

Running Head: Algebra A Core Curriculum Reference Manual

DEVELOPMENT OF AN
ALGEBRA A CORE CURRICULUM REFERENCE MANUAL
BY A COLLABORATIVE TEAM

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Abstract

Math disabilities have been the focus of less systematic study than have reading disabilities (Ginsburg, 1997; Miller & Mercer, 1997). Much of the literature and focus is on basic math skills and strategies for teaching these skills. While basic math skills will always be needed, special educators have had to expand their focus to make sure students are being taught State mandated math core objectives. Special educators who teach higher level math face the challenge of teaching complex concepts when they often lack the content knowledge of the State core curriculum. General educators are faced with the challenge of teaching these concepts to lower achievers when they lack the knowledge of how to adapt math curriculum to lower performing students. The current Utah State Office of Education core curriculum lists general objectives without providing operational examples or strategies for teaching these objectives. Having a math core curriculum that is written without concrete examples has created confusion about what math operations fit under the current objectives. Collaboration between special educators and general educators could clarify what the objectives in the core really mean and bridge the gap between content knowledge and instructional strategies to help struggling students. The purpose of this project was to create and evaluate a core curriculum reference manual for the Algebra A curriculum by a collaborative team of special and general educators.

Introduction and Literature Review

Math instruction in special education has undergone significant changes the past few years, mostly related to the implementation of No Child Left Behind (NCLB). NCLB has required special educators to move away from the drill and practice of basic math facts to address the rigors of advanced math concepts. With the passage of NCLB, expectations and accountability have been redefined (McLeod, D'Amico, & Protheroe, 2003). Previously, focusing on a "life-skills" model, teachers helped special education students prepare for day to day math, or applied math they might find in the workplace. Special education research has historically emphasized rote learning and mastery of basic operations while limiting instruction in problem solving (Swanson, Hoskyn, & Lee, 1999). Now, we must prepare students to pass high stakes testing or face the possibility of special education students leaving high school with diplomas that indicate they failed government-mandated testing (Cizek, 2001). These high stakes tests also affect the general education population. General educators are faced with students who do not qualify for special education services but still struggle in mathematics. Schools are looking for solutions to help these low achievers be successful and acquire the knowledge they need to pass these tests. Special education and general education teachers can help each other overcome these challenges by working collaboratively.

Special Education

The main challenge that special education teachers face is that they do not have sufficient knowledge about math curriculum (Maccini & Gagon, 2002). Special educators must still focus on how to best meet individual needs, but there is also an increasing demand for content expertise in math curriculum (Salyer, Curran, & Thyfault,

2002) as evidenced by the statement by the National Council of Teachers of Mathematics that “teachers must know and understand deeply the mathematics they are teaching” (National Council of Teachers of Mathematics: NCTM, 2000). When special educators lack content knowledge it undermines their ability to provide support to students with disabilities (Maccini & Gagon, 2002). Because of the need to provide general education curriculum to students with disabilities, special educators need to look at the instructional approaches used in the general education classroom (Woodward & Montague, 2002).

An informal study was conducted with a group of 11 special education teachers during a weeklong training called “Teaching Pre-Algebra to Special Education Kids” (Hadley, 2009). The focus of the training was to teach math core content to special education teachers. The teachers were first given an assessment about their anxiety levels. The results of the data indicated that “when teachers have math anxiety, they are also likely to be anxious about teaching math in the classroom” (Hadley, 2009). The teachers who were assigned the more advanced mathematics had the greatest anxiety. Also, the study examined the improvement the special education teachers made in content knowledge after spending a week receiving instruction. The result was a mean math content knowledge increase by teachers of 17% after only one week of instruction. Hadley concludes that “it would be essential for special educators assigned to teach secondary math topics to seek out opportunities to develop greater content and pedagogical understanding of mathematics” (Hadley, 2009).

Another study investigated how to effectively teach standards to teachers and then observe how their teaching improved (Paulson, 2005). Teacher educators should provide student teachers with explicit instruction and practice in effective teaching strategies.

The study focused on a math intervention developed around five standards needed to be an effective math teacher of students with disabilities (Paulsen, 2005). The five standards are (a) modeling good mathematics teaching, (b) understanding the content of mathematics, (c) knowing students as learners of mathematics, (d) knowing mathematics pedagogy, and (e) developing as a teacher of mathematics by learning and applying theories about teaching math as well as using explicit instruction (Paulsen, 2005). These standards, along with validated teaching practices, were used as a framework to create an intervention. The math intervention was a series of scripted lesson plans, based on the five standards, designed for first graders and to be given by university students learning to become teachers. The intervention was taught to nine master's level students and two project staff. After they were taught the scripted lesson plans, they practiced teaching each other before teaching small groups of students. To determine who would receive the intervention, a group of 444 first graders were tested in math and reading, from which a subset of 130 were identified as being at risk. This subset received small group instruction three times a week for 20 weeks. The master's level students and two project staff were taught the five standards as they learned how to implement the intervention. As they used the intervention on the at-risk students, the university students also received feedback on their performance. At the end of the 20-week study, students were given post-tests in math computation and math concepts/application. The purpose of the study was two-fold. The first purpose was to increase the acquisition, proficiency, and maintenance of math skills through the use of the scripted lesson plans and interventions (Paulson, 2005). The results showed that at-risk students who received the small group

instruction did better on the computation and concept application post-tests than those who did not receive the intervention (see Table 1).

Table 1

Mean Results from Computation and Concepts/Application Post-Tests

<i>Post-tests</i>	Mean Improvement Scores		
	Tutored At Risk Group	Non-tutored At-risk Group	Non-tutored Students Not at risk
Computation Test	13.2	9.3	11.28
Concepts/Application Test	11.64	9.14	10.4

The second purpose was to teach university students explicitly and provide feedback they need to become effective teachers (Paulson, 2005). The results reported in the study were vague, but indicated university students felt the intervention was successful and that they had improved their teaching abilities.

While there were numerous studies (Barrera, Liu, Thurlow, Shyyan, Yan, & Chamberlain, 2006; Bottage, Heinrichs, Mehta, Rueda, Hung, & Danneker, 2004; Wisniewski & Smith 2002) conducted on teaching teachers effective teaching practices and interventions, there was a lack of research about actually teaching special education teachers' higher level math content knowledge. Special educators face a unique challenge because, traditionally, teachers in special education do not have a math degree. They do not receive the intense math training in university programs that general education teachers do. Providing opportunities for special education teachers to learn and become familiar with the math core curriculum will increase their confidence, hopefully translate into more effective teaching, and ultimately culminate in higher student achievement.

General Education

General education teachers face the challenge of working with low achieving math students in their classes. It is difficult to find ways to help meet the needs of struggling students and DeNoble, DeNoble, Fleres, and McCabe (2007) stated that:

Teachers who do accept the challenge of educating lower achievers are often frustrated due to their students' inability to immediately grasp learning concepts.

In addition, these teachers often lack the essential resources and/or time necessary to address the educational needs of this population. (p.4)

According to the 2009 National Assessment of Educational Progress (NAEP), 73% of eighth graders scored at or above the basic level while only 34% performed at or above the proficient level (The Nations Report Card, 2009). To address the need for improving student proficiency, districts need to examine interventions to help these struggling students.

One study focused on the effect of two separate interventions given to low performing students in a district in the Pacific Northwest. The first intervention, called *Knowing Math* (Ma & Kessel, 2003), was a program that focused on daily practice of basic math principles. The second intervention, called *Extended* (Ma & Kessel, 2003), was developed by classroom teachers and the research team. *Extended Core* focused on expanding the regular math lesson with more explicit instructional practices and recapping the material covered in the core on that particular school day.

Participants were identified in the fall of 2004 when students were given a grade-level, district wide, mathematics test and a state wide test. Participants were randomly selected from the bottom 40th percentile to participate in the study. They were then

divided into three groups. The first group of 17 received the *Knowing Math* intervention and the second group of 27 students was assigned the *Extended Core* intervention. The third group was a control group of eight students who did not receive any interventions.

The two interventions were taught to two separate groups of teachers and monitored by the researchers. The interventions were performed 4 days a week for 30 to 45 min per day after school for 16 to 20 weeks. At the end of the intervention period the students were given a posttest of the *District Math Screener Test, Statewide Accountability Test in Mathematics* (Ma & Kessel, 2003), and the *Knowing Math* test created by the publishers of the *Knowing Math* intervention (see Table 2).

Table 2
Post-tests Results for the Knowing Math and Extended Core Interventions.

Posttest Measure	Treatment Groups					
	EC (n = 26)		KM (n = 17)		C (n = 8)	
	M	SD	M	SD	M	SD
<i>District Math Screener Test</i> total	25.4	6.7	25.6	5.4	21.7	6.0
<i>Statewide Accountability Test in Mathematics</i> total	219.9	7.0	217.7	4.3	217.7	6.2
<i>Knowing Math Test</i> total	51.6	14.1	65.0	12.6		

Note : EC = Extended Core; KN=Knowing Math; C= Control

The results of the *District Math Screener Test* showed students who received the intervention increased test scores more than the students in the control group. On the *Statewide Accountability Test in Mathematics* the *Extended Core* group increased scores only slightly better than the students who received the *Knowing Math* intervention, while the control group increased scores just as well as the *Knowing Math* group. The *Knowing Math* group scored much higher on the *Knowing Math Test* than the students in the *Extended Core* group. It is interesting to note that there was no posttest covering the *Extended Core* intervention and that the control group did not take the *Knowing Math*

Test. It is not surprising that students scored higher on this test because the test was directly related to the intervention they received. It would be interesting to see results from a test created for the Extended Core intervention and even more telling if they had given those tests to the control group. Ultimately, the results suggest the interventions may provide additional instructional supports for struggle in mathematics (Ketterlin-Geller, Chard, & Hank, 2008).

Two years ago, the state of Utah implemented an intervention for students who are struggling with Algebra 1. Previously 9th graders could re-take pre-algebra if they failed the course or if the pre-algebra teacher determined the student was not prepared to move on to Algebra 1. Two years ago, Utah created what they called “Stretch Algebra” for 9th graders who were not ready for Algebra 1. Essentially, the state split the curriculum so Algebra 1 is taught over 2 years. Algebra A is taught in 9th grade and Algebra B in 10th grade. This change in how algebra is taught to general education students who are struggling has created general education classes that resemble resource classrooms. The challenge this creates for general educators is a class of low achieving math students who need more effective instructional strategies to be successful. Though the general education teachers who teach this new course have the content knowledge in math, they often lack the training to adapt and develop materials that match the learning needs of struggling students.

Collaboration

Dr. Richard DuFour is an educational consultant who authored and co-authored several books and articles on professional learning communities (DuFour, Dufour, & Eaker, 2006; DuFour & Eaker, 1998; DuFour, Eaker, & DuFour, 2005; Eaker, Dufour,

& Dufour, 2002). He defines collaboration as “a systematic process in which we work together, interdependently, to analyze and impact professional practice in order to improve our individual and collective results” (Eaker, Dufour, & Dufour, 2002). In the article, *What is a Professional Learning Community*, he talks about the importance of creating a culture of collaboration. Dr. Dufour asserts that even though working collaboratively is best practice, teachers still continue to work mostly in isolation (DuFour, 2004). Creating a culture of collaboration requires a systematic approach. Collaborative teams need to establish norms, clarify expectations regarding roles and responsibilities, and engage in a cycle of ongoing questions (DuFour, 2004). When creating a collaborative team it is important to know what makes a team effective.

The Maryland Coalition for Inclusive Education (MCIE) has taken a systematic approach to creating a culture of collaboration. The MCIE works with the Maryland State Department of Education to train teachers to collaborate with each other so they can help students with disabilities. The roles they suggest for a collaborative team are facilitator, recorder, timekeeper, encourager, jargon buster, and observer (Maryland Coalition for Inclusive Education: MCIE, 2006). Each team member should be trained on what their role is and the responsibilities associated with that role. The facilitator is leader of the team, creates the agenda, keeps members focused, and helps with problem solving. The recorder keeps notes at the meeting and makes sure that all major decisions are written down. The timekeeper keeps track of how much time the team spends on each agenda item and makes sure that meetings begin and end on time. The encourager recognizes contributions in the group and motivates members to participate. The jargon buster makes sure that the professional language being used is consistent and understood

by everyone. The observer watches team interactions and gives feedback to the team on how they are doing in their roles.

The MCIE also identified six guiding principles of collaborative teams. These principles are (a) participation and leadership, (b) development of collaborative goals, (c) communication, (d) decision making, (e) brainstorming, and (f) dealing with conflict (MCIE, 2006). The MCIE also created a collaboration team checklist that is based on these guiding principles and helps keep the team organized (see Appendix A).

Establishing roles and responsibilities, understand the norms of the group, and knowing how the team is going to function is just one part of organizing a collaboration team.

Often the difficulty in finding time is used as an excuse to avoid collaboration. Schools can break down this barrier by giving teachers the time to analyze and discuss State and district curriculum (DeFour, 2004). Regardless, teachers should seek opportunities to work together because their ultimate goal is to improve student learning. Dufour states, “A group of staff members who are determined to work together will find a way.” However, it is important to recognize that administrators on the district and school level have a responsibility to find ways to give teachers the time they need if they expect teachers to be effective collaborators.

Denver Public Schools made it a priority to set aside time for special education and general education teachers to collaborate. They piloted a two year program for math educators to collaborate with the “two-fold goal to support mathematics and special education teachers to improve their use of differentiated instruction in mathematics, and to provide students in special education an enriched mathematics curriculum and the opportunity to learn meaningful mathematics” (Paek, 2008). Using resources from the

Educational Development Center (EDC), the district developed a collaboration model. Every six weeks, after school, general and special education math teachers met in pairs. First, they chose sample students and discussed their strengths and weaknesses. Then, they discussed accommodations and how to implement them. In developing accommodations, the goal was “not to alter the mathematics concepts but rather support students reaching the mathematical “big idea” of the lesson” (Paek, 2008).

Collaboration sessions concluded with reflection on how they collaborated, what was successful and what was not, what their next steps would be, and keeping track of their most successful interventions. The district looked at the end of level math testing over a three year period to see what effect collaboration may have had on student achievement (see Table 3).

Table 3

Percentage of Students Scoring At or Above the Proficient Level on the Mathematics Portion of the Colorado Student Assessment Program by Special Education Classification.

Academic Year	Classification	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10
2003-2004	Special Education	4	3	3	2	3
	Non-Special Education	29	20	17	12	10
2004-2005	Special Education	7	4	4	2	2
	Non-Special Education	34	24	19	14	14
2005-2006	Special Education	10	5	4	3	3
	Non-Special Education	38	23	24	19	16

The results showed the greatest improvement with the 6th graders in both the special education and general education student populations. The data also showed that the special education students in the upper grades were not as successful on the end of level testing. It would be interesting to find out how their collaboration meetings were organized and what collaboration model they used. Denver has not collected a formal set

of information to show evidence of the effect of the collaborative model on instructional practice or student performance (Paek, 2008). They also chose not to continue the collaboration between general and special educators even though the feedback from the teachers expressed a desire to continue.

Collaboration is an effective way to bridge the gap between the issue of special educators lacking content knowledge and general educators needing help with interventions for struggling students. Special education teachers can provide task analysis and curriculum adaptation while general educators can provide content knowledge (Ripley, 1997).

In Nebo School District, general and special education teachers have collaborated on math instruction for only a few months. The special education department at our school has used that time to collaborate about how to help specific resource students. This year we have been doing more collaboration with other resource teachers on math core content. Recently, I collaborated for the first time with the general education math teachers about math content. During our collaboration time I had a question about some of the math core objectives. I have always struggled with understanding the core because the objectives are written without examples. When I read the objectives I am never quite sure what math operations fit that objective. The general education math teachers were very helpful in clarifying my questions, but they also expressed their wish that the state core contained math examples. Then, they expressed their frustration about teaching the Algebra A course and how they felt like they did not know how to reach these low achievers. In fact, when they had approached the principal for ideas on how to structure

the course so the students could be successful his response was, “just teach the material slower.”

By the end of our collaboration meeting, I knew I would benefit from their knowledge of the content and they would benefit from my knowledge of how to modify content so struggling students could access the curriculum. That meeting made me eager to work with my fellow educators to develop an Algebra A core curriculum manual that teachers could use as a resource that included concrete math examples and instructional strategies to help teachers reach struggling students.

Purpose Statement

The purpose of this project was to create and evaluate a core curriculum manual (see Appendix N) for the Algebra A state core by bringing special education teachers and general education teachers together to collaborate on the content. The objective of the manual is to provide clarity to the current core curriculum and serve as a reference for teachers as they prepare lesson plans. Collaboration sessions provided opportunities for the general education teachers to clarify curriculum questions and for special education teachers to provide insights into how material could be presented to struggling students. When resources are combined they can strengthen teaching and learning opportunities, methods, and effectiveness (Ripley, 1997).

Ultimately, this manual may be a tool for teachers to use when preparing lessons because it provides information about the pre-requisite knowledge that students need to be successful, the math operations for each objective, math application problems, and lesson ideas and instructional strategies. The manual was organized so these four pieces of information were connected to the math core objectives (see Table 4 and Table 5). In

order for students with disabilities to perform better in math, teachers have to make math more accessible and meaningful to them (Cawley, 2002). Working together, we can make math more accessible and meaningful for all students.

Table 4
Example of how the Algebra A manual is organized

Standard 2: Extend concepts of proportion to represent and analyze linear relations

OBJECTIVE 2	Model and interpret problems having a constant rate of change using linear functions
OBJECTIVE 2.a.	Write algebraic expressions or equations to generalize visual patterns, numerical patterns, relations, or data sets.

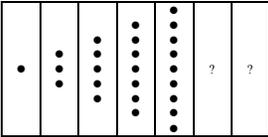
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies										
<p>Language & Symbols</p> <p>Function Linear Non-Linear Pattern Relation</p> <hr/> <p>Skills</p> <p>Co-ordinate graphing X values vs. Y values Domain vs. range</p>	<p>Use the table to write a function rule (algebraic equation) :</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Cans of soup</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td># of servings</td> <td>4</td> <td>8</td> <td>12</td> <td>16</td> </tr> </table>	Cans of soup	1	2	3	4	# of servings	4	8	12	16	<p>1. Determine the number of dots in the next two groups.</p> 	<p>Strategy: Soda Machine Analogy</p> <p>Domain (x) <u> </u> button Range (y) <u> </u> soda you get out</p>
Cans of soup	1	2	3	4									
# of servings	4	8	12	16									

Table 5
Explanation of the sections in the Algebra A manual.

Prerequisite Knowledge (language/symbols)	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>This section contains symbols, vocabulary, and prerequisite knowledge the student needs to be successful in mastering the objective.</p>	<p>This section contains math calculation problems aligned with the objectives. It is the intent of the manual to include a scope of examples in a "leveled" order to help teachers determine the most effective order to teach the concept</p>	<p>This section contains word problems aligned with the objectives. It is the intent of the manual to help teachers teach real world connections to the math concepts they are teaching.</p>	<p>This section contains a strategy bank to help teachers with their lesson plans. It is not the intent to make this section complete at this time. This will be a "living" section with ideas added throughout the year and beyond ☺!</p>

Method

Participants

The participants in this project were divided into three teams. The collaboration team consisted of two special education teachers and two general education teachers. The first team member was a general education teacher who has her bachelor's degree in math from Brigham Young University and a Master's of Education Degree from Southern Utah University in Math Education. She has been teaching at Springville Junior High for 3 years. She is currently the math department head and teaches two Algebra A courses and five Geometry courses. The second team member was also a general education teacher who has been teaching at Mapleton Junior High for three years. She has a bachelor's degree in statistics and business from Brigham Young University and finished her teaching certificate through Alternative Routes to Licensing this year. She is currently on the "Pyramid of Interventions" team and teaches two Algebra A courses. The third team member was a special education teacher who has her bachelor's degree in Elementary Education with a Special Education Licensure and Reading Endorsement from Brigham Young University. She also obtained a Mentor Teacher Certificate through the Utah Personnel Development Center and is currently completing her masters in Special Education at BYU. She is the special education department head and has been teaching resource math for 7 years. The final team member was a special education teacher who has her bachelor's degree in special education from Brigham Young University and is currently pursuing a master's degree in special education from Utah State University. She has been teaching at Springville Junior High for 12 years and is

currently the special education department head and teaches two resource Pre-Algebra courses and two resource Algebra A courses.

The auxiliary team consisted of the district curriculum director, a district curriculum specialist, a special education district liaison, and the vice-principal of Springville Junior High. The district curriculum director and specialist did not attend any of the collaboration meetings. However, I did meet with them three times at the district office to review our progress and discuss manual improvements. The special education liaison attended one full collaboration day and came two additional days for an hour to review our progress. The vice-principal attended one hour of every scheduled collaboration day.

The final group of participants was the peer evaluators. This group of evaluators consisted of two general education teachers and two special education teachers who teach Algebra A. The first team member was a general education teacher who has a bachelor's degree and a level 3 math endorsement. He has been teaching math for 21 years and currently teaches at Diamond Fork Junior High. He is the math department head and teaches Algebra A, Algebra, and Geometry. The second team member was a general math teacher who has a bachelor's degree and has been teaching 7 years. She currently teaches Math 7 and Algebra A at Mount Nebo Junior High. The third team member was a special education math teacher at Mount Nebo Junior High. She has a bachelors and masters degree in special education. She has been teaching for 21 years and is currently the special education department head. The final team member was a special education math teacher at Payson Junior High. She has a bachelor's degree in special education and

an ESL endorsement. She has been teaching 20 years and is currently the special education department head.

