Algebrawl: The Winner Is Not Always the Best

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Content Objectives

Overview

Algebrawl: The Winner Is Not Always The Best, is seeking to provide Algebra I students with a concrete picture of how math is and can be used in the real world. This unit will connect the concepts of systems of linear equations (systems) with "real world" applications. The unit is recommended for those students in an eighth grade or higher Algebra I class. For year-long Algebra I courses, it is recommended to be used during the second half of the year when systems are taught or after systems have already been taught. The curriculum unit will focus on student created teams and their records after playing one another. There is a little twist. Students must "play" one another using various math problems as the "game". More detail will follow throughout the unit.

Rationale

From the first day of teaching I heard the question "Why do I have to take Algebra I?" I have been searching myself for the answer to that question. Math was my favorite subject so I never questioned why. I do understand at this stage in life why students would question this class. Although I have yet to come up with a concrete answer, I am learning from my current CTI seminar, Math Through Pop Culture led by Tim Chartier, that many daily applications and daily occurrences involve math. Many of those applications/occurrences involve Algebra skills or can be shortened by using Algebra. I was floored when we reviewed the sports ranking and realized how elementary it was to compute each ranking. If students, especially sports enthusiasts, realize this concept, they may begin to enter a "team version" of fantasy football or try to predict the outcome of the NFL season. Bragging rights would be on the line because as a student(s) accurately picks the correct team, all eyes will be on them as to how they were able to accomplish that feat. If this continues, that student(s) will be uncontrollable in bragging rights.

Background

Algebra I teachers have been tasked with teaching students the concept of setting up and solving systems of linear equations and inequalities. The North Carolina Standard Course of Study (NCSCOS) standard 4.03 states: Use systems of linear equations or inequalities in two variables to model and solve problems. The High School: Algebra Common Core Standards associated with this topic are A-CED 3 (Creating Equations), A-REI 3, 5, and 6 (Reasoning With Equations and Inequalities). Three methods are taught to the students. I typically start with graphing to solve the system. I make the students graph by hand to allow them to see how the two lines relate and we discuss what the answer means. I then move to solving by substitution. I remind the students that they already know how to solve this type of problem because we would have studied substitution earlier in the year. When I relate new topics back to previous ones, they seem to make the connection. From substitution we move to elimination. This tends to be a more difficult method for the students but when the concept sinks in, they are ready to run with it.

Students typically perform well on this standard. After learning the process of transforming "words" into algebraic equations, students enjoy system problems because they feel accomplished. This section also lends itself to explore how math is used in the "real-world". I try to drown the students in word problems because this section lends itself so well to tackling word problems. We typically deal with problems that involve having a piggy bank or a jar full of coins. Information is given in various ways but students are typically asked to find how many of each type of coin they have. I may extend the question to ask how much money will they have with each type of coin. Teaching the students to understand that a solution written in the form of money must have parts that are in the form of money. For example, if I have 10 coins made up of quarters and dimes and the total amount that I have is $1.60, I must have a dollar amount + a dollar amount to equal $1.60 ($.25x + .1y = 1.6$). Once the students understand the concept of multiplying the value times the quantity, they are often ready to tackle more difficult problems because they know they must think about what they are given and to check to see if their equation makes sense.

Population

I am currently a regular education teacher teaching Foundations of Algebra I/Algebra I in an inclusion setting. I do have a co-teacher who is the exceptional education teacher. This is my thirteenth year teaching with Charlotte-Mecklenburg School District (CMS). All thirteen years have been with West Charlotte High School (WCHS). Over the thirteen years, I have seen WCHS transform into a neighborhood school that accepts students with unlimited boundaries, when compared to other CMS schools. Using the 2009-2010 school's Progress Report, our school is 84.3% African-American with a high number of students receiving exceptional children (EC) services, 19 of 115 teachers are in the exceptional children's department. 78.4% of students are classified as Economically Disadvantaged Students. Using the same data year, 72% of students were at or above grade level on the composite EOC scores. 67.4% of students made or exceeded a year's worth of growth.

Beginning with the 2011-2012 school year, WCHS became a Title I school. There are 96 students that are assigned to my class this current semester, as of September 28, 2011. Of that, 88.5% are African-American and 57.3% are male. Seven to ten of the students are coded as McKinney-Vento (MCV), which is the designation of a homeless student. 20% (19) of the students have received out of school suspensions totaling 56 absences. Of these 19 students, 12 are students with disabilities. Many of the students have an excessive number of absences that are not related to suspensions. Even with so many disadvantaged students and students with a high number of suspensions, each student is expected to take and pass both the Algebra I course and the EOC.

