Drum Corps and Marching Band Formations and Geometry

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Math 407 A: Mathematical Patterns and Structures trough Inquiry

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Drum corps and marching bands utilize mathematics in a variety of formats. One of the most utilized aspects of math is geometry, primarily in the use of different formations. These formations are often changing at quick speeds, and are a variety of solid geometric shapes as well as fluid and circular shapes. These formations can often times be broken up into smaller geometric shapes that can also further a students understanding. Using both sheets showing the solid figures, as well as videos of the groups moving can be used to help students to understand different aspects of geometry.

Introduction:

For me, marching band and drum corps are some of the most enjoyable experiences of my life. They have helped me form bonds that have helped me become who I am, as well as help develop the skills I have today. I have now been a member of a marching band for 9 years (between high school and college), and have been in a drum corps for a season. I have seen a range for marching bands, having been in both bands to entertain, as well as bands whose goal was primarily to compete. I have felt a range of emotions from performing as well as rehearsing, and it has helped lead me to be where I am today.

Marching bands and drum corps are known in today's society for being the halftime entertainment for football games, leading parades, and for rigorous competitions that are the finale to a summer devoted to nothing but learning one show. These traditions are partially a brand new idea, as well as the traditions of their originators. The idea of marching bands can be traced back to groups of musicians who would travel between trade festivals to play for entertainment(History of Marching Bands: A Brief Overview, 2004) as well as to the use of drums, brass, and flags that would be present as an army marched off to war. We can look at these individually to see how the tradition of these is still maintained throughout time. If one was to examine a drum corps competition, a connection could be drawn to the musicians performing at trade festivals. While there isn't a separate festival going on at the same time, the groups who perform do so for the entertainment of the crowed, in a festival like style. Similarly, the game of football is similar to war, with 2 opposing forces attempting to take land from their foe.

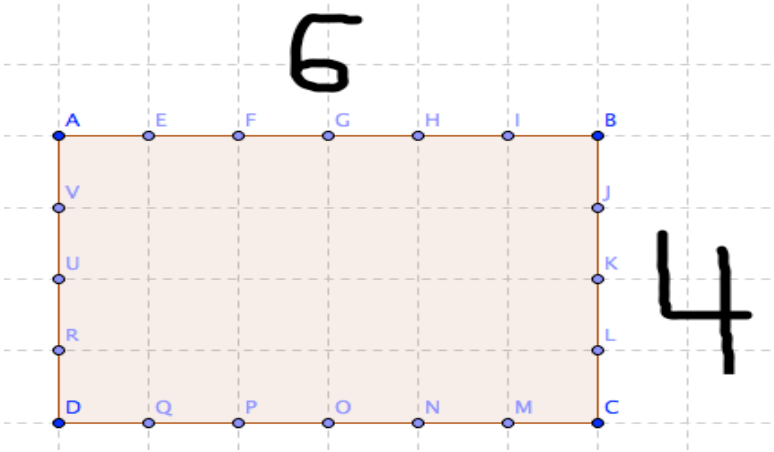
With this analogy, a marching band would be very similar to the drums, brass, and flags used in war, to keep morale high for their troops, to push them towards victory, and to use similar formations to show their pride, and courage in the face of the enemy.

As I though about the project, my first thought was to incorporate something that was primarily visual, but could also include audio and kinesthetic movement to teach the subject. My initial thought was that geometry would make the most since, and I instantly decided on the use of marching band, as I felt that it could be incorporated in a number of ways. I decided that the best course of action was to focus on the drill that was used by the bands, how it could be used in a class, as well as how it could be interactive. The majority of the project will focus on how these formations can be used to help students understand two-dimensional shapes, as well as being able to divide up those shapes. The topic allows for little bit of a stretch into three-dimensional shapes, and will go into some of aspects of arithmetic that can be utilized by the subject.

