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An Integrated Instructional Approach for Algebra: Infusing Hands-on, Cooperative, and Independent Learning with Technology and Vocabulary Enrichment

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An Integrated Instructional Approach for Algebra: Infusing Hands-on, Cooperative, and Independent Learning with Technology and Vocabulary Enrichment

by

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ABSTRACT

This paper provides educators with a structure for integrating multiple learning methods by topic in the Algebra classroom. Within a literary review supporting the need for higher levels of cooperative and independent learning, educators are given strategies and reasoning for using hands-on activities that incorporate many different types of intelligences and learning styles. More than twenty-five activities are included for use with many Algebra I TEKS reporting categories with a comprehensive suggested use of vocabulary throughout the course. An instructional model by topic is provided for integrating cooperative learning, independent learning, hands-on activities, vocabulary enrichment and the use of technology into the standard classroom routine of learning.

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CHAPTER I

INTRODUCTION

Learning can come from fun, energized experiences that stimulate student motivation, deepen understanding and maintain interest. In order to achieve a learning environment that is engaging for students, the goals, materials, methods and assessments must be designed to be flexible for the diverse styles and abilities in the classroom. Since classrooms are filled with diverse learners, educators must provide students with multiple ways to express and demonstrate learning. Incorporating different learning methods, such as cooperative and independent learning with hands-on activities, as well as daily vocabulary review is important in today's Algebra classroom. Hands on activities, whether collaborative or independent, can not only energize a classroom but also address multiple intelligences. Through organized instruction by topic, involving multiple learning methods, educators of Algebra students can provide an energized learning structure in order to maintain student interest.

With the continuously changing curriculum, useful resources may be hard to find. A major challenge in today's classroom is integrating multiple aspects and learning strategies into the daily classroom routine. Incorporating cooperative learning, independent learning, hands-on activities, technology and vocabulary all within a topic can definitely be a challenge. Structuring the daily routine and lesson presentation can take time that many educators are pressed to find. In addition, resources can be a challenge to locate. In Chapter III, an instructional model is presented to help integrate different learning strategies throughout a topic. Chapter IV and Chapter V each incorporate specific instructional topics using the model in Chapter III. Chapter VI and Chapter VII include multiple resources of hands-on activities, both cooperative and independent, which cover a wide range of topics taught in an Algebra course. Chapter VIII includes a comprehensive guide of Algebra vocabulary and suggestions to integrate vocabulary into quick and simple activities and associated assessments. Many of the activities may be altered to fit any classroom size or student needs. Many of the activities may be transformed into cooperative learning or independent learning opportunities. By creating activities that coordinate with the TEKS guidelines, these learning opportunities will not only meet state guidelines but will also increase student engagement, energy in the classroom and reinforce knowledge and understanding.

CHAPTER II

LITERARY REVIEW

More than half of the students going from middle school to high school lose confidence in their mathematical ability (Thomas, Silver, & Strong, 2003). What happens between those years that causes so many to lose their confidence in this particular subject? How can educators encourage students and build their confidence? How can educators motivate students to give forth the effort in learning the information, meet the high expectations of colleges and the ever changing curriculums?

High schools continue to go about their business in ways that sometimes bear startling resemblance to the flawed practices of the past. Students pursue their education largely in traditional classroom settings, taught by teachers who stand before row upon row of desks. Mostly, these teachers lecture at students, whose main participation in class is limited to terse answers to fact-seeking questions. (Breaking Ranks: Changing an American institution)

Teaching strategies can promote or demote student effort and learning. Verbatim note taking does not allow students to engage in the learning process (Marzano, Pickering, & Pollock, 2001). No single method of teaching is appropriate for every student. A teacher needs to have opportunities for coaching and constructivism. Direct instruction does not allow a teacher time to check for student understanding. It is important to design opportunities for students to learn beyond the single method of entire class instruction. Hands-on activities can be a means of addressing multiple intelligences in the classroom. In the book So Each May Learn; Integrating Learning Styles and Multiple Intelligence, Silver, Strong & Perini (2000) stress the importance of structuring learning to encompass the multiple intelligences in the classroom. Table 1 shows the eight intelligences and their diversity. Each type of intelligence has different inclinations and abilities. The challenge is to reach as many different dispositions as possible and have a positive effect on learning.