Teaching Strategies

Foundational Information

Systems of linear equations can be a fun section to teach, in my opinion. It lends itself to include many word problems and "real life" situations. My students typically perform above average in this section. Once the concepts are taught by hand, the students are taught how to use the graphing calculator to solve the system. Teenagers quickly learn how to manipulate the calculator and find the answer. They enjoy the shortcut, using the calculator, instead of working the problems by hand and "using up too much paper" and "doing too many steps".

On the first day of the section the students are shown an overview of "systems land". The overview will include the three methods that will be taught and possibly key information for each method. The overview can be filled in as each method is presented later. The methods are taught in the order of graphing, substitution, and finally combination/elimination (broken up into 2 sections). The entire unit could last 10-15 school days depending on the level of student and how fast they grasp the concept. Each method is given approximately 2 days to teach and practice. Another 2-4 days are devoted to setting up and solving word problems.

Graphing

A system of linear equations is defined as having two or more equations. A solution of the system is an ordered pair, in the form (x , y), that makes both equations true. In Algebra I, we only work with two linear equations.

Days 1 – 3

On day 1 we begin with a warm up that will prepare the students for the instruction that is to come. Solving literal equations would have been taught in a previous quarter or semester. This warm up serves as a reminder for students on how to solve for "y" when two variables are given in one equation. I would choose equations of varying levels for students, easy, medium, and difficult. A typical warm up would be:

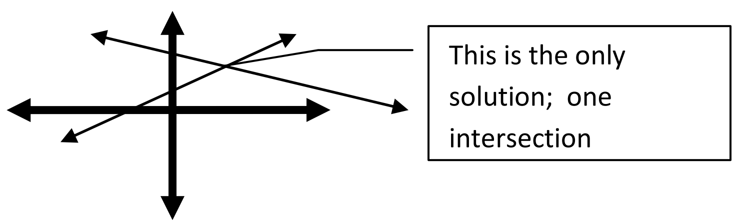
Solve the following equations for y.

1. $2x + 4y = -8$
2. $y + 5 = -2(x - 2)$
3. $10x + 5y = 80$
4. $3x + y = 10$

From there, we would begin to discuss key vocabulary words, which include the terms: consistent, independent, dependent, and inconsistent. Each term is introduced with a picture and key ideas to remember.

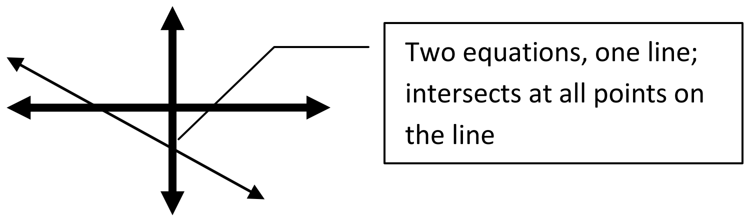
An important part of linear systems is when a system is **consistent**. Such a system has at least one solution. A consistent system with only one solution, (x,y), is called **independent**. We see such a system below. In our systems, rather than being given a picture of a line, we will be given the equations. When the two equations result in two lines that intersect at one point, the system is independent. This is the type of system that many students expect to solve. We will see that systems can also lead to no solution and many solutions, in fact, infinitely many.

Consistent- a system with at least one solution
Independent- a consistent system with only one solution, (x,y)



Let's consider infinitely many solutions. What would this mean? Remember, the intersection point in the picture above is the solution to the linear system. Since we intersect at one point, there is only one solution. If there are infinitely many solutions, then how many intersection points must there be? What does that mean about the two lines? Such questions can help deepen the understanding of the topics but can also be challenging. Even if not answered correctly, struggling with the question can help a student appreciate and understand the resulting picture. A system that has infinitely many solutions is said to be **dependent**. I tell my students that each line is "dependent" on the other to have solutions. Since there are infinitely many points on a line, two equations share all points on the line. Since there is at least one solution, it is also said to be **consistent**.

