appreciate and celebrate their cultures of origin while gaining knowledge of and fluency in at least one other culture” (Ladson-Billings, 2014, p. 75). While the use of flag designs of African countries (Remijan, 2021) illustrated how flags could enrich linear equations/inequalities using Desmos and provided students of African ancestry the opportunity to see their culture, history, or background represented within the math classroom, the integration of “Flags of Latin America” will showcase how flags can enhance additional algebra concepts as well as geometry concepts using not only Desmos, but also using GeoGebra, Google Sheets Pixel Art, NCviewer, and Computer Numerical Control (CNC) Machines. As such, these activities and corresponding technology tools can enhance the teaching and learning of algebra and geometry concepts as well as provide Latinx students the opportunity to engage in experiences that highlight their ancestry, history, and culture. With intentional planning for the integration of learning experiences involving flags within the mathematics classroom, teachers can use flags of Latin America as a springboard to provide opportunities for students to discuss global issues and/or their own

culture/heritage as well as the cultures of other people within their own community or around the world.

Having a desire to learn about other countries and their cultures, I have traveled to various countries and have shared my experiences with my students through personal pictures and the creation of related problems and activities. Incorporating flags of various countries within algebra and geometry activities across all levels, I have seen first-hand the discussions that can occur regarding culture, heritage, experience, history, geography, and/or current events. These discussions would often help me to learn more about the backgrounds and interests of students as well as recognize the lack of global awareness that exists among middle school and high school students. As such, with the U.S. Latinx population being one of the fastest-growing populations in the U.S. (Krogstad & Noe-Bustamante, 2021) and identity of this group rooted in their (or their ancestors') country of origin (Cohn et al., 2021), this article provides middle school and high school math teachers, as well as college instructors, with examples of learning experiences involving a sample of flags from various Latin American countries. Flag-based experiences can promote various cultures and engage students in culturally relevant math activities and discussion topics that enhance mathematics learning, promote global awareness, and build cultural competence.

### Flag-Based Learning Experiences Enhancing Geometry and Algebra Concepts

This paper provides examples of flag-based learning experiences involving a sample of Latin American countries. It is important to note that these experiences can be implemented within the classroom as an introductory activity, warm-up review, lesson example problem, critical thinking activity, or extension project. Even though technology is highlighted in this paper, many of the activities can be done with or without technology. Considering the technology skills of one's students and the availability of technology, teachers can modify the activity to be done without technology or can choose to use the technology as a research, checking, or creating tool. As such, it is important to consider the

abilities, prior knowledge, and technology skills/access of the students before implementing the technology component of these activities. Furthermore, while this paper offers "talking points" about each country, natural conversations and discussions within the classroom are encouraged based on student knowledge and/or heritage as well as current events happening in the world.

#### *Mexico*

For an introductory activity in geometry focused on dimensions, ratio, or area, the teacher can display the flag shown in Figure 1<sup>1</sup> and ask students what they know about the flag. Some students may be able to identify that the flag is that of Mexico while some may simply describe the flag as having 3 colors represented by 3 rectangles with a bird of some kind and something in the bird's mouth. Students may wonder what country the flag represents, what the colors of the flag mean, what kind of bird is displayed in the flag, what is the bird sitting on, or what is the significance of the bird. Students could conduct internet research to find the answers to the various questions. While questions of "wonder" are open-ended and do not need to revolve around math (Ray, 2013), the math teacher could build on students' notes of what they see or what they wonder. If students do not wonder about any additional mathematical information about the flag, the teacher could transpose the flag on a grid background using PowerPoint, as shown in Figure 2, and pose questions focusing on the math concepts for a particular lesson such as "What are the dimensions of the flag?", "What is the aspect ratio [width/height] of the flag?", "What is the area of the green region?", or "What is the perimeter of the white region?"

