HIGH SCHOOL MATHEMATICS: A VENUE FOR
POLITICAL RESISTANCE TO WHITE SUPREMACY
PROJECT

by

Morgan Kendall Fierst

A capstone submitted in partial fulfillment of the
requirements for the degree of Master of Arts in Teaching.

Hamline University
Saint Paul, Minnesota
December 2017

Secondary Advisor: Lesa Covington Clarkson

Primary Advisor: Laura Halldin
To Keziah, Koah, and Aubrielle for your unconditional love, curiosity, and compassion.

Thank you Dr. Covington Clarkson, your poise, integrity, strength, and ferocity in this work is remarkable and inspiring. Special thanks to my sister, mother, brother, and father who have provided me with relentless support and love. Thank you to CF, LC, LA, TH, SW, MZ, KBF, SM, KF, LA, SB, LZ, SO, EB, AE, FA and every single one of my students. Your perspectives, voice, courage, have influenced my participation in this world. I am in awe of your courage, creativity, and relentless pursuit in fighting for the full recognition of every person’s humanity.
ACKNOWLEDGEMENTS

Special thanks to The Ed Factory for their invaluable guidance in research and creative design. Lisa Arrastia, thank you for sharing your critical, yet artistic, vision for education. Thank you Vanessa Abanu for your incredible ability to create sustainable networks of support. Your capacity to connect provided us with real and current data on every project.
# TABLE OF CONTENTS

## PROJECT DESCRIPTION

- Introduction ................................................................. 1
- Overview of Project ...................................................... 1
- Rationale ........................................................................... 2
- The Foundation ................................................................. 4
- The Framework ................................................................. 6
- Assessment ........................................................................ 11
- Conclusion ........................................................................ 12

## REFERENCES .................................................................. 13

## APPENDICES ................................................................ 14

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>COURSE LEARNING TARGETS ........................................ 14</td>
</tr>
<tr>
<td>B</td>
<td>COURSE PACING GUIDE ............................................. 21</td>
</tr>
<tr>
<td>C</td>
<td>NAME TENT FEEDBACK FORMS .................................... 25</td>
</tr>
<tr>
<td>D</td>
<td>PREFERRED NAMES CHECKLIST .................................. 26</td>
</tr>
<tr>
<td>E</td>
<td>UNIT 1 CHALLENGE QUESTION ................................... 27</td>
</tr>
<tr>
<td>F</td>
<td>STUDENT GENERATED QUESTIONS ................................. 28</td>
</tr>
<tr>
<td>G</td>
<td>UNIT 1 CHAPTER CHALLENGE .................................... 32</td>
</tr>
<tr>
<td>H</td>
<td>UNIT 1 RESULTS ....................................................... 36</td>
</tr>
<tr>
<td>I</td>
<td>CRITICAL LEARNING PROJECT ................................... 37</td>
</tr>
<tr>
<td>J</td>
<td>STUDENT EXHIBITION NIGHT BROCHURE ....................... 41</td>
</tr>
</tbody>
</table>
PROJECT DESCRIPTION

Introduction

Three main structural issues in mathematics education need to be addressed: inequitable access, the dehumanization of students, and the emphasis of the individual. These three structures support the structure of White Supremacy in the mathematics classroom and will continue to do so until mathematics education in America is interrupted and transformed.

There are many systems and structures that create inequities in access to mathematics education. Chapter two examined systems that routinely oppress particular groups of students. The purpose of this chapter is to provide a framework for high school mathematics teachers in developing a curriculum that will interrupt White Supremacy in the mathematics classroom. This framework can be used across content areas and should not be limited to mathematics courses. The curriculum responds to my research question: *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?*

Overview of the Project

Culturally relevant curriculum and Critical Race Theory are absent in an overwhelming majority of high school mathematics courses. In Chapter two, research clearly indicates the need for educators to engage in Critical Race Theory that implements a culturally relevant curriculum. Despite good intentions and a desire to engage with this type of curriculum, mathematics educators lack resources and know-how for successful implementation. This project aims to be a curriculum that is culturally relevant, practical, and uncovers systems of power, privilege, and race.
This chapter outlines a yearlong advanced algebra curriculum that is rooted in student voice and community engagement. The project includes essential foundational work, curriculum design, a pacing guide, course-learning targets, Minnesota state mathematics standards, and a five-step framework. The framework engages educators in designing a set of yearlong unit challenges that are based in student voice, current community issues, and content specific learning targets. This five-step framework also discusses how Critical Race Theory and culturally relevant teaching practices are integrated to expose oppressive systems. The impact of the curriculum will be evaluated through an end-of-the-year student capstone project.

**Rational**

“When are we ever going to use this?” is a question students often ask when they do not see the connection or relevance from the instruction to the real-world. In addition, students’ social connections are basic needs that must be met before learning can take place. This project sought to address students’ need to know (relevance), content, and even more importantly how they see themselves in it.

Our survival is dependent on social connections; our society is not. Way implores us to foster a political resistance to this disconnection. Lieberman’s work urges educators to shape their curriculum and the context in which they teach it to engage the social brain. Coates reminds us to use education to find our humanity; to use questions to uncover structures and systems of White Supremacy. Mathematics is an important venue to foster a political resistance to disconnection and White Supremacy.

My project incorporates culturally relevant teaching (CuRT), Critical Race Theory (CRT), and the social brain to build and analyze our community as a means to find the
humanity of our students, develop our students’ agency, and interrupt the unbalanced and inequitable power structure in the mathematics classroom.

White Supremacy has built strong and powerful systems in mathematics education. Boaler advocates for educators to engage in equitable strategies that interrupt oppressive systems in the schools (2016). Educators can implement equitable learning experiences by engaging students in hands-on activities, project-based curriculum, real-life application, and opportunities to work together (Boaler, 2016). Moreover, Coates proposes that education can uncover structures and systems through questioning (2015). He states “questions are the heart of education, because questions matter as much, perhaps more than, the answers” (Coates, 2015, p. 116). Gay and Ladson-Billings recommend implementing a CuRT to humanize students, build relationships, and to honor student voice. They believe students deserve access to an equitable and accurate representation in their curriculum. Gay and Ladson-Billings also believe students need to develop their agency to change the world for the better.