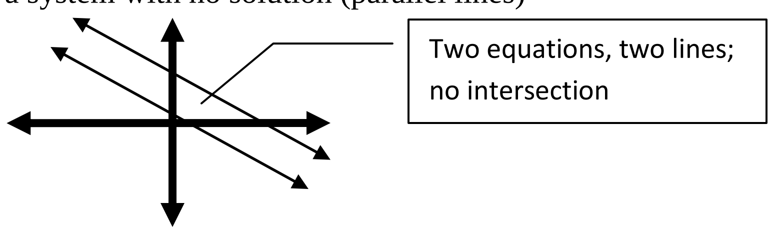
Dependent- a consistent system with infinitely many solutions (same line)



Clearly, if two lines have the same equation then they are the same line. For example, 2x + y = 5 and 2x + y =5 would result in infinitely many solutions since all we have done is written the same line twice. It can be helpful to note that sometimes the equations do not initially look exactly the same and we have to use math to discover what is what! An example of using discovery techniques would be the above system given in the format of: 2x + y = 5 and y = -2x +5 or even 2x + y = 5 and 4x + 2y = 10.

After discussing dependent systems, there is one more type to discuss. We have seen that one intersection point leads to one solution of a system. We have seen that if two lines intersect everywhere then they have an infinite number of intersections. This means there are an infinite number of intersection points. How many intersection points would there be for no solutions? Add a line to the picture above so we would have no solutions. How would you know they would never intersect? When could this happen? Again, this can be difficult to answer but struggling with such questions can deepen one's appreciation for the solution. If lines are parallel, remember they "fall/rise" at the same rate and will never touch/cross. Their slopes are the same and there is no intersection of the lines. This type of system is said to be **inconsistent**.

Inconsistent- a system with no solution (parallel lines)



As a class we would look at the following picture with several lines graphed and equations identified on each line. Systems would be given to the students and they would be asked to use their vocabulary words (consistent, inconsistent, dependent, and independent) to identify the systems. It has proven to be useful over the years to have students trace over each line with a different colored pencil. This will help the visual students to see each individual line and not just a group of lines. Below are a few systems that would be given to the students based on the graph below.

Identify the following systems:

A. y = 6x + 2
   y = -5x + 6

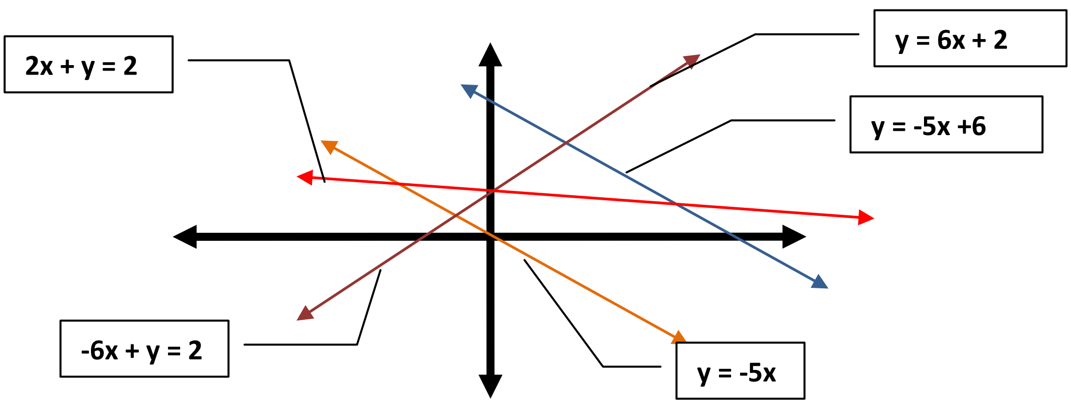
B. y = -5x
   y = -5x + 6

C. -6x + y = 2
   y = 6x + 2

D. 2x + y = 2
   -6x + y = 2

E. y = -5x
   y = 6x + 2

F. 2x + y = 2
   y = -5x +6



Students at this point would have been taught how to graph a line using a table, x and y intercepts, slope and y-intercept, and using the table in the calculator. If given the system y = 2x + 2 and 4x – 2y = 10, I would encourage the students to graph the first equation using slope and y-intercept since the equation is in slope-intercept form, y = mx + b. With slope being positive 2, coefficient of x, and y-intercept being positive 2, I would remind students that we must graph the y-intercept first and that we would be on the y-axis, hence the term y-intercept. From there, I would turn the slope into a fraction, $\frac{\mathbf{2}(y)}{\mathbf{1}(x)}$ and label the y and x components. Starting at the y-intercept, we would move up 2 units and then right 1 unit based on the signs (if y is positive move up, negative move down; if x is positive move right, negative move left) to find our second point. Continue that pattern until there are at least 3 points on the graph. If we were limited in space and needed to extend the line, I would remind students that we could adjust the slope and graph a different part of the line by making it $\frac{-\mathbf{2}(y)}{-\mathbf{1}(x)}$. This change would require us to reverse our direction and move down 2 units and left 2 units. For the second equation, I would suggest that the students use the intercepts or the table depending on their comfort level. If using the intercepts, they would need to set the variable they are not looking for to 0 and solve for the remaining variable. For example, consider 4x – 2y = 10.