Mathematical Connections:

Marching band formations will commonly use solid geometric shapes, be it triangles, squares, rectangles, or other shapes. More often, however, they will make a shape that utilizes multiple geometric shapes to create it. There will be non geometric shapes that will also be used, such as an ameba shape, which could be utilized in higher level math classes to help students find the area of non geometric shapes, but in this topic, I am focusing on how to utilize these formations for middle school students. These formations are not just useful in geometry however, but can also be utilized in other aspects of math, such as fractions, algebra, and more. The easiest way that you can use

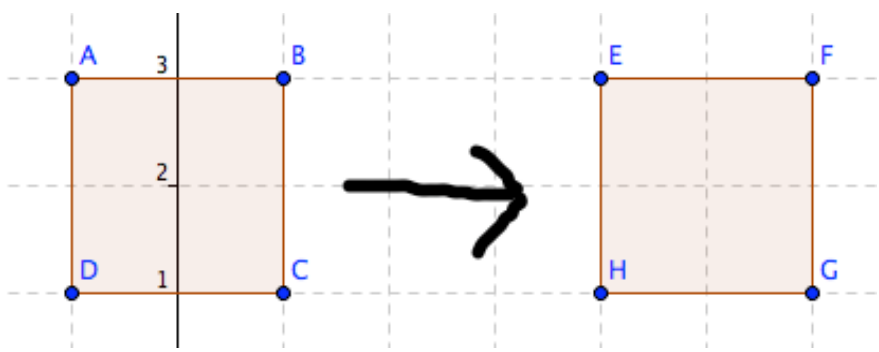
this is if you create drill charts, or something similar (these are essentially a shape that is displayed on a grid). (Bailey & Caneva, 2003)



With the formations that are solid squares (or other geometric shapes), there are a lot of things that you can utilize. The first thing that I would utilize is to help students understand perimeter, as well as angles, the length of a side, and the area of the form. With a circle, you can help students to find the radius, diameter, and circumference, and help to explain these concepts. One of the most convenient reasons to utilize these forms to show the shape is that during the beginning, when the students are trying to understand the concept, there are multiple people in the line, so that the students could just count each person to see how long a side is. (Bailey & Caneva, 2003) (Sidewaters & Williams)

With the use of these forms, there will be transformations, both in the mathematical terms, as well as in the concept of the form physically changing. In one image, you can have the image of a square, and in the next image you can have the same square with a diagonal going across it to help students find the length of the diagonal. You can show a circle in the first image, and then show the circle with a line in the radius to help students visualize the radius. The ability to move a form can be very helpful to

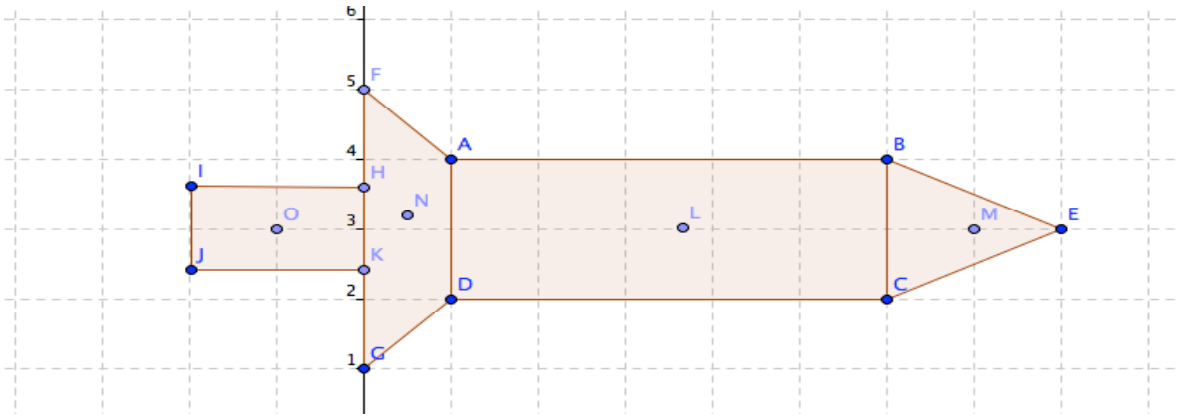
show the students their math concepts work. You can display a square where the center of the square is on the 50-yard line, and in the next image, show the image where the same square is centered on the 25-yard line. This can be a beneficial way to show how a transformation is done with an image. Similarly, you can do the same thing, rotating the square around one of its corners, or using a non-symmetric shape to show a reflection. Another option with these charts, are to utilize a symmetric image, where there are two shapes the same size, and shape that are reflected around a yard line. In addition, if a drum corps form cannot be found, I can easily create a form to meet my needs to teach the class. If I can't find a drum corps form that can show a glide reflection, then I can create one that will give the image that I need. Also, if I decide to show a clip, I could easily show one of the images of a square transforming into a rectangle or rhombus. This will allow me to help show students the connections from one polygon to another. (Barger & Cooper, 2009) (Sidewaters & Williams)



