

## Math 2100 Project Summaries

In my analysis I relate the subjects of roller coasters and competition sailing. In my analysis of roller coasters I include the history of engineering and roller coaster construction and then use this information to show that many cultures have an interest in thrill rides. I then go on to show how piecewise functions are used to model a theoretical rollercoaster design. I also include a segment as to how a polynomial function of  $n$ th degree can be used as a piecewise function to describe the form of a roller coaster. In my analysis of competition sailing I review over the history of nautical engineering as well as the origin of one of the most famous nautical races that is known worldwide and participated in by many different cultures and countries. I then go on to describe the various ways that bearing can be used to determine distances and how travel speed and time can be used to model distances based upon bearings. These bearings are based upon the four primary directions of north, south, east and west and these bearings get their values from the degree values of the unit circle. I also show how the subject of bearings and distances can be used to relate to other cultural interests and can engage students on multiple levels.

### ..... **Video Games**

Today, video games are one of the main sources of entertainment by all age groups especially middle school and high school ages. Whether you're a boy or a girl video games can be fun and exciting. That is why I think that using video games is a great way to enhance a mathematics lesson. Designing a video game uses algebraic reasoning, coordinate graphing, linear equations and rate of change or slope to create games. In the activity that I chose students will have the opportunity to solve the problem, which involves plotting a linear path for a spaceship and determining the path of an asteroid. I strongly believe that this connection will be effective because it will keep the students interested and engaged throughout the lesson because it is doing something out of the ordinary and relating it to something that they like.

### **Basketball**

Sitting in a desk working on math problems out of your textbook can be dull and boring. This is why I believe this topic and lesson will be very effective. A math basketball game will allow your students to be active and have fun while learning. In this activity you will divide the class into groups of five and head outside or to gym. Each student will have to calculate their shooting percentage. Once outside or in school gym each student will shoot the basketball a number of times assigned from a specific location. Each student will record the number of shots they made. Once everyone has made their shots we will go back into classroom and calculate averages, ratios, decimals, and percentages.

### ..... Baseball and Math

In this paper, I connected baseball to finding batting averages and percentages. I gave the "students" some statistics of the Texas Rangers and had them compute their batting averages. I gave them a players total number of at bats and the number of actual times on base, then they would have to compute the average. Also, I gave them the batting average and the total number of at bats then had them tell me how many times they actually got to base.

### Ferris Wheels and Math

In this paper, I connected a Ferris wheel to the unit circle. I showed the students little tricks to help learn the unit circle using the Ferris wheel structure. Also, I taught the class sine, cosine, and tangent by using the unit circle. I found a pretty cool website that also helps demonstrate this connection that would be good to show the students who struggle to visually see this connection.

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Cultural Activity 1: This activity shows the relationship between trigonometric ratios and hiking. Different lengths of a mountain can be determined by using these ratios. Given a certain rate, amount of altitude covered can also be determined in a set amount of time. The ratios used in the two examples provided are the following:

$$\cos(\theta) = \text{adjacent/hypotenuse}$$

$$\sin(\theta) = \text{opposite/hypotenuse}$$

Cultural Activity 2: This project relates probability and card games. Students can determine probability of picking a certain card from a standard deck of cards. They will also be able to distinguish between dependent and independent events, as well as hypothetical and theoretical probability by selecting cards from a deck. This is a good introduction to probability using cards, and students can later learn more advanced probability, such as probability of selecting four of a kind or a flush.

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Brief Description of Project

My first project starts off with the concepts of probability and statistics. It includes the brief history of probability and statistics. It has the information about the contributions of scientists and mathematicians in developing probability and statistics. I also demonstrate the important application of probability and statistics in daily life. The project shows the connections of probability in weather forecasting with mathematics. It mentions how meteorologist uses the mathematical formula of probability to calculate the likelihood how weather will be. Then I talk about the important of probability in daily life such as application in medical field, social and nature science, financial world, politics, and law. Next, I introduce the topic of probability to students by asking students to make guess about what probability of two people share a birthday. After the explanation of concepts and application of probability, I give two problems that involve counting probability aspects for students to solve. Finally, I give the opinion about the advantages and disadvantages of the connections of my topic into classroom.

The second project indicates the Pythagorean Theorem. I start off project with the concept and history of Pythagorean Theorem. I also talk about brief background of baseball diamond. Next, the reason I choose baseball to talk about the Pythagorean Theorem because it is a practical example and interesting sport that may attract more attention from students. In addition, I also show the connections between baseball and Pythagorean as the baseman want to know how far he has to throw the ball from the first base to third base. The baseball diamond is 90 feet square so the baseman will calculate the distance from first base to third base by applying Pythagorean Theorem. Then I demonstrate the applications of Pythagorean Theorem in real life. It is used in architecture world, building construction, navigation areas, earthquake location, crime scene investigation, and missile trajectory. I give two example of Pythagorean Theorem in real world problems with the answers. Finally, I have opinion about the advantages and disadvantages of my connection in this project.

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My first activity involves basketball and arc length. I created a problem where the student will have to solve for arc length according to the three point line. The student will have to choose whichever player to pass to by calculating the distance of the arc to determine who is the shorter distance. The second activity consisted of battleship and probability. I created a problem to find the statistics of how often a ship would be hit if placed on the four corners of the game board. This activity relates to the math used to cheat at the game and now it is considered strategic rather than luck.