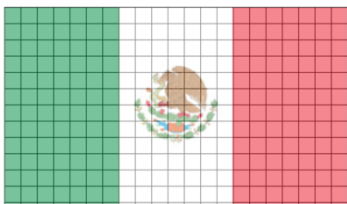
**Figure 1**  
*Flag of Mexico (Smith, 2001a)*



<sup>1</sup> See Smith (2001) entries for more information on each country flag

**Figure 2**

*Figure 1 With 4:7 Ratio on Grid*



Beyond mathematics, discussion could occur regarding the connection of the flag’s emblem to Aztec legend as well as the music, food, history, traditions, and multicultural heritage of the country which has been influenced not only by the Aztecs but also by the Mayans, European colonization, and the African slave trade (Schmal, 2020). Additionally, it can be pointed out that: (a) Mexico is recognized as having the largest Spanish population in the world, with the United States being second (Burgen, 2015), (b) There are 68 indigenous languages recognized in Mexico (Talley, 2021), and (c) Afro-Mexicans have only started to receive recognition by Mexico with the 2020 National Census being the first time in Mexico’s 500-year history (Talley, 2021). As such, further discussion could occur regarding the discrimination and racism that Indigenous, Afro-Mexican, and dark-skinned Mestizos, people who are of mixed race with Spanish and Indigenous descent, face today (Vallejo, 2021), despite the efforts of Mexico “to create a national mixed-race identity that melded Hispanic, Indigenous and African ethnicities” (Varagur, 2016) after its independence from Spain in 1810.

*Cuba*

For a warm-up review activity focused on area, the teacher could display the flag of Cuba and ask students “What do you see?”. While some students may recognize the flag of Cuba, other students may observe that the flag consists of a red triangle with a white five-pointed star (concave decagon), two blue trapezoids, two white trapezoids, and one blue concave pentagon. After students have a chance to share what they notice, students can then share what they wonder regarding the flag such as the meaning behind the colors and overall design. Next, the teacher can provide students with a student-activity worksheet as shown in Figure 3.

Working collaboratively or independently, students can answer the math-based questions and research additional extension questions that focus on topics involving flag symbolism, history, or geography. Discussion could occur regarding the change in meaning behind the design of the flag after the Revolution of Cuba in 1959 led by Fidel Castro (Cuba Flag Map, n.d.). Furthermore, the concept of Communism could be discussed which caused thousands of Cubans, along with their heritage, culture, and language, to leave their homeland for Miami, now known as “The Capital of Latin America” with the largest Latinx population outside of Latin America (Booth, 2001).

**Figure 3**

*Cuba Activity Worksheet*

**Exploring Flags of Latin America:**  
Cuba

1. Use your mathematical knowledge to answer the following questions:

- a. What are the dimensions of the given flag?
- b. What is the aspect ratio of the Cuban flag?
- c. If the triangle is an equilateral triangle, what is the area of the triangle? Show your work below.
- d. What percentage of the flag is blue? Show your work below.

2. Use your given resources (Internet, etc.) to answer the following questions:

- a. What do the colors and symbols of the flag of Cuba represent?
- b. When was the flag of Cuba adopted?
- c. Where is Cuba located?

Flag of Cuba (Smith, 2013) transposed onto a grid background

*Honduras*

For a warm-up activity focused on linear equations/inequalities and domain/range, the teacher can display the flag of Honduras like the one found in a corresponding student activity worksheet (Figure 4). Students could again be asked what they notice and what they wonder. Student might describe what they see in terms of colors, numbers, and shapes such as two blue rectangles and five blue stars (concave decagons) found

within a white rectangle. Questions of wonder might pertain to the country the flag represents, the meaning behind the colors, or the significance behind the five stars within the design. Electronically displaying the flag of Honduras along with a map of the Western Hemisphere, a teacher can share that the blue stripes of the flag represent the two bodies of water in which Honduras lies, the Pacific Ocean and the Caribbean Sea. Furthermore, it can be pointed out that the name “Honduras”, meaning “depths”, was given by Christopher Columbus on his fourth and final trip to the Americas (History of Honduras, n.d.).

