

# A Teaching Practicum in Secondary Education: Mathematics

An Interdisciplinary Quality Project  
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## Abstract

This paper discusses the preparation, experience, and reflection of Student Teaching at Worcester North High School during the fall semester of 2013. It is prepared to fulfill the requirements of the Massachusetts Department of Education teacher licensing requirements as well as Worcester Polytechnic Institute's Interactive Qualifying Project.

The paper begins with demographics of the school, and follows through the concepts of professional teaching standards. It ends with a picture of the classroom, who the students were, and what they were like.

## Chapter 1: Background and Demographics

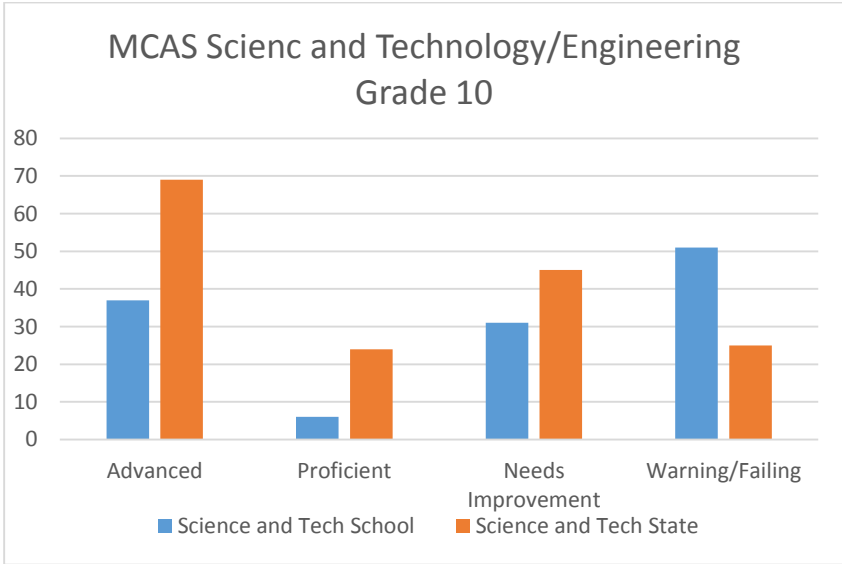
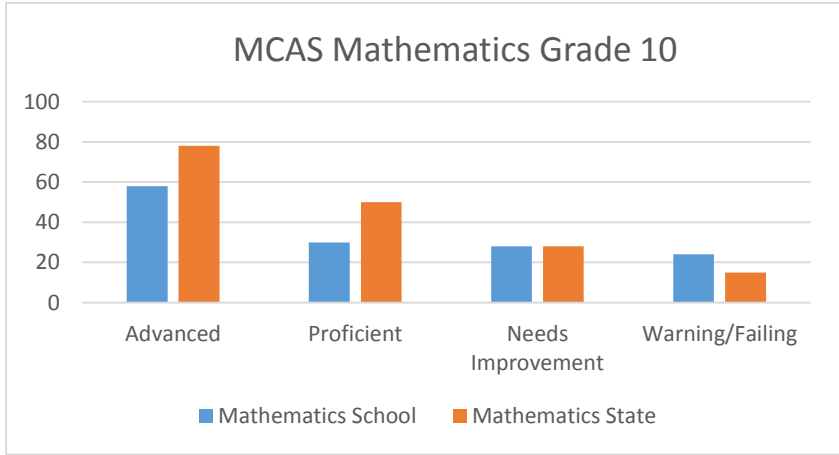
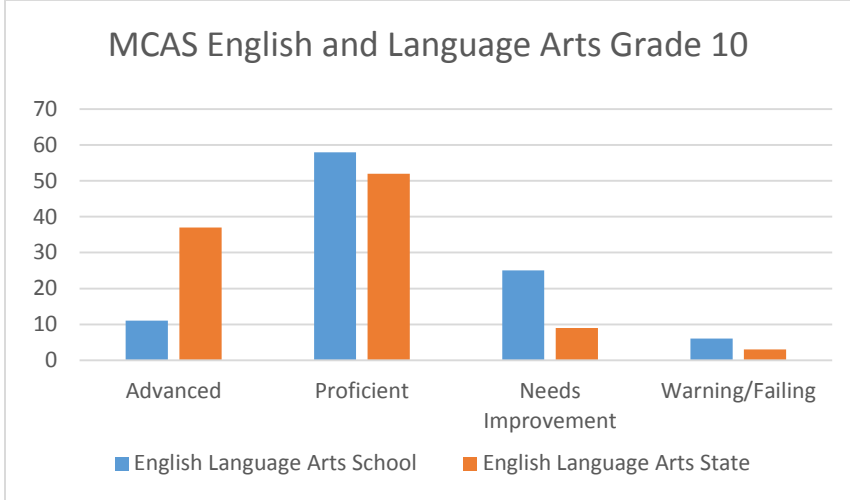
Massachusetts education has turned around rapidly since 1993. The state has risen to the second best state in the country. Massachusetts Education Reform Act (MERA) was designed to give more money to urban schools, ambitious academic standards, and a state-wide test to pass before receiving a diploma. This test now requires students to learn algebra by eighth grade.

Before MERA standards were created you could graduate without knowing algebra.

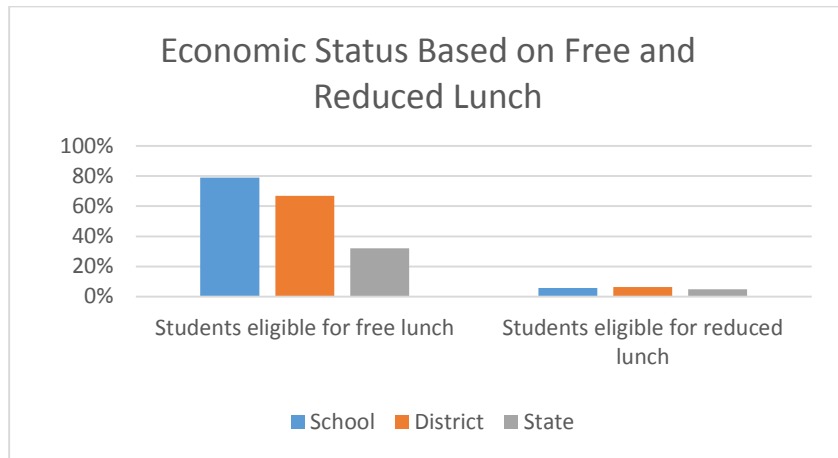
The state test, Massachusetts Comprehensive Assessment System (MCAS) was administered for 5 years before it became mandatory for graduation in 2003. In many urban areas in Massachusetts, the learning curve isn't necessarily how to complete a math problem. It is focused on how to interpret the problem. Word problems that ask the same question different ways confuse English Language Learners and native English speakers alike.

TIMSS, Trends in International Mathematical and Science Study. It is a test used to determine how different nations compare to each other on their ability in mathematics and science. The test is administered to fourth grade and eighth grade students. Based off 24/7 Wall St, an analysis and commentary website, Massachusetts ranks second in the nation for education. This is based off a high graduation rate. The assessment tests taken by fourth and eighth graders in 2011 returned with proficient scores for more than half the students. The only state in the nation that can claim this.

North High School in Worcester, MA is an urban school in Massachusetts. This school differs from the averages of the state in ethnicity, economic status, and performance on MCAS. The graphs below show North High in comparison to the State of Massachusetts in MCAS results:

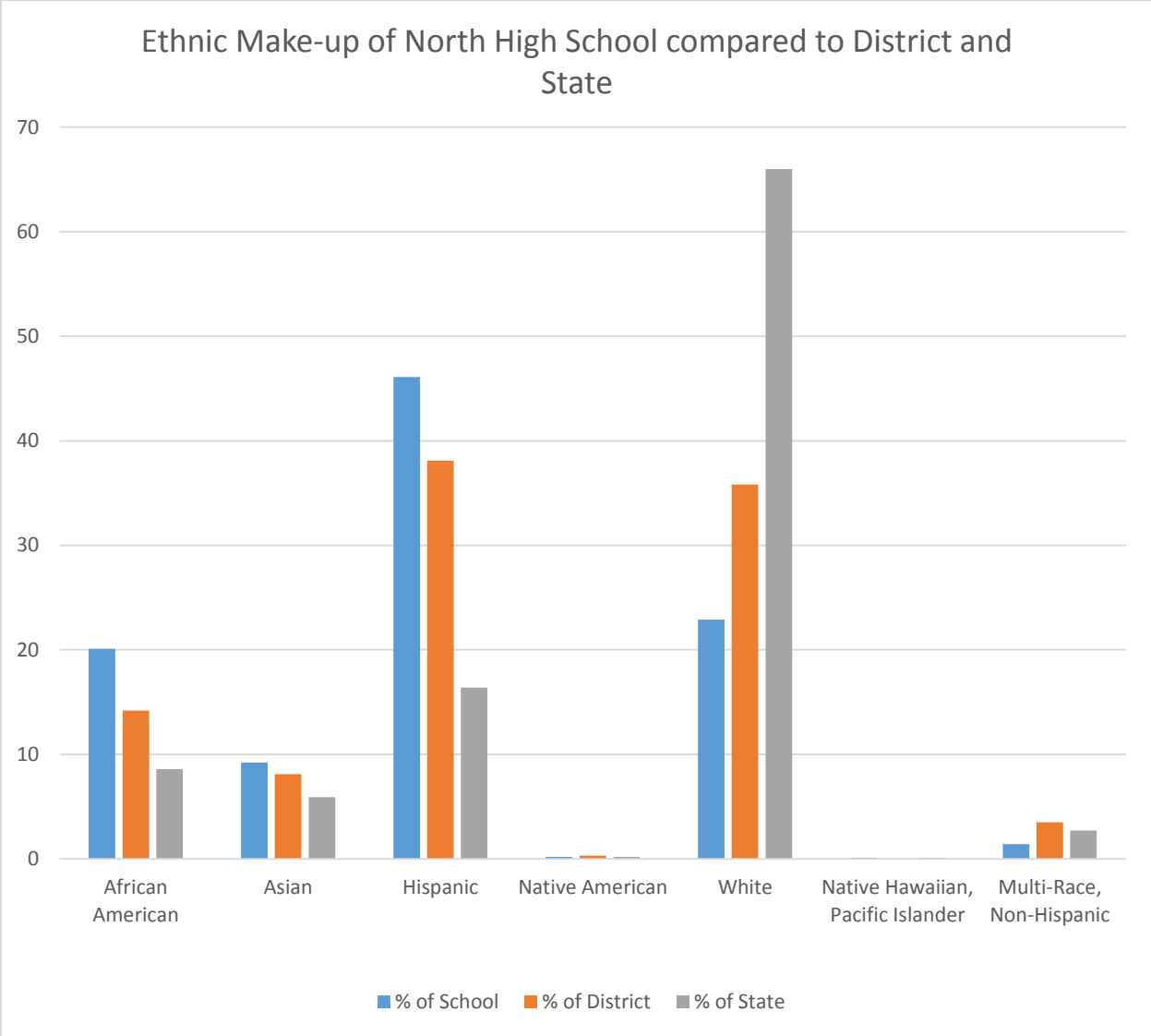


Economic status can be defined by the amount of students on free or reduced lunch plans. If a family of three has an annual income of less than \$36,131 then the children are eligible for a free or reduced lunch. Nearly 85% of North High School is on a free or reduced lunch plan. Compared to the 73% within the district and the 37% in the state.