My project aims to incorporate questions, real-life application of mathematics, project-based curriculum, and opportunities to work together. Moreover, the project develops a framework that honors student voice and their prior experiences to build authentic community-based investigations that develop student agency. Students come to rely on one another to uncover structure and systems of White Supremacy in the classroom and in their community while simultaneously building content mastery. This project combines the work of Coates, Gay, Ladson-Billings, Way, and Lieberman to provide a response to my question: *How can mathematics education be restructured to dismantle White Supremacy in the mathematics classroom, improve content mastery, and increase student agency?*
The Foundation

The development of this curriculum acknowledges many external pressures public high school educators face. Educators often find it difficult to change systems because they are overwhelmed with district mandates, content pacing directives, high-stakes assessments, coverage of state standards, and more. Many educators find themselves in survival mode and unable to be transformative in their work.

Successful implementation of the project requires a detailed review of course content and pacing. Prior to the beginning of the year, educators must identify the scope and sequence of their course. Educators must eliminate any superfluous and redundant content. Course learning targets must be written in a student-friendly language, cover all state standards designated for their course, and cover all necessary prerequisites content for subsequent upper level mathematics courses (See Appendix A).

It is important to be intentional about what will be taught in the course and how much time is necessary to cover each topic. Unit challenges range from one to five days each and require a thoughtful analysis of pacing and content coverage. Once course content is defined, educators must establish a pacing guide that will cover all of the content and incorporate as many unit challenges as possible (See Appendix B). A yearlong pacing guide will help educators strategize on how to incorporate unit challenges throughout the year.

In addition to setting up the logistics of the course, educators must be intentional about how they will construct the social-emotional learning atmosphere of the classroom in the beginning of the year. As research indicates, a few things must be in place to make the work as effective and meaningful as possible. It is essential that educators intentionally create a safe classroom by building relationships with the students and between the students. If
students do not feel safe to discuss tough issues in the classroom, they will not fully participate in unit challenges.

The first two weeks of the school year should be used to intentionally build community. Many educators are concerned about delaying the start of curriculum, but building a safe classroom allows educators to move through the curriculum faster than their colleagues. This is important for social justice investigations but also the development of students who will challenge themselves with content.

For example, Name Tent Feedback forms built relationships immediately (See Appendix C). They were used the first five days of the school year. On the outside they were blank and used as a name tent. Students wrote the name they preferred to be called in class. On the inside, students wrote comments, questions, concerns, etc. to the teacher, who would then respond each day. The daily communication between student and teacher built connections immediately and authentically.

Another powerful tool in building relationships within the classroom was providing students with a list of names; an edited roster that reflects preferred names, along with a blank seating chart (See Appendix D). Each day, a group of five students were introduced. All students documented the preferred and phonetic spelling of their classmates’ names on their seating charts. The next day, students assessed their own knowledge of their classmates’ names, and the cycle continued until all students were introduced. Once all students were introduced, names were reviewed for a few days, and a name assessment was conducted.

Social connections improve cognitive function and should be intentionally built every single class. Relationship building and name fluency should not end after the first couple weeks of school. Every time new seating charts are introduced, an additional introduction
activity should be implemented. In addition, group work routines and expectations can be built to promote healthy relationships throughout the year.

**The Framework**

Once a pacing guide, course-learning targets, and a safe classroom environment have been developed it is time to engage students in a culturally relevant curriculum in the mathematics classroom rooted in Critical Race Theory. Educators should use this framework along with students’ voices to develop unique unit challenges that are relevant to their interests and community. At the beginning of the unit, the teacher presents an essential question that will be explored throughout the unit. Educators will develop and design a unit challenge that responds to students’ interests and applies mathematical content that requires further attention. Students will complete unit challenges at the end of a unit but prior to the unit exam. Below is a description of the framework:

**Step 1: Generate questions.** Design unit challenges to respond to student questions. In each unit of study, present students with an essential question about a specific social issue present in their community. Questions should be open-ended and general. For example, the initial question asked in Unit 1 was “To what extent is racism a factor in mortgage lending? How does access to fair and equitable lending practices impact my community?” (See Appendix E).

Students work in their groups to generate as many questions as they need in order to answer the essential question. Students should not try to answer the question at this point. They should think about all the things they would need to know in order to respond to the unit question. This is an opportunity to assess students’ social and mathematical prior knowledge. These questions will eventually guide the design of the unit challenge. Students
asked many questions. Examples include: “What is mortgage lending?” “Is it like this in my neighborhood?” “Who decides who gets loans?” “How does credit scores play a role in this?” “How do loans work?” “Does the area of a house affect who gets to live there?” “Does the price of the home matter?” (See Appendix F).

**Step 2: Build & Master Unit Concept & Skills.** Learning targets for the unit will guide daily lessons that encourage student mastery of mathematics concepts and skills. During this time, use tasks to address student questions developed from *Step 1*. Analyze current articles and/or news stories in class. Include materials to help build connections and curiosity between the mathematics and social topics focused on in that unit.

For example, students at South High School in Minneapolis read several articles about mortgage companies that were sued or settled outside of court for discriminatory lending practices and redlining. In addition, students examined a report, *Communities in Crisis*, from the Institute for Race and Poverty, which examined race and lending practices in Minneapolis (2009).

**Step 3: Unit Challenges.** At the conclusion of the unit, apply mathematics concepts and skills to develop a better understanding of an issue present in the community. Design the challenge using student interest, as collected from the unit’s essential question, and develop it to involve mathematical content that students struggled with conceptually, as observed during formative assessments. Unit challenges must be relevant and use current data and information, and they must not result in a specific right or wrong answer. Rather, design the challenge so each student arrives at and justifies their conclusion through the mathematics generated in the unit challenge.
For example, many students struggle to master calculator proficiency with recursive sequences because they did not have the technology at home. In addition, students struggled to write recursive sequences that involved annual compound interest. The unit challenge was designed to explore the structure of mortgage loans and provided a group task that required all group members to work together in writing recursive sequences to model mortgage loans (See Appendix G). Students were presented with an actual home that was for sale at the then current median home price in Minneapolis. Students were tasked with determining the monthly payment required to pay off a mortgage loan in exactly 30 years. This work required students to use their calculators and to write recursive routines that modeled annual compound interest. In addition, students had to report the total price paid for the home and more. Students were unaware that each group had been given a different annual interest rate. The *Communities in Crisis* report indicated that many Black applicants were given a higher interest rate than for which they qualified (2009). Groups shared results on the impact that a difference in one or two percentage points could have on a monthly payment and on the total amount paid for a home (Appendix H).