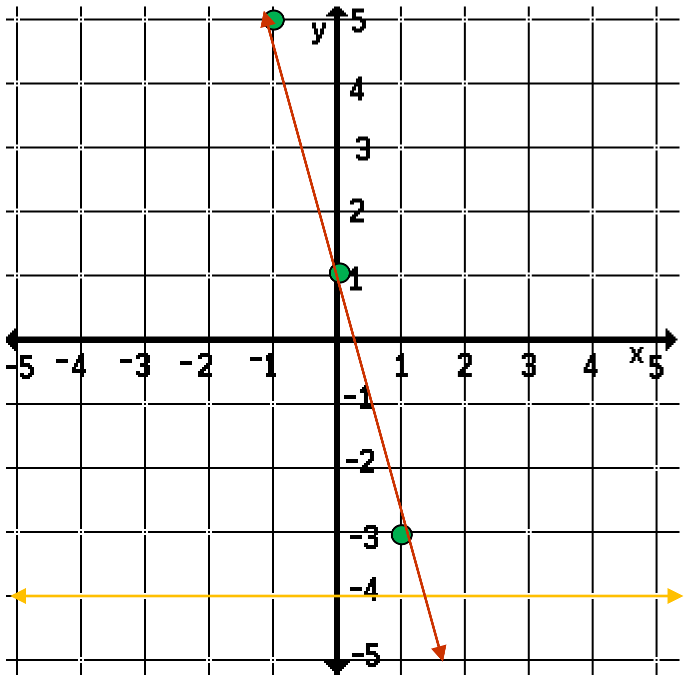
To find x-intercept, set y equal to 0: 4x – 2(0) = 10 and solve for x; **To find y-intercept**, set x equal to 0: 4(0) – 2y = 10 and solve for y. The x-intercept would be in the form (#, 0) and the y-intercept would be in the form (0, #). The # would come from the solution of the equation that the students would have solved for.

If using the table of values, the set up would look like:

X	4x – 2y = 10	Y	(X,Y)
0	4(0) – 2y = 10	-5	(0, -5)
1	4(1) – 2y = 10	-3	(1, -3)
2	4(2) – 2y = 10	-1	(2, -1)
-2	4(-2) – 2y = 10	-9	(-2, -9)

Students would use the last column to graph the points on their paper.

Students would be reminded of the steps for using the table in the calculator. They must remember that in order to enter an equation, the equation(s) must be solved for y. I have a trusted worksheet that I use yearly with eight mini graphs on each side. Each graph has one system in which to graph on the given coordinate plane. I would walk the students through graphing the systems on a duplicate copy on the overhead. They would be given at least two colored pencils so that they could draw each line in a different color. This will allow the students to see each line separately. Our first step together would be to solve all equations for y. Our second step would be to identify the slope and y-intercept of each equation. Our third step would be to identify the direction of the graph based on the slope (rising or falling left to right including zero and undefined slope). Our fourth step would be to graph each system together, one system per graph, using the slope and y-intercept. Some students will move ahead and use the calculator to find points to graph. Once we complete one side, I will allow the students to complete the second side independently. They can use any form that they wish to use when graphing the systems, i.e. table in the calculator, slope and y-intercept, intercepts, etc. An example of one system that we would work together would be y = -4 and 4x + y = 1.



Days 2 – 3 would involve finishing day one's lesson if needed and teaching the students to find the intersection on the calculator and setting up word problems. We would again review how to enter the equations in the calculator. I would teach them how to use the calculate intersection function on the calculator (2^{nd} and trace buttons then option 5 calculate). The students always ask "Why didn't we do this to begin with?" If time permits, we begin to set up word problems that can be solved easily by graphing. An example of a word problem would be: An office building has two elevators. One elevator starts out on the 4th floor, 35 feet above the ground, and is descending at a rate of 2.2 feet per second. The other elevator starts out at ground level and is rising at a rate of 1.7 feet per second. Write a system of equations to represent the situation. When will the two elevators be the same distance above the ground?