#### Figure 4

##### Honduras Activity Worksheet

**Exploring Flags of Latin America**  
**Honduras**

*Introduction*  
The design and colors of the flag of Honduras symbolize the history & geography of the country with the 5 stars representing the five countries that received independence from Spain in 1821 (Honduras, El Salvador, Costa Rica, Guatemala, and Nicaragua) and the blue stripes representing the two bodies of water in which Honduras lies. As such, it was Christopher Columbus who named the country “Honduras”, meaning “depths”, when he reached the region on his fourth and final trip to the Americas (History of Honduras, n.d.). <http://www.history.com/topics/central-america/honduras>

*Use your mathematical knowledge to answer the following questions.*

- Model the rectangular border of the given Honduran flag with linear equations restricted by a discrete domain or range.
- Model the blue stripes of the given Honduran flag with linear inequalities restricted by a discrete domain and/or range.
- Test your equations/inequalities as well as restrictions using: [www.desmos.com/calculator/uc7mjyu991](http://www.desmos.com/calculator/uc7mjyu991)

*If time, research the Geography of Honduras*

- Between what two bodies of water does Honduras lie?

*Reflecting on History*  
When Columbus reached present day Honduras, the region was inhabited by the Mayan and other Indigenous Groups. As such, Latin American countries, such as Honduras, celebrate “Dia de la Raza” or “Day of the Race” instead of “Columbus Day” where Indigenous People and their cultures are celebrated and the struggles that Indigenous people have faced throughout history, and continue to face today, is recognized. Additionally, with historians now recognizing that Columbus enslaved and killed Indigenous People during his various voyages, many cities and states across the United States are choosing to observe Indigenous People’s Day instead of Columbus Day. In fact, in 2021 “President Joe Biden became the first US president to issue a proclamation commemorating Indigenous Peoples’ Day”.  
Source: <https://www.fox.com/story/2021/09/11/indigenous-peoples-day-2021/> and <https://www.history.com/news/indigenous-peoples-day> and <http://www.desmos.com/calculator/uc7mjyu991>

With the Honduran flag having an aspect ratio of 1:2, the students can use the given flag shown in Figure 4 to identify the borders of the flag to be  $x = 0$  where  $0 \leq y \leq 9$ ,  $x = 9$  where  $0 \leq y \leq 9$ ,  $y = 0$  where  $0 \leq x \leq 18$ ,  $y = 9$  where  $0 \leq x \leq 18$ . Students could also mathematically identify the blue stripes as  $0 \leq y \leq 3$  where  $0 \leq x \leq 18$  and  $6 \leq y \leq 9$  where  $0 \leq x \leq 18$ . A specific link in Desmos, such as <http://bit.ly/3HhGkIO>, could be used by

students as a checking tool or challenge depending on student familiarity with Desmos as shown in Figure 4. It is important to note that if the position of the flag is moved on the coordinate plane or if the flag is made bigger or smaller, results could vary. As a result, this activity could be used to lead into other topics such as transformations with raising the flag up a flagpole; allowing for discussion on the traditions that occur with flag ceremonies associated with Honduran National Day. (As a side note, it might be worth sharing that Honduran National Day, September 15<sup>th</sup>, also happens to be the first day of Hispanic Heritage Month.) Furthermore, the controversy of “Columbus Day” versus “Indigenous Peoples’ Day” can be discussed regarding Columbus “discovering” land that was already inhabited by the Mayan and other Indigenous Groups which historians now recognize Columbus enslaved and killed during his various voyages (National Geographic Kids, n.d.; Abrams, 2015; Willingham et al., 2021).

#### Brazil


For an example problem involving a lesson pertaining to circles or parallelograms, students could be shown the flag of Brazil (Figure 5). Students could talk about the colors of the flag or what images they see in the flag...a circle (or planet) with stars inside of a rhombus. The teacher could ask students to write the equation for the circle representing the circle on the flag and students could further test their equation using Desmos where the flag image has been inserted onto a coordinate plane, found at <https://bit.ly/3DSUXKU>. Additionally, teachers could pose the question “How can we prove mathematically that the flag’s design in fact involves a rhombus?” Students could then discuss the various methods of proving that a rhombus, in fact, exists. Following this, students could measure opposite angles, with a protractor by hand or electronically using GeoGebra, to show both pairs of opposite angles are congruent proving a parallelogram exists. Alternatively, students could measure the sides of the parallelogram to show that all sides of the parallelogram are congruent proving that the parallelogram is a rhombus.