**Step 4: Reflections.** It is essential to create time for students to reflect. This is one of the most important parts of the entire process. Reflections should be open for approval and criticism of the work. In addition, they should be group- and individual-based. In the Unit 1 Challenge, groups had to decide if lending practices were racist in Minneapolis and justify their response on their solution page. In addition, each student had to submit their own reflection on the work. In the individual journal, students spoke to the strengths and weaknesses of the challenge.
Specifically, students appreciated the connection between the course content and their community. Many students wrote about the impact of a one-percent increase in interest can have on a mortgage loan (short and long term). Students overwhelmingly appreciated the knowledge to build a deeper understanding about loans. Many students communicated that this was the first time they had discussed loans and financial health. Students reported that they still had a lot of unanswered questions and wanted to know more about why subprime lenders were able to operate and take advantage of Communities of Color. Students wished there was more closure in terms of what happened to the banks and to North Minneapolis.

**Step 5: Repeat.** This process will repeat for as many units as time permits throughout the school year. Each unit will build on the previous unit (See Figure 3). Not every unit will include a unit challenge due to pacing and content limitations. That is okay as long as students participate in several unit challenges throughout the year. It is important to make the process of challenging social constructs transparent to the students.

![The Framework Cycle](image)

*Figure 3. The Framework Cycle (Fierst, 2017).*
After looking at discriminatory lending practices in Minneapolis, students were confused as to how lenders were allowed to engage in racist decision-making, especially when race had not been recorded field on the loan application. One student suggested that lenders did not need applicants to indicate race on the application because Minneapolis is segregated. The student went on to say, as long as lenders knew the location of the home, the applicant’s race could be inferred. Therefore, the next unit challenge asked students, “To what extent is Minneapolis segregated?” (See Figure 4).

Figure 4. Example of Framework Cycle (Fierst, 2017).
Assessment

In the final quarter of the year, students create their own unit challenge, a critical learning project (See Appendix I). Throughout the project students work in groups to identify and explore an issue they are passionate about. Educators should provide each group with a set of course-long learning targets. Students will use the collection of learning targets to reflect on the mathematical arsenal available to them. It also helps students to name and label the mathematics used. Students determine which mathematics will best develop a deeper understanding about the impact of the issue within the community. Their critical learning project is a product, driven by course-level mathematics that expresses a deeper understanding of an injustice to an audience of community members and stakeholders.

For example, advanced algebra students created short public service announcements. The videos sought to bring awareness to an issue the students cared about deeply—their message driven by course-level mathematics. Students investigated fair and equitable public school funding options, access to affordable post secondary education, voter ID amendments, standardized testing, the school-to-prison-pipeline, race disparities in unemployment, and more. Videos were then presented at a student exhibition night in which over 300 people attended (See Appendix J).

The learning process will emphasize students’ capacity to think critically and about how they can use mathematics to better understand their world. Contrary to unit challenges, where students worked with a specific set of mathematics and social context was connected to the mathematics, critical learning projects challenge students to take a context and determine how mathematics could be applied to it. This is a critical step in building mathematical fluency with students.
Conclusion

As educators, we are charged with developing learners. We need to facilitate the development of big and critical thinkers. We want to support the creation of socially conscious citizens who will generate and work for change. I propose that in order to achieve these lofty goals we must first provide students the opportunity to develop critical skills for recognizing and analyzing social inequities. We must have the courage to talk about race, power, and privilege in all of our courses. We must be creative in finding ways to bring cultural relevancy, Critical Race Theory, and real-world meaning to our content. Being a good mathematics teacher cannot be about the mere instruction of mathematic skills anymore. Being a mathematics teacher must evolve into providing students the opportunity to utilize mathematics in ways that are meaningful to themselves and their community. We must empower students to embrace mathematics as a means through which they can question and explain, create and convince. They must have the chance to see how mathematics can work to inform their life’s decisions so that the students, in turn, may someday work to institute change.
References


# Unit 1: Sequences & Series

**Approximate Duration:** 17 lessons

**1.1 I can write a recursive formula for arithmetic, geometric, and shifted geometric sequences.**

- a. I can recognize a pattern and explain how to find the next 4 terms.
- b. I can use multiple forms of recursive notation.
- c. I can identify the three parts (rule, term, and domain) of a recursive model.

**Minnesota State Math Standards (9.2.2.4)**

**1.2 I can model and solve relevant real-world problems using recursive sequences and series.**

- a. I can determine when to use $u_0$ versus $u_1$.
- b. I can determine how many terms in a sequence are necessary to determine an appropriate recursive model.
- c. I can interpret the three parts (rule, term, and domain) of a recursive model in context.
- d. I can use recursive formulas to model and solve real-world situations using a graphing calculator.
- e. I can find the limit of a decreasing geometric sequence and shifted geometric sequence if it exists.
- f. I can use geometric sequences to model growth and decay word problems.
- g. I can determine how interest and depreciation can be modeled in a recursive formula.
- h. I can use recursive formulas to model loans and investments.
- i. I can incorporate compound interest in a recursive and explicit model.

**Minnesota State Math Standards (9.2.2.2; 9.2.2.5; 9.2.4.2; 9.2.4.8)**

**1.3 I can move fluently among multiple representations of recursive sequences.**

- a. I can determine the common difference/common ratio from a graph, table, recursive formula, and explicit equation.
- b. I can determine the y-intercept from a graph, table, recursive formula, and explicit equation.
- c. I can write an explicit equation from a recursive formula.
- d. I can recognize arithmetic, geometric, and shifted geometric sequences from a table, graph, recursive formula, or explicit equation.

**Minnesota State Math Standards (9.2.2.3)**

**1.4 I can express the partial sums of a geometric series recursively.**

- a. I can generate a table of the partial sums of a geometric series.
- b. I can write a recursive rule to model the partial sums of a geometric series.
- c. I can use sigma notation to represent the partial sums of a geometric series.
- d. I can determine the partial sum of a geometric series.

**Minnesota State Math Standards (9.2.2.5)**
### Unit 2: Function Families

**Approximate Duration:** 18 lessons

#### 2.1 I can define a function and determine its important aspects.

- a. I can identify a practical and theoretical domain and range of a function.
- b. I can identify intercepts, zeros, maxima, minima, and intervals of increase and decrease for a function (using equations, tables, and graphs).
- c. I can use mathematical notation to describe the domain and range of a variety of functions.
- d. I can obtain information and draw conclusions from a graph, table, and equation.
- e. I can evaluate a function at a given point.
- f. I can determine the rate of change from a graph, equation, or table.
- g. I can evaluate compositions of functions.

**Minnesota State Math Standards (9.2.1.1; 9.2.1.2; 9.2.1.3; 9.2.1.4)**

#### 2.2 I can model a quadratic, square root, & absolute value function using the parent function and move fluently among the multiple representations within each function family.