My report describes the projectile motion of a punted football and how the it is velocity is considered two dimensional motion throughout its course on a curve which is mathematically named parabola which is quadratic equation.

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Using baseball statistics is great wait to illustrate fraction to decimal conversion. If a batter goes 2 for 4 in a game, he is said the be batting .500 or 2/4. Simply take the total number of hits and divided by the total number of at bats (AB) to reach the batting percentage. This could be done on a game by game basis, for an individual player or for an entire team.

Using billiards is a great representation to illustrate angles. Often a player will have to bank a shot off of the railing to make a ball blocked by the opponent's ball. Assume that the ball will come off the rail at the exact same angle as it was struck, just in opposite direction. Eliminate side spin or English to account for this. Also, use the diamond system on a billiards table to help with the visualization of the angles necessary to make certain shots.

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Cooking was a topic that I chose to relate it to dividing fractions. All of the recipes use fractions for measurements so it would be a good idea to tie cooking and fractions together. Also, conversions can also be introduced with cooking. For example, if the recipe says you need two tablespoons of a certain ingredient, but you only have a teaspoon, you need to be able to convert teaspoons to tablespoons. Cooking is a great way to introduce math because it involves food, which catches their attention especially when they are hungry.

I used credit cards to introduce the compound interest rate formula. Many students are looking forward to obtain a credit card so they need to know how interest rates work. Also, one could possibly introduce positive and negative numbers. The bank that is lending the money will have a negative amount. If you are the person who is receiving the money you have a positive amount. Credit cards could interest the students because they will need one in the future, especially when they are trying to purchase expensive objects such as a house, car, or phone (etc.).

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With pool, teachers are able to teach geometry to students by using the measurement of the angles and sides. We can use an actual pool table to help the students visualize the pool table and see the different dimensions of the balls and pockets. With the knowledge of geometry, a student can learn about the angle they would need to shoot at and how far the ball is from the cue ball.

With origami, the teacher can teach about the properties of the different shapes and angles that are within the shape. In order to do this, the teacher can provide steps to do a certain type of origami and ask the students to describe the shape changes and properties every time they do a new step until they reach their final outcome.

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**Topic 1:** Prom is an important, but costly experience many teenagers want to participate in. Girls need to buy that perfect dress for this special event, but prom dresses can be very expensive. One way to save money is to not only look for dress sales, but to calculate exactly how much a desired dress would cost after the sale discount. A higher percentage number does not necessarily mean that dress will be the cheapest though.

**Topic 2:** Graduation is an important goal for students, but graduation doesn't happen without a GPA. Keeping up with one's GPA is vital for success and calculating GPA can motivate a student to challenge himself to work harder and do better in school. GPA traditionally is on a 4.0 scale, and depending on what a student's average is, they can calculate their own GPA whenever they need to for motivation or to check their progress toward a GPA goal.

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The first part of my project is using the pythagorean theorem during the sport of volleyball. It is able to be used in the case of having two players verses each other and if one wanted to keep the other player from scoring by spiking the ball. Students will learn that the pythagorean theorem is easiest used in this sport. One leg is the length of space between the players, the other leg is the length of how high the offensive player jumps in order to spike the ball, and the hypotenuse is the length of the ball being spiked from the offensive player to the defensive player on the other side of the net. There is some negatives to this because obviously players cannot just stop playing a game in order to solve this equation, so the pythagorean theorem in volleyball can be used in a practice to try and learn how to estimate the equation to a more familiar level to be used during games. It is extremely easy to learn and definitely helps out whenever trying to figure out how to win a volleyball game by deflecting spikes by offensive players.

The second part of my project is using a cosine graph in a simple song, "Deck the Halls". For this part, I have found specific parts of the song that could occupy one full period of a cosine graph by using the notes. I will need to make up numbers for the amplitude and period in order to show my example, but it will make a better understand to students of how it resembles a cosine graph.

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I decided to graph parabolic functions and use matrices to solve systems of equations. I made the connections to sports so the majority of students would have a good understanding of what is going on in the problem as they relate prior knowledge to something new. I made a connection of basketball and using matrices by making up a newspaper article that is ripped and missing the second half of the story that has "important" information about how Dirk (The Fadeaway Fueher) Nowitzki dominated the Spurs. Then I ask the students to find out how many free throws, 2-pt shots, and 3-pt shots that dirk made in his make believe heroic come from behind victory, topped off with an unnecessary Technical foul just because he could. I also ask the students to find the important information from the article that they need to solve the problem, and cross out all the extra stats and information. For the parabolic calculations I used baseball, making a comparison of two home runs under the exact same conditions hit by Barry Bonds 10 years apart.

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My first cultural event is soccer, or better known around the world as futbol. Since we live in Texas, we have many citizens who have a Hispanic background. I plan to use soccer to help students with their trigonometry functions like tangent, cosine, and sine. Giving my students a scenario with two given sides or a side and an angle the students can find how far their teammates are or on what angle to pass the ball so that their teammate can get the ball without stopping or going backwards. Hopefully my students would enjoy that I placed a favorite sport into my lesson.

The second event is baking. My mother bakes a lot of different snacks from brownies cheesecake, so I can tell her that I am dedicating a lesson to her. I would compare baking with composition of functions, mainly the domain of the composite function. The point is if given bad ingredients, a domain that does not work inside the first function, the final product would not taste good, the new domain would not work.