Each team had a specific purpose and was given a list of responsibilities. The collaboration team's purpose was to collaborate together to create the Algebra A manual. They were responsible for attending all six collaboration days, creating the Algebra A manual, completing the formative evaluation, reviewing feedback from the other teams, making decisions about manual changes, using the manual, completing the evaluation in use, and completing the collaboration feedback. The auxiliary team's purpose was to make sure the manual was in line with the math core. They were responsible for making sure the collaboration team was on track during the manual development, one team member attending the last hour of the collaboration days, completing the formative evaluation, and providing feedback on manual improvements and corrections. The peer evaluator team's purpose was to provide feedback about the usability of the manual. This team was crucial because they did not have any part of the development of the manual. It was important to know if the manual was given to any math would they be able to understand and use it with ease. The peer evaluator team was able to provide unbiased insight about how user friendly the manual was. They were responsible for completing the formative evaluation, using the manual, completing the evaluation in use, providing feedback on manual improvements or corrections, and attending the last collaboration day with the collaboration team.

Setting

The collaboration days were held at Springville Junior High in Nebo School District. The collaboration team met in the conference room on May 7, 2010 for our

collaboration preparation and planning meeting. During the summer on June 2, June 9, and June 23 we worked at Springville Junior High in the school library.

The collaboration team members and the peer evaluator team used the manual individually in their classrooms as a guide to prepare lesson plans starting in August 2010. The collaboration team met on September 24 in at Springville Junior High to review the formative evaluations again, talk about the lesson plans we had created so far, discuss the effectiveness of the manual, and make any needed corrections. A final meeting with the collaboration team and the peer evaluator team was held on October 22 at Springville Junior High.

Materials

The Utah State Office of Education divided the Algebra 1 core curriculum into two parts, Algebra A and Algebra B. We used the Algebra A core curriculum (see Appendix B) and the pacing guide (see Appendix C) as the jumping off point for the main structure of the manual. We also used the Prentice-Hall Algebra 1 Math Textbook and Workbook (Bellman, Bragg, Charles, Hall, Handlin, & Kennedy, 2007), and any teacher made materials that team members felt would aide in the creation of the manual. I purchased a math program online called *Math Composer* (Data Illustrated, 2005) so I would be able to create the math problems for the manual.

Procedures

This project was divided into three distinct phases. The first phase was the development of the materials. The second phase was the formative evaluation and revisions. The final phase was manual implementation and evaluation. A timeline of the

phases, dates and activities followed by a detailed description of each phase was created to keep the project on track (see Table 6).

Table 6
Timeline for project phases

Phase 1 : Development of the Materials	
May 7	1. Collaboration Preparation Meeting with Collaboration Team
May 8 – June 1	2. Preparation for Collaboration Day One
June 2	3. Collaboration Day One
June 3 – June 8	4. Preparation for Collaboration Day Two
June 9	5. Collaboration Day Two
June 10 – June 22	6. Preparation for Collaboration Day Three
June 23	7. Collaboration Day Three
June 24 – July 1	8. Update All Changes
Phase 2 : Formative Evaluation and Revisions	
July 6	1. Formative evaluations sent to auxiliary team and peer evaluator team.
August	2. Adjustments made, final manual copied, bound, and sent
Phase 3 : Manual Implementation and Manual in Use Evaluation	
August–October	1. Manual Implemented
September 24	2. Follow-up Day 1
September 25-28	3. Make any adjustments to the manual and send copies to the team
October 22	4. Follow-up Day 2

Phase 1: Development of the Materials

1. Collaboration preparation meeting with collaboration team. Before the first official collaboration day, it was necessary to organize the collaboration team and the materials we would be using. I read through the collaboration materials provided on the MCIE website and printed off the collaboration team checklist (see Appendix A) for

each member of the team. Before we met for the first time I prepared for the first meeting by putting together a binder for each team member that included:

- Calendar of dates and times of our meetings
- Contact list with all the team members names, e-mail, and phone numbers
- A copy of the collaboration team checklist
- Copies of all the agendas for our meetings
- A copy of the collaboration review, reflection, and planning form
- A copy of skeleton manual
- A copy of the Evaluation Rubric

A district team member, the district special education liaison, attended the entire day. The following materials were used at this meeting: Algebra A core curriculum and pacing guide, Prentice-Hall Algebra 1 Math Textbook, Prentice-Hall Algebra Math Workbook, and teacher created materials. The agenda (see Appendix D) for this meeting included several objectives. First, we outlined the projected outcomes and objectives of our collaboration meetings and how we would evaluate when these objectives had been met. We scrutinized the packet of materials that I put together and discussed the feasibility of accomplishing these tasks, making adjustments to the agendas as needed. Second, we determined the roles each team member would have for the duration of the project. The roles assigned were time keeper, recorder, and observer. I assumed the facilitator role for all meetings. We established group norms and read through the collaboration team checklist (see Appendix A). Third, we split into two groups and spent the majority of the time going through the textbook and identifying which concepts fit which standards of the core. We used post-it notes in four different colors and tagged the pages in the textbook that corresponded with the standard. As we collaborated, one member came up with the idea of using poster board to organize the manual as we were creating it. The idea was to get four colored poster boards to correspond with the

standards and then use the post-it notes to write out the math problems and place them on the board. This way we would have the ability to easily manipulate the information until we determined how we wanted it in the manual. After we made the final decision about what would be in the manual I would write or type it into the manual format. This suggestion proved to be a great idea that saved a lot of time. The last two hours we came together and reviewed what we had marked in the books and made decisions as a team if those concepts fit the right standards. At the end of our meeting we reviewed the objectives on the agenda, evaluated our progress, and made assignments for the team members. We determined that standard 4 was not well represented in our current math book and we would each research math problems that would fit that standard.

2. Preparation for collaboration day one. After reviewing the textbook pages we had marked at our preparation meeting I determined that creating a textbook reference manual would be useful as we begun filling out the manual. I went through the textbook and copied every page we had marked and then sorted the pages by math standard. The final textbook reference manual contained a list of each standard and objective, a list containing what pages from the math book were copied and what standard and objective it correlated with, and a copy of the actual textbook page. I made a copy of the textbook reference manual for each member of the team and I copied the “skeleton” manual for each person on the team to use during our collaboration meetings. I created four posters corresponding to the four math standards. One week prior to our first collaboration day I e-mailed the team members with a reminder of their assignments and the agenda for the meeting.

3. Collaboration day one. The first day included the collaboration team members, with an auxiliary member attending for part of the day. We began by reviewing the agenda (see Appendix E), went over the objectives for the day, and reviewed our team norms and responsibilities. The focus of day was to fill in the Prerequisite Knowledge and Math Operations columns in the skeleton manual. For the first 2 hours we each took one of the four standards and used post-it notes to write down math operations problems that fit the standard. When we were done we put our post-it notes on the poster boards and then took turns presenting the problems that we had written. We discussed each problem as a team and made additions and changes as needed. After lunch, we went back and wrote in what pre-requisite knowledge we would need for each standard.

At the end of the day, an auxiliary team member came and we presented each standard to them. We reviewed the objectives that we achieved for the day and filled out the objectives form (see Appendix J). We reviewed the agenda for the second collaboration day and made assignments. Each team member was assigned to come prepared to share resources and ideas to include in the application and lessons/strategies sections.

4. Preparation for collaboration day two. I prepared for day two by typing the pre-requisite knowledge and math operation problems into the manual and made copies for the team members. I also e-mailed all the team members to see how they were progressing on their assignments. I scheduled a time to meet with the district curriculum director and specialist to review what we had done so far. Two days before our meeting,

I sent another e-mail to remind them about our meeting and remind them to bring their assignments.

5. Collaboration day two. Collaboration day two began much the same as the first day. We reviewed the objectives, agenda (see Appendix F), team norms and roles, and reviewed the assignments that were given. The main focus of the day was to fill out the math application and lesson ideas/strategies column of the manual. For the math application section, we divided into two groups and each took two standards to work on. After 3 hours, we came back together as a team to present what we had for the application section. Adjustments were made per a team decision. In the afternoon we went through the manual standard by standard and took turns sharing the ideas we had developed, determining what to include in the manual.

At the end of the day we reviewed our objectives, filled out the review form (see Appendix J), and evaluated the progress we made with the auxiliary team member. Additionally, we reviewed the agenda for our final collaboration day and made some adjustments. We determined that we wanted to bring more ideas for the math application and lesson ideas/strategies sections.

6. Preparation for collaboration day three. In preparation for the final collaboration day I made changes to the manual and set up a time to meet with someone on the auxiliary team to review what we had accomplished. I was able to talk with the district curriculum director and one of the specialists about the possibility of creating a “strategies database” on the district website in the future. One week before our meeting I e-mailed a copy of the updated manual to the collaboration team to review and note areas

of correction or concern. Two days before our meeting, I sent another e-mail to remind them about our meeting and their assignments.

7. Collaboration day three. We began the final collaboration day by reviewing the objectives and agenda (Appendix G). The main focus of this collaboration was to add more lesson ideas and review and revise the manual. After adding more lesson ideas and strategies we went through the manual page by page making corrections and additions.

Phase 2: Formative Evaluations and Revisions

1. Formative Evaluation. On July 6, 2010, I sent a completed manual, instructions, and an evaluation form (Appendix K) to the collaboration team members, the auxiliary team members and the peer evaluators. I e-mailed them 2 weeks prior to that date so they will be aware that the manuals would be arriving in the mail. I included a stamped and addressed envelope to return the evaluation and manual to me when they completed the evaluation. The instructions for the evaluation were to (a) read through the evaluation form so they knew what they were evaluating, (b) examine the manual and write on the manual any questions they had or note any errors, and (c) fill out the evaluation (see Appendix K). Evaluators were given until August 1, 2010 to mail back the manual and evaluation form. I received all the evaluations and manuals by July 22.

2. Evaluation Review and final copies sent. After receiving the evaluations and suggestions, I compiled the information and sent an e-mail to the collaboration team members with the suggestions to determine if we needed to meet to review any major changes. One issue that arose was that two of the teachers were using an Algebra 1 core that had been split into Algebra A and Algebra B by another group of teachers. They were unaware that the Utah State Office of Education (USOE) had created a set core for

the two courses. Their initial evaluation of the manual was based on this, so I contacted them and sent them the link to the USOE web site so they could see for themselves that we were using the USOE core. Fortunately, they were one of the first evaluations that I received and I was able to re-send them another evaluation and manual to do their evaluation again. I made corrections to the manual after conferring with the other team members. Then, I copied, bound, and sent a manual to all the team members.

Phase 3: Manual Implementation and Manual in Use Evaluation

1. Manual implemented. From the beginning of school until our first follow-up day, the collaborative team members and the peer evaluators used the manual as a guide for lesson planning. As they used the manual they took notes on how they used the manual to plan and align their teaching with the core standards. Team members also used this time to identify ways to add to the lesson plan and strategies section as well as making note of ways to improve the manual. Every two weeks team members sent their notes to me. I used the notes to compile a list of ideas, suggestions, and areas to discuss at our first follow-up day on September 24.

2. Follow-up day 1. On September 24, 2010 we held the first of two follow-up meetings. We began the follow-up meeting by reviewing the objectives and the agenda (see Appendix H). Then, we went through the manual and corrected errors that were noticed as we were using the manual. We also went through the manual page by page and took time to review suggestions made by the peer evaluators as well as adding strategies submitted the past few weeks. One issue that came up again was the way the Algebra 1 core has been split. All of the peer evaluators were unaware that USOE had officially split the core. Some of the peer evaluators had previously met with the teachers

who were teaching Algebra B and they decided to just split the book in half. Other teachers had looked at the Algebra 1 core and divided up the standards into Algebra A and Algebra B, but the division they made did not match the curriculum split provided by the state of Utah. Because of this, the peer evaluators have to re-think their curriculum to align with the split. Even though it is a difficult transition, we all agreed that it was necessary so that there was consistency across the district.

After making corrections, we took time for each team member to share their experiences with using the manual and creating lesson plans. We all agreed that the manual has focused our planning so it is more math core driven. All the teachers on the collaboration team used the pre-requisite skills as a way to review before introducing the core concepts. We all used the math calculations section as a guide to know what concepts to teach. One of the teachers used those questions for pre and post testing her students. Two of the teachers are using the math reasoning questions in their lessons to help students make connections. We agreed that one task we would like to do in the future is create a common assessment for each objective in the core. We were only a few weeks into the school year, but several of the lesson ideas and strategies have been used with positive results (see Table 7).

At the end of our meeting we discussed questions that we wanted to ask the peer evaluation team when we met in October. We concluded the collaboration by reviewing our objectives, filling out the review form (see Appendix J) and making assignments for the final follow-up day.

3. Make adjustments to the manual and send copies to the team. After our meeting I made revisions to the manual and sent copies out to the team and the peer evaluators. I e-mailed team members to remind them of any assignments or materials they will need for the final follow-up meeting.

4. Follow-up day 2. On October 22, 2010 we met for our final follow-up day. During this meeting we reviewed the objectives and the agenda (see Appendix I). Then we had a round table discussion about how people used the manual and specifically what they had used. We also discussed the need to get everyone in the district the correct core curriculum. At the end of our meeting everyone filled out the manual in use evaluation (see Appendix L). The collaboration team filled out the collaboration evaluation (see Appendix M) and then we meet with an auxiliary member to report on the outcome of the manual.

Evaluation Process

The project was evaluated in three ways. First there was a formative evaluation (see Appendix K) of the manual conducted after the collaboration team finished the manual, second an evaluation of the use of the manual (see Appendix L), and third an evaluation of the collaboration meetings conducted by the main collaboration team (see Appendix M).

Formative Evaluation

The first step was to evaluate the manual before it was implemented. The evaluation was conducted by (a) the four collaboration team members, (b) the four auxiliary team members, (c) and the four peer evaluators. The purpose of this evaluation

was to ensure the manual was aligned with the Algebra A core, determine additions to the manual to make it more effective, and edit out grammatical or mathematical errors.

Evaluation of Use of the Manual

The second evaluation (see Appendix L) was conducted on the final follow-up day after the collaboration team and the peer evaluators had been using the manual as a lesson-planning guide. The team members completed a scoring rubric and answered open-ended questions about the manual's effect on their lesson planning.

Collaboration Evaluation

The collaboration evaluation (see Appendix M) was done at the last follow-up meeting. This evaluation was completed by the collaboration team. The evaluation consisted of a scoring rubric and open-ended question about their experience with the collaboration meetings.

Results

The results are separated into the three evaluations (a) the formative evaluation, (b) the manual in use and (c) the collaboration evaluation. Each evaluation results summary contains the scoring rubric and the number of responses for each question and a selection of responses from the open-ended questions. Additionally, I included how the problems were addressed in the formative evaluations.

Evaluation 1: Formative Evaluation

The formative evaluation (see Appendix K) was performed by the collaboration team, auxiliary team, and the peer evaluators. After receiving their responses, I compiled the results then created a summary of the comments made. Additionally, I reviewed the manual and made note of any comments written in the manual that did not correspond

with a question in the evaluation. After compiling the results, I e-mailed them to the collaboration team and we decided as a team how to address the problems, comments and suggestions given by the evaluators (see Tables 8 through 11).

Table 8
Formative Evaluation: Evaluation of the Overall Manual Formatting

	1 Poor	2 Fair	3 Good	4 Excellent	Summary of problems, comments, & suggestions
Table of Contents				12	Clear and easy
Headings				12	Accurate and helpful
Captions & Labels			1	11	Easy to follow Direct and Informative
Organization				12	Very organized Easily referenced
Format			2	10	Organized and clear The appendix pages are a different direction then the manual, should they be uniform? A little overwhelming
Readability/Font			1	11	Good balance-there is not TOO much on a page. I like a larger font
Clarity in Writing			2	10	Things are clear and easy to understand. Some concepts I need more personal explanation.
Grammar & Punctuation			2	10	Good – a few errors Two grammar errors.
Math Symbols				12	Nice use of symbols

Table 9
Formative Evaluation: Results for Evaluating the Manual Content (Standards 1 & 2)

Standard 1 : Expand number sense to use real numbers				
Question	Responses			Summary of comments, questions, & concerns
	No	Mostly	Yes	
Core Alignment Is the content in alignment with the core?			12	
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?			12	Should we include definitions with the pre-requisite knowledge?
Math Operations Do the examples provide an accurate idea of what the standard and objective is?			12	I would like answers to the math problems, maybe a step by step process to solving the problems.
Math Reasoning/Application Do the application problems represent the standard and objective?			12	
Lesson Plans/Ideas Do the lesson plans and ideas align with the standard?		2	10	More ideas would be great! I will know more when I get the chance to use the strategies.
Lesson Plans/Ideas Would the ideas be helpful in planning lessons?		3	9	Leave room for the teachers to add their own notes. Not sure what 2 nd strategy on 1.c. means, add example Love the hands on and visual activities.
Standard 2 : Expand proportions to represent and analyze linear functions				
Question	Responses			Summary of comments, questions, & concerns
	No	Mostly	Yes	
Core Alignment Is the content in alignment with the core?		2	10	Objective 3.b. examples with inequalities.
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?			12	
Math Operations Do the examples provide an accurate idea of what the standard and objective is?		2	10	I am not as familiar with these problems; I would like more information to help me!
Math Reasoning/Application Do the application problems represent the standard and objective?		2	10	Explain the vertical line test. Even more application problems would be great!
Lesson Plans/Ideas Do the lesson plans and ideas align with the standard?		2	10	A little more information needed on some lessons. Why the vertical line test?
Lesson Plans/Ideas Would the ideas be helpful in planning lessons?			12	I would like more ideas in this area. I like that it includes previously tried classroom tips.

Table 10*Formative Evaluation: Results for Evaluating the Manual Content (Standard 3&4)*

Standard 3 : Develop fluency with the language and operations of Algebra				
Question	Responses			Summary of comments, questions, & concerns
	No	Mostly	Yes	
Core Alignment Is the content in alignment with the core?			12	
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?			12	
Math Operations Do the examples provide an accurate idea of what the standard and objective is?			12	This standard feels very abstract – these are helpful examples.
Math Reasoning/Application Do the application problems represent the standard and objective?			12	I like the teaching for understanding
Lesson Plans/Ideas Do the lesson plans and ideas align with the standard?			12	
Lesson Plans/Ideas Would the ideas be helpful in planning lessons?			12	A great starting point for any teacher. More lesson ideas would be great!
Standard 4: Apply concepts of Algebra to Geometry				
Question	Responses			Summary of comments, questions, & concerns
	No	Mostly	Yes	
Core Alignment Is the content in alignment with the core?			12	
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?			12	
Math Operations Do the examples provide an accurate idea of what the standard and objective is?			12	
Math Reasoning/Application Do the application problems represent the standard and objective?			12	This section is mostly application of previous sections and is a good extension of many concepts.
Lesson Plans/Ideas Do the lesson plans and ideas align with the standard?			12	M&M's may not be the best for volume For Volume use objects with consistent size and shape.
Lesson Plans/Ideas Would the ideas be helpful in planning lessons?			12	I like the "Teacher I Shrunk the Classroom" Great ideas. Concrete ideas to ensure good understanding!

Table 11*Formative Evaluation: Results for Manual Effectiveness*

	1 No	2 Maybe, A little	3 Probably	4 Yes, somewhat	5 Definitely, a lot
Will this manual help special education teachers teach math to struggling students?				2	10
Will this manual help general education teachers teach math to struggling students?			1	1	10
1. What do you think are the strengths of this manual?					
<ul style="list-style-type: none"> • Organization • Relevant, "Why we need to learn this." • The organization of the manual. • I also like the examples that are given. • Organization-simple easy to read. • Easy to read, nice layout, great core focus. • Takes core objectives and give actual examples of what that concept is suggesting. • There are word problems and story type problems – both are good and needed. • The appendix items were helpful. • Definitely pares down the Algebra core to make Algebra A less material. • Could provide consistency from teacher to teacher. • Enables flexibility, you do not need to follow a textbook. • Clearly articulates and provides examples of the core • Includes multiple examples • Lists pre-requisite knowledge and skills. • Easy, concise explanations – great teaching ideas. • Explicit information regarding the content and its application. • It clarifies the Algebra A core and helps me know what is expected. • Great examples – specific examples! • Pre-requisites are great – I know how to prepare. 					
2. What do you think could be improved? How?					
<ul style="list-style-type: none"> • I would like the answers to problems included. • Create a correlation to the text book or supplementary materials. • More activities focused around understanding before procedure. • There could be more lesson ideas and strategies .This often comes from teachers and their experience and trying different things. • Standard 4 needs to be adjusted a little and would be good to make other decisions about what's Algebra A or Algebra B collaboratively. • In speaking with the high schools there is a definite problem with dove-tailing content and curriculum. • Some additional examples in the math operations section. • Include a suggested scope and sequence. • Larger Font • Actual worksheets for students • Room to compute answer • After this manual has been put into use, a revised edition would provide additional insights. • An outline of order to teach in • A curriculum map 					

Table 11 (continued)*Formative Evaluation: Results for Manual Effectiveness*

3. How does this manual compare to the current curriculum material available?
<ul style="list-style-type: none"> • Currently not many good relevant application problems. • I love seeing how others teach it. • It really defines what the core is in a simplistic manner. • Is there anything else available? • I think it does a great job focusing on indicator level data and skills. • This is very good. • The specific example problems of the core objectives make things very helpful. • Much better! All that was there before was "teach half the book." • While this manual is not a curriculum, I think this manual will help me more accurately select the correct parts of the available curriculum so I am sure it aligns with the core. Good overview. • It surpasses all current material by organization of topic, definition of standards and examples of content. • It is the only thing available. • The Algebra manual/textbook is not geared to students who need to go slower, easier, and more basic.
4. How do you think this manual will help teachers prepare more effective lessons?
<ul style="list-style-type: none"> • Ways to frontload students. • What "pre-requisite" things students need to be successful with the concepts. • It gets rid of the "fluff" teachers might want to teach. • Boiled the standard down to understandable concepts. • It is a great springboard for lesson prep. • The concrete examples of the core are there – often a core principle is given and even teachers are left to wonder exactly what is intended. • This work helps students see what the concept is they are to master. • It is concrete and allows for expanding concepts of the core listed. • Gives ideas on reaching differentiated learners. • This manual will help me be sure that my students have the necessary prerequisite knowledge. In addition, the manual will help me sequence my lessons more smoothly. • We can zero in on a specific vocabulary and key ideas. • Teachers will be able to spend valuable time generating specific and valuable class instruction rather than a trial and error method of "I think this will help" approach. • The core is very vague. • This clearly shows what each objective covers so I know what to teach.
5. Please provide any other feedback or ideas you have for this manual 😊!
<ul style="list-style-type: none"> • I am excited to implement some of these strategies in my lesson plans. • How does this match with other materials? • Perhaps manuals like this could be made available to all Algebra teachers. In fact, if they could be put together as effectively as this one, why not for math 7 and pre-algebra?? • Thanks! I look forward to using some of your ideas! • I loved seeing your tips for helping students remember. • I will use the lesson plan ideas in my resource Algebra A class. • I think this manual will really help to clarify what the core consists of, which will help with consistency throughout the district. • I think the manual is very accurate .Great job! • As a quick reference guide it is "gold!" • It provides clarification and direction to a core that is vague and removed from the actual classroom. • I feel it will help me provide a more complete math instruction to my students. • Love it – this is so helpful in terms of planning and knowing what to include.