The ethnicity of North is vastly different from the district, and even more so compared to the state level. This shows extreme diversity in North. The school has several students from Ghana and Kenya that move back and forth between the US and their home country. This urban public school has many students that scored poorly on MCAS, receive free or reduced lunches.





This large amount of diversity leads to a significant English Language Learner (ELL) population in North. An ELL student is defined as a student who is acquiring English and has a first language other than English. A Limited English Person (LEP) normally is considered as having limited language skill for 3.5 years. A Sheltered English Immersion (SEI) student is an ELL student who is in a classroom where his or her native language is spoken. They are slowly immersed into English classrooms, and cultured from bilingual staff.

When MERA was first created, it was designed as a way to bring the curriculum together as a universal set for the state. The Massachusetts Curriculum Frameworks were designed to pull

Massachusetts Education together to one standard. The Common Core was introduced to the Massachusetts Curriculum Frameworks in 2011. It was part of a nationally sponsored program as an incentive for more funding through the “Race to The Top” program. The Common Core was adapted to strengthen the state’s weak areas, and where Massachusetts already was strong, stay strong. The state received \$250 million dollars for this program.

After I started teaching at North High School, teachers told me stories from their time as teachers. Stories that I thought were on the verge of unbelievable.

A teacher told me that she worked part-time as a teacher for remedial MCAS before she became a full-time teacher. She had a class of 15 students who were Juniors and Seniors, ready to drop out of school at a moment’s notice. These students were in her class because they had failed the MCAS exam once, and if they did not pass it again, they would not graduate.

Throughout the course of her time teaching, over half of her students admitted they wanted to drop out. They had work lined up outside of school. They were going to sell drugs on the street. This teacher told me that she was also shocked when the students told her that. She found a way to keep them in school. She convinced the students that they will need to have a mathematics education to be able to successfully perform any job. Even if it is selling drugs on the street.

I learned that gangs have initiated members that are still attending high school. In class one day I made a mistake I’ll never forget. I simply counted to three and held up three fingers. Similar to the common “OK” symbol, but with the back of my hand turned out. The response I received “Whoa Mistuh, you can’t go around throwing up gang signs. If the wrong person walks by the door, you could have a problem.” The “wrong person” is a member of an opposing gang. I don’t know gangs or how they work, but it shocked me.

On October 30th, four fights occurred in school. The building had hallways searched between classes. Halloween was the next night, a known time for gang initiations. Knowing the school and that there are at least four active gangs in Worcester, these fights most likely can be associated with gang violence.

I was also told that there have been MCAS test dates where students have to change rooms because they are known to be in opposing gangs. It was more effort to ensure that students did not approach each other, and cause a scene than to simply move a student to another classroom.

## Chapter 2: Planning Curriculum and Instruction

Curriculum guidelines are provided by the state so that all schools are standardized in the material they cover. The original intention is to ensure that all students are prepared to pass the MCAS testing and are prepared to enter the workforce or attend college upon graduation. I have found that there is a sharp distinction between intentions and reality.

I began observation the first day of school at North High School. From the first day of school I noticed that the majority of the students were not excited about math, let alone Algebra II. Mr. Turner started teaching at the very beginning with these students. The beginning of chapter one of the text book. Negative integers, fractions, decimals, any form of multiplication stumped many students.

The Massachusetts system decided to use something called lattice multiplication at some point along these students' education. The lattice system of multiplication is not bad, it works, however it is time consuming for larger numbers, and uses up much more time on the MCAS, more time than the students have to complete the mathematics section of the exam.

Below is an example of the classic long multiplication on the left, and the lattice system on the right. It is a small detail to multiply without the lattice, but being able to skip the time to draw the graph saves a large amount of time during testing.

$$\begin{array}{r} \overset{1}{2}3 \\ \times 14 \\ \hline \overset{1}{9}2 \\ 23 \\ \hline 322 \end{array}$$

	2	3	
1	02	03	
4	08	12	
	2	2	

$23 \times 14 = 322$

During the first several weeks of the school year we were forced to review Pre-Algebra and Algebra I concepts. Similar to multiplication, students did not know how to correctly perform long division. This effected our plans for following the curriculum framework.

The actual lesson plan that I developed involved “homework quizzes.” I observed Mr. Turner give students these quizzes, and I continued to do so periodically throughout my time teaching. The quiz is closed book, open notebook. The students are instructed to take notes and complete homework in their notebook. The quiz that we give includes four problems, two from the homework, notated by the page number and problem number. The other two problems are written out on the board. If students did not complete their homework, they can only receive a 50% on the quiz. North High School has an interesting policy regarding homework, it is encouraged to assign work, however teachers are not supposed collect and grade it as a homework grade. Without a strong emphasis on homework, it is difficult for teachers to cover all material in good faith and have students retain it.

Lesson plans and effective instruction required determining how to connect with the students. Consistently they did not know basics. The simple arithmetic was holding them back from answering problems correctly. To answer this problem, I reviewed basics with the students and immediately quizzed them on it the next day, December 2, 2013. The quiz is part of Appendix C. It was a simple quiz drawing off of material that should have been covered during earlier years of schooling. It was given to the students to increase their confidence, give them something easy and a good grade, so they will work harder.

## Chapter 3: Delivering Effective Instruction

To ensure comprehension, a teacher needs to know his or her students. How they learn, and what engages them into the class. In elementary and secondary education students are taught, in college and further education students must actively learn. High school and college are radically different, being a good student does not compare to being a good teacher.

Observation started on the first day of school. I was able to see students from their first introduction to Algebra II. I watched how students responded to my mentor and another teacher I observed Period Six. It was similar to my own high school experience. One activity stuck out, unorganized instruction, team work, or individual problem sets turned into off-topic conversations.

I reviewed this problem multiple times throughout my teaching. Trying to determine how best to keep the students engaged. Teachers in general follow many different methods to instruct students. Projects, lecture, experiments, individual problem work, or group work are common methods.

I started integrating into the class by monitoring the students during team work exercises. Two classes stayed relatively focused, the other two did not. I would walk up to students who see me and then quickly say “so which problem was that again?” Trying to cover up the fact they weren’t working on the assigned problems. I began confronting students when they did this. They tried making excuses and backing out of it because they didn’t have a pencil, paper, or a textbook. Three materials required for every class since the beginning of the school year. The fact they did not ask for replacement materials showed their lack of initiative.

When I began teaching, I tried to minimize their time working in groups to minimize conversations. I focused primarily on lecture in the front of the classroom using the board. I

would begin the lecture by introducing the topic verbally explaining how the lesson tied in with previous topics. State an example of how the students might use the lesson topic in the future, and then proceed with the actual lesson.

Theory was kept to a minimum, I would give a generic equation that can be applied to multiple types of problems. This was to keep them interested in solving equations. After they have seen the basic concept, we began examples. We solved multiple examples on the board, breaking down the problem into clear organized steps that can be replicated. Students were encouraged to assist with arithmetic along the way through the problem. Students are then asked to solve a problem on their own. Once complete, a student shows the answer on the board, and explains the process to the rest of the class.

After I completed teaching, I created a survey to give to the students. I gave a survey to every class, with a series of questions regarding my teaching. As well as some economic-based questions. One of the questions was “Mr. H uses effective methods to teach material to students. Rate 1-5 with 5 being strongly agree and 1 strongly disagree.” The Average value from 61 students was a 4.39. This number is the average all students from the classes together.

I worked with Mr. Turner to develop a probability lesson. We were using six-sided dice as well as cards to try and determine chances of drawing a specific card out of the deck. We covered this during class, students nodded along and did not ask many questions. When the quiz came around regarding the material students did not know how many cards were in a deck. They did not know how many suits there were, or what these suits even looked like. What was considered a “face card” or how many of them would be in a deck.

## Chapter 4: Managing Classroom Climate and Operation

Gossip was rampant, and the students did not worry about hiding what they were talking about. Gossip about which student had sexual relations with whom, derogatory names associated with a student based upon their sexual life. Stories about who were recently busted for drugs, who got in a fight earlier that day, and who got suspended or expelled of the student body.

A large portion of every class was spent dealing with student behavior issues. In all four classes there were groups of students who did not want to pay attention to the lesson. Every time it was a different activity that stole their stream of consciousness. Texting, YouTube videos, games, and Facebook were all available on their cell phones. Then groups of students had off-topic conversations frequently. Keeping students focused was difficult, but the classroom was managed.

My normal approach to cell phones was a warning during class for the first phone I saw. After that I would approach a student and ask for their phone to put on the desk at the front of the room. The difference between myself and older teachers is that I used a cell phone in high school. I know how students try and hide their phone. Girls keep their purses on their desk specifically to hide their phone. Everyone uses books at different angles to keep me from seeing the phone, or simply putting the phone under their desk to text. I remember all of these techniques that my peers used in high school and frequently was able to call on students accurately when they were using their phones.

When I began teaching I would work with the class as a whole, but had difficulty focusing in on students individually with too much emphasis. I would ask a student to answer a problem at the board. When the student ran into trouble I would approach the board and work individually with the student while the rest of the class started talking amongst each other. Mr.



Turner pointed this challenge out to me early on. To accommodate these actions I worked to sit in the back of the room while students went to the board. This way I could have the rest of the class work together to answer the problem on the board. After making this conscious effort to include the class, it increased efficiency of the lesson.

When I was able to teach students a completely new concept they paid attention. I remember specifically when I taught binomial expansion. Taking a binomial:  $(x^2 + 3y)^5$  and expanding it out correctly using Pascal's Triangle. These students paid close attention to the process and worked hard to understand it. At the same time I was also teaching students two dimensional graphing as well as solving absolute value inequalities.

The students claimed that they knew how to solve inequalities as well as how to graph two dimensional graphs on the x-y plane. I still reviewed the material, assigned homework and prepared for the exam.

I gave the students exam on November 4<sup>th</sup>, the majority of students did very well on the binomial expansion, yet very poorly on the absolute value inequalities and basic graphing. The test is included in Appendix C.

When I taught binomial expansion the students asked me a difficult question, "Why are we learning this?" I started with a simple answer of, "It will be on the quiz." A student claimed that it was faster to apply the FOIL method repeatedly to the problem:  $(x^2 + 3y)(x^2 + 3y)(x^2 + 3y)(x^2 + 3y)(x^2 + 3y)$ . I challenged him to a race. I explained that using Pascal's Triangle was faster and we would show it on the board. He used the FOIL method, I used Pascal's Triangle. I approached the last step of the problem as he capped the marker, sat down and resumed taking notes.