Beyond mathematics, the flag can provide a starting point for the discussion of the geography, history, and language of Brazil. First, the significance of the design of

**Figure 5**  
*Brazil Activity Worksheet*

**Exploring Flags of Latin America**  
**Brazil**

**Introduction**  
Over a course of 300 years, five million Africans were forcibly taken across the Atlantic Ocean to Brazil during the time of slave trade. With Brazil being the last country to abolish the slave trade in 1888, four times as many Africans were brought to Brazil compared to the United States. As such, Brazil has the second largest black population in the world outside of Nigeria with "half of the population identifying themselves as black or of mixed race" and African culture found throughout dance, music, and food across Brazil. (Source: <https://www.fox.com/2012/12/12/100-facts-about-brazil-fox-fox.com>)



Flag of Brazil inserted into Desmos found at: <https://www.desmos.com/calculator/p9x6frewwhi>

**Reinforcement of Mathematical Concepts**

- The flag of Brazil is said to contain a green rectangle, yellow rhombus, and blue circle. Write the equation of the outline of the blue circle.
- Test the equation of the circle you derived using <https://www.desmos.com/calculator/p9x6frewwhi>

If time, review information about the flag of Brazil from the Vanderbilt University Center for Latin American Studies found at: <https://cdn.vanderbilt.edu/vu-vpl/wp-content/uploads/sites/99/2017/06/09/194124-Flag-from-Brazil.pdf>

- As the white stars in the blue circle symbolize the 27 states that currently make up the country, the placement of the stars identify the various constellations that can be seen in the sky over Brazil. How many constellations are presented on the flag of Brazil?
- Across the blue circle there is a phrase written in Portuguese written on the flag of Brazil which is the motto of Brazil. What does this phrase translate to in English?

**Interesting Fact**  
Brazil is the only "Latin American" country that speaks Portuguese while all other "Latin American" countries speak Spanish. "Latin American" countries are considered those that speak a language derived from Latin which can be found in South America, Central America, and in some parts of the Caribbean. With Indigenous Peoples inhabiting the Americas for thousands of years before European conquest, and likely not thinking of themselves as part of a single geographic entity, the term "Latin America" did not come into use until the middle of the twentieth century (Source: <https://www.getty.edu/news/an-overview-of-latino-and-latin-american-identity/>)

the flag of Brazil could be discussed with the green color being representative of the Amazon Rainforest and the importance of the region to "10 percent of all plant and animal species known on Earth" and "home to more than 24 million people...including hundreds of thousands of Indigenous Peoples belonging to 180 different groups" (Greenpeace, n.d.). Second, discussion can occur regarding: (a) Five million African slaves forcibly brought to Brazil during the Slave Trade compared to nearly 500,000 forcibly brought to the United States (Public Broadcasting Service [PBS], n.d.), (b) The impact of African culture on Brazil which has the second largest black population in the world outside of Nigeria (PBS, n.d.), and (c) The social inequality that exists with more than half of the Brazilian population considering themselves as Black or of mixed race (Darlington, 2013). Lastly, discussion can occur regarding the official language of Brazil being Portuguese, making it the only non-Spanish speaking country in Latin America.

### Bolivia

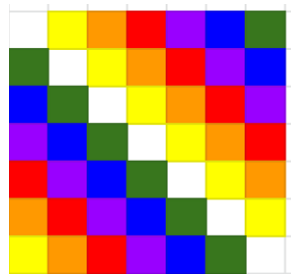
For a critical thinking activity involving geometry concepts such as ratio and area, students can research the

flag of Bolivia. Discovering that Bolivia has two official flags, students could replicate each flag either by hand using grid paper or with technology using Google Sheets Pixel Art found at <https://tinyurl.com/skz55uup>. After replicating the National Flag of Bolivia (Figure 6) as well as the Indigenous Wiphala Flag (Figure 7), students could further research the history and meaning behind each flag's design. The teacher could then ask students to compare the percentage of each flag being green, yellow, and red. Furthermore, discussion could occur regarding the social and political issues that occur with a country having two official flags.