After compiling all the evaluations we reviewed the feedback and addressed the concerns raised. Listed below is how we resolved the issues from the feedback we received and discussion about the evaluation.

1. Captions and labels. Each page contains the standard, a statement of the main objective, and the alphabetic objective point i.e.: Objective 1.a. The suggestion was made to have only the alphabetic objective on each page. However, after conferring with the collaboration team, we decided that listing the main objective was useful information so we left it.

2. Format. On the appendix pages, we determined that the direction of the numbers would not be changed on the manual. There was a comment by an evaluator about the format being overwhelming. We were unsure what the evaluator meant by this comment. I e-mailed the evaluator for some clarification. She stated that she just felt overwhelmed with how much she did not know about the math core. I asked her if there was something we could do with the formatting that would make it less overwhelming, but she stated that it was not really the format but the content that was formidable.

3. Readability. We decided not to increase the font size, but determined that if the strategies were all put in the appendices there would be more room. However, we felt that the convenience of having the strategies right next to the standards outweighed the need for a larger font.

4. Clarity in writing. There were a few of the strategies that were not well explained. As a team, we re-wrote the strategies, and in some cases moved them to the appendix so we could have more room for an explanation.

5. Core alignment. Two separate evaluators mentioned the lack of examples without inequalities. We reviewed this section and included problems with inequalities as well as a few other examples to increase the scope of example problems.

6. Pre-requisite knowledge. Though no concerns were listed on the evaluation form, there were a few additions handwritten in the manual when they were returned to me. We conferred as a collaboration team and added the pre-requisite knowledge suggestions. There was some discussion by two evaluators about including definitions of the pre-requisite knowledge words. As a collaboration team, we felt that would make the manual too “wordy” and hoped that teachers would be able to access this knowledge elsewhere if they were unfamiliar with the language.

7. Math operations. We went through the operations and added more examples. There was some concern with one evaluator feeling like we should go through the manual and work all the problems in the manual to show teachers how to do the work. We determined as a team that the purpose of the manual was solely a reference to clarify the core, not a way to teach teachers math concepts. However, we also decided that this is an issue we wanted to discuss further when the collaboration team and peer evaluator team met on the last collaboration day in October.

8. Math reasoning/application. We added a visual for the vertical line test to clarify what this would look like. We went through the application section and added more application problems

9. Lesson plans/ideas. There was some hesitation in this area on the part of the evaluators. We felt that perhaps when the manual was used starting in August we would get more feedback. Because of the lack of room to write notes, we did not copy the

manual on front to back pages. Instead, we placed lines for writing notes on the back of each page as well as a page at the end for taking notes. We added an example for Objective 1.c. to clarify.

10. Comments from the open ended questions. We reviewed and clarified the lesson ideas that were noted by the evaluators as needing more explanation. Before printing the final manual, I sent out an e-mail to the evaluators with those clarifications to see if we needed to make additional adjustments. The feedback we received was that evaluators felt the revisions were much clearer. I clarified with the evaluators that the manual would not be in a scope and sequence format and that we would address this topic when we met as a group in October. I invited the evaluators to send me other lesson ideas and strategies that they felt would work well in the manual. There was concern by two evaluators about the volume activity in standard 4. They felt that candy in the containers should be exactly the same size. We added a disclaimer that using M&M's and Skittles in the activity would be for approximate volume. We also added a few more lesson ideas to strengthen this section of the manual.

11. Formative evaluation results discussion. The formative evaluation provided insight into the areas that needed to be improved. Standards 1 and 2 had several areas of concern that we were able to address as a collaboration team. In the open ended questions, the evaluators generally felt that the manual provided clarity to the core in an organized and useful manner, and was more useful than the current materials available. As a collaboration team, we addressed the need for more math operations, application, and lesson strategies. The additions to these sections completed and improved the manual. Some of the improvement suggestions, specifically creating a curriculum map,

scope and sequence, adding more lesson ideas, and making sure all schools had the correct core, were issues we decided to address when we met on the last follow-up day with the peer evaluators.

At the end of the evaluation there were two questions asked that were really important. The first question was: Will this manual help special education teachers teach math to struggling students? From the responses, 83% felt that it definitely would help. The second question was: “Will this manual help general education teachers teach math to struggling students? From the responses, 83% felt that it definitely would, a lot. The responses that were that it “probably would”, or that it would help “somewhat” were from the auxiliary evaluators. I was encouraged that all the teachers responded that they felt the manual would be useful in helping struggling students.

It was interesting to note that the concerns about needing more clarification on math operations or wanting the solutions the problems were from the resource teachers. Though this was not part of the formative evaluation, the collaboration team felt that this warranted discussion when we met with the peer evaluators.

Evaluation 2: Use of Manual

The manual in use evaluation (see Appendix L) was completed by the collaboration team and the peer evaluators. After receiving their responses, I compiled the results and a selection of responses from the open ended questions. The evaluation results were e-mailed to the collaboration team. We used this information when making changes at our September follow-up meeting. The results summary is listed below in Tables 12 and 13.

Table 12*Manual in Use: Results for Manual Format Evaluation Summary*

	1 Poor	2 Fair	3 Good	4 Excellent
Table of Contents Information is accurate and page numbers are correct				8
Headings Headings support the content and give a clear idea about the section				8
Captions and Labels Captions and labels are accurate and informative				8
Organization Information is organized in a clear and logical way				8
Format Pages are visually appealing without being overwhelming				8
Readability/Font Font used is readable and correctly sized/ Line spacing is acceptable				8
Clarity in Writing Writing is clear and understandable				8
Grammar and Punctuation Correct grammar and punctuation are used				8
Math Symbols Correct math symbols are used in the problems				8
Usability The manual is easy to use and aided in guiding lesson preparation				8

Table 13*Manual in Use: Results for Manual Use Evaluation Summary*

	1 No	2 Maybe, A little	3 Probably	4 Yes, somewhat	5 Definitely, a lot
Did you incorporate the "prerequisite knowledge" into your lesson planning?				2	6
Did the manual provide enough math operation examples to help guide your planning?				3	5
Did you use the math reasoning/application problems in your lesson plans?		1		2	5
Did the manual provide you with useable lesson ideas or strategies?			1		7
Did you use the lesson ideas or strategies?			1	1	6
Did the manual help clarify questions you may have had about the core curriculum?			1	2	5
Did the manual help you think of math strategies to include in your lessons?				1	7
Did the manual help you develop effective lesson plans?				2	6

Table 13 (continued)*Manual in Use: Open Ended Questions Summary*

1. How did you use the manual to prepare your lessons?
<ul style="list-style-type: none"> • I read through the entire manual, and then tagged concepts with ideas to try. • Comparing the core with the lesson manual was helpful knowing that I am teaching to the core. • I looked at the vocabulary and included them in my math vocabulary journal. I used the sample problems at the beginning of instruction as a post-quiz. • Good reference to help guide my daily student notes that are presented to the students before an assignment is given. Students then copied my notes from the board and used them like a textbook. • Side benefit: This helped me with writing my pre-algebra lesson plans. I used the pre-requisite knowledge and I hope to see students make easier connections because of this when they go to Algebra A • I went through the manual and identified what I was and was not teaching the kids – I realized how much I needed to add and what I could remove or review. • Determining what pre-requisite skills my students needed. • Planning the reviews at the beginning of my lessons • Writing daily objectives and clarifying the meaning of the core. • I incorporated some of the ideas into lesson plans where students have struggled with concepts. • I matched the objectives to my textbook and manual and prepared an outline of what I planned to teach. This manual helped me create a specific scope so I no longer teach unnecessary material. The ideas and strategies made a huge difference- made it much easier.
2. What was the most effective part of the manual for you? Least effective?
<ul style="list-style-type: none"> • The specific examples from the core are very useful! I am not sure what is least effective! • The most effective part was the lesson ideas and activities. I needed more explanation of some concepts. • The most effective was the lesson ideas and strategies and it was very user friendly. The least effective was the lack of a pacing guide. This is a good guide or starting point for instruction – but it would be great to include pre and post assessment. • The sample problems were the most effective for me- this really helped to clarify the meaning of the core. • The least effective – nothing! I felt every part of the manual is very usable and helpful. • Most effective : examples • Least effective: that it does not completely line up with how our district currently split Algebra A and B. • The most effective part was the lesson strategies! Love them! There was no “least effective” for me. • The most effective part was finally realizing what the core really “meant” – I have never taken the time to really analyze every part of the core – this helped so much! • Specific core definition – finally! • Prerequisites – helped me with initial front-loading • The strategies included great new ideas that worked with my students. • The least effective – I would love to see a second section where the manual is ordered by a sequence that makes sense instead of ordered by core objective.
3. How did the pre-requisite knowledge section help you in preparing your lessons?
<ul style="list-style-type: none"> • It helped me start where the students are at and review what was needed before teaching, which is critical. • As I began the year, it helped me to choose what basic concepts to spend the most time reviewing. • It helped me put the core into a sequence that made sense. • It helped me assess student readiness for that concept. • Good guide for assessing schema before concepts were taught. I used this for pre-tests. • I used this to teach and review vocabulary. • This helped me to sequence lessons effectively • I planned reviews and connected this to students’ knowledge before teaching the concepts. • This made me re-think vocabulary – it helped remind students of their concepts and vocabulary. • It was quite helpful for deciding which concepts to teach in what order. • This helped me with re-teaching kids background knowledge.

Table 13 (continued)*Manual in Use: Open Ended Questions Summary*

4. How did the math operations section help you in preparing your lessons?
<ul style="list-style-type: none"> • Specific examples that showed me what kinds of problems students needed to be able to solve was helpful. • It was helpful to know what the calculations were that the students needed to know and how that related to the application problems. • I used the sample problems in my anticipatory set. I saw a different way of explaining some things. • I liked how this section was aligned with the reasoning/application section. Nice flow for introducing story problems and how to solve them. • This helped to select the appropriate materials for student use (textbook, workbook, or teacher-created). • It helped me to expand my repertoire of example choices. Clarified for me “how far” to go with concepts.
5. How did the math applications section help you in preparing your lessons?
<ul style="list-style-type: none"> • The application is a way for students to connect with real-life situations and is great for these students. • Kids want to know how/when/why they will use math- these were good ideas to incorporate into lessons. • This area was the most difficult for resource students - we set up the problems together and it helped. • This section helped demonstrate the need to learn Algebra. I mainly used this section to foster classroom discussion and problem solving together. • Anticipatory set and the extension activities. Gave me new ideas to try and apply things differently. • This helped me see new ways to show/answer the “why” do we have to do this question. • New ideas!! Gave me great ideas to try and apply things differently. • Application is very difficult for students who already struggle with math calculations. I have not done much of this in the past, but it gave me courage to try it. I found that working through problems with students is really helpful! I loved how the application was right next to the calculations so I could make that connection.
6. How did the lesson ideas and strategies section help you in preparing your lessons?
<ul style="list-style-type: none"> • I am always looking for new and different ways to teach concepts. These are great! I’m using them with my general Algebra class as well. • Ideas & strategies section is where the rubber hits the road this was the biggest help in preparing lessons. • This began my brainstorming and thinking about other things I could do! Excellent resource. • I used some strategies and could tell my students were making connections they had not made before. • I loved the use of actual objects and practical life examples. Great for creating interest. • I liked the visual/tactile approach. This was my favorite section because it gave me additional teaching tools for students with disabilities. • This helped me conceptualize and plan more effective ways to teach the concepts to my students. I am looking forward to using more lesson strategy ideas from the manual! • This gave another way to explain to kids if they struggle with my previous knowledge.
7. Do you think this would be useful for other teachers? Why?
<ul style="list-style-type: none"> • Yes. The core is so vague and hard to decipher. This clarifies it. It tells me what to teach and should give Algebra B teachers a place to start and continue. This is so helpful! • This is very useful for all teachers. The organization and concentration on the core is critical. • Yes, I have not been able to use all the ideas yet. I hope we get to keep this! • New teachers would appreciate the “road map” for breaking down the core into “doable” chunks. Of time. As a seasoned teacher, the manual kept me on track with specifics I needed to cover before moving on. • It is the ultimate guide for implementing the Algebra A core. I absolutely depend on this manual. • Absolutely! It helps to clarify the vagueness from the wording of the core and has helped me more effectively sequence and plan my instruction. If teachers throughout the district, or state, were to use this manual, I think our students would be more “on the same page” This could, theoretically, help if/when students transfer teachers or schools within a school year. And will help students be prepared for CRTs. • Yes I do! This has become my new “math bible” and I have referred to it or used it everyday • Especially someone teaches Algebra A for the first time! It breaks down the core into more understandable math language.

The manual in use evaluation gave me great data on what areas of the manual were used the most. The majority of the evaluators used the pre-requisite knowledge a lot, 75%. The remainder of the teachers, 25%, used the pre-requisite knowledge somewhat. The math operations examples helped 63% of the teachers a lot in guiding their lesson planning while 37% felt it helped somewhat. The math reasoning section was used a lot by 63%, 25% somewhat, and 12% only a little. The majority of teachers felt there were usable lesson ideas, 88%, while 12% said there probably were. When asked if they used the lesson ideas or strategies, 75% of the teachers said they did a lot while 12.5% said they did somewhat and 12.5% said they probably did. The manual provided clarity to 63% of the teachers, for 25% it did somewhat, and for 12% it probably did. When asked if the manual helped teachers think of math strategies to include in their lessons 88% said it did a lot and 12% said somewhat. As far as developing effective lesson plans, 75% of the teachers said that it helped a lot and 25% said it helped somewhat.

It was clear from the open ended questions that the pre-requisites and lesson ideas and strategies sections were the most helpful to the teachers. The overall response was very positive and I was excited to see all the additional ideas that teachers had of ways to use the manual. This re-enforced my feeling that collaboration between special and general education teachers could make a difference in improving lesson planning and ultimately for our students.

The biggest limitation of this evaluation was that it has only been used for a few months. To get a clearer picture how useful the manual is, a full year of use would provide a better platform for evaluation. Also, because we ultimately want to see student

improvement, the ability to incorporate some kind of student assessment would be helpful in evaluating the manual's ability to help create core driven lessons. Another limitation was that two of the teachers were not using the Algebra A core curriculum and were just doing the first half of the book. Future evaluations and meetings would give a better idea of the areas in the manual to improve. Working with the district to ensure that all teachers are following the USOE core is also crucial.

Evaluation 3: Collaborative Evaluation

The collaborative evaluation (see Appendix M) was completed by the collaboration team members. After receiving their evaluations, I compiled the results and a selection of responses from the open ended questions (see Table 14).

Table 14
Results for Collaborative Evaluation Summary

	1 Poor	2 Fair	3 Good	4 Excellent
Meetings began and ended on time				4
There was an updated agenda at every meeting				4
Agendas were followed with little deviation				4
Objectives for the meetings were clear and understandable				4
Assignments given were clear and understandable				4
Team Members knew their roles				4
Team Members functioned well in their roles				4
Team members stayed focused on objectives				4
Team members followed through on their assignments				4
Team facilitator reminded members of their assignments				4
Team members were respectful of each other's ideas				4
Team members were respectful of each other's roles on the team				4

Table 14 (continued)*Collaborative Evaluation: Open Ended Questions Summary*

1. What was your experience like working in a collaborative team of general educators & special educators?
<ul style="list-style-type: none"> • Very positive-nice to get perspective from both sides. Great to clarify understanding of methodology to each student with different needs. • It was an amazing experience! I learned so much about effective teaching and collaboration. • This has been the most valuable experience I've had with this subject. I feel like I now fully understand what I need to teach and have ways to teach. I cannot put a number to the value of this! Hearing the resource perspective was especially helpful and gave me new insights to ways I can be better. • I did not know what to expect, but was so impressed by everyone's dedication to finding ways to help students be successful. Working with the general educators opened my eyes to how much I have to learn content wise. But, knowing that they are there as a resource is so helpful.
2. What worked well and what could have been improved?
<ul style="list-style-type: none"> • We all worked well together – bringing different experience and training. We made much faster progress than expected because we did work so well together. • Everything worked well! Diane had such a clear vision and guided the meetings with purpose and gave each of us a voice for our students. Thank you for including me in this project!! • We collaborated so well. We are very opinionated and have definite ideas. It was great to listen & look at ideas & really pick out the best strategies. Improve nothing! I just wish we had more time to dedicate to this. • I would suggest that every special education teacher be paired with a general education teacher so they can have this experience – it was amazing! I do not know what could have been done better except that I wish we could meet once a month for a whole day and do more!

The results of the collaborative evaluation were not surprising. From the very beginning of this project, there was a professional, excited, involved attitude from all the collaborators. A successful collaboration group has a sense of membership, group norms, a common purpose, and meets its objectives. As the facilitator, I took it upon myself to make sure that the meetings were organized and ran smoothly. I didn't want anyone to feel like they were wasting their time being a part of this team. The participants of this collaborative team took their roles seriously and remained focused on the goals we set. All of the teachers on the collaboration team felt that the experience of working together was invaluable and that the final result of the Algebra A manual would be a key resource for their lesson planning.

Final Follow-up Meeting

On the final follow-up day, the collaboration team and peer evaluator team had the opportunity to spend the day talking about how they used the manual and where we should go from this point. The overall feeling was that the manual was a great resource for guiding lesson planning because it clarified so much about the core. The favorite section by far was the lesson plans and ideas section. One of the teachers used the funnel strategy for teaching students classifying numbers. She created a great visual by combining rocks, Legos, almonds, and rice. Then she used different sized strainers to explain the “levels” in the funnel described in the strategy. She poured the contents through the strainers, showing how the different objects would not go through the strainers. We all loved that idea because it is the kind of visual our students respond to. Both teams felt like continuing this collaboration group would benefit teachers and students. We discussed meeting in January and again in May to review how we were all using the manual. The district curriculum director has approved future funds to provide substitutes over the next two years so that we can continue collaborating together.

Discussion

This project created and evaluated a core curriculum reference manual for the Algebra A curriculum by a collaborative team of special and general educators. The product was an Algebra A curriculum reference manual developed by collaborative teams. The Algebra A core curriculum reference manual (see Appendix N) was created to clarify the Algebra A core and serve as a reference manual for general and special education teachers. The results from the formative evaluation, manual in use,

collaboration evaluation, and the last follow-up meeting have shown that this objective was met.

The manual would not have been possible without an effective collaboration team. I have been a part of many teams and groups that have been created to solve problems, create goals, evaluate data, or improve curriculum. The reality is that I often leave the meeting wondering what we have accomplished, what I need to do, what my role on the team is, and wondering what the point was because nothing or very little was accomplished. Sometimes I lack motivation to be involved because the facilitator doesn't provide a clear vision, or appears unorganized. I knew there would be some challenges in creating these collaborative groups because others have had the same experience. In fact, one of the team members was reluctant to join because she was not sure that it would be worth her time. I knew that I would need to be organized and knowledgeable about the best way to go about creating this group.

The Maryland Coalition for Inclusive Education (MCIE) was an invaluable resource as I looked at the best way to go about establishing a collaborative team. I used the information from their website to decide on team roles and the organization of the team. Our team consisted of a facilitator, timekeeper, recorder, and observer. We read through the responsibilities and the team checklist and established norms for the group on the first day and reviewed them before each collaboration meeting. We decided that our norms would be to begin and end on time, review goals and the agenda at the beginning of every meeting, review what we had accomplished so far and what we would work on that day, be respectful of each other's ideas, solve conflict professionally and respectfully, and end the meeting by reviewing our accomplishments and reviewing the

agenda for the next meeting. Team members fulfilled their roles and followed the norms we established without variation.