Showing the class perspective on this example was easy by racing. They saw before their eyes that the method I taught was faster. Other examples were more difficult. I had to convince students along the way that they would need to know the material for chef school and the real world. One of the last assignments that I gave students was a project for winter break. It was about data collection and weather prediction using past weather records for a region. The project was using statistical analysis techniques we reviewed earlier in the semester and probability that we had recently covered. The students were not overly excited about the project, but were happy that they were applying their knowledge to real world application.

## Chapter 5: Promoting Equity

Equity is a phrase which covers a large range of categories. Foremost in my mind is race, gender, and sexual orientation. Also there is division based on language background, economic status, cultural background, and learning ability.

Classes are so diverse at North High School that a Caucasian student is the minority at the school. The students were very accepting of all students in my classes. In my classroom, I worked hard to ensure I was asking the same of all students. All students were treated the same in class, If I asked a student a question, any student was responsible for the answer. Occasionally gang violence and rivalry appeared during the school day, however this did not carry into the classroom.

I found out throughout the course of the semester that I had three openly gay students. I am very oblivious normally, but I was told by other students throughout the semester. These students excelled in the classroom, simply because they worked hard, asked questions, and studied before tests.

An interesting division that many students may not consider is economic background. It is the difference between working two jobs that end at 1:30 in the morning on a school night, or being forced to go to bed by parents at a “reasonable” hour. I had both of these students in class. One student, I thought had a language barrier and would not participate in class for that reason. I later found out, it was actually that he did not have time to do homework and stay awake during class because he was working to pay for his brother and him to survive in Worcester. Other students work afternoons, or weekends, but they also have the support to own powerful calculators such as the Texas Instrument graphing series.

Over eighty percent of the student body is on free or reduced lunch at North High. On my first day walking in, I didn't know what I'd see. I saw wired populace. Nearly every student was texting in the hallway. In my survey at the end of the semester, I asked three questions that I think respond to priorities of money management.

1.	Do you own a Smartphone?	78% Yes
2.	Do you have internet access at home?	95% Yes
3.	Do you have a TV service provider at home?	90% Yes

I took a teaching preparatory course at Doherty High School in Worcester, same school district, same city. These teachers informed me that very few of the students they had had internet access at home. The administration at North High School discourages teachers from assigning homework that requires internet access because too few of students have recognized that they do have access at home.

Language and culture differences among students are common. Even difficult to communicate with me. The joy of teaching math is that it is universal. My best student in period 4 was an immigrant from Iran half-way through the semester. She had a strong background in mathematics, and was working hard to learn more.

Throughout my time teaching, the Red Sox won the World Series. A lot of the staff were excited about the outcome of the game, however the students were not as energetic. The incredible diversity in the classroom focused more on Soccer, or International Football games that were taking place.

In one class, I had several students that had IEPs. It was an inclusion class, an assistant teacher assisted with ensuring these students were understanding material. These students were brought into the class half-way through the semester from another class which had too many

students. These students were shocked at the pace of the different class and how much material we had already covered. They were at least two weeks behind our class when they arrived and were worried about the material. The Inclusion teacher and I worked hard to ensure these students did not become discouraged. One student in particular sticks out. I was never able to read her IEP, but from what the inclusion teacher told me, she has had a very difficult home life, and more psychological problems than he could imagine. When he first read the report he was moved to tears. One day I noticed that she was not paying attention to the lecture. She was staring off into space, I talked to her and asked if she was alright. She had hit a wall and was upset with the amount of work that was being asked of her. I asked her what she wanted to do with her life. Her answer was a chef, I explained that basic mathematical concepts are important for being a teacher. I also asked her if she wanted children. With that I encouraged her to press on through the course so that she would be able to help her children with these assignments when they reach her age. This small pep talk worked wonders, because she immediately began to take notes and proceeded to excel in the class.

## Chapter 6: Meeting Professional Responsibilities

My responsibilities as a student teacher did not stop at simply conveying the subject matter to the students. I had to worry about my appearance, discipline techniques for the students, a fair and impartial grading system, while also ensuring the curriculum framework is followed for the students.

I found that my appearance was noted consistently by the students. When I returned to North High to substitute teach a day in the spring semester, a student noticed when I had a new belt, watch, and shoes. It surprised me that the student was so attentive to this. Something small that I would not have noticed of a teacher when in High School, and something I still do not focus on in college. The clothing I wore was not all that mattered of my appearance. Energy was a key, I focused on putting energy into every lesson that I taught to the students. When energy was lacking, the students could tell.

Part of appearance is also confidence. It includes confidence in one's ability to teach, confidence to maintain control of a classroom, and confidence to look like you know what you are doing. I witnessed two or three substitute teachers during my time at North, some of them were relaxed, took the time to get to know the students and interact with them. The other substitutes were focused solely on control, which they immediately lost. The students could tell they were nervous, and were not enjoying themselves, and like an animal in a fight, they could sense the weakness.

Mr. Turner liked to give students difficult exams. They should be able to answer every question when they apply what they have recently learned. When he grades the exams he applied standard deviation to the exams to assign a point value and percentage to each exam. When I was teaching and making exams we continued to do this.

Working at North High School opened my eyes to inner-city life. I came from a rural community where the school had issues with fights, racism, and homosexual acceptance. North was an entirely different arena. The issues that these students had were more serious than the ones I had in high school. Some of these students were worried about the food on their table at home. The livelihood of their family, the health of their parents and grandparents. For many of them, school was a safe environment that they were able to relax in.

A student came to school one day out of the blue with a cast on his arm. The teacher in the room asked the student what happened to his arm. His simple answer was that he punched a wall. The teacher could tell that there was more to the story. I was given control of the classroom as she took the student to the hallway and asked again. When she came back in, the student was not with her. We gave the students work to complete by themselves as she told me what happened. The student had punched a wall out of anger while his mother was beating him. He did not want to hit her back, so he punched the wall. She explained that it was her obligation as a teacher to ensure that he saw a Guidance Counselor and that she submit a report to the school to initiate an investigation through child services.

## Chapter 7: WPI Education

When I came to WPI, I was coming to the school for Mechanical Engineering among other things. During my time at school, I learned that I really am not interested in becoming a professional engineer. I remembered coaching wrestlers during the summer and I enjoyed tutoring after school in High School, so I looked into the teaching program. I found that it fit my schedule, and was a great opportunity for IQP. Throughout my time as a Student Teacher, my eyes were opened. I was able to see first-hand a school that has serious issues. I worked with students who may drop out before graduation to sell drugs and make money. If I was able to make an impact on my students, I succeeded.

### Subject Matter

Applying what I have learned at WPI is very rewarding. Shows value to the education I have so far received at school. The most valuable education has not been in engineering, mathematics, or science. Army ROTC has remained pertinent to teaching because of its goal to build confidence. It is taught that whatever you do, do it with confidence. The first several days I was in front of students I followed this. I was able to show the students I knew what I was doing, and that they needed to pay attention for various reasons.

I saw the topics that I taught as easy. I learned that material during my freshman year of high school. Seven years prior to my time as a student teacher. I found that my WPI education was able to pull on the basics of Algebra into completely different paths. Classes involved Calculus 1-4, Physics, Statics, Stress, and Dynamics, along with other more technical courses. Using this knowledge I was able to show students that there is a reason to learn  $y = mx + b$  and other equations we emphasized so much during my time in front of the classroom.



## Perspective

The most common question from students: “What will we use this for?” Answers for this vary. Earlier I explained how I raced a student to show the proficiency of a technique. This question was as common as a lesson on new material. Students like to know when they will apply techniques. The courses at WPI have helped drastically. I am not a mathematics student, but an engineering student. All of the concepts of Algebra II came to be used in Calculus courses that I took, but there were instances I was able to talk about relations to more complicated forms of engineering, stress analysis, thermodynamics and other courses. Most of my students had not considered a career in Engineering, but the fact that it is necessary to further education helped.

## Chapter 8: The Classroom

During a day at Worcester North High School, I taught four separate Algebra II classes. Each class behaved differently, and required different techniques to keep them focused on the material. Throughout the day, the students would progress from drowsy, to engaged, to overly energized by Period 7. Students' names will be changed throughout the report to ensure confidentiality for them.

### Period 2

Each morning started off relatively calm. The second period class was a highly motivated group of individuals. Brad and Deborah sat in the front row, they were good friends and very motivated. Brad missed two weeks of school due to Pneumonia, but upon his recovery he managed to catch up on all material missed and lead the class in grades. Thomas is engaging in material, enjoys learning on his own. He has begun teaching himself computer programming on his own at home. Shows boredom with material

Alexis and Anna are two great students, Anna's father attended WPI. Alexis was having difficulty with the material, she began attending Period 7 class as well to catch up. This worked until Period 7 fell behind in class.

### Period 4

Pablo and Elaine sat up front for the entire class and worked well together. Pablo sticks out specifically around Halloween. He decided to dress up for Halloween as Miley Cyrus. This was right at the time that the pop actress released "Wrecking Ball" and changed her appearance drastically. Elaine is much calmer than Pablo and was on topic about the material throughout the class.

Cynthia and another student sat on the right side of the room. Cynthia is on the basketball team and asked intellectual questions when she was engaged. Certain days she would come to class unprepared and take several minutes to become engaged in the material.

## Period 5

This class was a lot of fun. The students were energetic, and it was just before or after lunch. The class was the most diverse class that I had. I had Jamaicans, Mexicans, an Iranian student, along with students of other races and cultural backgrounds.

An Inclusion class was added due to too many students in another class. These students came from different backgrounds and all had IEPs. Some were related to learning disabilities, some were related to psychological evaluations. These students were motivated, that is what made the difference between them and the rest of the class. They may have had learning disabilities, but with the assistance of the inclusion teacher these students attacked the material once they joined our class. Their grades soon became the top of the class.

A student had a parent-teacher conference to try and change into an easier class. When the parent saw the student's grade compared to the rest of the class the parent calmed down. The student had one of the top grades in the class, and was doing well.

An Iranian student moved straight from Iran and joined our class. She spoke broken English, but knows mathematics. She had a strong background in arithmetic and picked up our Algebra II class quickly. She had one of the best grades in the class consistently.

Raymond was in this class, and missed school for a period of time. When he returned I asked where he was. His response was that he was kicked out of his house. After I collected myself, I asked if he would be able to make up the work and if he was doing alright. He informed

me that Algebra II was not his priority anymore, he was trying to focus on AP Psychology. He actually proceeded to miss the next couple days of school. When he returned this time he spoke frankly that he was at the city library completing all work he missed for this AP class.

### Lunchroom

I met many different teachers with different backgrounds in the lunch room. Some were career teachers, others retired from a previous job and began teaching as something to do. All of them have been teaching for at least ten years. They have seen administration come and go. They were all part of the Union. I have very little experience with the Unions. The Teachers Union seems to be very clear on their goals and decisions. I saw disagreements between the teachers and administration solved by the Union. The teachers were very calm in their disagreements, but I learned that I had chosen the lunch-room with very vocal members of the Union, it was an experience to hear the discussions that occurred there. A physics teacher was a WPI grad and was a meteorologist for years before he became a teacher. He would consistently share the upcoming weather, his predictions were always more accurate than anything I could find online.