**Figure 6**  
*Bolivia Flag (15:22 Aspect Ratio Without Coat-of-Arms)*



**Figure 7**  
*Indigenous Wiphala Flag of Bolivia (1:1 Aspect Ratio)*

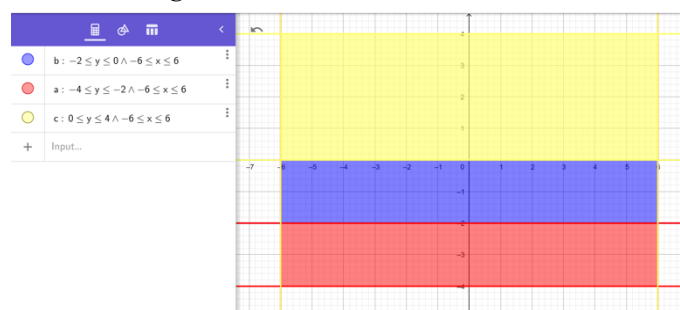


### Colombia

For a critical thinking activity involving algebra concepts, teachers can play a song from the 2021 Disney movie *Encanto* found at <https://bit.ly/3hvvVKc>. Afterwards, students can be asked to research and replicate the flag of the country celebrated in the song using linear equations, linear inequalities, and domain/range. To begin this process, students can discover the flag has a 2:3 aspect ratio and consists of a top yellow stripe that is twice as wide as the blue and red stripes (Smith, 2001f), thus making the horizontal stripes in a 2:1:1 ratio. With this information, students could sketch the flag and its

dimensions on a hand-drawn coordinate plane and then electronically replicate the flag on a coordinate plane in GeoGebra as shown in Figure 8. (It is important to note that GeoGebra allows for a multitude of colors, including yellow, unlike Desmos which offers only 6 colors, none of which are yellow.) Students could research the meaning behind the colors, why the flag of Colombia is similar to the flags of Ecuador and Venezuela, and how similarity of flags can often help tell the history or culture of a country. Finally, discussion could occur on how Colombia is the first and only NATO alliance “partner” from Latin America (NATO, 2021), and how such affiliation may impact Colombia as well as other Latin American countries.

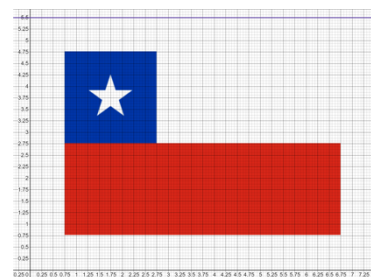
**Figure 8**  
*Colombia Flag in GeoGebra*



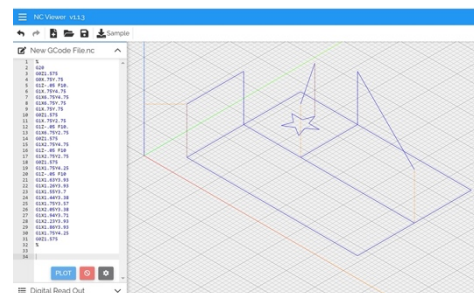
*Chile*

For an extension project involving coordinate geometry, students can be asked to replicate or re-imagine the flag of a country such as Chile. To do this, students can (a) Research the flag, (b) Insert the flag into Desmos (Figure 9), (c) Identify ordered pairs making up the image, (d) Write a computer program involving a Computer Numerical Control (CNC) programming language called G-Code to create the flag’s design, and (e) Check their computer program using an online simulator program such as <https://ncviewer.com/> (Figure 10). Furthermore, with access to a Computer Numerical Control (CNC) machine, students can machine their design, as shown in Figure 11, which can make math more meaningful for students and inspire students to consider a future career in machining, engineering, or design. (Note: Math teachers are encouraged to collaborate with Career Technology Education (CTE) teachers within their school/district who may have a CNC machine or teachers can connect