Substitution

Days 4 – 7

Substitution is the second method taught. Discussion is held around substituting for a variable, a concept learned earlier in the year, through warm ups that will prepare for the lesson. Easier substitution problems are given initially and then gradually they increase in difficulty. I prepare guided notes for the students to use so that the flow of class will be smooth. They would have to complete the steps for solving by substitution. With every problem initially, I review the steps as we work. The steps would be:

1. Solve one of the equations for one of the variables. Always look to see if a variable is already solved for. If not, solve for the variable with a coefficient of one or negative one.
2. Substitute the value found in step 1 into the other equation. Solve for the variable; they should be the same variable at this point.
3. Take the value from step 2 and substitute it into the final equation from step 1. Solve for the other variable.
4. Write your answer as an ordered pair (x,y). There are two exceptions in this step. If your variables cancel out and the equation that you have left is a true statement, your answer is infinitely many solutions (consistent, dependent). If your variables cancel out and the equation that you have left is a false statement, your answer is no solution (inconsistent).

In day 4 we would solve systems similar to the following (one variables already solved for):

$y = 3x$	$x + y = 8$	$y = 6x$	$x = 9$
$x + y = -32$	$y = 3x$	$y = x + 5$	$y = -x + 9$

As students begin to feel comfortable with solving the above systems, we move to the next level of difficulty with problems similar to (one equation is solved for an expression instead of a monomial):

$3y + 4x + 14$	$6y + 5x = 8$	$y = 8 – x$	$x + 3 = y$
$y = 2x – 3$	$x = -3y – 7$	$7 = 2 – y$	$3x + 4y = 7$

The final problem type that would be presented would be systems similar to the following (one equation has to be solved for one of the variables):

$x + y = 60$	$2y + x = 4$	$-2x + y = -1$	$2.5x – 7y = 7.5$
$5x + 3y = 220$	$3.5x + 7y = 14$	$4x + 2y = 12$	$6x – y = 1$

This section could span for days 4 – 6 depending on the students and how comfortable they are with moving forward to the next difficulty level. Checks for understanding will be given at various points to ensure that all students are grasping the information and that no one has been left behind as we move forward. In days 6 and 7, word problems would be introduced, again similar to the type of problems just learned. Word problems typically deal with combinations of two food items purchased or two types of tickets purchased. Sample word problems would be:

> Adult tickets to a play cost $22. Tickets for children cost $15. Tickets for a group of 11 people cost a total of $228. Write and solve a system of equations to find how many children and how many adults were in the group.

> Suppose you bought a cheeseburger and a small fry for $3.15. Brandon bought 2 cheeseburgers and 2 small fries for $6.30. What is the cost of each item?

As a class we would discuss what information was missing from each set of word problems. I would remind the students that we must have two unknowns in order to have a system of equations. I typically point out that the unknowns may be found in the question that is asked…how many children/adults were in the group (problem 1)…what is the cost of each item (problem 2). Most of the word problems are parallel so as they pick up on the first equation, they are able to set up the second problem with ease. As more word problems are given, the students begin to identify the unknowns easier and are able to create the equations with less adult input. As a teacher, it is a delight to see students succeed at this level of word problems.

Elimination

Days 8 – 13

The third and final method to be taught is combination/elimination. I referred to this method as elimination but some textbooks refer to it as combination. In preparation for this section, I have the students review combining integers, standard form of an equation, Ax + By = C, operations with fractions, and the distributive property. This method in particular is most difficult for the students. At the end of learning this section, students are rewarded once again by being allowed to use the calculator to solve for the solution. Steps on solving are given so that students have a guide in which to use in and out of class. On the first day, we look at systems that have at least one variable with the same coefficient. We discuss how to make them opposite and then move into multiplying one or both equations to create opposite coefficients of the same variable. Steps for solving elimination systems are:

1. Both equations should be in standard form.
2. Determine which variable you would like to eliminate. Hint: look for a variable with a coefficient of 1 or -1 and if a variable already has the same coefficient.
3. If a variable has the same coefficient, multiply one equation by -1. If not, create opposite coefficients for one of the variables by multiply one or both of the equations by a number to create opposites.
4. "Combine" the two equations; one variable should be eliminated. Solve for the other variable.
5. Substitute the value from step 4 into either of the original equations and solve for the other variable.
6. Write your answer as an ordered pair, no solution, or infinitely many solutions.

Examples of the different types of systems would include:

$2x + 5y = 17$	$3x + 3y = -9$	$3x - 2y = 1$	$4x + 3y = -19$
$6x - 5y = -9$	$3x - 4y = 5$	$8x + 3y = 2$	$3x - 2y = -10$

Teachers can use their discretion as to how long to spend on each type of equation. It is possible to spend a day on each type shown above and then move into word problems for the remainder of the time. Students begin to become tired of systems at this point. Many will be frustrated with word problems because they struggle. Continue to show them repetitive problems of the same type. By the fifth one, they will start to catch the pattern and will soar. Finding the number of coins and other world application problems, keep the students' attention. Many times I will work with the students in class to set up the system. Their homework would be to solve the system and explain the answer.