### Period 6

Starting the first day of observation I went downstairs to Mrs. Snow's classroom. Her class consisted of freshman Algebra 1 Honors Students. This was the higher end of the algebra students. The students were bright, but also had very low maturity and a short attention span. In this class I observed primarily as Mrs. Snow worked with the students, teaching and mentoring them, preparing them for high school, and ultimately life. Mrs. Snow would take time developing these students to be able to plan out their course-work at North.

I was able to teach Mrs. Snow's class a couple times throughout my observation. Her class was learning very similar material at the same pace as the students I had with Mr. Turner. I was able to teach the same lesson in both classrooms to an Algebra I class of freshman, and an Algebra II class of juniors and seniors.

### Period 7

The last Period of the day. Students across the school have now woken up for the day. All students had eaten lunch, woken up from any post-lunch naps, and were energized. I really got to know this class well through consistent observation. From the first day of class there were groups of students who joined together. A group of three students sat at the center of the room. Michael, Vincent, and James. These students were always maintaining side conversations and would try to cover up the fact that they were not paying attention.

Jared and George were moved to sit directly in front of the teacher's desk because how off-topic they could get. Both Jared and George were enrolled in the JROTC program at the school along with Jerry. Jared had very little respect for authority, I think a large part of that was boredom. He would rarely take notes and was always trying to find ways to skip class. I caught him trying to have me sign passes with the wrong time to a location different than where he asked to go. George was never engaged and rarely understood the material. Mr. Turner called home one day to tell his guardian that he was not doing his homework. George lost his Xbox and was now retaliating by paying even less attention to what was occurring in class. He ended up switching into a different class at a slower pace.

Cara and Jesus were active students, quiet, but asked questions frequently. They would both get frustrated when material did not make sense, yet would continue to persevere until they understood it.

Sarah and Jerry were always in the back of the room. A large challenge I had with Sarah was her phone. She was always using, never admitted to it, and would not turn it in to me very often. Jerry was a ring-leader of the classroom. He may have been in JROTC, but he was wild as ever, he challenged me to push-up competitions, and was overly confident in his ability to do well on exams.

Carolyn sat by herself in the front row. She was energetic, talkative, but a good student. She worked hard in the class and would always ask for help when she needed it. When I came back to substitute for Mr. Turner she was using her peers to assist her in work frequently.

On Thursday, October 17th I devised plan to have student Jerry cooperate better. Jerry decided to start making frequent animal noises after one class previously. I bet him that if he scored over a 95% on a test that I would buy him a McDonald's lunch. If he scored lower, than he would be limited to three animal noises per day and cooperate with my wishes of him. Friday I was on break. Monday, October 23rd I was teaching the class, I reviewed the majority of problems on the test. Jerry admitted that from that review, he knows he did not receive the required 95%. He immediately started "quacking." I called him out that he went back on the bet, I then asked if he would simply cooperate if I got McDonald's anyway for him. He responded with "yes." Tuesday I purchased McDonald's for the entire class. Before anyone had any, I told the class that even though Jerry went back on his word, I got everyone McDonald's and now should hold him accountable. While this method to gain a student's cooperation is not approved, and is frequently not appreciated, it worked. While I had minor problems with Jerry throughout the remainder of the semester, I only needed to reference McDonald's and he would settle down.

## Math League

Math League is an after-school program run by Mr. Turner and another teacher at the school. I was privileged to assist Mr. Turner as a coach on one of the math meets. We went to Auburn High School where close to 1000 students from around Worcester County came together to compete in Mathematics. They competed through different rounds focused on topics that ranged from integers to set theory. The majority of the students on the team were from the Calculus class that Mr. Turner taught first period. The rest of the students were all aiming for high achievement and were very motivated to do well at all levels.

## Conclusion

I am grateful that I was able to be a part of the Teaching Program at WPI. I learned so much from the students at North High School. How to engage them, how not to engage them. Teaching techniques that are successful, how to develop myself as an educator.

The WPI teaching program is much different than other schools where an individual may major in Secondary Education. Four courses on top of the IQP concludes the Teaching Practicum. “Cross-Cultural Psychology,” “Educational Psychology,” “Teaching Methods in Mathematics and Science,” and “Sheltered English Immersion Endorsement Course for Teachers” are the only courses we must take along with our student teaching to become certified for the State of Massachusetts.

In my time as a teacher I worked to follow the “Standards for all Teachers” as defined by the State for licensing. This paper is a medium to show my ability to teach based on my experience as a student teacher in the Worcester Public Schools system. An experience that could never be replicated, but only built on by teaching in the future.



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## Appendix A – Lesson Plans

October 21, 2013 – October 25, 2013

North High School MATH Weekly Lesson Plan-

Topic: Algebra 2

Week Of: 10/21/13

Period: 2,4,5,7

### Weekly Objectives

1. Review & Extend Arithmetic of Signed Fractions & Decimals; % Problems; Prime factorization, GCF, LCM & Application to Problem Solving; Ratios and Other Simple Algebraic Problem Solving; Sundry Unit Conversions; Circular Area Problems, Simple & Compound

### Instructional Strategies

Students will demonstrate understanding through....

Cornell Notes    Note-taking Guide  
Guided practice    Exit Slips    OR  
questions  
Other **TEAMWORK** \_\_\_\_\_

### Assessments and Rubrics

WPS students write effectively

### Summative Assessments

4-pt. WPS rubric 4=96 3=84 2=72 1=60

4-pt. AP O/R rubric 4=96 3=84 2=72 1=60

Tests

Quizzes

Group Work

Class work

Homework

Other \_\_\_\_\_

### Formative assessments

Observation of Individual Work & Team Work; My selection of student for answer to question; Daystarter (aka, icebreaker); HW/Notebook Content Checks

### Accommodations/Differentiation:

- Manage everything from basic algebra confusion to bored during review via TW, extra help 2-3 days per week, 1:1 discussion; long run: diff. HW/Testing
- Honors = College + extra enrichment in Class + HW; some "H" HW + "College" Bonus Credit

### Outline of Monday's Class

- Review of Test from 18OCT13
- Focus on pg. 39 #32
- Lecture on § 1.4 Rewriting Formulas and Equations
- HW: pg. 30, # 7, 9, 18, 21, 28, 33, 34

### Outline of Tuesday's Class

- Continue Test review
- HW Quiz to ensure homework was completed
- Review HW for any questions
- More on § 1.4
- Review pg. 33 work
- HW: Mixed Reviews on pg. 32 and 33
- HW Word Problems: pg. 688 # 62, 65, 66, 69, and 71

### Outline of Wednesday's Class

- HW: p. 40 #34-52 + book quiz 1.3-1.5
- Review session with Q & A

### Outline of Thursday's Class

- Test § 1.1-1.5 plus § 10.1

### Outline of Friday's Class

- Review of Thursday test

October 28, 2013 – November 1, 2013

North High School MATH Weekly Lesson Plan-

Topic: Algebra 2

Week Of: 10/28/13

Period: 2,4,5,7

### Weekly Objectives

Review Absolute Values and Inequalities, Functions, 2D graphing, slope, and two-variable equations  
Combinations, binomial expansion & Pascal's Triangle

### Instructional Strategies

Students will demonstrate understanding through....

Cornell Notes    Note-taking Guide

Guided practice    Exit Slips    OR questions

Other **TEAMWORK** \_\_\_\_\_

### Assessments and Rubrics

WPS students write effectively

### Summative Assessments

4-pt. WPS rubric 4=96 3=84 2=72 1=60

4-pt. AP O/R rubric 4=96 3=84 2=72 1=60

Tests

Quizzes

Group Work

Class work

Homework

Other \_\_\_\_\_

### Formative assessments

Observation of Individual Work & Team Work; My selection of student for answer to question;

Daystarter (aka, icebreaker); HW/Notebook Content Checks

\_\_\_\_\_

### Accommodations/Differentiation:

Manage everything from basic algebra confusion to bored during review via TW, extra help 2-3 days per week, 1:1 discussion; long run: diff. HW/Testing

Honors = College + extra enrichment in Class + HW; some "H" HW + "College" Bonus Credit

Extra Help available after-school M, T, W, Th. When attended, bonus points will be awarded

### Outline of Monday's Class

**Review of Test from 25OCT13**

**§ 1.7 "Solve Absolute Value Equations and Inequalities"**

**TW pg. 55 #9-19 odd, 21-31 odd**

**HW Complete unfinished TW plus pg. 56 #43-53,60 and pg. 59 #1, 2**

### Outline of Tuesday's Class

**Review pg. 59 #1, 2**

**HW Quiz**

**Pascal's Triangle and  $nC_r$  Triangle**

**FOILing Review**

**$nC_r$  and expanding binomials**

**HW STUDY pp. 690-694 & DO pg. 694 # 3, 5, 7, 9, 11, 12, 13, 19, 20, 21, 40**

### Outline of Wednesday's Class

**Discuss §2.1 "Represent Relations & Functions"**

**Graph simple equations with class**

**TW pg. 77 #10-13, 21-33  $\leftrightarrow$  Discuss problems as class as needed**

**HW Study pp. 72-76 & DO "G.P." #1-7 plus pg. 694 #14, 16,18, 36, 37**

### Outline of Thursday's Class

**Slope: Definition; perpendicular & parallel lines, with examples**

**TW: Review HW & then DO pp. 82-85 "G.P." #1-13**

**Key problems from HW and TW to review in comparison to test questions.**

**HW pp. 86-87 # 1-3,6,8,12,14-16,18,22-24**

### Outline of Friday's Class

**Test on §1.7, 2.1, 2.2, 10.2**

**HW Study §2.3 & DO "G.P." #1-14 plus p. 93 #1,2**

December 2, 2013 – December 6, 2013

North High School MATH Weekly Lesson Plan-

Topic: Algebra 2

Week Of: 12/02/13

Period: 2,4,5,7

### Weekly Objectives

1. Augmented Matrices
2. Probability Chapter 10.1-10.5

### Instructional Strategies

Students will demonstrate understanding through....