I determined that the most important key to our success would be my efforts. The reason this collaboration worked so well is because, as the facilitator, I was prepared, organized and presented a clear vision with an outline of each step. The preparation I did between each of the collaboration days was just as important as the collaboration days themselves. The second time we met as a group everyone was surprised how much I had done in-between our meetings. I could tell they had buy-in to the project. In fact, one member said she felt we were really going to accomplish something and she was excited about it.

Perhaps the reason why many collaboration teams don't function well is because of the amount of time needed to organize and prepare for an effective collaborative experience. Or, people underestimate the scope of what they need to do and quickly give up when they realize how much work is involved. Before beginning any project that involves creating a team, the facilitator needs to think through and organize the logistics of the project. For the creation of this manual, I spent several hours over several weeks brainstorming ideas, researching collaborative teams, thinking about goals, and the logistics of how it would all work. I also met with the potential team members to discuss what being a member of the team would involve so they would have time to think about whether or not they wanted to commit to being a part of this project. Even though it was time intensive, the preparation paid off in the end. Below is a list of the phases and the approximate amount of time it took to complete all the tasks in each phase (see Table 15).

Table 15
Time Table: Amount of time needed to complete each phase.

Phase 1 : Development of the Materials	
30 hours	Brainstorming and organizing logistics
20 hours	Preparation for the first meeting
7 hours	Collaboration Preparation Meeting with Collaboration Team
20 hours	Preparation for Collaboration Day One
7 hours	Collaboration Day One
60 hours	Preparation for Collaboration Day Two
7 hours	Collaboration Day Two
50 hours	Preparation for Collaboration Day Three
7 hours	Collaboration Day Three
10 hours	Update All Changes
218 hours	TOTAL
Phase 2 : Formative Evaluation and Revisions	
3 hours	Formative evaluations sent to auxiliary team and peer evaluator team.
25 hours	Review evaluations, adjustments made, final manual copied, bound, and sent
28 hours	TOTAL
Phase 3 : Manual Implementation and Manual in Use Evaluation	
2 months	Manual Implemented
7 hours	Follow-up Day 1
10 hours	Make any adjustments to the manual and send copies to the team
7 hours	Follow-up Day 2
2 months 26 hours	TOTAL

Another issue not always discussed is that often people do not want to be part of a collaborative group because they already have many responsibilities and are concerned that being part of a group would require them to do more work. I wanted the team to feel

valued, but also compensated for their efforts. I met with the district curriculum director to talk about how much time this project would take and ask if money was available to pay the collaboration team. I volunteered my time, but wanted them to be paid for their summer work. After seeing the amount of work it would take, she agreed to pay the team for 21 hours of work. In addition, I assured the team that I would do all of the work and preparation in-between the meetings and they would not be required to do anything beyond their responsibilities. When the team saw how much I did in-between the meetings they seemed even more motivated to work hard and contributed to make sure the manual was completed.

The completed manual is a great reference for me as a teacher and I can already feel a difference in how I prepare my lessons. When I began this project, I knew it was just the first step in what would hopefully turn into a long-term collaborative experience. This manual is just a jumping off point. With continued collaboration between general and special educators, I would like create a curriculum map with a scope and sequence, common assessments developed, a pre-test and post-test for the Algebra A class, and coordinate future in-service for special educators on learning math concepts. The creation of this manual came from my desire to be a more effective teacher for my students by focusing on the state math core curriculum and incorporating effective strategies for the math concepts. The manual has changed how I approach lesson planning and what I teach my students. For me, the ultimate test will be when I am able to analyze data on student achievement. But for now, having such a valuable resource to draw from is a step in the right direction.

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Appendix A
COLLABORATIVE TEAM CHECKLIST
 Maryland Coalition for Inclusive Education (MCIE, 2006)

Teams	<ul style="list-style-type: none"> <input type="checkbox"/> share common beliefs and work toward common goals <input type="checkbox"/> establish and share roles and responsibilities <input type="checkbox"/> establish mutually agreed upon methods for meetings <input type="checkbox"/> are willing to share personal feelings and insights <input type="checkbox"/> continue to change and grow <input type="checkbox"/> have fun!
Roles	<ul style="list-style-type: none"> <input type="checkbox"/> roles and responsibilities are clear <input type="checkbox"/> lines of communication are clear <input type="checkbox"/> expectations regarding work performance (quality, timeliness, etc.) are clear and equitable
Team Meetings	<ul style="list-style-type: none"> <input type="checkbox"/> meet regularly and consistently <input type="checkbox"/> start meetings on time (members be on time) <input type="checkbox"/> sit facing toward each other at meetings (in a circle) <input type="checkbox"/> have an agenda (agreed upon in advance) <input type="checkbox"/> begin with celebrations, sharing, or other positive note <input type="checkbox"/> have a facilitator (regular or rotating) who effectively keep the discussion on track <input type="checkbox"/> have a recorder take notes on discussions, decisions, and responsibilities for follow-up <input type="checkbox"/> hold no one solely responsible for success/failure of team actions <input type="checkbox"/> share group tasks, responsibilities and group leadership <input type="checkbox"/> develop action plans, follow up on decisions, & monitor issues as part of the agenda of following meetings <input type="checkbox"/> keep to scheduled time limits
Individual Interactions and Responsibility	<ul style="list-style-type: none"> <input type="checkbox"/> demonstrate positive personal interactions <input type="checkbox"/> encourage each other to interact <input type="checkbox"/> contribute opinions, participate in problem-solving and decisions <input type="checkbox"/> support teammates by offering assistance <input type="checkbox"/> be honest <input type="checkbox"/> openly communicate (and agree to disagree at times) <input type="checkbox"/> demonstrate respect through facial expression, body posture and tone of voice <input type="checkbox"/> engage in active listening <input type="checkbox"/> give eye contact to the speaker <input type="checkbox"/> don't interrupt the speaker <input type="checkbox"/> ask questions related to the discussion and when necessary, repeat or paraphrase the speaker to ensure understanding <input type="checkbox"/> make decisions by consensus <input type="checkbox"/> poll each other for understanding and clarification of issues/ideas <input type="checkbox"/> be flexible when necessary and compromise to reach agreement on next steps <input type="checkbox"/> share decision making credit and blame (use "we" and "us" vs. "I" and "you") <input type="checkbox"/> set rules for methods to deal with controversial issues or subjects <input type="checkbox"/> complete assignments outside of meetings <input type="checkbox"/> generate lots of potential solutions to an identified problem <input type="checkbox"/> review how they are doing and give each other feedback on how they are doing as a team
Conflict Resolution Methods	<ul style="list-style-type: none"> <input type="checkbox"/> remain calm <input type="checkbox"/> look at the speaker <input type="checkbox"/> don't interrupt the speaker <input type="checkbox"/> don't adopt a defensive posture <input type="checkbox"/> listen to what is being said <input type="checkbox"/> accept criticism of ideas without being defensive <input type="checkbox"/> criticize ideas and not people <input type="checkbox"/> don't talk about others behind their back <input type="checkbox"/> check the accuracy of the message (don't assume) <input type="checkbox"/> validate the other person's feelings <input type="checkbox"/> try to imagine the other person's point of view <input type="checkbox"/> use a tone of voice which is calming <input type="checkbox"/> avoid tones which suggest impatience, disgust, or sarcasm <input type="checkbox"/> speak clearly and slowly at a moderate volume <input type="checkbox"/> attempt to reach agreement on a mutual goal and next steps <input type="checkbox"/> plan to return to the issue with ground rules or with an agreed-upon agenda

Appendix B

Course Name Algebra A: Core Curriculum

Standard I: Students will expand number sense to understand, perform operations, and solve problems with real numbers.

Objective 1: Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers.

- a. Define a rational number as a point on the number line that can be expressed as the ratio of two integers, and points that cannot be so expressed as irrational.
- b. Classify numbers as rational or irrational, knowing that rational numbers can be expressed as terminating or repeating decimals & irrational numbers can be expressed as non-terminating, non-repeating decimals.
- c. Classify π and square roots of non-perfect square numbers as irrational.
- d. Place rational and irrational numbers on a number line between two integers.

Objective 2: Compute fluently and make reasonable estimates with rational and irrational numbers.

- a. Simplify, add, subtract, multiply, and divide expressions with square roots.
- b. Evaluate and simplify numerical expressions containing rational numbers and square roots using the order of operations.
- c. Compute solutions to problems, represent answers in exact form, & determine the reasonableness of answers.
- d. Solve problems involving percentages and unit rates using proportional reasoning.
- e. Calculate the measures of the sides of a right triangle using the Pythagorean Theorem.

Standard II: Students will extend concepts of proportion to represent and analyze linear relations.

Objective 1: Represent the slope of a line.

- a. Identify the slope of a line when given points on a graph.
- b. Identify horizontal and vertical lines given the slope.

Objective 2: Model and interpret problems having a constant rate of change using linear functions.

- a. Write algebraic expressions or equations to generalize visual patterns, numerical patterns, relations, or data sets.
- b. Distinguish between linear and non-linear functions by examining a table, equation, or graph.
- c. Interpret the slope of a linear function as a rate of change in real-world situations.

Objective 3: Represent and analyze linear relationships using algebraic equations, expressions, & graphs.

- a. Identify the x - and y -intercepts from an equation or graph of a line or a table of values.
- b. Graph linear relations and inequalities by plotting points, or by finding x - and y -intercepts.

Standard III: Students will develop fluency with the language and operations of algebra to analyze and represent relationships.

Objective 1: Simplify monomials and the quotient of monomials.

- a. Simplify and evaluate monomial expressions and formulas.
- b. Simplify the quotient of monomials using positive exponents.

Objective 2: Solve and interpret linear equations and inequalities in various situations including real-world problems.

- a. Solve single-variable linear equations and inequalities algebraically and graphically.
- b. Solve real-world problems involving constant rates of change.
- c. Solve equations for a specified variable.
- d. Solve proportions that include algebraic first-degree expressions.

Standard IV: Students will apply concepts of algebra to geometry.

Objective 1: Solve real-life application problems involving measurement.

- a. Measure real life objects using a variety of tools and techniques.
- b. Derive and apply geometric measurement formulas.

Objective 2: Use proportional reasoning to solve geometry problems.

- a. Draw and interpret scale drawings.
- b. Find missing measures in similar figures.

Appendix C

Utah Core Pacing Guide: Algebra A

Utah Core Suggested Pacing Guide: Algebra A

		Mid-year											
Standard I: Expand on the forms to use real numbers.	Obj. 1	Represent real numbers as points on the number line and distinguish rational from irrational numbers											
	Obj. 2	Compute fluently and make estimates with rational numbers											
Standard III: Expand proper to represent and analyze linear functions.	Obj. 1	Represent the slope of a line											
	Obj. 2	Model and interpret problems having a constant rate of change using linear functions											
	Obj. 3	Represent and analyze linear relationships using algebraic equations, expressions, and graphs											
Standard III: Develop fluency with the fact- and operation of integers.	Obj. 1	Simplify monomials and the quotient of monomials											
	Obj. 2	Solve and interpret linear equations and inequalities											
Standard IV: Apply concepts of Algebra to Geometry.	Obj. 1	Solve real-life application problems involving measurement											
	Obj. 2	Use proportional reasoning to solve geometry problems											

Appendix D

Agenda: Collaboration Planning Day

- Objectives**
- 1. Review and correct any material in the team packets
 - 2. Establish roles on the collaborative team
 - 3. Review current materials
 - 4. Identify Standards in the current materials
 - 5. Determine additional resources and materials to use
 - 6. Evaluate our progress and make assignments
 - 7. Make any adjustments to the agenda for collaboration day 1
 - 8. Make assignments for collaboration day 1

Schedule

8:00 – 9:00 Team Business

Introduction of Team Members

Review Objectives

Review Items in the Packets

- Calendar of dates and times of our meetings
- Contact list with all the team members names, e-mail, and phone numbers
- Copies of all the agendas for our meetings
- A copy of the collaboration review, reflection, and planning form
- A copy of skeleton manual
- A copy of the Evaluation Rubric

Determine Roles on the Collaborative Team: Facilitator: Diane Hamilton

Time Keeper: _____

Recorder: _____

Observer: _____

9:00 – 11:30 Review Current Materials and Identify Standards

There are four standards in the core, we will use this planning day going through the textbook and identifying which concepts fit which standards. We will break into pairs and split the book in half so we can do this more efficiently. We will use colored post-it notes to signify the different standards:

- a. Standard 1 : yellow
- b. Standard 2 : blue
- c. Standard 3: pink
- d. Standard 4 : green

11:30 – 12:15 Lunch

12:00 – 1:00 Standards Alignment

Come back together and review the marked books. Does the information align with the core standards? What do we need to fix?

2:00 – 2:30 Reflection and Planning/Review with Auxiliary Team

- Review the objectives that we achieved, fill out the form for the day and tie up loose ends.
- Evaluate our progress and discuss any questions or concerns.
- Discuss agenda planning for the next meeting.
- What other materials will we need?
- Make assignments for the next meeting.
- Each team member should come prepared to share resources and ideas to include in the manual and more specifically in the application, lessons, and strategies columns.
- Review progress with auxiliary team member.

Appendix E

Agenda: Collaboration Day 1

- Objectives**
- 1. Review roles on the collaborative team
 - 2. Fill out Math Operations
 - 3. Fill out Prerequisite Knowledge
 - 4. Determine additional resources and materials to use
 - 5. Evaluate our progress
 - 6. Make any adjustments to the agenda for collaboration day 2
 - 7. Make assignments for collaboration day 2

Schedule

8:00 – 8:15 Team Business

Review Objectives

Review Agenda

Review Roles

Textbook Reference Book

Standards Posters – how we will use them

*At least one auxiliary team member will be attending part of the day to check on progress

8:15 – 10:15 Math Operations

We will split the standards up and each take one. We will use post-it notes to write out math operations problems (include the objective on the post-it note). Then arrange them in order on the posters.

10:15 – 11:15 Review and Present Math Operations

We will each take a turn and go through the operations we selected and make adjustments.

11:15 – 12:00 Lunch

12:00 – 2:00 Prerequisite Knowledge

As a group we will go through each standard and fill in the pre-requisite knowledge you would need to know for the math operations problems we chose earlier.

2:00 – 3:00 Reflection and Planning

- Review the objectives that we achieved, fill out the form for the day and tie up loose ends.
- Evaluate our progress and discuss any questions or concerns.
- Discuss agenda planning for the next meeting.
- What materials will we need?
- Make assignments for the next meeting.
- Each team member should come prepared next time to share resources and ideas to include in the manual and more specifically in the application, lessons, and strategies columns.

Appendix F

Agenda: Collaboration Day 2

- Objectives**
- 1. Review roles on the collaborative team
 - 2. Fill out Math Applications
 - 3. Fill out Lesson Ideas/Strategies
 - 4. Determine additional resources and materials to use
 - 5. Evaluate our progress
 - 6. Make any adjustments to the agenda for collaboration day 3
 - 7. Make assignments for collaboration day 3

Schedule

8:00 – 8:15 Team Business

Review Objectives

Review Agenda

Review Roles

Review Assignments

*At least one auxiliary team member will be attending part of the day to check on progress

8:15 – 10:15 Math Applications

Divide into two pairs. One pair will do Standard 1 and 3. The second pair will do Standard 2 and 4. Go through and fill out a math application problem to fit with the operations problems.

10:15 – 11:15 Review and Present Math Applications

We will each take a turn and go through the operations we selected and make adjustments.

11:15 – 12:00 Lunch

12:00 – 2:30 Lesson Ideas/Strategies

We will do this section as a group. We will go around and each take a turn sharing what we brought for this section.

2:30 – 3:00 Reflection and Planning

- Review the objectives that we achieved, fill out the form for the day and tie up loose ends.
- Evaluate our progress and discuss any questions or concerns.
- Discuss agenda planning for the next meeting.
- What materials will we need?
- Make assignments for the next meeting.
- Team members will be given a copy of the manual one week prior to the final collaboration day. They will read through, edit, and come prepared to share their suggestions

Appendix G

Agenda: Collaboration Day 3

- Objectives**
- 1. Manual review and make revisions
 - 2. Sequence the math concepts that have not been done yet
 - 4. Determine additional resources and materials to use
 - 5. Evaluate our progress and make assignments
 - 6. Discuss calendar items and planning
 - 7. Fill out the evaluation form

Schedule

8:30 – 8:45 Team Business

Review Objectives

Review Agenda

Review Roles

Review Assignments

*At least one auxiliary team member will be attending part of the day to check on progress

8:45 – 9:45: Lesson Ideas and Strategies

Add more lesson ideas and strategies.

9:45 – 12:00 Manual Review and Revisions

Go through the manual page by page making any corrections and additions. What errors did team members notice when they went through on their own? What needs to be added or removed? Formatting? Grammar?

12:00 – 12:45 Lunch

12:45 – 2:00 Wrap-up any unfinished items

2:00 – 2:30 Reflection and Planning

- Review the objectives that we achieved, fill out the form for the day.
- Evaluate our progress and discuss any questions or concerns.
- Make assignments
- Discuss calendar issues and the next steps

Appendix H

Agenda: Follow-up Day 1

- Objectives**
- 1. Manual review and make revisions
 - 2. Share experiences from using the manual
 - 4. Add Lesson Plans and Strategies
 - 5. Evaluate our progress
 - 6. Make any adjustments to the agenda for follow-up day 2
 - 7. Make assignments for follow-up day 2

Schedule

8:00 – 8:15 Team Business

Review Objectives

Review Agenda

Review Roles

Review Assignments

*At least one auxiliary team member will be attending part of the day to check on progress

8:15 – 10:15 Manual Review and Revisions

Go through the manual page by page making any corrections and additions. What errors did team members notice when they were using the manual? Review Formative Evaluations and address additional issues we may have overlooked.

10:15 – 11:30 Sharing Experiences

Now that we have all had the opportunity to use the manual, we each take 10-15 minutes to share the lesson plans we created and our experience with using the manual. How is this affecting our teaching? Students? Outcomes?

11:30 – 12:15 Lunch

12:15 -2:00 Finish Sharing Experiences /Additions of Lesson Plans and Strategies

Finish sharing experiences. Using the information everyone brought to the meeting, what are some ideas and strategies we could add.

2:00 – 3:00 Wrap-up, Reflection and Planning

- Review the objectives that we achieved, fill out the form for the day and tie up loose ends.
- Evaluate our progress and discuss any questions or concerns.
- Make assignments
- Discuss calendar issues and the final steps
- Diane will make revisions and send them to your schools.

Appendix I

Agenda: Follow-up Day 2

- Objectives**
- 1. Share experiences from using the manual
 - 2. Manual review and make revisions
 - 4. Add Lesson Plans and Strategies
 - 5. Evaluate our progress
 - 6. Fill out final evaluation and reflections form

Schedule

8:00 – 8:15 Team Business

Introduce all team members

Review Objectives

Review Agenda

Review Roles

Review Assignments

*At least one auxiliary team member will be attending part of the day to check on progress

8:15 – 10:15 Sharing Experiences

We will each take 10-15 minutes to share the lesson plans we created and our experience with using the manual. How is this affecting our teaching? Students? Outcomes? Have things improved since our first follow-up meeting?

10:15 – 11:30 Manual Review and Revisions

Go through the manual page by page making any corrections and additions. What errors did team members notice when they were using the manual?

11:30 – 12:30 “Thank You” Lunch

12:30 – 1:30 Additions of Lesson Plans and Strategies

Using the information everyone brought to the meeting, what are some ideas and strategies we could add.

1:30 – 2:30 Wrap up and Reflection

- Review the objectives that we achieved, fill out the form for the day and tie up loose ends.
- Evaluate our progress and discuss any questions or concerns.
- Fill out the evaluation in use form and collaboration form
- Meet with auxiliary team members to review and reflect

Appendix K

Formative Evaluation: Manual Evaluation

The purpose of this manual is to provide clarity to the current core curriculum, be a reference for teachers as they prepare lesson plans, and provide strategies and lesson ideas for core concepts. The manual has been divided into the four standards provided by the Utah State Office of Education. Each standard has also been broken down into its individual objectives. The manual format and objectives for each section are below:

Prerequisite Knowledge (language/symbols)	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
This section contains symbols, vocabulary, and prerequisite knowledge the student needs to be successful in mastering the objective.	This section contains math calculations problems aligned with the objectives	This section contains word problems aligned with the objectives.	This section contains a strategy bank to help teachers with their lesson plans. It is not the intent to make this section complete at this time. It will be a "living" section with ideas added throughout the year and beyond 😊!

Thank you for your participation in this evaluation. Your input is invaluable as we strive to create more useful tools help teachers prepare lessons and meet the challenges of helping students achieve in math. This manual evaluation is divided into five parts:

1. Evaluator Information
2. Evaluation of the Overall Manual Format
3. Rubric for Evaluating the Content of the Manual – Standard 1 & 2
4. Rubric for Evaluating the Content of the Manual – Standard 3 & 4
5. Manual Effectiveness Feedback and Suggestions

Please complete each section fully and return the evaluation, along with the manual, to Diane Hamilton. As you go through the manual please write any editing marks or questions for clarification as they arise. A stamped and addressed return envelope has been provided for your convenience. If you have any questions, please feel free to contact me at your convenience via e-mail or telephone.