- a. I can identify the parent equation, graph, and table for a quadratic, square root, and absolute value function.
- b. I can apply transformations including translations, reflections, stretches, and shrinks to a parent function and determine the resulting graph and/or equation.
- c. I can identify the important features of a function to determine which function family best models a given situation.
- d. I can determine which function family best models the relationship between two variables.

**Minnesota State Math Standards (9.2.1.5; 9.2.1.8; 9.2.1.9; 9.2.2.3; 9.2.2.6; 9.2.3.1)**

#### 2.3 I can model a cubic, cube root, & inverse (rational/reciprocal of linear) function using the parent function and move fluently among the multiple representations within each function family.

- a. I can identify the parent equation, graph, and table for a cubic and inverse function.
- b. I can apply transformations including translations, reflections, stretches, and shrinks to a parent function and determine the resulting graph and/or equation.
- c. I can identify the important features of a function to determine which function family best models a given situation.
- d. I can determine which function family best models the relationship between two variables.
- e. I can identify the asymptotes for the reciprocal of a linear function using symbolical and graphical methods.

**Minnesota State Math Standards (9.2.1.7; 9.2.1.8; 9.2.1.9; 9.2.2.6)**
### Unit 3: Exponential, Power, & Logarithmic Functions

**Approximate Duration:** 19 lessons

#### 3.1 I can define exponential, power, and logarithmic functions.
- a. I can define exponential, power, and logarithmic functions
- b. I can make a table for an exponential, power, and logarithmic functions.
- c. I can identify and interpret asymptotes for a function.
- d. I can write an equation based on the graph and vice versa.
- e. I can make statements about the rate of change for a function.

**Minnesota State Math Standards (9.2.1.7; 9.2.2.3)**

#### 3.2 I can solve equations and simplify expressions involving exponents.
- a. I can solve equations with exponents as the variable.
- b. I can apply properties of exponents (list will be provided in class).
- c. I can represent and solve problems using exponentials (investment growth, depreciation, & population growth).

**Minnesota State Math Standards (9.2.2.2; 9.2.4.2; 9.2.4.8)**

#### 3.3 I can solve equations with rational exponents and radicals.
- a. I can write a root with rational exponents.
- b. I can rewrite expressions with rational exponents as expressions involving roots.

**Minnesota State Math Standards (9.2.3.1; 9.2.4.7)**

#### 3.4 I can solve equations and simplify expressions with logarithms.
- a. I can use the definition of logarithm to change between logarithmic and exponential form.
- b. I can simplify expressions with logarithms.
- c. I can solve equations with logarithms.
- d. I can apply the Change-of-base formula.

**Minnesota State Math Standards (9.2.4.8)**
## Unit 4: Quadratics

**Approximate Duration:** 23 lessons

### 4.1 I can create equivalent quadratic expressions.

- a. I can identify and locate the scale factor of a quadratic.
- b. I can identify and use general form, vertex form, and factored form of a quadratic function.
- c. I can convert forms by graphing.
- d. I can identify and write an equation for the line of symmetry for a quadratic equation.

**Minnesota State Math Standards** (9.2.1.5; 9.2.3.7; 9.2.4.1)

### 4.2 I can identify and locate the zeros of a quadratic function.

- a. I can identify and use the factored form of a quadratic function.
- b. I can factor quadratic equations.
- c. I can use the quadratic formula to find the roots of a quadratic in general form.
- d. I can expand a binomial product to go from factored to general form.

**Minnesota State Math Standards** (9.2.1.5; 9.2.1.6; 9.2.2.1; 9.2.3.3; 9.2.4.1; 9.2.4.3; 9.2.4.8)

### 4.3 I can identify and locate the vertex of a quadratic.

- a. I can identify and use the vertex form of a quadratic function.
- b. I can recognize perfect square binomials.
- c. I can recognize difference of squares binomials.
- d. I can “Complete the Square” to go from general to vertex form.

**Minnesota State Math Standards** (9.2.1.5; 9.2.1.6; 9.2.2.1; 9.2.4.1; 9.2.4.8)

### 4.4 I can define and apply properties of complex numbers.

- a. I define complex numbers.
- b. I can add/subtract complex numbers.
- c. I can multiply/divide complex numbers.
- d. I can use complex conjugates to simplify expressions.
- e. I can find and check solutions to quadratic equations.

**Minnesota State Math Standards** (9.2.3.6; 9.2.4.1; 9.2.4.3; 9.2.4.8)
# Unit 5: Polynomials

Approximate Duration: 18 lessons

## 5.1 I can identify important features of higher-degree polynomials.

- a. I can determine if an expression represents a polynomial.
- b. I can write a polynomial in standard form.
- c. I can name a polynomial by its degree and by the number of terms.
- d. I can recognize the roots of a polynomial function from its graph and equation.
- e. I can use notation to describe intervals of increase/decrease.
- f. I can identify local minima, maxima, and end behavior of polynomials.
- g. I can write an equation given its zeros and y-intercept.

Minnesota State Math Standards (9.2.1.6; 9.2.4.3)

## 5.2 I can perform operations on polynomials.

- a. I can add, subtract, and multiply polynomials.
- b. I can divide polynomials using long-division and synthetic division.
- c. I can use polynomial operations to solve word problems.

Minnesota State Math Standards (9.2.3.2; 9.2.3.3)

## 5.3 I can factor rational functions to simplify expressions.

- a. I can add, subtract, multiply, and divide rational expressions.
- b. I can factor polynomials.
- c. I can simplify and solve rational expressions.

Minnesota State Math Standards (9.2.3.4)
## Unit 6: Matrices & Inequalities

**Approximate Duration:** 24 lessons

### 6.1 I can perform matrix operations.

- I can create a polygon matrix.
- I can express the translation of a polygon with matrices.
- I can define vocabulary associated with matrices (dimension, row, column, entry).
- I can perform matrix addition.
- I can perform matrix multiplication.
- I can perform scalar multiplication.

**Minnesota State Math Standards (none – prerequisite material for pre-calculus)**

### 6.2 I can solve a system of equations using matrices.

- I can write a system of equations as a matrix (augmented matrix).
- I can use row-reduction to solve a system of equations.
- I can solve a system of equations using inverse matrices.
- I can perform matrix multiplication.
- I can identify the identity matrix.
- I can define an inverse matrix.
- I can use matrix inverse notation.

**Minnesota State Math Standards (9.2.3.7; 9.2.4.8)**

### 6.3 I can solve a system of inequalities.

- I can graph an inequality.
- I can graph a minimum of 3 inequalities to find a feasible region.
- I can determine the vertices of the feasible region.
- I can find the optimal value.
- I can determine the reasonableness of a solution based on the graph.
- I can represent contextual problems using inequalities.
- I can write constraints (inequalities) for a linear programming problem.
- I can determine the reasonableness of solution based on the context of a problem.