Cornell Notes      Note-taking Guide  
Guided practice      Exit Slips      OR  
questions  
Other **TEAMWORK** \_\_\_\_\_

### Assessments and Rubrics

WPS students write effectively

### Summative Assessments

4-pt. WPS rubric 4=96 3=84 2=72 1=60

4-pt. AP O/R rubric 4=96 3=84 2=72 1=60

Tests

Quizzes

Group Work

Class work

Homework

Other \_\_\_\_\_

### Formative assessments

Observation of Individual Work & Team Work; My selection of student for answer to question; Daystarter (aka, icebreaker); HW/Notebook Content Checks

### Accommodations/Differentiation:

- Manage everything from basic algebra confusion to bored during review via TW, extra help 2-3 days per week, 1:1 discussion; long run: diff. HW/Testing
- Honors = College + extra enrichment in Class + HW; some "H" HW + "College" Bonus Credit
- Extra Help available after-school T, W, Th, and Fr. When attended, bonus points will be awarded

### Outline of Monday's Class

- Brief Test Review
- Review of basic functions and vocabulary with quiz
- Begin Simultaneous Equations
- HW: Study PowerPoint Link or in packet along with book.  
<http://www.maths.usyd.edu.au/u/gartht/Wshops/SimultaneousEqns.pdf>
- HW: Complete problems attached to packet

### Outline of Tuesday's Class

- Review Homework problems, post odd solutions
- Substitution, Elimination, Algebra
- Complete Worksheet in packet for TW

### Outline of Wednesday's Class

- Follow instructions on board to begin class
- Matrices
  - Who, What, When, Why?
  - Basic Operations review
- HW: Matrix Worksheet in packet review link:  
<http://www.classzone.com/eservices/home/pdf/student/LA204EAD.pdf>

### Outline of Thursday's Class

- Review HW
- Begin combining matrices with Systems of Equations
- HW: #1-31 odd of link from last night (problems in packet)

### Outline of Friday's Class

- Review Probability
  - Theoretical Probability
  - Experimental Probability
  - Probability of Compound Events
  - Probability of Independent Events
- HW: Probability problems in packet

December 9, 2013 – December 13, 2013

North High School MATH Weekly Lesson Plan-

Topic: Algebra 2

Week Of: 12/02/13

Period: 2,4,5,7

### Weekly Objectives

3. Augmented Matrices
4. Probability Chapter 10.1-10.5

### Instructional Strategies

Students will demonstrate understanding through....

Cornell Notes      Note-taking Guide  
Guided practice      Exit Slips      OR  
questions  
Other **TEAMWORK** \_\_\_\_\_

### Assessments and Rubrics

WPS students write effectively

### Summative Assessments

4-pt. WPS rubric 4=96 3=84 2=72 1=60

4-pt. AP O/R rubric 4=96 3=84 2=72 1=60

Tests

Quizzes

Group Work

Class work

Homework

Other \_\_\_\_\_

### Formative assessments

Observation of Individual Work & Team Work; My selection of student for answer to question;

Daystarter (aka, icebreaker); HW/Notebook

Content Checks

### Accommodations/Differentiation:

- Manage everything from basic algebra confusion to bored during review via TW, extra help 2-3 days per week, 1:1 discussion; long run: diff. HW/Testing
- Honors = College + extra enrichment in Class + HW; some "H" HW + "College" Bonus Credit
- Extra Help available after-school T, W, Th, and Fr. When attended, bonus points will be awarded

### Monday

- Review Homework on probability
- TW: pg. 219 problems 1, 2, 3, and 4
- HW: Review notes, homework, study the book. Pg. 215 #25-33 odd. USE AUGMENTED MATRICES

### Tuesday

- Quiz on Matrices
- Continue with probability lecture on 10.3 and 10.4
- TW: Pg. 701 #1-9 odd, pg. 710 #1-15 odd
- HW: Finish TW and pg. 702 #11-15 odd and pg. 710 #42-47 odd

### Wednesday

- Review Homework
- TW: section 10.5 Guided Practice
- HW: pg. 721 #1-21 odd, prepare questions for test

### Thursday

- HW review
- TW: pg. 705 #4, 5; pg. 711 #42; pg. 722 # 22-28

### Friday

- Test on Probability and matrices

December 16, 2013 – December 20, 2013

North High School MATH Weekly Lesson Plan-

Topic: Algebra 2

Week Of: 12/16/13

Period: 2,4,5,7

### Weekly Objectives

5. Quadratic Functions and factoring
6. Quiz on material on Thursday

### Instructional Strategies

Students will demonstrate understanding through....

Cornell Notes      Note-taking Guide  
Guided practice      Exit Slips      OR  
questions  
Other **TEAMWORK** \_\_\_\_\_

### Assessments and Rubrics

WPS students write effectively

### Summative Assessments

4-pt. WPS rubric 4=96 3=84 2=72 1=60  
4-pt. AP O/R rubric 4=96 3=84 2=72 1=60

Tests  
Quizzes  
Group Work  
Class work  
Homework  
Other \_\_\_\_\_

### Formative assessments

Observation of Individual Work & Team Work; My selection of student for answer to question; Daystarter (aka, icebreaker); HW/Notebook Content Checks

### Accommodations/Differentiation:

- Manage everything from basic algebra confusion to bored during review via TW, extra help 2-3 days per week, 1:1 discussion; long run: diff. HW/Testing
- Honors = College + extra enrichment in Class + HW; some "H" HW + "College" Bonus Credit
- Extra Help available after-school T, W, Th, and Fr. When attended, bonus points will be awarded

### Monday

- Review Test and weekend HW
- Lecture on 4.1
- TW: GP 1-8
- HW: pg. 240 1, 2, 4-6, 7-19 odd, 34-38

### Tuesday

- Review HW
- 4.2 forms of a quadratic equation
- TW: GP 9-16
- HW: pg. 249 #1, 2, 3-22 odd, 23

### Wednesday

- Review HW
- 4.3 Factoring
- TW: GP 1-7
- HW: pg. 255 #1, 2, 7-11, 18-20, 23-33 odd

### Thursday

- Quadratics Quiz
- Project explanation
- HW: Project preparation

### Friday

- Logic problems
- HW: Project Data Collection

## Appendix B – Student Agendas



October 28, 2013 – November 1, 2013

**Agenda For Monday 10/28/2013**

- Review of Test from 25OCT13
- § 1.7 “Solve Absolute Value Equations and Inequalities”
- TW pg. 55 #9-19 odd, 21-31 odd
- HW Complete unfinished TW plus pg. 56 #43-53,60 and pg. 59 #1, 2

**Agenda for Tuesday 10/29/2013**

- Review pg. 59 #1, 2
- HW Quiz
- Pascal’s Triangle and  ${}_nC_r$  Triangle
- FOILing Review
- ${}_nC_r$  and expanding binomials
- HW STUDY pp. 690-694 & DO pg. 694 # 3, 5, 7, 9, 11, 12, 13, 19, 20, 21, 40

**Agenda for Wednesday 10/30/2013**

- Discuss §2.1 “Represent Relations & Functions”
- Graph simple equations with class
- TW pg. 77 #10-13, 21-33  $\leftrightarrow$  Discuss problems as class as needed
- HW Study pp. 72-76 & DO “G.P.” #1-7 plus pg. 694 #14, 16,18, 36, 37

**Agenda for Thursday 10/31/2013**

- Slope: Definition; perpendicular & parallel lines, with examples
- TW: Review HW & then DO pp. 82-85 “G.P.” #1-13
- Key problems from HW and TW to review in comparison to test questions.
- HW pp. 86-87 # 1-3,6,8,12,14-16,18,22-24

**Agenda for Friday 11/1/2013**

- Test on §1.7, 2.1, 2.2, 10.2
- HW Study §2.3 < pp. 89 – 92 > & DO “G.P.” #1-14 plus p. 93 #1,2

December 2, 2013 – December 6, 2013

### Outline of Monday's Class

- **Brief Test Review**
- **Review of basic functions and vocabulary with quiz**
- **Begin Simultaneous Equations**
- **HW: Study PowerPoint Link or in packet along with book.**  
<http://www.maths.usyd.edu.au/u/gartht/Wshops/SimultaneousEqns.pdf>
- **HW: Complete problems attached to packet**

### Outline of Tuesday's Class

- **Review Homework problems, post odd solutions**
- **Substitution, Elimination, Algebra**
- **Complete Worksheet in packet for TW**

### Outline of Wednesday's Class

- **Follow instructions on board to begin class**
- **Matrices**
  - **Who, What, When, Why?**
  - **Basic Operations review**
- **HW: Matrix Worksheet in packet review link:**  
<http://www.classzone.com/eservices/home/pdf/student/LA204EAD.pdf>

### Outline of Thursday's Class

- **Review HW**
- **Begin combining matrices with Systems of Equations**
- **HW: #1-31 odd of link from last night (problems in packet)**

### Outline of Friday's Class

- **Review Probability**
  - **Theoretical Probability**
  - **Experimental Probability**
  - **Probability of Compound Events**
  - **Probability of Independent Events**
- **HW: Probability problems in packet**

## Simultaneous Equations



### Definition (Simultaneous Equations)

If two equations are both "true" at the same time, they are called **simultaneous equations**.

[More](#)

### Example

A **system** of two simultaneous equations:

$$\begin{aligned} y &= 4x \\ 2x + y &= 6 \end{aligned}$$

### Definition (Solution)

To **solve** a system of simultaneous equations we need to find values of the variables that satisfy **all** equations in the system.

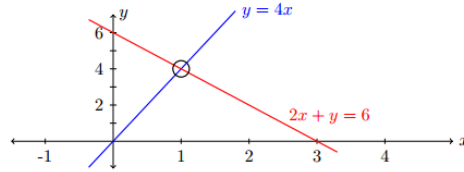
## Simultaneous Equations



### Definition (Solution)

To **solve** a system of simultaneous equations we need to find values of the variables that satisfy **all** equations in the system.

Graphically this is the point where the two lines cross:



## How to solve systems of equations?



The general approach consists of 3 steps:

1. Manipulate the equations to find an expression in terms of one variable only.
2. Solve the equation for that one variable
3. Use that solution in one of the original equations to find the other solution.

There are two main ways to manipulate the equations in step 1:

### Definition (Substitution Method)

Substitute one equation into another.

[More](#)

### Definition (Elimination Method)

Add or subtract a multiple of one equation from the other.

[More](#)

## Substitution Method



We can use the 3 step approach to solve the following system:

$$y = 4x \quad (1)$$

$$2x + y = 6 \quad (2)$$

1. **Substitute** Equation (1) into Equation (2):

$$\begin{aligned} 2x + 4x &= 6 && \text{(substituting } y = 4x\text{)} \\ 6x &= 6 \end{aligned}$$

2. Solve this equation for  $x$ :

$$\begin{aligned} 6x \times \frac{1}{6} &= 6 \times \frac{1}{6} && \text{(divide both sides by 6)} \\ x &= 1 \end{aligned}$$

3. Use this solution,  $x = 1$ , in Equation (1) to find  $y$ :

$$y = 4x = 4 \times 1 = 4$$

## Elimination Method



3 step approach using the elimination method:

$$y = 4x \quad (1)$$

$$2x + y = 6 \quad (2)$$

1. **Eliminate**  $y$  in Equation (2) by subtracting (1) from (2):

$$\begin{aligned} 2x + y - y &= 6 - 4x \\ 2x &= 6 - 4x && \text{(no longer any } y\text{'s)} \\ 6x &= 6 \end{aligned}$$

2. Using exactly the same approach as in the substitution method we solve to find  $x = 1$ .
3. As before, we substitute  $x = 1$  back into Equation (1) to find  $y = 4$ .

## Simultaneous Equations Your Turn...



Solve the following system of equations

$$2x + y = 8 \quad (3)$$

$$x + y = 6 \quad (4)$$

1.