Thanks again,

Diane Hamilton
 (801)885-7754
diane.hamilton@nebo.edu

Part 1: Evaluator Information

Name: _____

Title/Position: _____ Years in Education: _____

Part 2: Rubric for Evaluation of the Overall Manual Formatting

Directions: Please rate the categories below by checking the box on the left with the corresponding evaluation number→

	1 Poor	2 Fair	3 Good	4 Excellent	Please list any problems, comments, or suggestions below
Table of Contents Information is accurate and page numbers are correct					_____ _____ _____
Headings Headings support the content and give a clear idea about the section					_____ _____ _____
Captions and Labels Captions and labels are accurate and informative					_____ _____ _____
Organization Information is organized in a clear and logical way					_____ _____ _____
Format Pages are visually appealing without being overwhelming					_____ _____ _____
Readability/Font Font used is readable and correctly sized/ Line spacing is acceptable					_____ _____ _____
Clarity in Writing Writing is clear and understandable					_____ _____ _____
Grammar and Punctuation Correct grammar and punctuation are used					_____ _____ _____
Math Symbols Correct math symbols are used in the problems					_____ _____ _____

Part 3: Rubric for Evaluating the Content of the Manual STANDARD 1 & 2

Standard 1 : Expand number sense to use real numbers		
Question	Response	If mostly or no, what should be included or removed?
Core Alignment Is the content in alignment with the core?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Operations Do the examples provide an accurate idea of what the standard and objective is?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Reasoning/Application Do the application problems represent the standard and objective?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Do the lesson plans and ideas align with the standard?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Would the ideas be helpful in planning lessons?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Standard 2 : Expand proportions to represent and analyze linear functions		
Question	Response	If mostly or no, what should be included or removed?
Core Alignment Is the content in alignment with the core?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Operations Do the examples provide an accurate idea of what the standard and objective is?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Reasoning/Application Do the application problems represent the standard and objective?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Do the lesson plans and ideas align with the standard?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Would the ideas be helpful in planning lessons?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	

****The Lesson Plans and Ideas section is a work in progress and will be updated as work on this manual continues. It is not intended to be a complete or exhaustive section at this time.**

Part 4: Rubric for Evaluating the Content of the Manual STANDARD 3 & 4

Standard 3 : Develop fluency with the language and operations of Algebra		
Question	Response	If mostly or no, what should be included or removed?
Core Alignment Is the content in alignment with the core?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Operations Do the examples provide an accurate idea of what the standard and objective is?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Reasoning/Application Do the application problems represent the standard and objective?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Do the lesson plans and ideas align with the standard?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Would the ideas be helpful in planning lessons?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Standard 4 : Apply concepts of Algebra to Geometry		
Question	Response	If mostly or no, what should be included or removed?
Core Alignment Is the content in alignment with the core?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Pre-requisite Knowledge Are the correct language, symbols, and skills listed?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Operations Do the examples provide an accurate idea of what the standard and objective is?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Math Reasoning/Application Do the application problems represent the standard and objective?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Do the lesson plans and ideas align with the standard?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	
Lesson Plans/Ideas** Would the ideas be helpful in planning lessons?	<input type="checkbox"/> Yes <input type="checkbox"/> Mostly <input type="checkbox"/> No	

**The Lesson Plans and Ideas section is a work in progress and will be updated as work on this manual continues. It is not intended to be a complete or exhaustive section at this time.

Part 5: Manual Effectiveness Feedback and Suggestions

Directions: Please rate the following categories below by checking the box on the left with the corresponding evaluation number→

	1 No	2 Maybe, A little	3 Probably	4 Yes, somewhat	5 Definitely, a lot
Will this manual help special education teachers teach math to struggling students?					
Will this manual help general education teachers teach math to struggling students?					

1. What do you think are the strengths of this manual?
2. What do you think could be improved? How?
3. How does this manual compare to the current curriculum material available?
4. How do you think this manual will help teachers prepare more effective lessons?
5. Please provide any other feedback or ideas you have for this manual☺!

Appendix L

Manual in Use Evaluation Form

Name: _____ Title/Position: _____

Part 1: Manual Format Rubric

Directions: Please rate the following categories below by checking the box on the left with the corresponding evaluation number→

	1 Poor	2 Fair	3 Good	4 Excellent
Table of Contents Information is accurate and page numbers are correct				
Headings Headings support the content and give a clear idea about the section				
Captions and Labels Captions and labels are accurate and informative				
Organization Information is organized in a clear and logical way				
Format Pages are visually appealing without being overwhelming				
Readability/Font Font used is readable and correctly sized/ Line spacing is acceptable				
Clarity in Writing Writing is clear and understandable				
Grammar and Punctuation Correct grammar and punctuation are used				
Math Symbols Correct math symbols are used in the problems				
Usability The manual is easy to use and aided in guiding lesson preparation				

Part 2: Manual Use Rubric

Directions: Please rate the following categories below by checking the box on the left with the corresponding evaluation number→

	1 No	2 Maybe, A little	3 Probably	4 Yes, somewhat	5 Definitely, a lot
Did you incorporate the "prerequisite knowledge" into your lesson planning?					
Did the manual provide enough math operation examples to help guide your planning?					
Did you use the math reasoning/application problems in your lesson plans?					
Did the manual provide you with useable lesson ideas or strategies?					
Did you use the lesson ideas or strategies?					
Did the manual help clarify questions you may have had about the core curriculum?					
Did the manual help you think of math strategies to include in your lessons?					
Did the manual help you develop effective lesson plans?					

Part 3: Manual Use Questions

1. How did you use the manual to prepare your lessons?

2. What was the most effective part of the manual for you? Least effective?

3. How did the pre-requisite knowledge section help you in preparing your lessons?

4. How did the math calculations section help you in preparing your lessons?

5. How did the math applications section help you in preparing your lessons?

6. How did the lesson ideas and strategies section help you in preparing your lessons?

7. Do you think this would be useful for other teachers? Why?

Appendix M

Evaluation of Collaboration Meetings

Name: _____ Title/Position: _____

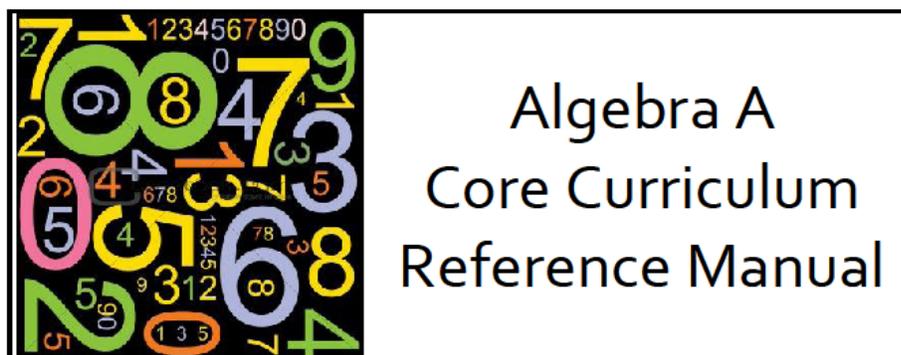
Directions: Please rate the following categories below by checking the box on the left with the corresponding evaluation number→

	1 Poor	2 Fair	3 Good	4 Excellent
Meetings began and ended on time				
There was an updated agenda at every meeting				
Agendas were followed with little deviation				
Objectives for the meetings were clear and understandable				
Assignments given were clear and understandable				
Team Members knew their roles				
Team Members functioned well in their roles				
Team members stayed focused on objectives				
Team members followed through on their assignments				
Team facilitator reminded members of their assignments				
Team members were respectful of each others ideas				
Team members were respectful of each others roles on the team				

1. What was your experience like working in a collaborative team of general educators, special educators, and auxiliary team members?

2. What worked well and what could have been improved?

Appendix N



The purpose of this manual is to provide clarity to the current core curriculum and be a reference for teachers as they prepare lesson plans.

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**The following textbook was used in the creation of this manual:

Bellman, A., Bragg, S., Charles, R., Hall, B., Handlin, W., & Kennedy, D. (2007). *Algebra 1*. Boston, Massachusetts: Prentice Hall

Course Name **Algebra A**; Suggested Course Outline

Year-long Endorsement Requirement: Mathematics Level 2, 3, Grade level: 9,10 Prerequisite: Pre-Algebra deficiency

<p>Standard I: Students will expand number sense to understand, perform operations, and solve problems with real numbers.</p> <p>Objective 1: Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers.</p> <ol style="list-style-type: none"> Define a rational number as a point on the number line that can be expressed as the ratio of two integers, and points that cannot be so expressed as irrational. Classify numbers as rational or irrational, knowing that rational numbers can be expressed as terminating or repeating decimals and irrational numbers can be expressed as non-terminating, non-repeating decimals. Classify π and square roots of non-perfect square numbers as irrational. Place rational and irrational numbers on a number line between two integers. <p>Objective 2: Compute fluently and make reasonable estimates with rational and irrational numbers.</p> <ol style="list-style-type: none"> Simplify, add, subtract, multiply, and divide expressions with square roots. Evaluate and simplify numerical expressions containing rational numbers and square roots using the order of operations. Compute solutions to problems, represent answers in exact form, and determine the reasonableness of answers. Solve problems involving percentages and unit rates using proportional reasoning. Calculate the measures of the sides of a right triangle using the Pythagorean Theorem. <p>Standard II: Students will extend concepts of proportion to represent and analyze linear relations.</p> <p>Objective 1: Represent the slope of a line.</p> <ol style="list-style-type: none"> Identify the slope of a line when given points on a graph. Identify horizontal and vertical lines given the slope. <p>Objective 2: Model and interpret problems having a constant rate of change using linear functions.</p> <ol style="list-style-type: none"> Write algebraic expressions or equations to generalize visual patterns, numerical patterns, relations, or data sets. Distinguish between linear and non-linear functions by examining a table, equation, or graph. Interpret the slope of a linear function as a rate of change in real-world situations. 	<p>Standard II(continued): Students will extend concepts of proportion to represent and analyze linear relations.</p> <p>Objective 3: Represent and analyze linear relationships using algebraic equations, expressions, and graphs.</p> <ol style="list-style-type: none"> Identify the x- and y-intercepts from an equation or graph of a line or a table of values. Graph linear relations and inequalities by plotting points, or by finding x- and y-intercepts. <p>Standard III: Students will develop fluency with the language and operations of algebra to analyze and represent relationships.</p> <p>Objective 1: Simplify monomials and the quotient of monomials.</p> <ol style="list-style-type: none"> Simplify and evaluate monomial expressions and formulas. Simplify the quotient of monomials using positive exponents. <p>Objective 2: Solve and interpret linear equations and inequalities in various situations including real-world problems.</p> <ol style="list-style-type: none"> Solve single-variable linear equations and inequalities algebraically and graphically. Solve real-world problems involving constant rates of change. Solve equations for a specified variable. Solve proportions that include algebraic first-degree expressions. <p>Standard IV: Students will apply concepts of algebra to geometry.</p> <p>Objective 1: Solve real-life application problems involving measurement.</p> <ol style="list-style-type: none"> Measure real life objects using a variety of tools and techniques. Derive and apply geometric measurement formulas. <p>Objective 2: Use proportional reasoning to solve geometry problems.</p> <ol style="list-style-type: none"> Draw and interpret scale drawings. Find missing measures in similar figures.
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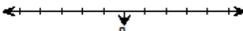
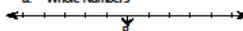
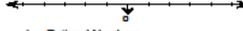
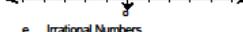
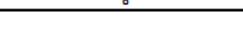
Algebra A Pacing Guide

Utah Core Suggested Pacing Guide: Algebra A



Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

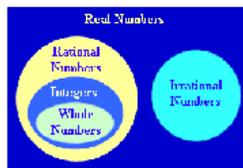
OBJECTIVE 1	Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers
OBJECTIVE 1.a.	Define a rational number as a point on the number line that can be expressed as the ratio of two integers, and points that cannot be so expressed as irrational.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies																											
<p>Language & Symbols</p> <p>Fraction Integer Irrational number Ratio Rational number $\sqrt{\quad}$</p> <p>Skills</p> <p>Know the concept of "number line"</p>	<p>Write these rational numbers as a ratio of two integers:</p> <p>a. $12 - \frac{?}{?}$</p> <p>b. $-6 - \frac{?}{?}$</p> <p>c. $\sqrt{16} \frac{?}{?}$</p> <p>d. $4.392 \frac{?}{?}$</p> <p>Place the following numbers on the number line:</p>  <p>a. $2\frac{1}{2}$</p> <p>b. .75</p> <p>c. $\sqrt{25}$</p> <p>e. -4</p>	<p>Rational numbers can be written as a simple fraction (ratio of two integers). Irrational numbers can not be written as a simple fraction. Below is a chart of numbers. If you can, convert the numbers into simple fractions and classify the numbers as rational or irrational. The first two have done as an example :</p> <table border="1" data-bbox="828 598 1063 892"> <thead> <tr> <th>Number</th> <th>Write as a Ratio</th> <th>Rational Or Irrational?</th> </tr> </thead> <tbody> <tr> <td>1.75</td> <td>$\frac{7}{4}$</td> <td>Rational</td> </tr> <tr> <td>$\sqrt{2}$</td> <td>Can't</td> <td>Irrational</td> </tr> <tr> <td>5</td> <td></td> <td></td> </tr> <tr> <td>.04</td> <td></td> <td></td> </tr> <tr> <td>1.0010001...</td> <td></td> <td></td> </tr> <tr> <td>-6</td> <td></td> <td></td> </tr> <tr> <td>$\sqrt{9}$</td> <td></td> <td></td> </tr> <tr> <td>$\sqrt{7}$</td> <td></td> <td></td> </tr> </tbody> </table>	Number	Write as a Ratio	Rational Or Irrational?	1.75	$\frac{7}{4}$	Rational	$\sqrt{2}$	Can't	Irrational	5			.04			1.0010001...			-6			$\sqrt{9}$			$\sqrt{7}$			<p>Connection w/ Other Objectives: Standard 1 Objective 1.c.</p> <p>Strategy: Explain that ratio=fraction. Any number that can be written as a fraction is a rational. Examples:</p> $4 = \frac{4}{1} \quad 3.4 = 3\frac{4}{10}$ <p>Lesson Idea: <i>Building Number Lines</i> Students create number lines ONLY containing the kind of numbers indicated. Then, make one number line containing all the numbers. This can help students with understanding the relationships between the different kinds of numbers.</p> <p>a. Whole Numbers </p> <p>b. Integers </p> <p>c. Fractions </p> <p>d. Rational Numbers </p> <p>e. Irrational Numbers </p> <p>f. Real Numbers </p>
Number	Write as a Ratio	Rational Or Irrational?																												
1.75	$\frac{7}{4}$	Rational																												
$\sqrt{2}$	Can't	Irrational																												
5																														
.04																														
1.0010001...																														
-6																														
$\sqrt{9}$																														
$\sqrt{7}$																														

5

Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 1	Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers
OBJECTIVE 1.b.	Classify numbers as rational or irrational, knowing that rational numbers can be expressed as terminating or repeating decimals and irrational numbers can be expressed as non-terminating, non-repeating decimals.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Decimal Integer Irrational number Negative sign Rational number Real number Whole number $\sqrt{\quad}$</p> <p>Skills</p> <p>Classifying numbers Converting numbers</p>	<p>Name the sets of numbers to which each number below belong.</p> <p>a. -1</p> <p>b. -4.8</p> <p>c. 7</p> <p>d. $\sqrt{5}$</p> <p>e. .5</p> <p>f. $\sqrt{123}$</p> <p>g. $\frac{1}{3}$</p>	<p>Are whole numbers, integers, or rational numbers the most reasonable for each situation?</p> <p>a. your shoe size</p> <p>b. the number of siblings in your family</p> <p>c. a temperature in a news report</p> <p>d. the number of quarts of paint you need to buy to paint a room</p>	<p>Lesson Idea: <i>Real Number Diagram</i> Draw the diagram below on the white board. Hand out numbers to students and then have them bring up their number and put it where it belongs and explain why it goes there.</p>  <p>Strategy: <i>Number Funnel</i> **see Appendix A (p.34)</p>
<p>Language & Symbols</p> <p>Non-repeating decimals Repeating "sign" : 0.366 Repeating decimals</p> <p>Skills</p> <p>Classifying numbers Converting numbers</p>	<p>Classify the decimals as repeating or non-repeating decimals.</p> <p>a. 0.0787878...</p> <p>b. 0.392</p> <p>c. 0.24666</p> <p>d. .9</p>	<p>Convert these fractions into decimals and classify them as repeating or non-repeating :</p> <p>a. $\frac{6}{11}$ b. $-\frac{7}{8}$</p> <p>c. $\frac{18}{33}$ d. $\frac{20}{7}$</p>	<p>Terminating and Repeating Decimals Worksheet Idea : http://www.odysseyk12.org/K8/curriculum/grade6/math6math6repeatingans.pdf **this link is the worksheet answer key. The worksheet without the answers can only be obtained by registering, but I thought this was a good example of what kind of worksheet you could create.</p>

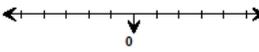
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Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 1 Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers			
OBJECTIVE 1.c. Classify π and square roots of non-perfect square numbers as irrational.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Irrational number Non-repeating decimals Rational number Repeating decimals $\sqrt{\quad}$ π</p> <p>Skills</p> <p>Rounding decimals Classifying numbers Converting $\sqrt{\quad}$ to decimal</p>	<p>Are these square roots rational or irrational?</p> <p>a. $\sqrt{2}$</p> <p>b. $\sqrt{7}$</p> <p>c. $\sqrt{16}$</p> <p>d. $\sqrt{5}$</p> <p>e. $\sqrt{23}$</p> <p>f. $\sqrt{9}$</p> <p>g. $\sqrt[3]{5}$</p>	<p>Why is π an irrational number?</p> <p>**Look at Standard 1 Objective 1.a. for another application problem.</p>	<p>Connection w/ Other Objectives: Standard 1 Objective 1.a.</p> <p>Strategy: Teach rounded value vs. actual value. Introduce the idea of "almost equal to (\approx)".</p> <p>Example: $.875 \approx .88$</p>

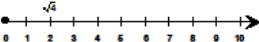
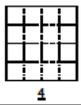
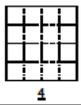
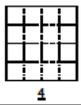
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Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

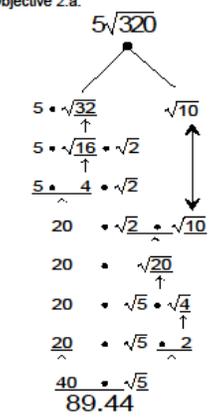
OBJECTIVE 1 Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers			
OBJECTIVE 1.d. Place rational and irrational numbers on a number line between two integers.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Decimal Negative sign Number line $\sqrt{\quad}$</p> <p>Skills</p> <p>Converting : fractions \leftrightarrow decimals radicals \leftrightarrow decimals mixed numbers \leftrightarrow decimals</p>	<p>Write the numbers on the number line:</p>  <p>a. $4\frac{3}{4}$</p> <p>b. $.04$</p> <p>c. $-\sqrt{5}$</p> <p>d. $\frac{5}{8}$</p> <p>e. -2</p> <p>f. $\frac{2}{7}$</p> <p>g. $\frac{9}{3}$</p> <p>h. $-\sqrt{8}$</p> <p>i. $2.\overline{333}$</p> <p>j. $-\sqrt{11}$</p>	<p>1. Write a number between the two given numbers :</p> <p>a. $.75$ and $2\frac{1}{2}$</p> <p>b. 12 and -4</p> <p>2. If John ran $.27$ miles and Becky ran for two-thirds of a mile, who ran furthest?</p>	<p>Connection w/ Other Objectives: Standard 1 Objective 2.d.</p> <p>Strategy: Teach converting numbers with this concept.</p> <p>Lesson Idea: Human Number Line Activity :</p> <p>a. give each student a different number (include fractions, decimals, etc)</p> <p>b. give the students 2 minutes to put themselves in order</p>

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Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 2 Compute fluently and make estimates with rational and irrational numbers												
OBJECTIVE 2.a. Simplify, add, subtract, multiply, and divide expressions with square roots.												
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies									
<p>Language & Symbols</p> Factoring Perfect squares Prime number Radical form Square Square root $\sqrt{\quad}$ $\sqrt{\quad}$ $\sqrt{\quad}$	Find the square root of each number. a. 9 b. 400 c. 2.25 d. $\frac{9}{49}$	Find the actual value of the square roots then place the square roots on the number line above their actual value. ("a" has been done as an example) 	<p>Strategy: Create a list of perfect squares. Have them practice recognizing perfect squares.</p> <p>Lesson Idea: Drawing out Squares</p> a. Take any number b. Square that number c. "Draw" the number using a grid d. Write out the square root									
<p>Skills</p> Factoring Finding perfect squares	Simplify. a. $\sqrt{169}$ b. $\pm\sqrt{9}$ c. $\sqrt{1.96}$ d. $\sqrt{144}$	a. $\sqrt{4} = 2$ b. $\sqrt{81} = \underline{\quad}$ c. $\sqrt{0} = \underline{\quad}$ d. $\sqrt{36} = \underline{\quad}$ e. $\sqrt{100} = \underline{\quad}$ f. $\sqrt{16} = \underline{\quad}$ g. $\sqrt{25} = \underline{\quad}$	<table border="1"> <thead> <tr> <th>Square any Number</th> <th>Draw out using squares. How many rows do you have?</th> <th>This means that:</th> </tr> </thead> <tbody> <tr> <td>$4^2 = 16$ <small>This is how many boxes you will need in your drawing</small></td> <td></td> <td>$\sqrt{16} = 4$</td> </tr> <tr> <td>$3^2 = \underline{\quad}$</td> <td></td> <td>$\sqrt{\quad} = \underline{\quad}$</td> </tr> </tbody> </table>	Square any Number	Draw out using squares. How many rows do you have?	This means that:	$4^2 = 16$ <small>This is how many boxes you will need in your drawing</small>		$\sqrt{16} = 4$	$3^2 = \underline{\quad}$		$\sqrt{\quad} = \underline{\quad}$
Square any Number	Draw out using squares. How many rows do you have?	This means that:										
$4^2 = 16$ <small>This is how many boxes you will need in your drawing</small>		$\sqrt{16} = 4$										
$3^2 = \underline{\quad}$		$\sqrt{\quad} = \underline{\quad}$										
	Simplify. a. $5\sqrt{320}$ b. $\sqrt{7} \cdot \sqrt{21}$ c. $-3\sqrt{20} \cdot \sqrt{15}$		<p>Strategy: Give the students an envelope with small perfect squares cut out. Have them practice creating perfect squares.</p>									

Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 2 Compute fluently and make estimates with rational and irrational numbers			
OBJECTIVE 2.a. Simplify, add, subtract, multiply, and divide expressions with square roots.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> Square root $\sqrt{\quad}$	Add or subtract. a. $\sqrt{18} + \sqrt{2}$ b. $2\sqrt{12} - 7\sqrt{3}$ c. $-4\sqrt{10} - 6\sqrt{40}$ d. $3\sqrt{7} - \sqrt{28}$	When simplifying $\sqrt{24} - \sqrt{48}$, a student wrote $2\sqrt{6} - 2\sqrt{24}$. a. What mistake did the student make? b. Simplify $\sqrt{24} + \sqrt{48}$ correctly.	<p>Strategy: Teach factoring for all of Objective 2.a.</p> 
<p>Skills</p> Factoring Simplifying Solving equations Solution by substitution Rules of radical operations	Solve. $a + b = 2a$ Let: $a = \sqrt{3}$ $b = \sqrt{5}$		<p>Lesson idea: Math Journal Journal why you can combine some $\sqrt{\quad}$ and not others</p>
	<p>*Objective 2.a and 2.b(with radicals)</p> Multiply or Divide a. $\sqrt{2}(\sqrt{8} - 4)$ b. $\frac{8}{\sqrt{7} - \sqrt{3}}$ c. $\sqrt{2}(3 - 3\sqrt{2})$ d. $\sqrt{3} : \sqrt{2}$ e. $\sqrt{3(4 - 7)} : 3$ f. $\sqrt{\frac{12}{4}} \cdot \sqrt{\frac{25}{5}} \cdot \sqrt{\frac{36}{9}}$		

Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 2 Compute fluently and make estimates with rational and irrational numbers																	
OBJECTIVE 2.b. Evaluate and simplify numerical expressions containing rational numbers and square roots using the order of operations.																	
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies														
<p>Language & Symbols</p> <p>Exponents Order of operations [] () 9 5 ing can represent -></p> <p>Skills</p> <p>Order of operations Calculation skills Calculator skills</p>	<p>Solve using the order of operations.</p> <p>a. $15 - (4 \cdot 2) - 8$</p> <p>b. $\frac{20}{9 - 5}$</p> <p>c. $2(8 - 4) + 2^2$</p> <p>d. $\frac{5 \cdot 2(8 - 3)}{4^2 \cdot 6}$</p> <p>e. $[10 - 5 + 2]^2 - (3 \cdot 2)^2$</p> <p>f. $\frac{(2^5 + 8) + 3}{4 + 3}$</p> <p>g. $[5^2 - (40 : 2)]^2$</p>	<p>1. Sara needed to buy 2 king size candy bars, 12 regular size candy bars, and three sodas. The king size candy bars are \$1.15 each, the regular size candy bars are \$0.85 each, and the soda is \$0.75 each. Sara has \$30.00 to spend.</p> <p>a. Write an equation to represent the problem.</p> <p>b. How much will it cost to purchase everything she needs?</p> <p>c. How much money will she have left?</p> <p>2. Becky worked on the math problem below and got 23 as her answer. What did she do wrong?</p> $5^2 + 18$	<p>Strategy: I teach my kids to write out the order of operations like this :</p> <p>[] () Ex + - * / LEFT to RIGHT</p> <p>I give them 3 minutes to write it as many times as they can. At the end of the 3 minutes, they count them up and the three kids that wrote it the most times get a treat. We do this everyday that we do the order of operations. It really helps them memorize it. I also have them put it at the top of their paper any time they have to use it.</p> <p>Strategy: I have my students memorize 4 ways to show multiplication and 2 ways to show division :</p> <table border="1"> <thead> <tr> <th>4 ways to show multiplication</th> <th>2 ways to show division</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>÷</td> </tr> <tr> <td>•</td> <td>Fraction [•]</td> </tr> <tr> <td>No Sign</td> <td>$\frac{12}{4}$</td> </tr> <tr> <td>$\frac{3(2)}{3a}$</td> <td></td> </tr> <tr> <td>$\frac{3(4+2)}{Exponent}$</td> <td>[•] I teach them top - bottom</td> </tr> <tr> <td>3^2</td> <td></td> </tr> </tbody> </table>	4 ways to show multiplication	2 ways to show division	X	÷	•	Fraction [•]	No Sign	$\frac{12}{4}$	$\frac{3(2)}{3a}$		$\frac{3(4+2)}{Exponent}$	[•] I teach them top - bottom	3^2	
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3^2																	

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Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 2 Compute fluently and make estimates with rational and irrational numbers			
OBJECTIVE 2.c. Compute solutions to problems, represent answers in exact form, and determine the reasonableness of answers.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>This objective applies to all of the standards in the core curriculum. Students should be able to compute and represent answers in exact form on any problem. Below is a general list of the main core skills that students need in order to successfully apply this objective :</p> <ol style="list-style-type: none"> Exploring Real Numbers <ul style="list-style-type: none"> Classifying numbers Comparing numbers Ordering numbers Absolute value Fractions Decimals Using Exponents Understanding the Properties of Numbers Using the Distributive Property Add, Subtract, Multiply, & Divide Rational Numbers Order of Operations Variables <ul style="list-style-type: none"> Understanding variables Evaluating variable expressions Writing variable expressions Solving One-Step Equations Solving Two-Step Equations Solving Multiple-Step Equations 			

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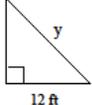
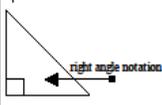
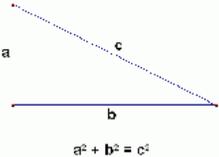
Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 2 Compute fluently and make estimates with rational and irrational numbers			
OBJECTIVE 2.d. Solve problems involving percentages and unit rates using proportional reasoning.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
Language & Symbols Proportions Ratio Skills Setting up a proportion Converting	Write these numbers as a percent : a. .56 b. $\frac{1}{9}$ c. .02 d. 2.34	1. Three-eighths of the students at Sunny Junior High participate in sports. What percent of the students do not participate? 2. Ken and Jody buy a bag of 12 cookies. Ken eats 25% of the cookies and Jody eats $\frac{1}{3}$ of the cookies. To the nearest percent, what percent of the cookies is left over?	Connection w/ Other Objectives: Standard 1 Objective 1.d. Strategy: Teach the formula of $\frac{\%}{100} = \frac{\text{is}}{\text{of}} = \frac{\text{part}}{\text{whole}}$ Lesson Idea: <i>Class Surveys</i> Collect information about the students: <ul style="list-style-type: none"> Eye color Pets Favorite foods Handedness Ways to tie shoes Have the students chart the information and figure out percents and fractional proportions with the information. Lesson Idea: <i>Application</i> To help students make connections, have them find examples in the news or in commercials. Also, show them how they use this to find their percentage on a test or assignment. Lesson Idea: <i>Bingo Game</i> **see Appendix B (p.35) Lesson Idea: <i>Skittles Activity</i> **see Appendix C (p.36-37)
	Write these numbers as a decimal : a. 7 % b. .03 % c. 297 % d. $\frac{1}{9}$	1. 58 of 100 students in a school are boys. Write a decimal for the part of the school that consists of boys. 2. 73% of people are right handed. Write a decimal to represent that percentage.	
	Write these numbers as a fraction : a. .19 b. .8 c. 350 % d. $\frac{4}{7}$ %	1. 65 % of dogs are brown. What fraction of dogs are not brown? 2. Mom bought a pizza that had 12 slices. David ate 75% of the pizza. What fraction of the pizza did David eat? How many slices did he eat??	

Standard I: Expand number sense to understand, perform operations, and solve problems with real numbers

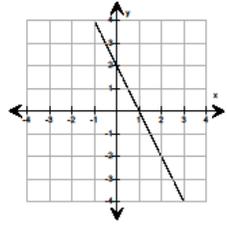
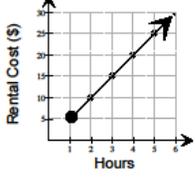
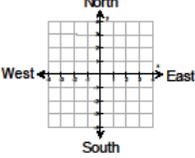
OBJECTIVE 2 Compute fluently and make estimates with rational and irrational numbers			
OBJECTIVE 2.d. Solve problems involving percentages and unit rates using proportional reasoning.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
Language & Symbols Cross product Proportion Ratio Skills Setting up a proportion Setting up a ratio Cross multiplying Converting	Find the unit rate : $\frac{524 \text{ cars}}{4 \text{ weeks}}$	Find the unit rate : a. 24 inches of snow fell in two hours. How much snow fell per hour? b. SuperMart sells ten candy bars for seven dollars. How much does each candy bar cost?	Connection w/ Other Objectives: Standard 3 Objective 2.d. Standard 4 Objective 2.b. Lesson Idea: Discuss when you might use this: tipping, miles per gallon, best prices at the store. I buy a big bag of chips and a \$.99 bag of chips and ask which one they would buy. They usually say the \$.99 bag. Then we figure out which one is really the best deal. It's a good visual – good with soda too. I bring in a two liter bottle, 20-ounce bottle, and a twelve pack of cans. We figure out various unit rates with this. Strategy: Teach the formula of $\frac{\%}{100} = \frac{\text{is}}{\text{of}}$ Lesson Idea: <i>School Contests</i> We do a lot of "all school" contests with the first period classes – i.e. a food drive where the class with the most gets donuts. My classes are smaller, so we talk about how it's not fair that we compete with a class of 30. The kids help me figure out how many cans of food we have to earn to compete proportionally and then I have one of my kids go down and tell the principal – they love this one ☺!
	What is 25% of 64?	The school had a fund raiser and made \$14,000. Find out how much money each department received: a. 40% went to the band b. 25% went to the math dept. c. 20% went to the English dept. d. 15% went to the library	
	12 is what percent of 40?	John took a test in science that had 46 questions. He got 23 answers correct. What percentage did he get on the test?	
	16 is 40% of what number?	Kelly bought a pair of jeans on sale for \$36.00. They were on sale for 25% off. What was the original cost of the jeans?	
	Solve for x. a. $\frac{x}{48} = \frac{7}{12}$ b. $\frac{x-4}{5} = \frac{x-2}{7}$	1. If it costs \$7.00 for 12 cookies how many cookies could you get for \$48.00? 2. Bill read four more than the assigned number of books over 5 weeks. Becky read two less than the assigned number of books over 7 weeks. What was the assigned number of books?	

Standard 1: Expand number sense to understand, perform operations, and solve problems with real numbers

OBJECTIVE 2 Compute fluently and make estimates with rational and irrational numbers				
OBJECTIVE 2.e. Calculate the measures of the sides of a right triangle using the Pythagorean Theorem.				
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies	
<p>Language & Symbols</p> <p>False statement Hypotenuse Pythagorean theorem True statement $a^2 + b^2 = c^2$</p>  <p>$\sqrt{\quad}$</p>  <p>Skills</p> <p>Solution by substitution Two-Step equations Finding a square root Writing equations</p>	<p>What is the length of the hypotenuse of the triangle?</p>	<p>1. A 16 foot ladder is placed 4 feet from the base of a building. How high on the building will the ladder reach?</p> <p>2. A bird leaves its nest in New York City and flies 5 km due east. The bird then flies 3 km due north. How far is the bird from its nest?</p>	<p>Connection w/ Other Objectives: Standard 4 Objective 1.a.</p> <p>Strategy: Pythagorean Theorem</p>  <p>$a^2 + b^2 = c^2$</p> <p>Strategy: I teach this after solving equations :</p> <ol style="list-style-type: none"> Teach without pictures where "c" is missing. Teach without pictures with any variable missing. Teach with pictures. 	
	<p>Find the length of the missing side.</p> <p>a. $a = 6$ $b = 8$</p> <p>b. $b = 12$ $c = 13$</p> <p>c. $a = .8$ $c = 1$</p> <p>d. $a = \frac{3}{5}$ $b = \frac{4}{5}$</p>	<p>1. A painter leans a 13-foot ladder against a house. The bottom of the ladder is 5 feet from the house. The top of the ladder just touches the bottom of a second-floor window. How high is the window off the ground?</p> <p>2. Doug is standing 40 feet away from a 36-foot tree. If the distance from the top of the tree to the top of Doug's head is 50 feet, how tall is Doug?</p>		<p>Strategy: I teach this after solving equations :</p> <ol style="list-style-type: none"> Teach without pictures where "c" is missing. Teach without pictures with any variable missing. Teach with pictures.
	<p>Determine whether the given lengths can be sides of a right triangle.</p> <p>a. 1 in., 2 in., 3 in.</p> <p>b. 4 m., 4 m., 8 m.</p> <p>c. 16 cm., 30 cm., 34 cm.</p> <p>d. 10 in., 24 in., 26 in.</p>	<p>Plug the values into $a^2 + b^2 = c^2$ And see if the result is a true statement.</p> <p>If true then =  If false then = </p> <p>a. 5 in., 10 in., 15 in.</p> <p>b. 24 ft., 10 ft., 26 ft.</p>		

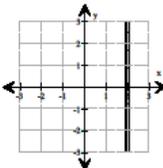
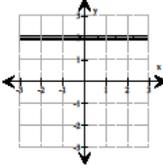
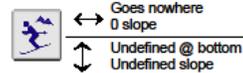
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Standard 2: Extend concepts of proportion to represent and analyze linear relations

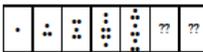
OBJECTIVE 1 Represent the slope of a line			
OBJECTIVE 1.a. Identify the slope of a line when given points on a graph.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Co-ordinates Co-ordinate graphing Co-ordinate grid Horizontal Negative slope Origin Ordered pair Origin Positive slope Slope Vertical X-axis Y-axis (x,y) y_1 ← subscript numbers rise run</p> <p>Skills</p> <p>Understanding graphs Locating points on a graph Plotting points on a graph Reading graphs Using slope formula</p>	<p>Find the slope of the line</p> 	<p>The graph shows how much it costs to play laser tag. Estimate the slope of the line. What does the number mean?</p> 	<p>Connection w/ Other Objectives: Standard 3 Objective 2.b.</p> <p>Strategy: When you have 2 points, always start on the left point. Go up or down then right.</p> <p>$\frac{\uparrow 5}{\rightarrow 3}$</p> <p>Lesson Idea: Staircase Draw a staircase. Count the rise and the run. Then check for appropriate sign.</p> <p>Visual Aid: Slope Overhead **See Appendix D (p 3)</p> <p>Strategy: Teach the formula :</p> $m = \frac{y_2 - y_1}{x_2 - x_1}$ <p>Strategy: I have my students label the points before they substitute into the formula:</p> <p>x_1, y_1 x_2, y_2 (4, -2) and (3, 0)</p>
	<p>Find the slope of the line that passes through each pair of points</p> <p>a. (3,2), (5,6)</p> <p>b. (-2,5), (0,-3)</p>	<p>Suzie lives at 200 West and 500 North. She is going to the library on Center Street and 300 South. Graph the shortest route. What is the slope of this route?</p> 	

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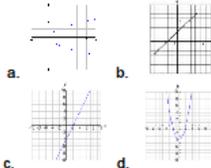
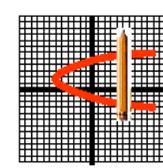
Standard 2: Extend concepts of proportion to represent and analyze linear relations

OBJECTIVE 1 Represent the slope of a line																																					
OBJECTIVE 1.b. Identify horizontal and vertical lines given the slope.																																					
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies																																		
<p>Language & Symbols</p> <p>Co-ordinates Defined Horizontal Slope Undefined Vertical</p> <p>Skills</p> <p>Finding Slope</p>	<p>1. State whether the slope is zero or undefined.</p> <p>a.</p>  <p>b.</p>  <p>2. Find the slope of the line that passes through each pair of points. State whether the slope is zero or undefined.</p> <p>(6,2) and (-4,2)</p>	<p>1. Which slope would represent a perfectly level table?</p> <p>a. slope = 0 b. slope = undefined</p> <p>2. Which slope would represent the side of a building?</p> <p>a. slope = 0 b. slope = undefined</p> <p>3. What type of objects could have these slopes? Draw a line to match up the slope with the object</p> <table border="1" data-bbox="852 661 1047 850"> <thead> <tr> <th>Slope</th> <th>Object</th> </tr> </thead> <tbody> <tr> <td>$\frac{1}{10}$</td> <td>Wheelchair ramp</td> </tr> <tr> <td>$\frac{6}{1}$</td> <td>Mountain</td> </tr> <tr> <td>$\frac{3}{2}$</td> <td>Tennis court</td> </tr> <tr> <td>0</td> <td>Slide</td> </tr> </tbody> </table>	Slope	Object	$\frac{1}{10}$	Wheelchair ramp	$\frac{6}{1}$	Mountain	$\frac{3}{2}$	Tennis court	0	Slide	<p>Lesson Idea: Finding Slopes Put students into pairs and have them calculate the slope of various objects around the school.</p> <p>Lesson Idea: Slope Drawings Give students a piece of graph paper. Make a list of slopes on the board. Have the students draw a picture using only the slope lines provided.</p> <p>Lesson Idea: Which do like to...? Give students a piece of paper with a list of slopes. Have them figure out the slopes and then decide "thumbs up" or "thumbs down" if they would like to do the activities listed – knowing the slope.</p> <table border="1" data-bbox="1096 703 1339 829"> <thead> <tr> <th>Slope</th> <th>Would you like to...</th> <th>☑</th> <th>☒</th> </tr> </thead> <tbody> <tr> <td>(4, 1), (2, -3)</td> <td>hike up that?</td> <td></td> <td></td> </tr> <tr> <td>(-2, 0), (5, 2)</td> <td>skate down that?</td> <td></td> <td></td> </tr> <tr> <td>(6, -3), (4, 0)</td> <td>push a cart up that?</td> <td></td> <td></td> </tr> <tr> <td>(4, 4), (3, 1)</td> <td>snowboard down that?</td> <td></td> <td></td> </tr> <tr> <td>(2, -7), (2, 0)</td> <td>bike up that?</td> <td></td> <td></td> </tr> </tbody> </table> <p>Strategy: Have students think about a skier and how that relates to slope:</p> 	Slope	Would you like to...	☑	☒	(4, 1), (2, -3)	hike up that?			(-2, 0), (5, 2)	skate down that?			(6, -3), (4, 0)	push a cart up that?			(4, 4), (3, 1)	snowboard down that?			(2, -7), (2, 0)	bike up that?		
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Standard 2: Extend concepts of proportion to represent and analyze linear relations

OBJECTIVE 2 Model and interpret problems having a constant rate of change using linear functions																											
OBJECTIVE 2.a. Write algebraic expressions or equations to generalize visual patterns, numerical patterns, relations, or data sets.																											
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies																								
<p>Language & Symbols</p> <p>Function Linear Non-Linear Pattern Relation</p> <p>$\frac{\Delta y}{\Delta x} = \frac{\text{change in } y}{\text{change in } x}$</p> <p>Skills</p> <p>Co-ordinate graphing X values vs. Y values Domain vs. range</p>	<p>Use the table to write a function rule (algebraic equation) :</p> <table border="1" data-bbox="552 1281 787 1333"> <thead> <tr> <th>Cans of soup</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td># of servings</td> <td>4</td> <td>8</td> <td>12</td> <td>16</td> </tr> </tbody> </table>	Cans of soup	1	2	3	4	# of servings	4	8	12	16	<p>1. Determine the number of dots in the next two groups.</p>  <p>2. Using the chart below</p> <p>a. Write an expression describing this pattern.</p> <p>b. Determine the next two numbers in the pattern.</p> <p>c. How much will you be paid for working 7 hours?</p> <table border="1" data-bbox="828 1480 1063 1533"> <thead> <tr> <th>Hours worked</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> </thead> <tbody> <tr> <td>Pay</td> <td>6</td> <td>12</td> <td>18</td> <td>24</td> <td>?</td> <td>?</td> </tr> </tbody> </table>	Hours worked	1	2	3	4	5	6	Pay	6	12	18	24	?	?	<p>Strategy: Soda Machine Analogy Domain (x) → button Range (y) → soda you get out</p> <p>Lesson Idea: Temperature Patterns Students can look up information about what the temperature was the previous year and also in the recent weeks. Then, using patterns, they anticipate the next week's temperature (another idea is using this idea for predicting the population of a city).</p>
Cans of soup	1	2	3	4																							
# of servings	4	8	12	16																							
Hours worked	1	2	3	4	5	6																					
Pay	6	12	18	24	?	?																					
	<p>Determine whether the relation is a function.</p> <p>{(11,-2), (12,-1), (13,-2), (20,7)}</p> <table border="1" data-bbox="617 1627 738 1732"> <thead> <tr> <th>domain</th> <th>range</th> </tr> </thead> <tbody> <tr> <td>11</td> <td>→ -2</td> </tr> <tr> <td>12</td> <td>→ -1</td> </tr> <tr> <td>13</td> <td>→ -2</td> </tr> <tr> <td>20</td> <td>→ 7</td> </tr> </tbody> </table>	domain	range	11	→ -2	12	→ -1	13	→ -2	20	→ 7	<p>Use the vertical line test to determine whether the relation is a function.</p> <p>a. {(3,-1)(-2,3)(-1,-5)(3,2)}</p> <p>b. {(2,5)(3,-5)(4,5)(5,-5)}</p>	<p>Strategy: Teach domain is X and range is Y.</p> <p>Strategy: Can you move your pencil across and only have the line cross it once? (vertical line test)</p> <p>Strategy: You can also make a mapping or a table. Some students see better with mapping.</p> <p>Strategy: Bow and Arrow Analogy. **See Appendix E (page 39)</p>														
domain	range																										
11	→ -2																										
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Standard 2: Extend concepts of proportion to represent and analyze linear relations