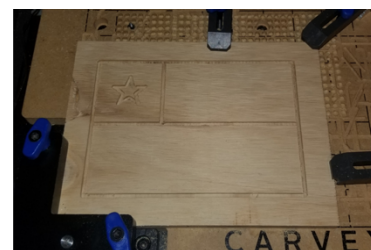
**Figure 9**  
*Chile Flag (2021) with 2:3 Aspect Ratio in Desmos*



**Figure 10**  
*Chile Flag Using G-Code and NC Viewer*



**Figure 11**  
*Chile Flag on 5.5” x 7.5” Piece of Wood*



with a local college or business to gain accessibility to a CNC machine). Discussion can occur regarding the meaning behind the flag’s design and the potential connection to the ancient Machupe Indigenous flag that was used during the Arauco War with the Spaniards (Flag of Chile, 2021). Additional dialogue can occur regarding Chile being the only country in Latin America that does not recognize Indigenous people in its constitution and the challenges that the Indigenous people face such as the lack of rights to the land that ancestrally belongs to them (International Work Group for Indigenous Affairs [IWGIA], n.d.).

*Other Countries Beyond Latin America*

Flags from Latin America can be a springboard to the replication and discussion of flags from around the world. Students, for instance, could be asked to research the flag of a country which is not considered to be part of Latin America but is located within South America or the Caribbean. After identifying and researching such countries, students could replicate a flag, like that for Trinidad and Tobago (Figure 12), through the application of online graphing technology such as Desmos. Additionally, discussion could occur on why some countries are considered part of Latin America and others are not. Finally, students could share or research what it means to be Latinx and how one's culture may compare with someone who is from a non-Latin American country such as Trinidad and Tobago.

Flags from countries around the world that have historic ties to Latin American could also be utilized to connect geometry and algebra connections and promote global awareness through further discussion. A map of Latin America and a map of the world can provide visual aids on the location and proximity to the United States as well as other countries connected to Latin America through history. As the slave trade, for instance, involved the forced transportation of slaves from Africa to Latin America during the European Colonialization of Latin America, many Latinx may have African or European Ancestry; thus, the use of African flags for geometry and algebra concepts could be incorporated as additional activities or activity extensions. In addition, with European explorers, such as Christopher Columbus, reaching present day Latin America, believing that the East could be reached by traveling West, the flags of the

present-day countries of these explorers and the countries they were seeking could also be used as extensions of flags from Latin America.

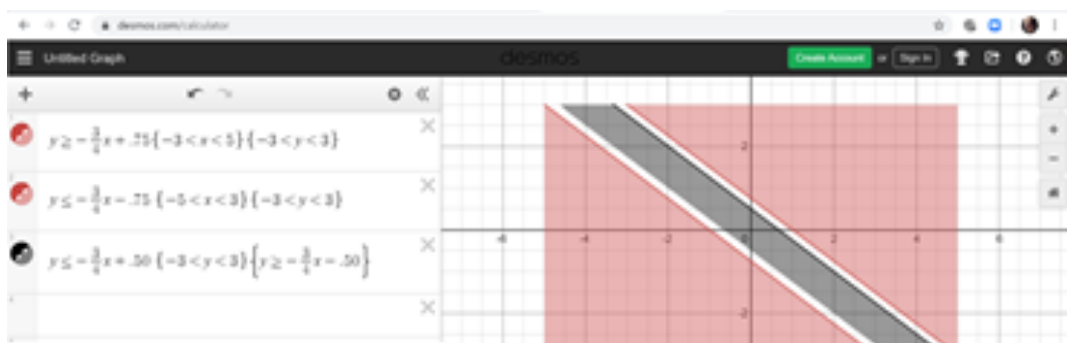
## Conclusion

Culturally relevant learning experiences within the mathematics curriculum can make math more meaningful for students. As culturally relevant pedagogy “uses student culture in order to maintain it and to transcend the negative effects of the dominant culture” with the negative effects occurring as a result of “not seeing one’s history, culture, or background represented in the textbook or curriculum or by seeing that history, culture or background distorted” (Ladson-Billings, 1994, p. 19), mathematics teachers must reflect upon their current curriculum and teaching methods and consider various ways to engage students in culturally relevant learning experiences. As such, teachers are encouraged to get to know their students and to incorporate flags from countries around the world, including flags that represent Indigenous groups, which recognize the diverse backgrounds of their students, community, and the world in which we live.