2.

3.

## Simultaneous Equations Your Turn...



Solve the following system of equations

$$2x + y = 8 \quad (3)$$

$$x + y = 6 \quad (4)$$

1. The **elimination** method and subtract (4) from (3):

**OR** the **substitution** method by rearranging (4) to get  $y = 6 - x$  and substituting this into (3):

2.

3.

## Simultaneous Equations Your Turn...



Solve the following system of equations

$$2x + y = 8 \quad (3)$$

$$x + y = 6 \quad (4)$$

1. The **elimination** method and subtract (4) from (3):

$$\begin{aligned} 2x + y - (x + y) &= 8 - 6 \\ x &= 2 \end{aligned}$$

**OR** the **substitution** method by rearranging (4) to get  $y = 6 - x$  and substituting this into (3):

$$\begin{aligned} 2x + (6 - x) &= 8 \\ x &= 2 \end{aligned}$$

2.

3.

### Simultaneous Equations Your Turn...



Solve the following system of equations

$$2x + y = 8 \quad (3)$$

$$x + y = 6 \quad (4)$$

1. The **elimination** method and subtract (4) from (3):

$$2x + y - (x + y) = 8 - 6$$
$$x = 2$$

**OR** the **substitution** method by rearranging (4) to get  $y = 6 - x$  and substituting this into (3):

$$2x + (6 - x) = 8$$
$$x = 2$$

2. No need to solve for  $x$  as we can see directly that  $x = 2$ .

3. Use  $x = 2$  in (4) to find  $y = 6 - 2 = 4$ .

From Powerpoint found at:

<http://www.maths.usyd.edu.au/u/gartht/Wshops/SimultaneousEqns.pdf>

## HW PROBLEMS due TUESDAY 03DEC

**A.** Solve the following simultaneous equations using substitution.

1)  $x + y = 7$   
 $x - y = 1$

2)  $5x + y = 23$   
 $2x + y = 11$

3)  $2x + 3y = 3$   
 $5x + 3y = 12$

4)  $3m - 4n = -18$   
 $5m - 4n = -22$

5)  $4x + 3y = 1$   
 $x - 3y = -11$

6)  $2n - 5m = 3$   
 $5m + n = 9$

**B.** Solve the following simultaneous equations using elimination

1.  $3x + 2y = 7$   
 $4x - y = 13$

2.  $4a - 3b = -6$   
 $a + 2b = 1$

3.  $3x + 5y = 13$   
 $7x - 2y = 3$

4.  $4x + 3y = 11$   
 $3x + 2y = 8$

5.  $7a - 3b = 10$   
 $3a - 7b = 10$

6.  $4a + 3b = 10$   
 $4b + 3a = 11$

**TW PROBLEMS for Class TUESDAY 03DEC**

**Solve these simultaneous equations by the method of substitution.**

a)  $2x + 3y = 5$   
 $x - y = 10$

b)  $x + y = 2$   
 $3x + 2y = 2$

c)  $x + y = 3$   
 $3x + 5y = 16$

**Solve these simultaneous equations by the method of substitution.**

a)  $y + x - 3 = 0$   
 $y = x^2 + 1$

b)  $y = x^2 + x$   
 $y = x + 1$

c)  $y = 2x^2 + 7x - 6$   
 $y - 2x = 6$

**Use algebra to solve these simultaneous equations.**

a)  $x^2 + y^2 = 17$   
 $y = x - 3$

b)  $x^2 + y^2 = 5$   
 $x + y = 3$

c)  $x^2 + y^2 = 9$   
 $2y - x = 1$

## HW PROBLEMS due WEDNESDAY 04DEC

### Exercise 1:

Solve these simultaneous equations by substitution. You must show all working.

1.  $3p + q = 7$   
 $2p - q = 3$

2.  $2x + 3y = 8$   
 $2x - 3y = 2$

3.  $5x + 2y = 16$   
 $3x + 2y = 8$

4.  $7x - 3y = 13$   
 $4x - 3y = 7$

5.  $4p + 3q = 6$   
 $2p - 3q = 12$

6.  $4p - q = 15$   
 $2p - q = 9$

### Exercise 2:

Solve these simultaneous equations by elimination. You must show all working.

1.  $3x + 4y = 9$   
 $3x + y = 7$

2.  $3x + 2y = 2$   
 $x + y = 2$

3.  $4x - y = 9$   
 $2x + 3y = 1$

4.  $4d - 3e = 26$   
 $d - 3e = 11$

5.  $4x + 3y = 11$   
 $3x - 2y = 21$

6.  $5m - 4n = 17$   
 $2m - 3n = 18$

## HW PROBLEMS due THURSDAY 05DEC

Simplify. Write "undefined" for expressions that are undefined.

$$1) \begin{bmatrix} 3 & 6 \\ -1 & -3 \\ -5 & -1 \end{bmatrix} + \begin{bmatrix} 0 & -1 \\ 6 & 0 \\ 2 & 3 \end{bmatrix}$$

$$2) \begin{bmatrix} -5 & 2 & -2 \\ 4 & -2 & 0 \end{bmatrix} - \begin{bmatrix} 6 & -5 & -6 \\ 1 & 3 & -3 \end{bmatrix}$$

$$3) -5 \begin{bmatrix} 5 & 6 & -4 \\ 4 & -2 & -1 \end{bmatrix}$$

$$4) -5 \begin{bmatrix} -3 & 0 \\ 0 & 5 \end{bmatrix}$$

$$5) \begin{bmatrix} 4 & 2 \end{bmatrix} + \begin{bmatrix} -2 & -6 \end{bmatrix}$$

$$6) 5 \begin{bmatrix} 4 \\ 3 \end{bmatrix}$$

$$7) -5 \begin{bmatrix} 1 & -2 & -1 & 2 \end{bmatrix}$$

$$8) 5 \begin{bmatrix} 5 & 1 \\ 1 & -2 \\ 1 & 2 \end{bmatrix}$$

$$9) -2u \begin{bmatrix} 7u & 3w^2 & 5u & 5 \end{bmatrix}$$

$$10) \begin{bmatrix} 2 \\ 4 \end{bmatrix} + \begin{bmatrix} 5 \\ 6 \end{bmatrix}$$

$$11) 4 \begin{bmatrix} -4 \\ 3 \\ -5 \end{bmatrix}$$

$$12) \begin{bmatrix} -4n & n+m \\ -2n & -4n \end{bmatrix} + \begin{bmatrix} 4 & -5 \\ 3m & 0 \end{bmatrix}$$

$$13) \begin{bmatrix} 2 & -5 & -3 \end{bmatrix} + \begin{bmatrix} 1 & -2 & -3 \end{bmatrix}$$

$$14) \begin{bmatrix} x+y \\ x-6 \end{bmatrix} + \begin{bmatrix} -5 \\ -6xy \end{bmatrix}$$

$$15) 4c \begin{bmatrix} 0 \\ 6 \\ 0 \\ 3a \end{bmatrix}$$

$$16) -3y \begin{bmatrix} -2x & -y \\ -4y & -3x \end{bmatrix}$$

$$17) 3 \begin{bmatrix} 2u \\ v^2 \\ u \end{bmatrix}$$

$$18) \begin{bmatrix} -x-1 & -2x & -5y \end{bmatrix} - \begin{bmatrix} y & -2 & -3x \end{bmatrix}$$

$$19) \begin{bmatrix} -6r+t \\ -r \\ 6s \end{bmatrix} + \begin{bmatrix} 6r \\ -4t \\ -3r+2 \end{bmatrix}$$

$$20) \begin{bmatrix} z-5 \\ -6 \\ -1-6z \\ 3y \end{bmatrix} + \begin{bmatrix} -3y \\ 3z \\ 5+z \\ 4z \end{bmatrix}$$

$$21) 5 \begin{bmatrix} 6 & 1 & 2 & -6 \end{bmatrix} - \begin{bmatrix} 1 & 6 & -6 & 6 \end{bmatrix}$$

$$22) -5 \left( \begin{bmatrix} 0 & -2 & 5 \end{bmatrix} + \begin{bmatrix} 2 & 0 & 2 \end{bmatrix} \right)$$

$$23) \begin{bmatrix} 5 & 3 \\ 5 & 1 \end{bmatrix} - \begin{bmatrix} -6 & 0 \\ 1 & -4 \end{bmatrix} - \begin{bmatrix} 5 & 4 \\ -2 & -6 \end{bmatrix}$$

$$24) \begin{bmatrix} 1 & 1 \\ 6 & -4 \\ 0 & 0 \end{bmatrix} + 5 \begin{bmatrix} -4 & 6 \\ 1 & 1 \\ -4 & -1 \end{bmatrix}$$



## HW PROBLEMS due FRIDAY 06DEC

### GUIDED PRACTICE

#### Vocabulary Check ✓

1. What are a matrix of variables and a matrix of constants, and how are they used to solve a system of linear equations?

#### Concept Check ✓

2. If  $|A| \neq 0$ , what is the solution of  $AX = B$  in terms of  $A$  and  $B$ ?

3. Explain why the solution of  $AX = B$  is *not*  $X = BA^{-1}$ .

#### Skill Check ✓

Write the linear system as a matrix equation.

4.  $x + y = 8$   
 $2x - y = 6$

5.  $x + 3y = 9$   
 $4x - 2y = 7$


6.  $x + y + z = 10$   
 $5x - y = 1$   
 $3x + 4y + z = 8$

Use an inverse matrix to solve the linear system.

7.  $x + y = 2$   
 $7x + 8y = 21$

8.  $-x - 2y = 3$   
 $2x + 8y = 1$

9.  $4x + 3y = 6$   
 $6x - 2y = 10$

10.  **INVESTING** Look back at Example 4 on page 232. Suppose you have \$60,000 to invest and you want an overall annual return of 9%. Use the expected annual returns shown to determine how much you should invest in each fund. Assume you are investing as much in stocks as in bonds and the money market combined.

Investment	Expected return
Stock mutual fund	12%
Bond mutual fund	8%
Money market fund	5%

## PRACTICE AND APPLICATIONS

#### STUDENT HELP

→ **Extra Practice**  
to help you master skills is on p. 945.