One of the best uses of these would be to show how the drum corps expand and contract their forms. There are many times that they will take a shape, and use a scale factor and expand or condense the entire form. This is great to show students how to use scale factor, and to teach a topic on how images are changes. These are also done at times while the image is rotating or using some other translation, so students could

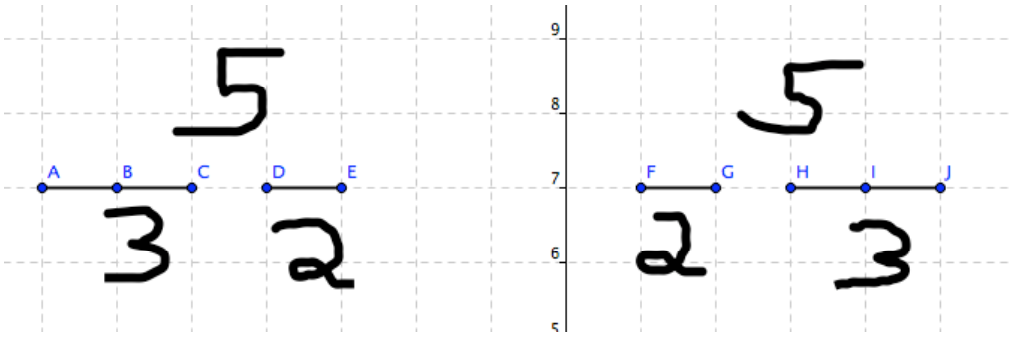
attempt more difficult problems to both expand and rotate a figure in the same problem. (Barger & Cooper, 2009)

Multiple times, images are a combination of multiple images. One drum corps (the Blue Devils) created a dagger in one of their shows while the Ohio State marching band utilized Tetris pieces in one of their shows. These are both images that can be made up of multiple forms, such as the dagger could be made up of a combination of triangles and parallelograms. This can help students to understand how shapes are related, and can be combined to make new images. Similarly, regular polygons in a form can be broken up into smaller pieces. A square can be divided into quarters, or a circle can be divided into cone shaped pieces. These can be very useful to help explain fractions to students. By using these, I could utilize a more visual example to show students how to make a whole, not just in a rectangle shape, but also in any shape. As students advance, by using non-regular polygons, I could help students to see what percentage of each shape the smaller shapes are. (Best 2006 DCI Moments – Youtube, 2008)



There are more ways that these can be utilized. You could show properties of math, such as having line segments of 2 and 3 people on each side, to help show the

transitive property of equality. You can show 2 lines of band members, one twice as long, to show how multiplying a number by 2 is equal to another number. I could utilize the fact that there are actual people on the field, so there would be a 3-D form to examine, and have a look into prisms, be it regular and non-regular. These forms can truly be used in almost any aspect of math. (Sidewaters & Williams)



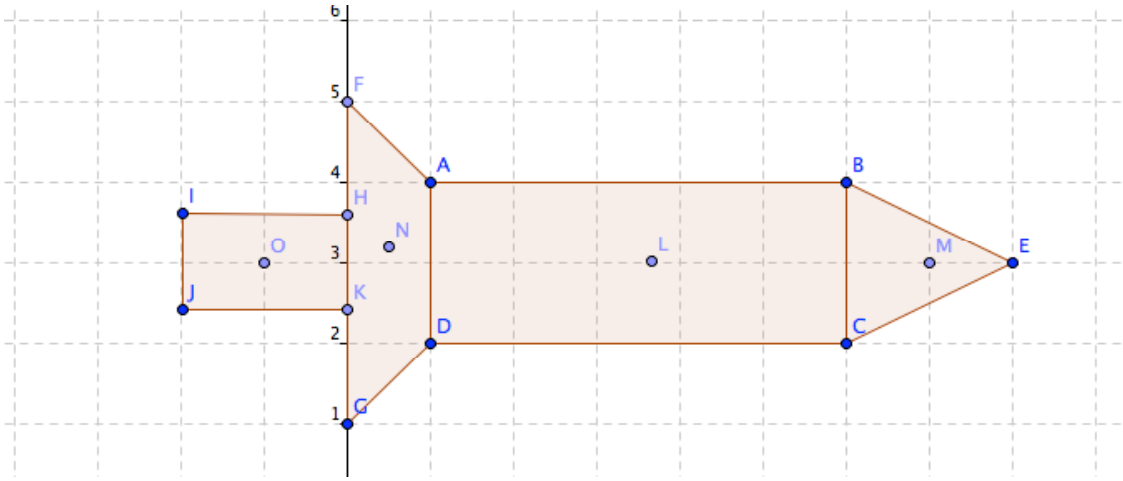
Pedagogical Connection:

I will start with the regular geometric shapes. To start, I would tell students the space between two members is equal to one. It would be very easy to show students the length of each side by just counting each person in the form. When moving onto perimeter, students would be able to count each person to find the perimeter. When it comes to finding the area, if the form is lined up on the grid, students could use the grid in early years to find the area. As they develop in their understanding of math, forms don't need to be centered on the grid, and can be utilized to show students how to find the area using the sides of the form. If the formation is non-regular, other uses can be used to find the formula. In the idea of the dagger, you can show the method of finding the areas of what makes up the form in order to find the whole area. (Bailey & Caneva, 2003) (Sidewaters & Williams)

While examining the translations of the shapes, I would start by having a square on the 50-yard line. I would show the square moving to the 25-yard line. I would show the video of how the form was moved and have my discussion then on a translation. After that, I would use the same square and different arrows to have the students demonstrate their understanding of the concept. This way of teaching could be used for any of the transformations in order to display students understanding of the concept that was taught. (Barger & Cooper, 2009)

For scale factor, I would use a similar concept to above. I would show the students the image where it starts, where it ends, as well as the video that shows the expansion. I would be able to utilize this in my discussion of scale factor, examining how much bigger or smaller the other image is. I would then give a few more examples of other expansions to ensure the students understanding, as well as asking students to their own expansions from a form that I would give them. (Barger & Cooper, 2009)

There are many different problems that I could go through, however I will show this one, finding the perimeter and area of a dagger to show how I would utilize these forms:



In the image above, I would start with finding the perimeter. I would ask the students if they are finding the perimeter of every shape, and then have the students find the length of the outside edges for the figure. I would have the students go onto find the area. I would start by making sure the students understand that finding the area of each figure could be added together to find the total area. I would have them find the area of figures L, M, N, and O. They would find the areas of the parallelograms and triangle, and add them together. This could help them see just how the area of these figures can be found. After this, I would have the students divide each section by the total area to understand the percentage of each section. (Best 2006 DCI Moments – Youtube, 2008) (Sidewaters & Williams)

This example covers standard 6.G.3-4, but these concepts in total cover standards 6.SP.5c-d, 6.RP.3, 3.MD, 5.G.3-4, 6-7.G, 6.G.1,3-4, 7.G.1-6, and 8.G.1-9 (K-8 Mathematics Comparative Analyisis of Common Core State Standards and teh Ohio OACS, 2011).

Reflection:

This project seemed very bipolar to me. I found it very easy to relate to the subject, and once I started to actually write the paper, I was able to write it fairly easily. I was able to make the connections with how to incorporate the topic very easy, and I feel really good about being able to actually use this topic in the future. Easily, the hardest thing for me to do was to find the resources that I needed. It was beneficial that, since I knew so much about the topic and already planed to incorporate it into my class that I

was able to expand off what I could find, but finding articles was very difficult. I also had difficulty not expanding into more aspects of how this topic could be utilized in other aspects of math. I constantly had to resist the urge to continue to make connections to other aspects of mathematics.

For me, having the ability to write my paper on this topic, I was greatly appreciative of the fact I could work with something I enjoy. Working with something I'm interested in, I was more inclined to work hard on the topic, and was more interested in general. These can be used as story problems in place of the dull problems used currently. I'm not saying that I would use this topic for every part of math, but I would use it for part of it. I would plan to try to incorporate multiple interests of the students during any given lesson to keep the students interested. This will also help the students to understand why learning math is relevant to their lives and their future, and not just ask why they have to be there.

Conclusion:

I can utilize marching band and drum corps formations for multiple aspects of geometry. It can be very useful to explain things such as perimeter, area and radius, as well as transformations and scale factor. Using videos can help students more easily see how the transformations are done. This can be used either in story problems or on their own, and can be more interesting then a number of textbook problems. This is just one possibility of a topic that could be used for math. This would best be used with other topics that students find truly interesting, and in a manor to be both educational as well as engaging.

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