Through the exploration and discussion of the mathematics, symbolism, and history behind flag design, as well as the skills or creativity required in replicating (or reimagining) a flag design with technology, flag-based learning experiences offer mathematics students the opportunity to engage in mathematics activities with cultural connections and technology tools which ultimately enhance skill development and student learning. In conclusion, the intentional implementation of culturally relevant learning experiences involving flags

**Figure 12**

*Trinidad and Tobago Flag in Desmos*





within the mathematics classrooms has the potential to ignite student interest, enhance mathematics learning, and increase global awareness which makes students not only more mathematically competent, but also more culturally competent.

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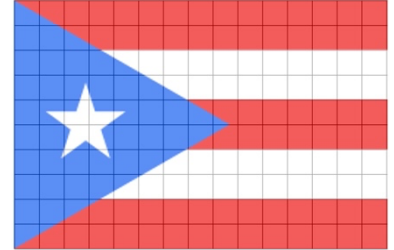
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### Discussion And Reflection Enhancement (DARE) Post-Reading Questions

1. Try This –

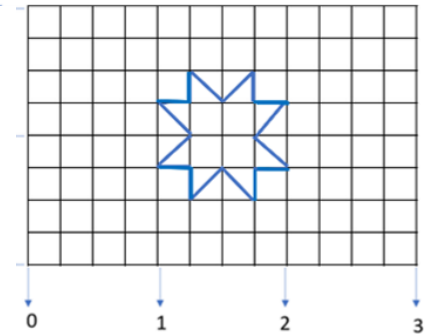
- a. What do you notice and wonder about the given flag?
- b. What is the aspect ratio of the flag?
- c. If the dimensions of the flag are 10 inches x 15 inches, and the blue triangle is an equilateral triangle, what is the area of the triangle?
- d. What percentage of the flag is not covered by a triangle?
- e. What is the meaning behind the design of the flag?



2. Try this – While the flag of Chile contains a five-pointed star, the original inspiration of the flag was the Mapuche flag containing an eight-pointed star called the Star of Arauco.

(Sources: <http://bit.ly/3TxwhgJ>, <http://bit.ly/3UpNWIp>)

- a. Write a computer program involving G-code that will cut an 8-pointed star (known as a 16-gon or a concave hexa-decagon) out of a 2-inch x 3-inch piece of material using a computer numerical control (CNC) machine as represented in the image to the right.
- b. Check your program using <https://ncviewer.com/>
- c. If you have access to a CNC machine and a 2-inch x 3-inch piece of material, machine the design using the program that you have written.



3. Try this –

- a. Using Google Sheets Pixel Art, found at <http://bit.ly/3XkxoDz>, re-imagine the National Flag of Bolivia as a mix of the current National Flag and the Indigenous Wiphala Flag of Bolivia.
- b. Explain the rationale behind your design.
- c. What are the pros and cons of creating one flag that mixes these two flags together?

4. Try this - During the time of European expansion to the Americas, slave ships transported slaves and goods from Africa to areas throughout Latin America and often returned to Africa leaving from Brazil. As a result, there are neighborhoods throughout Ghana, Nigeria, Togo, and Benin that consider themselves ethnically Brazilian even though live in Africa.

(Source: <http://bit.ly/3E2R3Px>)

- a. Research the flags of the African countries mentioned above
- b. Replicate one of the African flags mentioned above using either Desmos.com or GeoGebra.org applying the concept of equations/inequalities and domain/range.

5. Discussion Question – Why should culturally relevant learning experiences involving flags of Latin America be utilized within the mathematics curriculum?