**WRITING MATRIX EQUATIONS** Write the linear system as a matrix equation.

11.  $x + y = 5$   
 $3x - 4y = 8$

12.  $x + 2y = 6$   
 $4x - y = 5$

13.  $5x - 3y = 9$   
 $-4x + 2y = 10$

14.  $2x - 5y = -11$   
 $-3x + 7y = 15$

15.  $x + 8y = 4$   
 $4x - 5y = -11$

16.  $2x - 5y = 4$   
 $x - 3y = 1$

17.  $x - 4y + 5z = -4$   
 $2x + y - 7z = -23$   
 $-4x + 5y + 2z = 38$

18.  $3x - y + 4z = 16$   
 $2x + 4y - z = 10$   
 $x - y + 3z = 31$

19.  $0.5x + 3.1y - 0.2z = 5.9$   
 $1.2x - 2.5y + 0.7z = 2.2$   
 $0.3x + 4.8y - 4.3z = 4.8$

20.  $x + z = 9$   
 $-x - y + 2z = 6$   
 $2x + 7y - z = -4$

21.  $8y - 10z = -23$   
 $6y - 12z = 14$   
 $-9x + 5z = 0$

22.  $x + y - z = 0$   
 $2x - z = 1$   
 $y + z = 2$

**SOLVING SYSTEMS** Use an inverse matrix to solve the linear system.

23.  $3x + y = 8$   
 $5x + 2y = 11$

24.  $x + y = -1$   
 $11x + 12y = 8$

25.  $2x + 7y = -53$   
 $x + 3y = -22$

26.  $7x + 5y = 8$   
 $4x + 3y = 4$

27.  $5x - 7y = 54$   
 $2x - 4y = 30$

28.  $-5x - 7y = -9$   
 $2x + 3y = 3$

29.  $x + 2y = -9$   
 $-2x - 3y = 14$

30.  $2x + 4y = -26$   
 $2x + 5y = -31$

31.  $9x - 5y = 43$   
 $-2x + 2y = -22$

#### STUDENT HELP

#### HOMEWORK HELP

**Example 1:** Exs. 11–22  
**Example 2:** Exs. 23–31  
**Example 3:** Exs. 32–39  
**Example 4:** Exs. 40–44

## **HW PROBLEMS due MONDAY 09DEC**

Solve the problems below using your knowledge of probability.

1. What is the probability of choosing an ace from a standard deck of playing cards?
2. What is the probability of choosing a red marble from a jar containing 5 red, 6 green and 4 blue marbles?
3. What is the probability of choosing a marble that is not green in problem 2?
4. What is the probability of getting an even number when rolling a single 6-sided die?
5. What is the probability of choosing a queen or a king from a standard deck of 52 playing cards?
6. What is the probability of landing on an odd number after spinning a spinner with 9 equal sectors numbered 1 through 9?
7. What is the probability of getting a 0 after rolling a single die numbered 1 to 6?
8. What is the probability of choosing a picture card (jack, queen or king) from a standard deck of playing cards?
9. What is the probability of choosing the letter a from the word mathematics?
10. What is the sample space for choosing a letter from the word mathematics?

December 9, 2013 – December 13, 2013

**Agenda for 09DEC2013**

**Monday**

- **Review Homework on probability**
- **TW: pg. 219 problems 1, 2, 3, and 4**
- **HW: Review notes, homework, study the book. Pg. 215 #25-33 odd. USE AUGMENTED MATRICES**

**Tuesday**

- **Quiz on Matrices**
- **Continue with probability lecture on 10.3 and 10.4**
- **TW: Pg. 701 #1-9 odd, pg. 710 #1-15 odd**
- **HW: Finish TW and pg. 702 #11-15 odd and pg. 710 #42-47 odd**

**Wednesday**

- **Review Homework**
- **TW: section 10.5 Guided Practice**
- **HW: pg. 721 #1-21 odd, prepare questions for test**

**Thursday**

- **HW review**
- **TW: pg. 705 #4, 5; pg. 711 #42; pg. 722 # 22-28**

**Friday**

- **Test on Probability and matrices**

December 16, 2013 – December 20, 2013

**Monday**

- Review Test and weekend HW
- Lecture on 4.1
- TW: GP 1-8
- HW: pg. 240 1, 2, 4-6, 7-19 odd, 34-38

**Tuesday**

- Review HW
- 4.2 forms of a quadratic equation
- TW: GP 9-16
- HW: pg. 249 #1, 2, 3-22 odd, 23

**Wednesday**

- Review HW
- 4.3 Factoring
- TW: GP 1-7
- HW: pg. 255 #1, 2, 7-11, 18-20, 23-33 odd

**Thursday**

- Quadratics Quiz
- Project explanation
- HW: Project preparation

**Friday**

- Logic problems
- HW: Project Data Collection

## Appendix C – Tests and Quizzes

September 18, 2013

Algebra 2

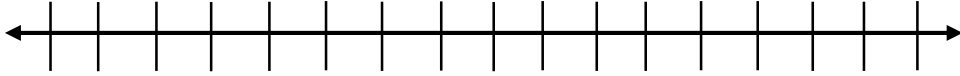
Test 1

Date: \_\_\_\_\_

Name: \_\_\_\_\_

Period: \_\_\_\_\_

1. On the number line below, label  $-7$ ,  $0$  and  $7$ . Then show and explain how far it is from  $-3$  to  $7$ .



Solve the following expressions

2.  $15 - 8 \cdot 4 +^{-}11$   
= \_\_\_\_\_%

3.  $^{-}0.435 + \frac{1}{2}$

4.  $(3^3 - 4)11x$

5.  $0.15$

6.  $6\%$  of  $42 = ?$

7.  $8 = 5\%$  of ?

8.  $2$  is what % of  $24$

Using prime factorization, find the greatest common factor (GCF), and the least common multiple (LCM) of the following numbers (SHOW ALL WORK):

9.  $27$  and  $36$

10.  $40$  and  $15$

11.  $25$  and  $20$

Using prime factorization find the least common denominator (LCD) of the following:

12.  $\frac{1}{2}$  and  $\frac{1}{3}$

13.  $\frac{5}{8}$  and  $\frac{3}{5}$

Solve for x:

14.  $x/6 = 3/4$

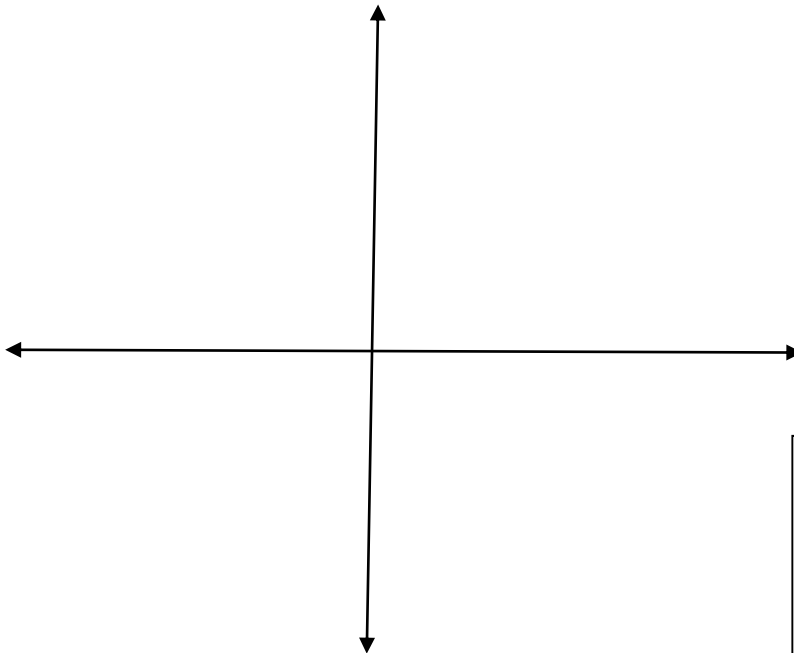
15.  $5/8 = x/4$

16. Martha is given a length of fabric 3 meters long. She only has an English ruler to measure it, how many inches long is Martha's fabric? ( $1'' = 2.54$  cm)

17. The Moon is around 380,000 km away from Earth. Express this distance in scientific notation.

18. The distance from Hong Kong to New York City is around  $1.3 \times 10^4$  km. What is this distance in standard form?

19. On the graph below, label the x and y axes



**BONUS 1:** add vector  $\langle 2, -4 \rangle$  to point  $(-3, 3)$  and mark down coordinate of sum  
 $(-3, 3) + \langle 2, -4 \rangle = \underline{\hspace{2cm}}$

**BONUS 2:** reflect point  $(3, -4)$  across the y-axis. What is the new coordinate?  
 $\underline{\hspace{2cm}}$

October 3, 2013

Algebra 2

Quiz 2

Date: \_\_\_\_\_

Name: \_\_\_\_\_

Period: \_\_\_\_\_

Use the following raw scores from exam 1 to answer the following questions: 27, 30, 12, 6, 14, 29, 23, 16, 14, 25, 20, 22, 24, 19, 21

1. Scores in order:

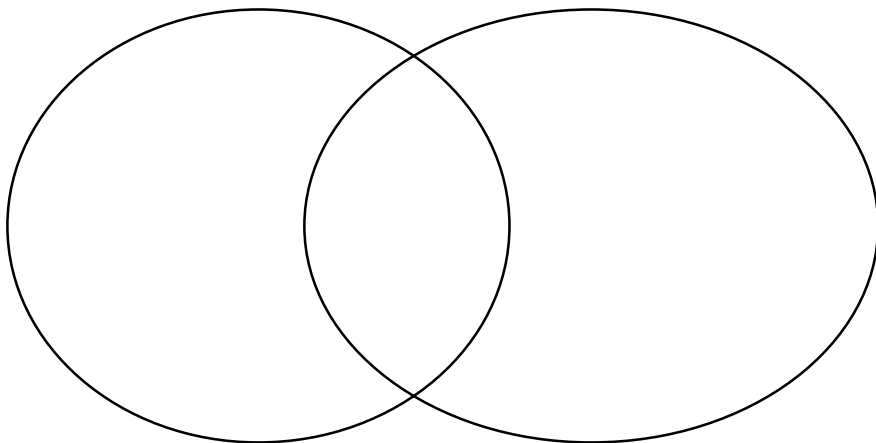
2. Mean: \_\_\_\_\_ 3. Median: \_\_\_\_\_ 4. Mode: \_\_\_\_\_ 5. Range: \_\_\_\_\_

6. Organize scores in Stem and Leaf Plot:

$A = \{1, 3, 5, 8, 12, 15\}$

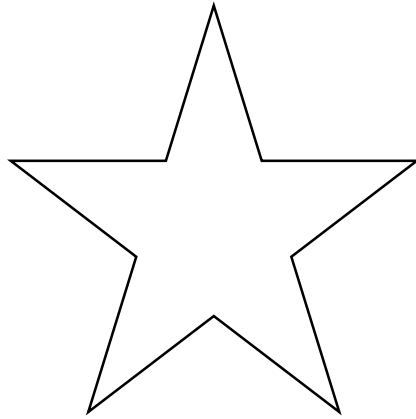
$B = \{2, 5, 9, 22, 3, 7, 19, 23\}$

7. Fill in the Venn diagram to illustrate  $A \cap B$





8. Find how many degrees must the drawing below be rotated for rotational symmetry. Show all lines of rotational symmetry



Degrees: \_\_\_\_\_

October 25, 2013

Algebra 2

Name: \_\_\_\_\_

Period: \_\_\_\_

Date: \_\_\_\_\_

Solve the following:

1.  $3(8 - 5q) = 4q - 6$   $q =$  \_\_\_\_\_

2.  $\frac{8}{16}z - \frac{1}{3} = -\frac{3}{4}z + \frac{1}{8}$   $z =$  \_\_\_\_\_

Solve for y:

3.  $5y - xy = 25$   $y =$  \_\_\_\_\_

Use the formula  $d = r * t$  for the distance traveled to solve for the missing variable:

4.  $d = \underline{\quad? \quad}$  when  $r = 30 \frac{mi}{hr}$  and  $t = 5 hr$   $d =$  \_\_\_\_\_

5.  $d = 630 mi$ ,  $r = \underline{\quad? \quad}$ ,  $t = 9 hr$   $r =$  \_\_\_\_\_

Write the Equation for the pattern represented in the table:

6.