**Minnesota State Math Standards (9.2.3.7; 9.2.4.1; 9.2.4.4; 9.2.4.5; 9.2.4.6; 9.2.4.8)**
## Unit 7: Probability

**Approximate Duration:** 25 lessons

### 7.1 I can describe and calculate chance behavior with a probability model.

- a. I can determine probability from two-way tables and tree diagrams.
- b. I can construct Venn Diagrams and determine probabilities.
- c. I can use basic probability rules, including the complement rule and the addition rule for mutually exclusive events.

Minnesota State Math Standards (9.4.3.1; 9.4.3.6; 9.4.3.7; 9.4.3.8)

### 7.2 I can interpret and calculate conditional probabilities.

- a. I can use notation to describe and compute conditional probabilities.
- b. I can calculate conditional probabilities of events using a two-way tables, Venn Diagrams, and tree diagrams.

Minnesota State Math Standards (9.4.3.5; 9.4.3.6; 9.4.3.7; 9.4.3.8)

### 7.3 I can determine if two events are independent.

- a. I can determine if two events are independent.
- b. I can calculate the probability of multiple independent events.
- c. I can calculate the probability of compound events.
- d. I can determine if two events are mutually exclusive.
- e. I can distinguish between intersections and unions.
- f. I can apply probability concepts to make informed decisions in real-world situations.

Minnesota State Math Standards (9.4.3.5; 9.4.3.6; 9.4.3.7; 9.4.3.8; 9.4.3.9)

### 7.4 I can design and perform simulations.

- a. I can define experimental probability, trials, and events.
- b. I can define theoretical probability, outcomes, and randomness.
- c. I can tell the difference between experimental and theoretical probabilities.
- d. I can interpret probability as a long-run frequency.
- e. I can explain the importance of randomness in simulations and other experiments.
- f. I can apply probability concepts to make informed decisions in real-world situations.

Minnesota State Math Standards (9.4.3.2; 9.4.3.3; 9.4.3.4; 9.4.3.8)

Fierst, Morgan (2017).
## Appendix B: Course Pacing Guide

**1st Quarter (44 days) 2017-2018**

<table>
<thead>
<tr>
<th>Week</th>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>August 28</td>
<td>Community Building Name Tents</td>
<td>Community Building Name Tents</td>
<td>Community Building Name Tents</td>
<td>September 1</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>NO SCHOOL Labor Day</td>
<td>NO SCHOOL Labor Day</td>
<td>NO SCHOOL Labor Day</td>
<td>NO SCHOOL Labor Day</td>
<td>NO SCHOOL Labor Day</td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Recursion</td>
<td>Recursion</td>
<td>Appreciation</td>
<td>Depreciation</td>
<td>Savings</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Loans</td>
<td>Kidneys &amp; Medicine</td>
<td>Multiple Representations</td>
<td>Multiple Representations</td>
<td>Series</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Series</td>
<td>Series</td>
<td>Unit Challenge</td>
<td>Unit Challenge</td>
<td>Review</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>October 2 Review</td>
<td>Unit 1 Assessment</td>
<td>Function Intro</td>
<td>Function Notation, Domain &amp; Range</td>
<td>Function Composition</td>
</tr>
<tr>
<td><strong>7</strong></td>
<td>Function Composition</td>
<td>Function Composition</td>
<td>Function Families</td>
<td>Parent Functions</td>
<td>Parent Functions</td>
</tr>
<tr>
<td><strong>8</strong></td>
<td>Translations</td>
<td>Translations</td>
<td>NO SCHOOL CONFERENCES</td>
<td>NO SCHOOL State Fall Conference Day</td>
<td>NO SCHOOL Conference Conversion Day</td>
</tr>
<tr>
<td><strong>9</strong></td>
<td>Reflections</td>
<td>Vertical Stretches &amp; Shrinks</td>
<td>Vertical Stretches &amp; Shrinks</td>
<td>Horizontal Stretches &amp; Shrinks</td>
<td>Rational &amp; Periodic Functions</td>
</tr>
<tr>
<td><strong>10</strong></td>
<td>Review</td>
<td>Review</td>
<td>November 1 Unit 2 Assessment 1st Quarter Ends</td>
<td>NO SCHOOL Teacher Prep/PD</td>
<td>NO SCHOOL Record Keeping Day</td>
</tr>
</tbody>
</table>
## 2nd Quarter (44 days) 2017-2018

<table>
<thead>
<tr>
<th>Week</th>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Persistence Work</td>
<td>Persistence Work</td>
<td>Exponential Functions</td>
<td>Power Functions</td>
<td>Exponential vs. Power Functions</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Properties of Exponents</td>
<td>Properties of Exponents</td>
<td>Properties of Exponents &amp; Roots</td>
<td>Rational Exponents &amp; Roots</td>
<td>Rational Exponents &amp; Roots</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>Unit Challenge</td>
<td>Unit Challenge</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>No School - Fall Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Review</td>
<td>Review</td>
<td>Unit 3-Part 1 Assessment</td>
<td>Logarithmic Functions</td>
<td>December 1 Logarithmic Functions</td>
</tr>
<tr>
<td></td>
<td>27</td>
<td>28</td>
<td>29</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>5</td>
<td>Properties of Logarithms</td>
<td>Unit Challenge</td>
<td>Unit Challenge</td>
<td>Unit 3-Part 2 Assessment</td>
<td>Quadratic Patterns</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>Quadratic Patterns</td>
<td>Quadratic Patterns</td>
<td>Equivalent Forms</td>
<td>Equivalent Forms</td>
<td>Equivalent Forms</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Scale Factor &amp; Y-intercept</td>
<td>Roots &amp; Factored Form</td>
<td>Roots &amp; Vertex Form</td>
<td>Roots &amp; General Form</td>
<td>Roots &amp; Graphing</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
</tr>
</tbody>
</table>