I LOVE this area because FINALLY, math makes sense and there is a real connection to math and the world outside of the class. I sometimes "create" problems for them based on personal experiences from a trip to the store. My typical scenario is "I bought 15 gallons of gas and 2 candy bars for $43.43. My husband bought 18 gallons of gas and 1 candy bar for $51.01. Neither of us could remember how much we paid per gallon nor the cost of the candy bar. Can you help us find the costs of each?" As a ticket out the door exercise, I have students create their own system of equations and write the answer on the back of the paper. The following day, I would either exchange the student papers among the students and have them to set up and solve the system or I would compile the problems onto one sheet and have the students work together to set up and solve the problems.

Classroom Activities

Activity one

In the first activity, students will be able to use a popular sport, football, to practice the concept of systems of equations. A football discussion will be had with the class prior to any "math" work being done. The football scoring guide and description would have to be established. A *touchdown* is made when the team who is in possession of the football crosses into the opposing team's end zone either by running into or catching the ball within the end zone. A touchdown is worth 6 points. Once a touchdown is made, the team has to decide whether to attempt a *1 point or 2 point conversion*. If the decision is to attempt 2 points, the team will line up at the two-yard line and must get the football into the end zone either by a completed pass or a successful run. If they succeed, they will earn 2 points. Many football teams choose to attempt the extra point by kicking the ball. If the ball enters between the yellow upright posts, the team will earn 1 point. If these attempts are not successful, the team would not receive any points.

A team can also earn points by kicking a *field goal*. This is done when the team in possession of the ball decides on fourth down to attempt a kick from the current line of scrimmage. If the ball enters between the two yellow goal posts the team earns 3 points. If they are unsuccessful, they do not earn any points. The final way to earn points in football is through a *safety*. This is achieved when the team on defense tackles the opposing team (team on offense) in their own end zone. This will earn a team 2 points.

Once the basic scoring has been established, we will begin our activity. For example, I would ask the class if the Cowboys had a final score of 39 and the Redskins had a final score of 9, how many touchdowns, 1 or 2 point conversions, field goals and or safeties did each team make? I would allow the students to break off into groups of two to discuss. I would anticipate many different scenarios from the groups. If someone did not holler out "there are a lot of different ways to reach those scores", I would be surprised. I would expect to hear this from the male students more so than from my female students.

In determining the number of touchdowns, PAT, field goals, and safeties, students will have to recall the points associated with each action. Those students who are football fanatics may apply too much logic to their scenarios. For example, a student may rationalize why a team cannot make x number of 1 or 2 point conversions because they are attached to touchdowns. A student, who is less of a football fanatic, may just add up the numbers in order to achieve the final score. They may not have the background knowledge of football to determine what makes sense when putting together scenarios to achieve the right points. When students feel as though they have reached all of the possible scenarios, as a class we will list them on the board and then discuss which ones make sense and which ones would be further from the truth in a real football game. We would also have discussion around what type of game would there be if all the points were scored from field goals and/or safeties. I can imagine how vivid this conversation would become between the students who play football or are diehard fans of the game and those students who may know little about the game, especially some of my female students.

From this activity, I would move to questions that students would be able to answer using systems of equations. For example, if the Cowboys scored 39 points from touchdowns and field goals only and together their touchdowns and field goals totaled 7, how many of each did they score? From this word problem students should be able to set up the system:

$6t + 3f = 39$
$t + f = 7$, where t = the number of touchdowns and f = the number of field goals.

A second example would be that Eagles had a final score of 18 points that consisted of touchdowns and field goals. They scored a combined total of 9 touchdowns and field goals. How many of each did they score? Students should set up the system:

$6t + 3f = 18$
$t + f = 9$, where t = the number of touchdowns and f = the number of field goals.

Notice that both sets of systems have the same left side of the equation. This is because a touchdown, t, will always have 6 points associated with it, and a field goal, f, will always have 3 points associated with it. When setting up systems from word problems, always write out the variable(s), the unknown, and what they stand for. Modeling this setup will show the students that it is very important to know the unknown(s) at all times and that they should put this into practice when setting up their own systems.