OBJECTIVE 2 Model and interpret problems having a constant rate of change using linear functions																																			
OBJECTIVE 2.b. Distinguish between linear and non-linear functions by examining a table, equation, or graph.																																			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies																																
<p>Language & Symbols</p> <p>Co-ordinates Co-ordinate points Linear Non-Linear Relation (x, y)</p> <p>Skills</p> <p>Reading graphs Graphing co-ordinate points</p>	<p>Determine if each graph is linear.</p>  <p>a. b.</p> <p>c. d.</p> <p>Is the equation linear or non-linear? Make a table or graph to verify.</p> <p>$y = x + 3$ $y = x^2 - 6$</p>	<p>Using the data in the table, decide if the relation between a dog's age and weight is a linear or non-linear function.</p> <table border="1"> <thead> <tr> <th colspan="2">Dogs</th> </tr> <tr> <th>Age (years)</th> <th>Weight (pounds)</th> </tr> </thead> <tbody> <tr><td>1</td><td>4</td></tr> <tr><td>2</td><td>8</td></tr> <tr><td>3</td><td>12</td></tr> <tr><td>4</td><td>16</td></tr> <tr><td>5</td><td>20</td></tr> <tr><td>6</td><td>24</td></tr> </tbody> </table> <p>Is the relation linear or non-linear?</p> <table border="1"> <thead> <tr> <th>Day</th> <th>Temperature</th> </tr> </thead> <tbody> <tr><td>1</td><td>69</td></tr> <tr><td>2</td><td>72</td></tr> <tr><td>3</td><td>83</td></tr> <tr><td>4</td><td>79</td></tr> <tr><td>5</td><td>84</td></tr> <tr><td>6</td><td>72</td></tr> <tr><td>7</td><td>75</td></tr> </tbody> </table>	Dogs		Age (years)	Weight (pounds)	1	4	2	8	3	12	4	16	5	20	6	24	Day	Temperature	1	69	2	72	3	83	4	79	5	84	6	72	7	75	<p>Strategy: Vertical Line Test.</p> <p>If a vertical line passes through a graph more than once, the graph is not the graph of a function.</p> <p>Hint: Pass a pencil across the graph held vertically to represent a vertical line.</p>  <p>The pencil crosses the graph more than once. This is not a function because there are two y-values for the same x-value.</p> <p><small>**graphic came from the PowerPoint listed below.</small></p> <p>Vertical Line Test PowerPoint: http://www.meade.k12.ky.us/trt/PowerPoints/vertical%20line%20Test.ppt</p>
Dogs																																			
Age (years)	Weight (pounds)																																		
1	4																																		
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Standard 2: Extend concepts of proportion to represent and analyze linear relations

OBJECTIVE 2 Model and interpret problems having a constant rate of change using linear functions															
OBJECTIVE 2.C. Interpret the slope of a linear function as a rate of change in real-world situations.															
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies												
<p>Language & Symbols</p> <p>Dependent variable Independent variable Rate of change = slope</p> <p>Skills</p> <p>Graphing a slope Finding equations from a table</p>	<p>The rate of change is constant in the graph. Find the rate of change.</p> <table border="1"> <thead> <tr> <th>People</th> <th>Cost</th> </tr> </thead> <tbody> <tr><td>2</td><td>7.90</td></tr> <tr><td>3</td><td>11.85</td></tr> <tr><td>4</td><td>15.80</td></tr> <tr><td>5</td><td>19.75</td></tr> <tr><td>6</td><td>23.70</td></tr> </tbody> </table>	People	Cost	2	7.90	3	11.85	4	15.80	5	19.75	6	23.70	<p>Find the rate of change for each situation:</p> <p>a. The cost of group concert tickets is \$48 for four people and \$78 for ten people.</p> <p>b. You drive 30 miles in one hour and 120 miles in four hours.</p>	<p>Strategy: Use the formula :</p> $m = \frac{y_2 - y_1}{x_2 - x_1}$ <p>Strategy: Use ratio and proportion</p> <p>Lesson Idea: <i>Graph Story Problems</i> Give students story problems and then have them graph the answer from every story. They should be able to interpret, find, and label the slope.</p>
People	Cost														
2	7.90														
3	11.85														
4	15.80														
5	19.75														
6	23.70														

Standard 2: Extend concepts of proportion to represent and analyze linear relations

OBJECTIVE 3	Represent and analyze linear relationships using algebraic equations, expressions, and graphs
OBJECTIVE 3.a.	Identify the x - and y -intercepts from an equation or graph of a line or a table of values.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies										
<p>Language & Symbols</p> <p>Intercepts X-intercept Y-intercept</p> <p>Skills</p> <p>Coordinate graphing Solution by substitution</p>	<p>Find the x-intercept and y-intercept.</p> $3x + 4y = 12$ <p>Identify the x and y intercepts.</p> <p>Graph the data and identify the x and y intercepts.</p> <table border="1"> <thead> <tr> <th>Time (hours)</th> <th>Temp. (degrees)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-2</td> </tr> <tr> <td>4</td> <td>7</td> </tr> <tr> <td>7</td> <td>16</td> </tr> <tr> <td>10</td> <td>25</td> </tr> </tbody> </table>	Time (hours)	Temp. (degrees)	1	-2	4	7	7	16	10	25	<p>You have \$30 to spend on a party. Soda costs \$4 per case and chips cost \$2 per bag.</p> <ol style="list-style-type: none"> Write an equation that relates the amount of soda and chips you can buy for \$30. How much soda could you buy if you didn't buy any chips? How many bags of chips could you buy if you didn't buy any soda? 	<p>Strategy: Explain that at the x-intercept, the y-value is 0. Likewise, at the y-intercept, the x value is 0. So, an easy way to find the intercepts when you have a line in standard form is to cover the y portion and solve for x :</p> $3x = 12 \quad x = 4 \quad (4, 0)$ <p>Cover* the x portion and solve for y:</p> $4y = 12 \quad y = 3 \quad (0, 3)$ <p>*I use my hand to cover up on the board while they do it.</p>
Time (hours)	Temp. (degrees)												
1	-2												
4	7												
7	16												
10	25												

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Standard 2: Extend concepts of proportion to represent and analyze linear relations

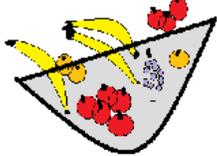
OBJECTIVE 3	Represent and analyze linear relationships using algebraic equations, expressions, and graphs
OBJECTIVE 3.b.	Graph linear relations and inequalities by plotting points, or by finding x - and y -intercepts.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Co-ordinates Intercepts Slope intercept form X-intercept Y-intercept $y = mx + b$ $Ax + By = C$ (x, y)</p> <p>Skills</p> <p>Coordinate graphing</p>	<p>Graph the equation using the x and y intercepts :</p> $2x + y = 4 \quad -3x + y \geq 6$ <p>Graph the line that contains the points (4,-2) and (7,3)</p> <p>Graph the line using the y-intercept and slope.</p> $y = \frac{3}{5}x - 6$	<ol style="list-style-type: none"> Graph $2x + 3y = -5$. Label 3 other points on the line. Test to see if they work in the equation. <ol style="list-style-type: none"> On the graph below graph a line for each set of points. <ol style="list-style-type: none"> (2,5), (0,3) (-4,5), (6,1) (3,-3), (4,2) (2,0), (-1,5) 	<p>Strategy: Typically when I am finished with a lesson my students do guided practice and a few independent practice problems on their individual white boards. It is difficult to do graphing on the white boards – and for me to get a good quick check to make sure they have it. So, I make a sheet of pre-made graphs that I give the students for guided practice. Then, I make a copy of that sheet on a clear overhead sheet. I graph the problems before class with an overhead marker. Then, during the guided practice and the few independent problems I check by going around and laying the overhead sheet on top of their paper and I can quickly see if they did their graphing correctly.</p> <p>Strategy: Label the slope and y-intercept (make sure students include the signs in their label). Then write out the co-ordinates.</p> $y = \underbrace{m}x + \underbrace{b}$ <p style="text-align: center;">slope y-intercept</p>

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Standard 3: Develop fluency with the language and operations of algebra to analyze and represent relationships

OBJECTIVE 1	Simplify monomials and the quotient of monomials
OBJECTIVE 1.a.	Simplify and evaluate monomial expressions and formulas.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Co-efficient Constant Like terms Simplify Term Unlike terms Variable $\frac{9}{5}$ can represent -</p> <p>Skills</p> <p>Solution by substitution</p>	<p>Simplify the expressions.</p> <p>a. $7xyxyxz$ b. $6xyxz$</p> <p>Simplify and evaluate where $a=7$, $b=5$, $c=2$, $x=3$, and $y=4$:</p> <p>a. $7x^2y$ b. $.35bc^3$ c. $2x^5 \cdot 3x^2$ d. $(15a^3)(-3a)$ e. $\frac{5x}{4}$</p>	<p>You are going to dye eggs for Easter. You plan on dyeing 5 dozen eggs. If one dozen eggs cost \$1.19 how much will the eggs cost?</p> <p>Write the algebraic expression:</p> <p>a. the quotient of 2 and 3 b. the difference between 9 and m c. the product of 2 times a number</p> <p>Write the algebraic equation</p> <p>a. ten subtracted from 10 times a number is that number plus 5 b. the sum of $5k$ and 10 is the product of that number and 15</p>	<p>Lesson Idea: Fruit Bowl I use a fruit bowl analogy to help my students with combining like terms. I draw a bowl filled with apples, bananas, grapes and oranges all mixed in. I tell them that I want to put all the same kinds of fruit together. I cross off the fruit as I "pull it out" of the bowl and write an equation, the variable is the first letter of the fruit:</p>  <p>$b + 2o + 2b + 10g + 5a + o + 3a$ Then I group the fruits together and have this equation : $3b + 3o + 10g + 8a$</p> <p>Strategy: Using Algeblocks makes it easy to see why x^2 is different than x.</p> <p>Lesson Idea: Teaching Vocabulary ** See Appendix F (page 40)</p> <p>Strategy: Translating English to Math **See Appendix G (page 41)</p>

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Standard 3: Develop fluency with the language and operations of algebra to analyze and represent relationships

OBJECTIVE 1	Simplify monomials and the quotient of monomials
OBJECTIVE 1.b.	Simplify the quotient of monomials using positive exponents.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Exponent $\frac{9}{5}$ can represent :</p> <p>Skills</p> <p>Rules of exponents Simplifying</p>	<p>Simplify.</p> <p>a. $\frac{a}{a^{14}}$ b. $\frac{c^1}{c^3}$ c. $\frac{6m^7}{18m^9}$ d. $a^4 \cdot a^5$ e. $\left(\frac{3}{5}\right)^2$ f. $\left(\frac{y^4}{y^8}\right)^2$</p>	<p>1. What error did the student make in simplifying the expression:</p> $5^4 : 5 = \frac{5^4}{5} = 1^4 = 1$ <p>2. Lena and Jared used different methods to simplify the equation :</p> $\left(\frac{b^7}{b^3}\right)^2$ <p>Why are both methods correct?</p> <p>Lena $\left(\frac{b^7}{b^3}\right)^2 = \frac{b^{14}}{b^6} = b^8$</p> <p>Jared $\left(\frac{b^7}{b^3}\right)^2 = (b^4)^2 = b^8$</p>	<p>Strategy: Teach it long hand first so they understand the concept, then teach them the short-cut :</p> <p>Long Hand $\frac{5^4}{5} = \frac{5 \cdot 5 \cdot 5 \cdot 5}{5} = 5^3$</p> <p>Short Cut $\frac{5^4}{5} = 5^{4-1} = 5^3$</p> <p>Strategy: Teach the rules of exponents:</p> $\frac{x^a}{x^b} = x^{a-b}$ $\frac{x^a}{x^a} = \frac{x^a}{y^a}$ $x^a x^b = x^{a+b}$

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Standard 3: Develop fluency with the language and operations of algebra to analyze and represent relationships

OBJECTIVE 2 Solve and interpret linear equations and inequalities in various situations including real-world problems																							
OBJECTIVE 2.a. Solve single-variable linear equations and inequalities algebraically and graphically.																							
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies																				
<p>Language & Symbols</p> <p>Distributive property Eliminating fractions Inverse operations Scientific notation Single-step equations Variable 9 can represent --</p> <p>Skills</p> <p>Inverse operations: +/ - , x/ ÷ Solution by substitution Solving equations</p>	<p>Solve.</p> <p>a. $x + 2 = 6$</p> <p>b. $3(c + 4) = 6$</p> <p>c. $2c + c + 12 = 78$</p> <p>d. $\frac{m}{7} = 12$</p> <p>e. $10 - 2 = \frac{m}{4}$</p> <p>f. $\frac{1}{2}k - \frac{2}{3} = k - \frac{7}{6}$</p>	<p>1. Last season Suzy scored 48 points. This is 6 less than twice the number of points Marie scored. How many points did Marie score?</p> <p>2. You and a friend are renting an apartment. You pay the landlord the first month's rent and a security deposit. The amount of the security deposit is half of one month's rent. The total amount you paid was \$1,725.00 Write an equation to calculate the cost of the monthly rent. Solve the equation.</p> <p>3. Miles has saved \$40.00. He wants to buy an mp3 player for \$129.00 in about 4 months. To find out how much he should save each week he wrote: $40 + 16x = 129$. How much does Miles need to save each week? Explain his equation.</p> <p>4. One cell phone plan costs \$39.95 per month. The first 500 minutes are included in the plan. Each minute after that costs \$0.35. Write an equation that describes the total monthly cost as a function of the number of minutes of usage (over 500 minutes). Then find the number of minutes of usage over 500 minutes for a bill of \$68.70.</p>	<p>Lesson Idea: Going Shopping I use this to help students understand how variables are used everyday. When you go to the store to buy a candy bar, does the cost of the candy bar change for every person? No, the cost is still \$.75. That is the CONSTANT, unchanging, part of the equation. I have a blank chart on an overhead that I show them. Then, I list a few students' names in the chart and ask them how many candy bars they would buy. We talk about how the VARIABLE changes depending on how many everyone buys.</p> <table border="1"> <thead> <tr> <th></th> <th>Constant Price of the candy</th> <th>Variable How many bought?</th> <th>Final Cost</th> </tr> </thead> <tbody> <tr> <td>Tom</td> <td>.75</td> <td>7</td> <td>5.25</td> </tr> <tr> <td>Joe</td> <td>.75</td> <td>4</td> <td>3.00</td> </tr> <tr> <td>Kayla</td> <td>.75</td> <td>6</td> <td>4.50</td> </tr> <tr> <td>Ms. H.</td> <td>.75</td> <td>40</td> <td>30.00</td> </tr> </tbody> </table> <p>Strategy: Inverse means to UNDO. We are also UNDOING the order of operations. So, we move over the adding and subtracting before the multiplying and dividing.</p>		Constant Price of the candy	Variable How many bought?	Final Cost	Tom	.75	7	5.25	Joe	.75	4	3.00	Kayla	.75	6	4.50	Ms. H.	.75	40	30.00
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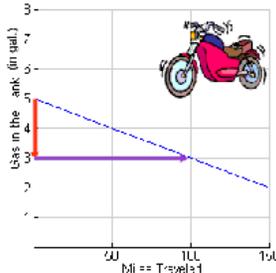
Standard 3: Develop fluency with the language and operations of algebra to analyze and represent relationships

OBJECTIVE 2 Solve and interpret linear equations and inequalities in various situations including real-world problems			
OBJECTIVE 2.a. Solve single-variable linear equations and inequalities algebraically and graphically.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Inequalities Number line Open and closed dots $>, <, \geq, \leq$</p> <p>Skills</p> <p>Graphing on a number line Manipulating inequalities Solution by substitution</p>	<p>Graph the inequalities on the number line:</p> <p>a. $x < 3$</p> <p>b. $4 > k$</p> <p>c. $m > -5$</p> <p>Solve and graph the inequalities:</p> <p>a. $19 \leq x - 7$</p> <p>b. $-3k \geq 21$</p> <p>c. $\frac{y}{-8} < 2$</p> <p>d. $\frac{y}{7-3} < 16$</p> <p>e. $30 \geq 3n + 6$</p> <p>f. $16 < 2(2y - 4)$</p> <p>g. $6k - 15 < 4k + 11$</p> <p>h. $-3(4-m) > 2(4m-14)$</p>	<p>Define a variable and write an inequality to model each situation :</p> <p>a. a bus can seat at most 48 students</p> <p>b. you must be at least 16 years old to obtain a driver's license</p> <p>c. it is not safe to use a light bulb of more than 60 watts in this light fixture</p> <p>d. at least 350 students attended the band concert Friday night</p> <p>1. Is each number a solution of $x < 7$?</p> <p>a. 9 b. -1 c. $14/2$</p> <p>2. You are a cross country runner. Your race is 7 and $\frac{3}{4}$ miles. You have run half the race. Draw a diagram to show the length of the remainder of the race. Write an inequality to show the distance you have run so far.</p>	<p>Strategy: I teach them that if you always put the variable first then you can use the inequality sign as an "arrow" guide for which direction to shade on the number line. If the inequality is written like this : $4 > k$ I have them flip it like this : $k < 4$ Then when they graph they shade in the left, like the direction of the sign. Obviously this gets trickier when we get into the special rules of moving negatives with multiplication/division. But, I just have them flip it with their final answer before they graph the solution.</p> <p>Strategy: Translating English to Math **See Appendix G (page 41)</p>

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Standard 3: Develop fluency with the language and operations of algebra to analyze and represent relationships

OBJECTIVE 2	Solve and interpret linear equations and inequalities in various situations including real-world problems
OBJECTIVE 2.b.	Solve real-world problems involving constant rates of change.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Dependent variable Independent variable Slope form x-axis y-axis $y = mx + b$ <u>rise</u> run</p> <p>Skills</p> <p>Understanding the coordinate grid Graphing Create an equation given a graph</p>	<p>Todd had 5 gallons of gasoline in his motorbike. After driving 100 miles, he had 3 gallons left. The graph shows Todd's situation.</p>  <p>a. Find the slope of the line. b. What does this slope tell us? c. What is Todd's mpg?</p>	<p>Connection w/ Other Objectives: Standard 2 Objective 1. a.</p> <p>Lesson Ideas: <i>Introducing Graphs</i> **See Appendix H (page 42)</p>	

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Standard 3: Develop fluency with the language and operations of algebra to analyze and represent relationships

OBJECTIVE 2	Solve and interpret linear equations and inequalities in various situations including real-world problems
OBJECTIVE 2.c.	Solve equations for a specified variable.

Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Variables</p> <p>Skills</p> <p>Solving equations Order of Operations</p>	<p>Solve for c</p> $2a + 7 - c = a + 9$	<p>The area of a room is 99 ft^2. The width of the room is 11 ft. What is the length of the room?</p>	<p>Strategy: Pair this with math problems that use formulas (i.e. – volume, area, Pythagorean Theorem)</p>

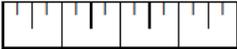
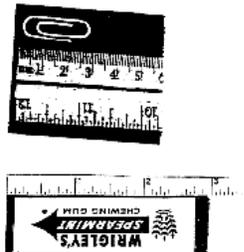
Standard 3: Develop fluency with the language and operations of algebra to analyze and represent relationships

OBJECTIVE 2	Solve and interpret linear equations and inequalities in various situations including real-world problems
OBJECTIVE 2.d.	Solve proportions that include algebraic first-degree expressions.