**WINTER BREAK * December 25, 2017 – January 5, 2018**

<table>
<thead>
<tr>
<th>Week</th>
<th>January 8, 2018</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Roots &amp; Factoring</td>
<td>Roots &amp; Factoring</td>
<td>Roots &amp; Factoring</td>
<td>Roots &amp; Factoring</td>
<td>Vertex Average of the Roots</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>NO SCHOOL MLK Day</td>
<td>Vertex Completing the Square</td>
<td>Vertex Completing the Square</td>
<td>Vertex Completing the Square</td>
<td>Review</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>16</td>
<td>17</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>10</td>
<td>Review</td>
<td>Review</td>
<td>Unit 4 Assessment</td>
<td>NO SCHOOL Teacher Prep/PD</td>
<td>NO SCHOOL Record Keeping</td>
</tr>
<tr>
<td></td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>Week</td>
<td>MONDAY</td>
<td>TUESDAY</td>
<td>WEDNESDAY</td>
<td>THURSDAY</td>
<td>FRIDAY</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>---------</td>
<td>-----------</td>
<td>----------</td>
<td>--------</td>
</tr>
<tr>
<td>1</td>
<td>29 Classifying Polynomials</td>
<td>30 Important Features of Polynomials</td>
<td>31 Important Features of Polynomials</td>
<td>February 1 Important Features of Polynomials</td>
<td>Polynomial Operations</td>
</tr>
<tr>
<td>2</td>
<td>5 Desmos</td>
<td>6 Desmos</td>
<td>7 Polynomial Operations</td>
<td>8 Polynomial Operations</td>
<td>9 Algebraic Fractions</td>
</tr>
<tr>
<td>3</td>
<td>12 Algebraic Fractions</td>
<td>13 Algebraic Fractions</td>
<td>14 Algebraic Fractions</td>
<td>15 Review</td>
<td>NO SCHOOL Parent Teacher Conferences</td>
</tr>
<tr>
<td>4</td>
<td>19 NO SCHOOL President's Day!</td>
<td>20 Unit Challenge</td>
<td>21 Unit Challenge</td>
<td>22 Review</td>
<td>23 Unit 5 Assessment</td>
</tr>
<tr>
<td>5</td>
<td>26 Intro</td>
<td>27 Matrix Operations</td>
<td>28 Matrix Operations</td>
<td>March 1 Practice</td>
<td>2 Solving Systems</td>
</tr>
<tr>
<td>6</td>
<td>5 Row Reduction Method</td>
<td>6 Calculator Day</td>
<td>8 Row Reduction</td>
<td>9 Solving Systems with Inverse Matrices</td>
<td>9 Solving Systems with Inverse Matrices</td>
</tr>
<tr>
<td>7</td>
<td>12 Solving Systems with Inverse Matrices</td>
<td>13 Solving Systems with Inverse Matrices</td>
<td>π Day * 14 Review</td>
<td>15 Review</td>
<td>Unit 6 Assessment Part 1</td>
</tr>
<tr>
<td>8</td>
<td>19 Graphing Inequalities</td>
<td>20 Systems of Inequalities</td>
<td>21 Linear Programming</td>
<td>22 Linear Programming</td>
<td>23 Unit Challenge</td>
</tr>
<tr>
<td>9</td>
<td>26 Unit Challenge</td>
<td>27 Review</td>
<td>28 Review</td>
<td>29 Unit 6 Assessment Part 2 3rd Quarter Ends</td>
<td>30 NO SCHOOL Record Keeping Day</td>
</tr>
</tbody>
</table>

3rd Quarter (42 days) 2017-2018

SPRING RECESS * April 2- April 6, 2018
### 4th Quarter (46 days) 2017-2018

<table>
<thead>
<tr>
<th>Week</th>
<th>MONDAY</th>
<th>TUESDAY</th>
<th>WEDNESDAY</th>
<th>THURSDAY</th>
<th>FRIDAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>April 9</td>
<td>10 Randomness &amp; Probability</td>
<td>11 Two Way Tables</td>
<td>12 Two Way Tables</td>
<td>13 Venn Diagrams</td>
</tr>
<tr>
<td></td>
<td>Randomness</td>
<td>17 Randomness</td>
<td>18 Two Way Tables</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; Probability</td>
<td>16 Venn Diagrams</td>
<td>17 Tree Diagrams</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>23 Independence</td>
<td>24 Conditional Probability</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>25 Independence</td>
<td>26 Multiplication Rule</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 Review</td>
<td>2 May 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 Simulations</td>
<td>9 Simulations</td>
<td>10 Simulations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 Unit Challenge</td>
<td>12 Simulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>14 Student Capstone Projects</td>
<td>15 Student Capstone Projects</td>
<td>16 Student Capstone Projects</td>
<td>17 Student Capstone Projects</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>21 Student Capstone Projects</td>
<td>22 Student Capstone Projects</td>
<td>23 Student Capstone Projects</td>
<td>24 Student Capstone Projects</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>28 NO SCHOOL Memorial Day</td>
<td>29 Student Capstone Projects</td>
<td>30 Student Capstone Projects</td>
<td>31 Student Capstone Projects</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>30 Review</td>
<td>30 Simulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>30 Review</td>
<td>30 Simulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>30 Review</td>
<td>30 Simulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>30 Review</td>
<td>30 Simulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>30 Review</td>
<td>30 Simulations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>30 Review</td>
<td>30 Simulations</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix C: Name Tent Feedback Form

<table>
<thead>
<tr>
<th>Day</th>
<th>Name</th>
<th>Tent</th>
<th>Feedback Form</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**First Week Feedback Form**

Use this form to communicate with me. This is a place for you to comment, question, and make suggestions about class activities and content. I greatly appreciate your input. Please turn this feedback form in at the end of class and it will be returned the next day of class.

Adapted from AVID
# Appendix D: Preferred Names Checklist

<table>
<thead>
<tr>
<th>Preferred Name</th>
<th>Phonetic Spelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morgan</td>
<td>More-gen</td>
</tr>
<tr>
<td>Caitlin</td>
<td>Kate-lynn</td>
</tr>
<tr>
<td>Keziah</td>
<td>Kah-zye-ah</td>
</tr>
<tr>
<td>Koah</td>
<td>Ko-ah (sounds like Noah)</td>
</tr>
<tr>
<td>Dridge</td>
<td>Drid-jeh (sounds like bridge)</td>
</tr>
<tr>
<td>Petra</td>
<td>Pee-tra</td>
</tr>
<tr>
<td>Katrina</td>
<td>Ka-treen-ah</td>
</tr>
<tr>
<td>Yasmin</td>
<td>Yeah-zz-mean</td>
</tr>
<tr>
<td>Ricarda</td>
<td>Rah-card-ah</td>
</tr>
<tr>
<td>Maren</td>
<td>Mare-en (sounds like Karen)</td>
</tr>
<tr>
<td>Jersahi</td>
<td>Jer-sah-hee</td>
</tr>
<tr>
<td>Elias</td>
<td>El-ee-us</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Number of Names I know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td></td>
</tr>
<tr>
<td>Monday</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
</tr>
</tbody>
</table>

Fierst, Morgan (2017).
Appendix E: Unit 1 Challenge Question

Unit 1 Challenge

**The Question**
To what extent is there racial discrimination in mortgage lending? How does access to fair and equitable lending practices impact my community?