I would continue to throw out scenarios like this one but include different point configurations. Once the students get comfortable with setting up and solving these, I will throw a curve ball with three equations. Even though we do not teach systems with 3 equations in Algebra I, there will be at least 1 – 2 students in each class that will attempt to figure the problem out and they will. An example of a three equation system would be: the Panthers scored some number of touchdowns, field goals, and safeties to have a total score of 23. The total number of touchdowns, field goals, and safeties are 6. The number of field goals is equal to the number of safeties and touchdowns. One equation in the system would be written as $6t + 3f + 2s = 23$, where t=touchdowns, f=field goals, and s=safeties. A second equation would be $t + f + s = 6$ and the final equation would be $f = s + t$.

Activity two

Algebrawl, a combination of Algebra and football, is the name of the second activity. Keeping in line with the name football, students will use systems of equations to play football. To review the basics of football, remember that a touchdown is worth 6 points, point after a touchdown is 1 or 2 points, a field goal is worth 3 points, and a safety is worth 2 points. Students will have the opportunity to earn points based on correct answers to problems of their choosing.

Using a class size of 28, students would pair up into 14 teams and create two different divisions, DRB and SAI, under the Algebrawl Football League. Within each division, there would be 7 teams, try to have an even number of total teams if possible even if one team has three members. Each team would play all the other teams in their division only once. The schedule of games would be created by the classroom teacher on a random basis similar to pulling names out of the hat. The students would be allowed to pick their division and to name their team, at the discretion of the teacher. She/he reserves the right to rename or reject any inappropriate team name.

The “regular season” will occur over a 10 – 15 day period. This will allow time for the teacher(s) to check all game scores. How do teams score points one may ask?

Through homework! Yes the dreaded word, HOMEWORK. When teams play one another, they will be given a play sheet for homework, see appendix. The team, which consists of a pair of students, will then have one night in which to complete the plays and return their sheet to the teacher. It will be left up to the team members as to how they would like to complete the homework. Some may decide to copy down the problems and discuss over the phone or FaceBook, others may assign problems for the members to complete individually, and still other team members may arrange to meet and work the problems face to face. All attempted points must have work shown in order to earn the point(s). Teams who do not turn in their play sheet will forfeit their game and earn a loss on their team's record.

The play sheet will contain problems categorized by potential points that a team could earn. The pair of students must correctly answer the problem in order to earn the points that they attempt. For example, under the touchdown category, there may be a word problem that must be set up and solved correctly. A sample problem would be: For a special order, the Hanes Company manufactured 1200 shirts. Sweatshirts were priced at $14 each and T-shirts at $8 each. The company received a total of $11,400 for the shirts. How many of each type of shirt did the Hanes Company manufacture for this order?

The higher the possible points attempted, the more difficult the problem(s). For one and two point possibilities, questions may include review problems of prior concepts (i.e. operations with polynomials, solving one/two/multi-step equations, etc) or easier system problems. Some sample problems could include: a. system of equations---x = 2y and y = x – 2, b. solve an equation---6y – 10 = 15 and -8h = 14, and c. simplify the expression---

$$\left(\frac{-9x^{6}y^{2}z}{5mn^{10}p^{3}}\right)^{3}.$$

Once the "regular season" has ended, the Algebrawl league will enter into playoff games. The playoff will be set up with the same ranking team from each division playing each other. The game will be played just as the "regular season" was played, with homework sheets given to determine the attempted plays and the teacher(s) will determine the earned points/score. After each regular season and playoff game, the teams will be ranked within each division. Ranking will be discussed later. If teams within a division tie in the ranking, the tie(s) will be broken by using the total number of points earned for each team in the regular and the playoff seasons. This will allow all teams to be ranked first, second, and third and avoid having ties. Once the playoff round is complete, the top two teams will compete in the SuperBowl. This game will be played in class where all students will be able to witness the "big game". Select students/teams will be assigned to check the correctness of the answers for the two teams playing.

Deciding how to reward the division winners and SuperBowl champs should be a teacher's discretion. Students' motivation varies by the person, the day, the hour, and the week. Teachers know what motivates their class, as well as their individual students. Some students may enjoy being praised in front of the class whereas another student may prefer to have additional points added to the next quiz/test. Still other students may be motivated by having their winning paper displayed in the classroom/hallway. Teachers use your knowledge and create rewards suitable for your students.

Rating Methods

Massey Method

One of two popular rating methods was developed by Ken Massey. In his undergraduate honors thesis at Bluefield College in Virginia, Massey developed his own rating system. His method is used by the Bowl Championship Series, the organization which determines which teams play in which bowl games. This rating system focuses more on past performances than on predicting future outcomes. Outside game influences can be factored in such as home field advantage.