$x$	0	1	2	3
$y$	21	11	1	-9

Equation: \_\_\_\_\_

7. It takes you 30 minutes to clean a fish tank, and it takes your sister 45 minutes. How long will it take the two of you working together to clean the tank?

Time in minutes: \_\_\_\_\_

8. You walk down the street and notice a worker in a dress store with limited stock dressing 8 mannequins. There are 2 identical yellow sundresses, 2 identical wedding dresses, 1 blue sundress, and 3 identical night club dresses. In how many ways can these dresses be displayed.

How many ways: \_\_\_\_\_

9. You keep walking down that street and start work in a clothing shop. Your first task is to dress the main mannequin in the store. For the mannequin to be correctly dressed, it needs a pair of shoes, a pair of pants, and a shirt. In your inventory, you have 18 pairs of shoes, 6 pairs of pants, and 10 shirts to choose from to dress the mannequin. How many different ways can you dress the mannequin?

How many ways: \_\_\_\_\_

November 4, 2013

Algebra 2 Test on § 1.7, 2.1, 2.2, 10.2

Period: \_\_\_\_\_

Name: \_\_\_\_\_

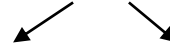
Date: \_\_\_\_\_

Solve and graph the equations on the corresponding line graphs:

1.  $|5x + 3| \leq 5$



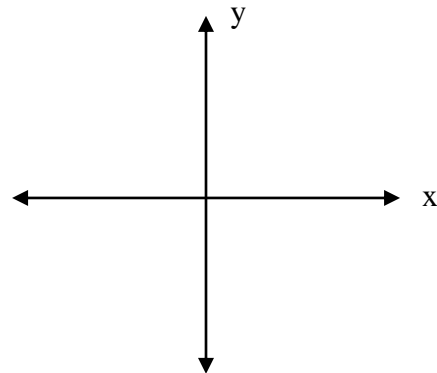
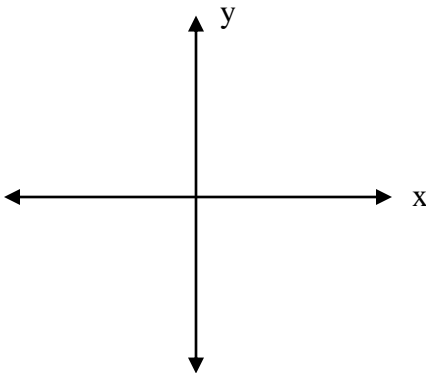
2.  $|4x - | > 7$



Graph the equation given and write an equation with a perpendicular slope and the same y-intercept.

3.  $y = 4x - 3$

4.  $y = -\frac{1}{2}x + 4$



$y = \underline{\hspace{1cm}}x - \underline{\hspace{1cm}}$

$y = \underline{\hspace{1cm}}x + \underline{\hspace{1cm}}$

5. Given  $(x + 7)^4$ , identify the values for a, b, and n in the equation:  ${}_nC_r(a^{n-r})(b^r)$  when  $r = 2$

a = \_\_\_\_\_ b = \_\_\_\_\_ n = \_\_\_\_\_

Write the missing term in the equation below

$$(x + 7)^4 = {}_4C_0(a^4)(b^0) + {}_4C_1(a^3)(b^1) + \underline{\hspace{4cm}} + {}_4C_3(a^1)(b^3) + {}_4C_4(a^0)(b^4)$$

Plug a and b in on the missing term:

$$(x + 7)^4 = {}_4C_0(x^4)(7^0) + {}_4C_1(x^3)(7^1) + \underline{\hspace{4cm}} + {}_4C_3(x^1)(7^3) + {}_4C_4(x^0)(7^4)$$

Using Pascal's Triangle – row n, diagonal r, identify the values for  ${}_4C_0$ ,  ${}_4C_1$ ,  ${}_4C_2$ ,  ${}_4C_3$ , and  ${}_4C_4$ :

			1		
		1		1	
	1		2		1
	1	3		3	1
	1	4	6	4	1
1	5	10	10	5	1

${}_4C_0 = \underline{\hspace{2cm}}$        ${}_4C_1 = \underline{\hspace{2cm}}$

${}_4C_2 = \underline{\hspace{2cm}}$        ${}_4C_3 = \underline{\hspace{2cm}}$

${}_4C_4 = \underline{\hspace{2cm}}$

Plug the values for  ${}_nC_r$  into the equation below:

$$(x + 7)^4 = \underline{\hspace{1cm}}(x^4)(1) + \underline{\hspace{1cm}}(x^3)(7) + \underline{\hspace{4cm}} + \underline{\hspace{1cm}}(x)(343) + \underline{\hspace{1cm}}(1)(2401)$$

Simplify the equation to a final answer

$$(x+7)^4 = \underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$$

December 2, 2013

Vocabulary and Basic Functions Quiz  
Algebra 2

Date \_\_\_\_\_

Name \_\_\_\_\_

1. Identify each letter in PEMDAS

P = \_\_\_\_\_

E = \_\_\_\_\_

M = \_\_\_\_\_

D = \_\_\_\_\_

A = \_\_\_\_\_

S = \_\_\_\_\_

2. Are the following grouping of mathematical terms an equation or expression?

a.  $3x - 4y + x^3$

b.  $3x/4 + 5y = 6$

c.  $54 - 13x + 33z$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. When  $m = 3/4$ , what is the slope perpendicular to this slope? \_\_\_\_\_

4. Using the ordered pair below, identify which is an x-value and which is the y-value.

( 3, 5 )

x-value \_\_\_\_\_

y-value \_\_\_\_\_

5. Identify each form of the equation below? (standard, point slope, slope intercept)

$3x + 4y = 6$  \_\_\_\_\_

$y = 4x - 5$  \_\_\_\_\_

$y-1 = 3(x + 2)$  \_\_\_\_\_

6. Identify ( h, k ) and a in the following equation:  $y = -3|x + 4| + 2$

( h, k ) = \_\_\_\_\_ a = \_\_\_\_\_

December 10, 2013

Matrix Quiz

Algebra 2

Period \_\_\_\_\_

Name \_\_\_\_\_

Date \_\_\_\_\_

1. Use following systems of equations to create an augmented matrix.

$$3y - x = 4 \qquad x + y = 2$$

2. Solve the augmented matrix to solve for x and y of the system of equations from problem one.

Over →

3.  $3 * \begin{bmatrix} 2 & 6 & 0 \\ 4 & 8 & 1 \end{bmatrix} = \underline{\hspace{2cm}}$

4.  $\begin{bmatrix} 5 & 8 \\ 5 & 3 \end{bmatrix} + \begin{bmatrix} 3 & 2 \\ 5 & 9 \end{bmatrix} = \underline{\hspace{2cm}}$

5.  $2 * \begin{bmatrix} 4x & 8 \\ 5x & 3y \end{bmatrix} - \begin{bmatrix} 4y & 2 \\ 5x & 3x \end{bmatrix} = \underline{\hspace{2cm}}$



December 13, 2013

Algebra 2

Matrices and Probability

Period: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Systems of Equations: Use Substitution or elimination to solve the following equations.

$$y - 3x + z = 4$$

$$7x + 3y = 8$$

$$z = 2$$

2. Matrices: Create a matrix using the following systems of equations. Solve this Matrix

$$5x - 3y = 4$$

$$4x - y = 6$$

3.  $x * \begin{bmatrix} 4x & 8y \\ 4 & 3y \end{bmatrix} - \begin{bmatrix} 4y & 2 \\ 5y & 3x \end{bmatrix} =$

4. Simon and Emmanuel are running for Co-Captains of the Golf Team at Worcester North High School. Their statistics team claims that Simon has 45% chance of winning. Simon *or* Emmanuel has an 80% chance of winning. The chance of both Simon *and* Emmanuel winning is only 15%. What percent chance does Emmanuel have to win?
5. You randomly select two cards from a standard deck of 52 cards. What is the probability that the first card is a heart, and the second card is not a heart? (*You do not place the card back into the deck*)
6. You and your neighbor both install new garage door openers. You each can program your own *4 digit numerical code* to activate the device. When you pull out of your garage the next day, you notice your neighbor's garage door goes up and down at the same time as yours. What was the probability that you entered in the same exact code?

December 19, 2013

Algebra 2

Quadratic Functions

Period: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. What form of the equation is the following function? \_\_\_\_\_

$$f(x) = 3x^2 + 4x - 2$$

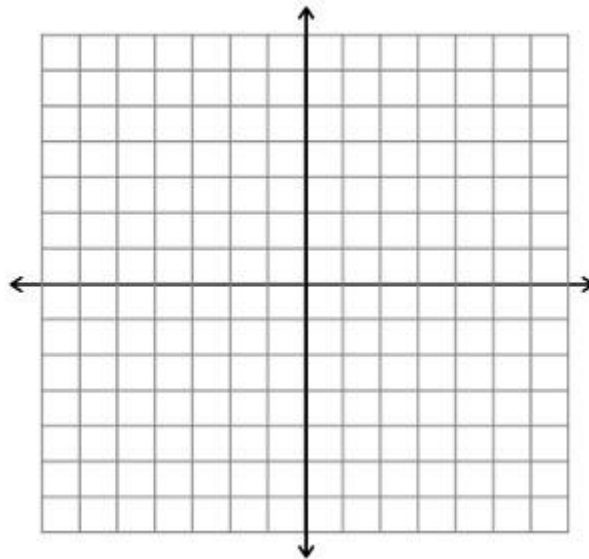
2. Find the vertex of the equation from question number one. (\_\_\_\_,\_\_\_\_)

3. Does the following equation have a maximum or minimum? Circle one: **max**, **min**

$$y = -2x^2 + 3$$

value: \_\_\_\_\_

4. Graph the equation from question number three.



5. Write an equation that goes through a vertex of **(2, 3)** when **a = 2**. Hint: use  $y = a(x - h) + k$

y = \_\_\_\_\_ and what form of the quadratic equation is this? \_\_\_\_\_ **form** \_\_\_\_\_

6. Turn the following equation into standard form of the equation using FOILING:

$$y = 3(x - 5)(x + 3)$$

y = \_\_\_\_\_

7. Write out the general formulae for the following forms of the quadratic equation and the axis of symmetry in terms of x:

Standard form:      y = \_\_\_\_\_                      x = \_\_\_\_\_

Vertex form:      y = \_\_\_\_\_                      x = \_\_\_\_\_

**\*\*BONUS\*\***

Intercept form:      y = \_\_\_\_\_                      x = \_\_\_\_\_