**Our Questions**
What do we need to know?
Appendix F: Student Generated Questions

Unit 1 Challenge

The Question
To what extent is there racial discrimination in mortgage lending? How does access to fair and equitable lending practices impact my community?

Our Questions
What do we need to know?

What is subprime lending?
How much does the house cost?
How much interest are we paying?
How much money do I make?
What’s the “down payment”?
What is a down payment?
What are the terms of the mortgage?
How can we keep track of our payments?
How do subprime loans work?
Who gave out the loans?
Were most people eligible for prime loans?
How many people have been foreclosed on?
What does it mean to qualify for a loan?
What are the criteria to qualify for a loan?
What is the difference between different types of loans?
What support does the bank give in tracking/paying the loan?
How many loans are given out to blacks?
How many loans are given out to whites?
Does location matter when it comes to cost?
Do all banks have the same problem?
Does loan amount matter?
What can we do?
What is the pattern for usual lending?
Who is this affecting?
Why is this happening?
Why is this topic significant?
How many white people were turned down?
What is the population of Minneapolis by race, who use subprime loans?
Why do blacks and Hispanics and other communities have to go through all the hoops to get a loan?
What is racism?
How many loans did they give out?
Do white people make that much more?
What are the requirements to get a loan?
Are there programs designed to benefit families close to foreclosure?
How do foreclosures work?
How often do foreclosed homes get broken into?
What are the loan policies?
What is the average fee for white people? Nonwhite people?
What are comparison rates?
How does this affect the community?
How do loans differ between different racial communities?
What is prime lending?
What are the difference white people pay vs. any other race?
Why did it take so long to bring attention to?
Will this situation ever turnaround?
How long does it take to pay off the loan?
How much can we pay in order to finish our payments?
What happens if I get stuck on my payments?
What are the demographics?
What is the ratio of whites to people of color that go into foreclosure?
What is a typical mortgage?
Do you have to give your race to apply for a loan?
Do they research/educate the subject?
How do they know what your race is?
What would evidence look like to support this claim?
Is this unconstitutional?
How do mortgages work?
How many minorities got subprime loans?
Why would they target the black and Hispanic communities?
Why didn’t the twin cities residents complain about the issue?
How many subprime lenders were involved?
Which communities had the most complaints reported?
How did people know they were being discriminated?
Who had benefited the most?
Could this be a coincidence?
What are the education levels of people getting loans?
Why would banks give unreasonable loans?
What are the loan statistics for the last ten years?
Why would Wells Fargo settle if they are going to deny claims?
What part of the country is segregation most common?
How does this issue affect Minneapolis?
What is the definition of census?

Why is it that, neighborhoods where more people own their homes tend to be “better?”
What does “faceless algorithms” mean? (“Even in this age of faceless algorithms that guide investment decisions.”)
Why can a white family get a loan and not a black family?
What does “racial composition of the neighborhood is a strong predictor of mortgage
activity” mean?
What is “America’s Wealth gap”?
What does the National Community Reinvestment Coalition do?
How big is the racial wealth gap?
Why are we studying this?
Why is the wage gap with race less talked about than the wage gap with gender?
Are people doing anything to make it better?
What are they doing?
Why do we still have racial discrimination?
Is it like this in my neighborhood?
Who makes the decision of whether or not someone can get a loan or not?
How much higher of a population? (“A higher population of African American residents correlates with fewer mortgage loan organizations.”)
What is the difference between racial categories acceptance of loans? (White vs. Black)
What is the diversity of the neighborhoods majority/minority?
How does credit score play a role in this?
What does census tracts have to do with this?
Why aren’t as many black people being accepted for loans and mortgages?
Does the area of the house affect who gets to live there?
How many people a year don’t get accepted because of race?
Is there a certain bank not accepting loans?
Is this more prevalent depending on location?
Do you have to be a citizen?
What is the evidence behind discrimination in mortgage lending?
If a black family was of a higher income than a white family, would they have higher chance of getting the loan?
What does algorithms mean?
In segregated areas, how many people own their home like in predominantly black area vs. predominately white?
In those same areas, how many people applied for a mortgage?
What percent of white/African Americans that apply for mortgage loans?
How many people apply for loans per year?
What do they mean by “normal social and economic measures”?
How does credit affect mortgage lending based on the individual?
Are the families who are affected aware of this or is it being covered up?
How are people resisting and fighting back if this is “one of the deep routes of America’s racial wealth gap”
How long has this been going on for?
Where in the US is the gap the smallest?
What neighborhoods are they getting the data from?
What race was the author of the first article?
What’s the wealth gap between white families and other races such as Latino or native American?
Historical Background: Has anything happen in the past areas that may make the bank resistant?
What race reviews the applications? Is it mixed?
Do the White people in the same area get loans?
Does it depend on the time of year you apply?
Is there a difference in price? Does the price of the house matter?
Is there any expectations or standards?
Where do they/we get information from?
What would bank policies look like if they were equitable?
Appendix G: Unit 1 Chapter Challenge

**Housing Investigation**

You plan to borrow $235,900 (September 2018 Minneapolis Median Home Price) to purchase a new home. The investment must be paid off in 30 years (360 months). The bank charges an annual interest rate of 4.5% compounded monthly.

**3906 Portland Ave**
Minneapolis, MN 55407 (Bryant)
5 beds • 1.5 baths • 2,364 sqft • 6098 sqft lot size • Single-Family Home

FOR SALE
$235,900


1. Experiment with values for the monthly payment. What monthly payment allows you to pay the loan off in exactly 360 months? How did you determine this payment (i.e. what is your recursive formula)?

2. How much do you actually pay for your home?

3. A household is considered cost-burdened when 30% or more of its monthly gross income is dedicated to housing. Based on your monthly payment, how much would your monthly gross income need to be so you are not considered “cost-burdened?”
Housing Investigation

You plan to borrow $235,900 (September 2018 Minneapolis Median Home Price) to purchase a new home. The investment must be paid off in 30 years (360 months). The bank charges an annual interest rate of 5.5% compounded monthly.

1. Experiment with values for the monthly payment. What monthly payment allows you to pay the loan off in exactly 360 months? How did you determine this payment (i.e. what is your recursive formula)?