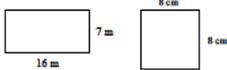
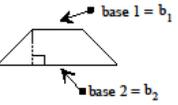
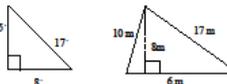
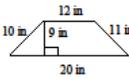
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Multiple-step equations Proportions Solution by substitution</p> <p>Skills</p> <p>Cross multiplication Solution by substitution</p>	<p>Solve.</p> <p>a. $\frac{5}{6} = \frac{c}{9}$</p> <p>b. $\frac{8}{d} = \frac{12}{30}$</p> <p>c. $\frac{x + 4}{5} = \frac{x - 2}{7}$</p>	<p>1. A canary's heart beats 200 times in 12 seconds. Use a proportion to find how many times its heart beats in 42 seconds.</p> <p>2. Laura swims an average of 22 meters per minute for 30 minutes. About how far does she swim? How far would she go in 3 hours? How long for 14 meters?</p>	<p>Connection w/ Other Objectives: Standard 1 Objective 2. d.</p> <p>Note: A "first-degree expression" has no variables with exponents greater than one.</p>

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Standard 4: Apply concepts of algebra to geometry

OBJECTIVE 1 Solve real-life application problems using measurement.			
OBJECTIVE 1.a. Measure real life objects using a variety of tools and techniques.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
Language & Symbols Degree Increment Skills Use tools: protractor, ruler, yardsticks, etc.	Label the ruler below at the following increments :  a. 3 inches b. $1\frac{1}{4}$ c. $2\frac{3}{4}$ d. $\frac{1}{2}$	What is the most precise measurement of the paperclip? the gum? 	Strategy: I like to pair this with teaching perimeter, area, and volume. After teaching measurement and doing some practice, I separate the students into groups and have them take the measurements of the classroom – then I have them figure out the perimeter, area, and volume of the class. Interactive Protractor: http://www.amblesideprimary.com/ambleside/mentalmaths/angleshapes.html Measuring Angles Worksheet Creator: http://www.worksheetworks.com/math/geometry/measuring-angles.html
	Mark the protractor at the following degrees 84°, 15°, 33°, 121°, and 180° 	Use a protractor to measure the following angles : 	

Standard 4: Apply concepts of algebra to geometry

OBJECTIVE 1 Solve real-life application problems using measurement.			
OBJECTIVE 1.b. Derive and apply geometric measurement formulas.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
Language & Symbols Area Base Circumference Height Length Perimeter Radius Sub Width Formulas for Rectangle Perimeter = $2l + 2w$ Area = $l \cdot w$ Formulas for Triangle Perimeter = $a+b+c$ Area = $\frac{1}{2}bh$ Formulas for Trapezoid Perimeter = $a + b + c + d$ Area = $\left(\frac{b_1 + b_2}{2}\right) \cdot h$ Formulas for Circle Circumference = πd or $=2\pi r$ Area = πr^2 Skills Using formulas	Find the perimeter and area of each shape: 	Ruth and Todd are going to put a fence around their yard. The yard is 25 ft wide and 14 ft long. How much fencing do they need?	Connection w/ Other Objectives: Standard 1 Objective 2.e. Strategy: Teach subscript numbers and  Interactive Practice and Games: http://www.woodlands-junior.kent.sch.uk/maths/shape.htm
	Find the perimeter and area of each shape: 	The city has purchased land for a park. The lot is triangular. The sides are 150 feet, 230 feet, and 400 feet. a) What is the area of the park? (Hint: this is not a right triangle) b) If the park is a right triangle and 2 sides are 150 feet and 230 feet what could the length of the last side be?	
	Find the perimeter and area: 	Given a trapezoid where the small base is 6 greater than the height and the larger base is 4 greater than three times the height, find all three dimensions (small base, large base, and height) if the area of the trapezoid is 133 square feet.	
	Find the circumference and area: 	The sprinkler head sprays water 14 feet. If the sprinkler head rotates 360°, how much area will the water reach?	

Standard 4: Apply concepts of algebra to geometry

OBJECTIVE 1 Solve real-life application problems using measurement.			
OBJECTIVE 1.b. Derive and apply geometric measurement formulas.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Depth Altitude Base Height</p> <p>Volume of Rectangles length • width • height</p> <p>Volume of Triangle area of triangle • length</p> <p>Volume of Trapezoid Prism area of trapezoid • length</p> <p>Volume of Cylinder area of circle • length</p> <p>Skills</p> <p>Using Formulas</p>	<p>Find the volume:</p>	<p>1. A water tank has been purchased for the farm. It will be used to water cattle. It is an oval shaped metal container that is 2.6 feet tall. The area of the bottom of the tank is 9.3 square feet. If the cattle drink two hundred four cubic feet of water a day, how many times per day will the tank have to be filled?</p> <p>2. You want to fill up your friends' room with balloons. The balloons are about 1 foot squared. If your friends' room is 12 feet wide, 8 feet high, and 10 feet long about how many balloons will you need to fill up the room?</p>	<p>Lesson Idea: How much candy? I bought four clear acrylic boxes in different sizes at the local craft store :</p> <p>I labeled the boxes and filled them with the following candy. If the candy was rectangular/square I stacked the candy neatly in the boxes:</p> <ul style="list-style-type: none"> • Box #1 Starburst (or Mambas) • Box #2 Camel squares (bulk Brah's) • Box #3 Skittles** • Box #4 Peanut M&M's** <p>** Use Skittles and Peanut M&M's for approximate volume</p> <p>I gave the students a piece of paper and they had to figure out how many pieces of candy were in each container. The top 3 closest answers for each box shared the candy as a prize.</p>

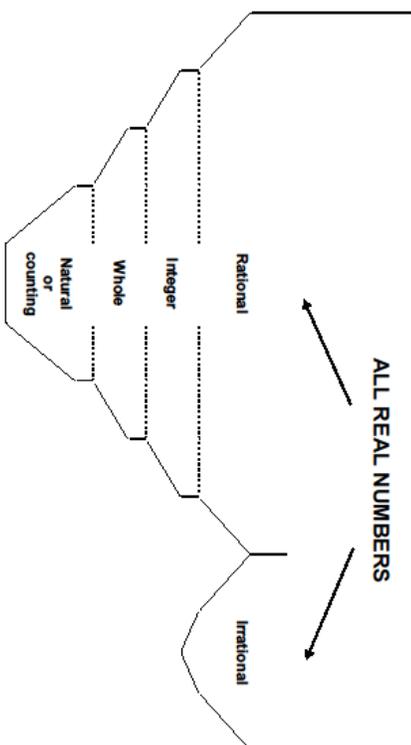
Standard 4: Apply concepts of algebra to geometry

OBJECTIVE 2 Use proportional reasoning to solve geometry problems			
OBJECTIVE 2.a. Draw and interpret scale drawings.			
Prerequisite Knowledge	Math Operations	Math Reasoning/Application	Lesson Ideas/Strategies
<p>Language & Symbols</p> <p>Proportion Ratio Scale Similar</p> <p>Skills</p> <p>Set up proportions Solve proportions Cross product</p>	<p>According to the scale, what will be the length in feet of the front of the actual house?</p> <p>The figure is a scale drawing of a basketball court. 1 inch = 25 feet.</p> <ol style="list-style-type: none"> Find the width of the foul line. Find the width of the court. Find the length of the court. 	<p>Using the scale of 2 inch = 1 foot, draw the following objects on your paper :</p> <ol style="list-style-type: none"> your shoe your textbook the teacher's desk you ☺ the classroom door your desk <p>A tree is drawn to scale on a piece of paper. The tree is drawn 5 inches high on the paper. The real tree is 30 feet high. What scale was used to create this drawing of a tree?</p>	<p>Lesson Idea: Map Activity I like to link this with proportion and ratios and all kinds of things ☺. I draw several pictures on the board –</p> <ol style="list-style-type: none"> a person standing next to the house and the person is as big as the house. a car where the tires are huge. A flower next to a tree where the flower is almost as big as the tree. <p>We talk about what is wrong with the pictures and how that relates to scale and proportion. Then we talk about places that they have seen scales – i.e. maps. I tell them that in the "olden days" I used a map to plan my trips because I didn't have Mapquest. I divide them up into groups and give each group a map of the United States. They have to plan two trips. Each trip has to cross at least four states.</p> <ol style="list-style-type: none"> How many miles to their destination? How many hours will it take to get there? What will it cost in gas? (use current gas prices) Gas prices change depending on where you get gas and what state you are in - What if halfway on your trip the gas price increases by .25/gallon?

Appendix A
Standard 1 Objective 1.b.

Lesson Idea: Classifying Numbers by "Running Them Through a Funnel"

Students often have a hard time classifying numbers with a single term. They tend to list every group that a number could belong to instead of the most specific single category that the number fits into (ex. Students list real, rational, integer instead of just saying that a number is an integer.) I use the idea of running a number through a funnel to help them be as specific as they can be.



When we sort the Real numbers, they will funnel down as far as they can go. I put this diagram on the board and have kids help me write in examples of what goes on each level, starting at the top. We list multiple examples in each level, with some duplicates as we go down. For example, 5 is a Rational number, but we will also see it on the Integer level, then again on the Whole level, and finally on the Natural level. I then explain that they can state the very smallest or bottom level that numbers funnel down to as their classification. In this case, 5 would be a Natural number.

I go through several numbers, starting at the top, and ask students how far down the number will flow before it has to stop.

Example:

- 7 – will flow down to the bottom, so it is a Natural number. I don't need to state everything above that.
- 0 – will stop at the Whole number level
- 14 – will stop on the Integer level
- $\frac{1}{2}$ – will stop at the Rational level
- π (:) – Irrational

Appendix B
Standard 1 Objective 2.d.

Lesson Idea: Fraction – Decimal – Percent Conversion Bingo Game

This is an activity designed to help students review converting fractions – decimals – percents.

1. Start by making a list of 20 or more equivalent fraction – decimal – percents. This will become your calling card as you play the game. It will look similar to this:

Fraction	Decimal	Percent
$\frac{1}{2} = 5/10 = 3/6$	.5	50%
$\frac{1}{4} = 6/8$	.75	75%
$\frac{1}{3}$	.3333...	33.33333%
$\frac{5}{6}$	.83	83%
$\frac{7}{10}$	.7	70%

You can make this as hard or easy as you need it to be by including several equivalent fractions or repeating decimals, etc.

2. Create BINGO cards and fill in each one with a variety of numbers from your table above. Make sure you use ONLY numbers from the table you have created. You don't necessarily need to create a unique card for each student. I use 4-5 different cards in a class of 20. Not every student will get the correct conversion, especially if they cannot use calculators or if you keep a steady pace and don't wait for everyone to figure things out.

B	I	N	G	O
40%	.25	16%	.33333	$\frac{1}{5}$
$\frac{5}{10}$	.7	$\frac{2}{5}$	$\frac{1}{3}$	45%
.67	65%	Free Space	50%	.6
.48	.5	$\frac{7}{10}$	.95	$\frac{5}{6}$
10%	$\frac{1}{2}$	.20	83%	$\frac{14}{21}$

3. Hand out a card and some kind of marker to each student.
 4. Explain the rules:
 - You will be calling out a fraction, decimal, or a percent.
 - They can cover ONE equivalent term in another form on their card, but not the number you call out. Ex. If I call out $\frac{1}{3}$ students could cover $\frac{1}{3}$, .333, or .33333, but NOT $\frac{1}{2}$. If more than one equivalent number is on the board, they have to choose ONE to cover. (You could choose to specify what conversion you want them to make – ex. you call out a fraction and tell them they have to convert it to a decimal).
 - When someone calls out BINGO, I have them come up and we compare what they covered with what I called out.
- As with any Bingo game, you can take multiple winners, blackout, or start over. You can also use 4 x 4 cards if you want to run a quicker game. You can allow calculators or only scratch paper or you could have them work in teams.

Appendix C
Standard 1 Objective 2.d.

Lesson Idea: Skittles Activity

You can also do this with M&Ms. You would need to change the list of colors in the chart. *The best time to buy mini bags of Skittles or M&Ms is at Halloween. They stay reasonably fresh for the duration of the school year.

Objective: Provide a hands-on activity to experience predicting, analyzing and converting data (ratio – percent – decimal), and demonstrating results with different graphs (line, bar, and circle.)

Materials Needed: 1 bag skittle per student

- Graph paper
- Colored pencils
- Rulers
- Compasses
- Protractors

Review concepts of changing a ratio to decimal and percent; creating graphs.

1. Distribute *Skittles Activity* sheets and one bag of Skittles to each student. Tell them not to open the candy until instructed to do so.
2. Have each student make predictions about the number of each color and fill in the appropriate spaces on their sheets. Encourage them to use the information from the candy packaging to make these predictions (according to Skittles.com there should be an equal number of each color. You can eliminate this column if you don't want to discuss the difference between estimates or predictions and actual data.)
3. Instruct students to open their candy and sort it by color. They will then enter their total number of candies as well as individual numbers of colors on their chart. (They can eat them at any point after this info is recorded.) They will also figure out the ratio of each color to the total in their bag. Then they should restate the ratios as both decimals and percents. They will fill in their charts as they work. They will make three graphs – a line, bar, and circle graph – to represent the distribution of colors in their bag of candy.

As an extension of this activity, you can have students compare their results to other students in the class. You could also put the students into small groups and combine their data for group info and graphs. You can then do one class set of combined data. I will do this and include mean, median, and mode for each color and then I will discuss how a larger sample size has a mean that is closer to what Skittles says the results should be (equal numbers of each color in each bag.)

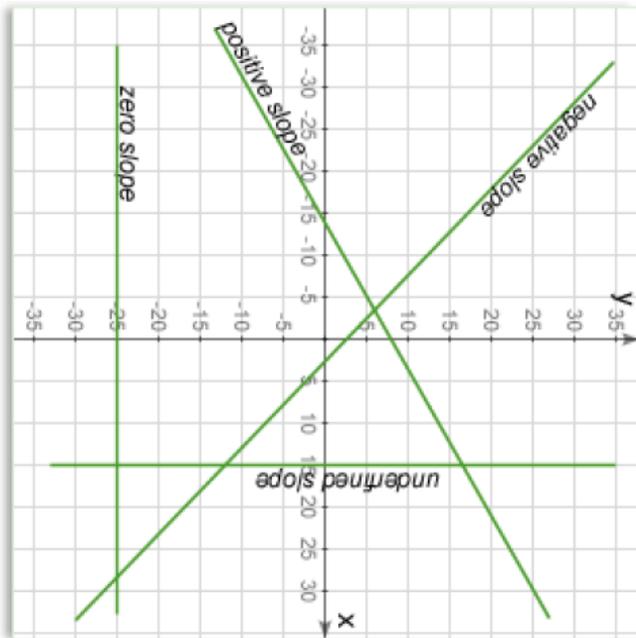
Skittles Activity Sheet

Color	Prediction	Actual # in Bag	Ratio # color / Total in bag	Decimal	Percent
Red					
Orange					
Yellow					
Green					
Purple					
Total					

1. **Predict** – Read the information on the back of the Skittles package. How many Skittles do you think will be in the bag? How many of each color do you think there will be? Record your predictions in the first column.
2. **Actual** – Open your bag and divide the Skittles into piles of each color. Count each and enter the results in the table. Make sure that when you add the number of each color it is the same as the total number in the bag.
3. **Ratio** – Record the ratio of each color to the total number of candies in the bag for each color.
4. **Decimal** – Change the ratio for each color into a decimal and record it in the table.
5. **Percent** – Change each decimal in to a percent for each color. Record your results in the table.
6. **GRAPH** – Using a piece of graph paper, a ruler, protractor, and compass you will create three graphs to demonstrate your results. Create a line and bar graph with COLOR along the bottom and NUMBER on the side. Create a pie or circle graph to show the percent of each color. Each graph should use about one third of the paper. Make sure you include labels and a legend for each graph if necessary. Be NEAT. Staple your graph paper to the back of this sheet.

Appendix D
Standard 2 Objective 1.a.

Visual Aide: Slope Overhead



Appendix E
Standard 2 Objective 2.a.

Strategy: Domain and Range Arrow and Target Analogy

^{1st} – Think alphabetical. D comes before R, just as x comes before y. So Domain is my set of x-values and Range is my set of y-values.

^{2nd} – To help students understand the concept of being able to use the Domain values just once in a function while Range values can be used multiple times, compare them to arrows and a target.

The x-values in our Domain are like arrows. We can pull each arrow out once and shoot it, but then it's gone. It's not there to be shot again.

The y-values in our Range are like the target. At this point I draw a large target with at least three concentric circles on the board. I shade each one in with a different color, then give examples (I have students tell me possible outcomes....)

If you shoot 3 arrows:

- 2 can land in the center black area and 1 could land in the yellow middle section.
- OR - one arrow could land in each section.
- OR - they could all land in one section
- etc. – I let them come up with the many ways 3 arrows could hit that target list them on the board

It doesn't matter – they all hit the target, but each area can be hit more than one time.

I'll go through this exercise again, but I'll give the arrows numbers and put different numbers on the target, as well. As we shoot each arrow (using our previous list as a guide), we create an (X,Y) pair based on where the arrow hits. I renumber the arrows each time we try a new combination. This helps them see how each x-value in the domain is used just once, but the y-values in the Range can vary.

Appendix F
Standard 3 Objective 1.a.

Strategy: Teaching Vocabulary

This is my introduction to the vocabulary before I start teaching variable expressions :

Constant:
I ask my students, "If someone is constantly talking what does this mean?" Constant means that it doesn't change. I tell them "a 4 is a 4 is a 4 is a 4 and will never be anything else."

Co-efficient:
I ask my students if anyone has played sports. We talk about co-captains and what that means. Then I relate that to the co-efficient - the number in front of the variable works with the variable (hence co-efficient). So, if a number is by itself it is constant. But, if a number is with a variable they are working together and it is called a co-efficient.

Variable:
I ask my students, "If I have various colors of pens do I have all black pens?" A variable is a letter that represents "various" numbers.

Terms:
I use the car analogy. A car has windows, doors, wheels, etc. Those are all its parts. (i.e. the constant, co-efficient, variable). The whole thing is the CAR/TERM (separated by a sign).

Practicing using the Vocabulary:

I have them practice with a chart. The variable expression is written in and they have to fill out the chart. Example:

Variable Expression	Constant	Co-efficient	Variable	Terms
$7y + 9$	none	7	y, 9	7y, 9
$44hy - 6x$	4	6	hy, x	4, hy, 6x
$y + 4k$				
$13 - 7y + k$				
$a + 6$				
$3y - 4d - m$				

Appendix G
Standard 3 Objective 1.a. & Standard 3 Objective 2.a.
Strategy: Reference Sheet: Translating English to Math

TRANSLATING ENGLISH TERMS INTO ALGEBRAIC SYMBOLS
+ Sum Add In addition More than Increased In excess Greater
- Difference Subtract Diminished Less than Decreased by Reduce Remainder
X Multiply Times as much Percent of Product / of Interest on
÷ Divide Per Quotient
= Equal Is / Was / Will be Results
> Greater than
≥ Greater than or equal to At least
< Less than
≤ Less than or equal to At most
() Quantity

TRANSLATING ENGLISH WORDS INTO ALGEBRAIC EXPRESSIONS	
Ten more than z	$z + 10$
A number added to 5	$5 + z$
A number increased by 13	$z + 13$
5 less than 19	$19 - 5$
A number decreased by 7	$z - 7$
Difference between z and 3	$z - 3$
Difference between 3 and z	$3 - z$
Twice a number	$2z$
Ten percent of z	$.10z$
Ten times z	$10z$
Quotient of z and 3	$\frac{z}{3}$ or $z : 3$
Quotient of 3 and z	$\frac{3}{z}$ or $3 \div z$
Five is three more than a number	$5 = z + 3$
The product of two times a number is 10	$2z = 10$
One half a number is 8	$\frac{z}{2} = 8$
Five times the sum of z and 2	$5(z + 2)$
Seven is greater than z	$7 > z$
Five times the difference of a number and 4	$5(z - 4)$
Ten subtracted from 10 times a number is that number plus 5	$10z - 10 = z + 5$
The sum of 5z and 10 is equal to the product of z and 15	$5z + 10 = 15z$
The sum of 2 consecutive integers	$z + (z + 1)$
The sum of 2 consecutive even integers	$z + (z + 2)$
The sum of two consecutive odd integers	$z + (z + 2)$

Appendix H
Standard 3 Objective 2.b.

Lesson Idea: Introducing Graphs

Before I teach functions or linear equations and graphing, I spend a day teaching students how to read and draw simple graphs.

I start with a simple graph, labeling the bottom with TIME (hours) and the side with DISTANCE FROM HOME (miles). I make sure they understand that time only moves forward (along the x-axis), so we must move forward as we plot our distance from home over the course of the day. I also discuss that I can leave home and return throughout the day. I talk about a typical day, having students tell me how to graph my distance from home as I talk about what I do (get up, go to school, teach, go home, go grocery shopping, go to Orem to pick up a package, stop for dinner, then go home). We look at the final graph and talk about how it represents my day. I have them do their own graphs, and then I have them trade and see if their partner can accurately describe their day based on the graph they drew.

We talk about and graph carnival rides with the side labeled DISTANCE FROM THE GROUND. We include a regular roller coaster, something like the gondola, and then we talk about a Ferris wheel. I ask kids how they would graph it. Many will try to draw a loop on their paper. I revisit the idea of not going back in time, and we talk about how the graph should look (like a sine wave, curving up and down over time).

At this point I hand out a piece of graph paper to everyone and have them divide it into four quadrants. They draw a graph in each quadrant and label it with TIME on the bottom of each, DISTANCE FROM THE GROUND on the sides of time, and SPEED on the side of one.

I show four different video clips and have students graph the movement of each:

1. Spiderman 1 – when Peter Parker is on top of a building, trying to figure out how to use his web. He flies across a street into the wall of the opposite building. I have them graph the distance of his feet from the ground.
2. Harry Potter 1 – broom lessons. The instructor leaves and Neville's broom takes off, flying all over. I have students graph his distance from the ground.
3. Princess Bride – when the Dread Pirate Roberts / Wesley and Mortvya are on top of the cliff having a sword fight. I have them graph Wesley's feet throughout the clip, keeping in mind that he starts higher than he ends, and that he does a flip around a bar at one point.
4. The Incredibles – the track race at the end. I have them graph Dash's speed as he runs the race. I show each clip twice, once for watching, and once for graphing.

When we are done, I have the kids compare graphs to make sure everyone has something similar.

For homework, I have students find graphs in a newspaper or magazine and bring it in with a written interpretation. I will provide copies of line graphs from newspapers for those who don't have access to papers at home. The next day they get into small groups and present what they brought.

This is a fun exercise that helps them understand how to read graphs.