Colley Method

The Colley Method was developed by Wesley Colley. His method is also used by the Bowl Championship Series. His method was created out of the problems he saw with the prior method of rating which was dependent on winning percentage. Many tried and true brackets have been tested using the Colley Method. As March Madness gears up for 2012, many individuals will use the Colley Method to create/predict the outcome of brackets. (See bibliography below for further explanation on the method and a simplified version of how ratings are computer). For my class ratings, we will set up a rating system by division and will use technology (Excel) to compute the systems of equations.

Resources

Alder, James. "Methods of Scoring in Football." About.com. http://football.about.com/od/football101/a/football101scor.htm (accessed November 27, 2011).

This website contained wonderful information about scoring in football and could be considered “football scoring 101”. A detailed explanation was given for each scoring opportunity.

Chartier, Tim. "Math Movement - Giving the NFL a rating." Davidson College Forum. http://forum.davidson.edu/mathmovement/2011/05/19/nfl-ratings/ (accessed November 25, 2011).

The Colley method is explained with a very elementary example. It walks one through setting up a matrix based on the number of times teams play one another and on their win/loss record. The matrix then leads to the ranking of the teams involved.

Chartier, Tim , Erich Kreutzer Kreutzer, Amy Langville, and Kathryn Pedings. "Bracketology: How can math help?." MathAware.org. http://mathaware.org/mam/2010/essays/ChartierBracketology.pdf (accessed September 28, 2011).

The math/sports enthusiast will enjoy this website. Detailed explanations are given for calculating both the Colley and Massey methods. Explanation is also given for variations to the “traditional” methods which take into consideration outside factors such as games played in the middle and end of the season carrying more of a weighted average versus games played at the beginning of the season.

"My Reports." CMS Teacher Portal. http://mfp.cms.k12.nc.us/Teacher/Pages/MyReport.aspx?UserDynamicFilterType=InstructionalGroup&UserDynamicFilter=&Session=5agcqr45eaezaf55ix1gzpaf&rex1_ComponentReportID=1091 (accessed September 28, 2011).

Informative information concerning students is found in the CMS Teacher Portal. Teachers have access to student suspensions, failing courses, past standardized test scores/levels, students risks etc. It is a very centrally located concise database for teachers to use to research and learn the history of their students.

"School Progress Report 2009-2010." West Charlotte High. http://www.cms.k12.nc.us/cmsdepartments/CIO/accountability/spr/Progress%20Reports/2009-2010/SPR_WestCharlotte_HS_10.pdf (accessed September 28, 2011).

Every school within CMS is given a progress report at the end of each school year. In the report, one can find a letter from the principal, key facts that include teacher and student demographics, EOC/EOG results etc.

Appendix A: Implementing District Standards

The North Carolina Standard Course of Study (NCSCOS) that will be implemented through Algebrall is standard 4.03: Use systems of linear equations or inequalities in two variables to model and solve problems.

The Algebrall unit will allow students to practice solving systems of equations through three methods: graphing, substitution, and elimination. Throughout the unit, students will be exposed to word problems and will craft their skill in identifying the unknowns, setting up related equations based on information given, solving the system, and analyzing what the solution means in context to the given problem.

Appendix B: Sample Play Sheet

1 or 2 point after touchdown conversions

1. Solve the system
   x + y = 3
   x – y = 1

2. Solve the proportion
   $$\frac{x}{\mathbf{18}} = \frac{\mathbf{2}}{\mathbf{9}}$$

3. State the slope of the line containing the points (3,4) and (-2,3).

Safety (2 points)

1. Write an equation in standard form given m = 4 and b = 1.

2. Solve the system
   x – 5 = y
   2x – 3y = -3

3. Solve the system
   5x + 2y = -8
   3x – 2y = -8

Field goal (3 points)

1. The sum of two numbers is 18 and their difference is 12. Find each of the numbers.

2. Solve the system
   3x + 2y = 19
   4x – 5y = 10

3. 7x – 6y = 12
   4x + 3y = -6

Touchdown (6 points)

1. The sum of two numbers is 8 less than twice the first number. Their difference is 4 less than twice the second number. Find each of the numbers.

2. A movie theater charges $7 for an adult's ticket and $4.50 for a child's ticket. On a recent night, the sale of child's tickets was three times the sale of adult's tickets.

If the total amount collected for ticket sales was $2009, how many adults purchased tickets?

3. The length of a rectangular poster is 10 inches longer than the width. If the perimeter of the poster is 124 inches, what is the width?