2. How much do you actually pay for your home?

3. A household is considered cost-burdened when 30% or more of its monthly gross income is dedicated to housing. Based on your monthly payment, how much would your monthly gross income need to be so you are not considered “cost-burdened?”

Housing Investigation

You plan to borrow $235,900 (September 2018 Minneapolis Median Home Price) to purchase a new home. The investment must be paid off in 30 years (360 months). The bank charges an annual interest rate of 6.5% compounded monthly.

1. Experiment with values for the monthly payment. What monthly payment allows you to pay the loan off in exactly 360 months? How did you determine this payment (i.e. what is your recursive formula)?

2. How much do you actually pay for your home?

3. A household is considered cost-burdened when 30% or more of its monthly gross income is dedicated to housing. Based on your monthly payment, how much would your monthly gross income need to be so you are not considered “cost-burdened?”

Group Members:

Recursive Formula:

Total Amount Paid for Home (Payment x 360):

Monthly Income needed to avoid being cost-burdened:
## Appendix H: Unit 1 Results

### Results

<table>
<thead>
<tr>
<th>Interest Rate</th>
<th>4.5%</th>
<th>5.5%</th>
<th>6.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Payment</td>
<td>$1,195.27</td>
<td>$1,339.41</td>
<td>$1,491.05</td>
</tr>
<tr>
<td>Total Amount Paid for the Home</td>
<td>$430,297.20</td>
<td>$482,187.60</td>
<td>$536,778.00</td>
</tr>
<tr>
<td>Total Interest Paid</td>
<td>$190,797.20</td>
<td>$242,687.60</td>
<td>$297,278.00</td>
</tr>
<tr>
<td>Minimum Monthly Gross Income (to avoid being “cost-burdened”)</td>
<td>$3,984.23</td>
<td>$4,464.7</td>
<td>$4,970.17</td>
</tr>
<tr>
<td>Minimum Yearly Gross Income (to avoid being “cost-burdened”)</td>
<td>$47,810.76</td>
<td>$53,576.40</td>
<td>$59,642.04</td>
</tr>
</tbody>
</table>

Fierst, Morgan. (2017)
Appendix I: Critical Learning Project

**Advanced Algebra: Social Justice and Mathematics Critical Learning Project**

**Objective:**
Students will create their own critical learning projects (similar to Chapter Challenges). Students will identify an equity issue within their community. Groups will research the issue and use mathematics to create a deeper understanding of the identified issue. Students will create Public Service Announcements to create awareness for the issue of concern.

**Project Details:**
This project is composed of two components. Students will submit a mathematical justification that provides a deeper understanding of the issue. Based on the students’ research and findings, groups will then create a PSA that will be filmed and edited by the group, to create awareness for their issue.

**Part 1: Mathematics**

Groups will conduct research to identify key elements of the issue. Students are encouraged to conduct interviews and analyze data to better understand why the issue exists and to seek possible solutions. The most important piece of the report will be the use of mathematics to better understand the impact this issue has on the community. (i.e. What do these issues mean to us?). Students will need to clearly identify which learning targets are incorporated in their project.

Key components of Part 1:
- Clearly defined issue
- Key elements of the issue are identified and supported by research
- Mathematics is used to create a deeper understanding
- Learning Targets are identified
- Research is cited using APA format

**Part 2: PSA**

Student groups will create PSA that are NO MORE than two minutes in length to create awareness for their issue of focus. A storyboard (script/plan) for the PSA is due before any filming can take place. The mathematics used in part 1 will be the basis for the PSA.

**Timeline**
- 5/16 – All groups submit their topic of concern
- 5/23 – Mathematical Justification
- 5/25 – PSA Story Boards (plans/scripts) are due
- 6/01 – Final PSA is submitted
Mathematics & Social Justice

### Critical Learning Projects:
This is a group project and all group members are expected to contribute in meaningful ways. ONLY projects that are completed on time are accepted. NO EXCEPTIONS!

<table>
<thead>
<tr>
<th>Date</th>
<th>MON</th>
<th>TUES</th>
<th>WED</th>
<th>THURS</th>
<th>FRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>14-May</td>
<td>15-May</td>
<td>16-May</td>
<td>17-May</td>
<td>18-May</td>
</tr>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class</td>
<td>Classroom</td>
<td>Instruction</td>
<td>Assignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project</td>
<td>Introduction</td>
<td>Brainstorm Ideas</td>
<td>Research Begins</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Due: Topics</td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21-May</td>
<td>22-May</td>
<td>23-May</td>
<td>24-May</td>
<td>25-May</td>
</tr>
<tr>
<td></td>
<td>Groups Meet</td>
<td>Groups Meet</td>
<td>Flip Camcorder &amp; iMovie Information Session</td>
<td>Groups Meet</td>
<td>Groups Meet</td>
</tr>
<tr>
<td></td>
<td>Mathematical Justification</td>
<td>Mathematical Justification</td>
<td></td>
<td>Scripts/Plans for PSA content</td>
<td>Start Filming</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
<td>Due: Storyboard</td>
<td>Mobile Mac Lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>28-May</td>
<td>29-May</td>
<td>30-May</td>
<td>31-May</td>
<td>1-Jun</td>
</tr>
<tr>
<td></td>
<td>Groups Meet</td>
<td>Groups Meet</td>
<td>Wrap up filming &amp; start editing</td>
<td>Groups Meet</td>
<td>Groups Meet</td>
</tr>
<tr>
<td></td>
<td>NO SCHOOL</td>
<td>Filming</td>
<td></td>
<td>Editing</td>
<td>Finish up!! Yay!!</td>
</tr>
<tr>
<td></td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
<td>Mobile Mac Lab</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4-Jun</td>
<td>5-Jun</td>
<td>6-Jun</td>
<td>7-Jun</td>
<td>8-Jun</td>
</tr>
<tr>
<td></td>
<td>Student Exhibition Night 5-8pm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Components:</td>
<td>Issue Identification</td>
<td>Mathematical Justification</td>
<td>Storyboard</td>
<td>PSA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Save the Date!! June 6th will be our project exhibition night! Dinner will be provided. Stay tuned for details.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Group Reflection

Our Group topic:

Mathematics Incorporated:

Things that are going well:

Things that are frustrating:

This week’s game plan:

Wednesday:

Thursday:

Friday (Projects are due):
Individual Reflection

Name:________________________

Write your thoughts about your experience with the entire project.

• How did this project help you to understand your community better?
• How did this project influence your perception about the importance and usefulness of mathematics?
• What advice would you give to future students who will take part in this project?
• What have you learned about yourself?
• What questions does this project have you asking?
Appendix J: Student Exhibition Night Brochure