Educators must change their daily habits of teaching in order for others to learn and understand (Wiggins, 1998). Understanding cannot be taught. Educators must present possibilities and design opportunities for understanding. The key to academic success is a student's engagement in school activities, school organizations, and in the classroom (Kuh, 2008). Engagement in the classroom creates a positive atmosphere and champion teachers get students engaged in productive and positive work (Lemov, 2010). Hands-on activities can help integrate many types of intelligence while allowing active engagement in learning. By creating cooperative and independent learning opportunities in the classroom, educators are opening the door to positive and self-regulated learning environment.

Table 1: Eight Types of Intelligences found in So Each May Learn by Harvey Silver

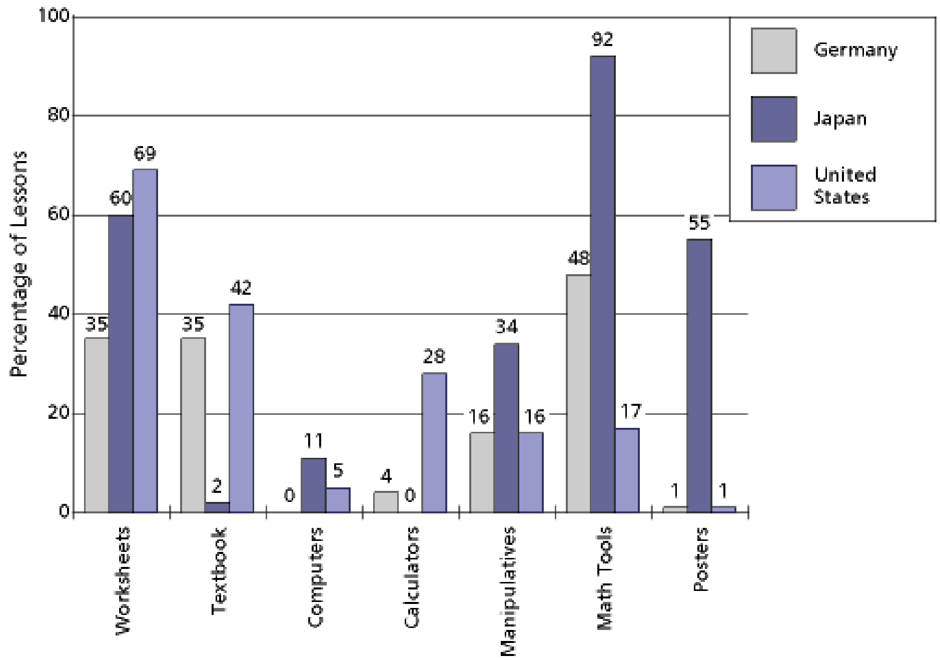
Disposition/Intelligence	Sensitivity to:	Inclination for:	Ability to:
Verbal-Linguistic Intelligence	the sounds, meanings, structures, and styles of language	speaking, writing, listening, reading	speak effectively (teacher, religious leader, politician) or write effectively (poet, journalist, novelist, copywriter, editor)
Logical-Mathematical Intelligence	patterns, numbers and numerical data, causes and effects, objective and quantitative reasoning	finding patterns, making calculations, forming and testing hypotheses, using the scientific method, deductive and instructive reasoning	work effectively with numbers (accountant, statistician, economist) and reason effectively (engineer, scientist, computer programmer)
Spatial Intelligence	colors, shapes, visual puzzles, symmetry, lines, images	representing ideas visually, creating mental images, noticing visual details, drawing and sketching	create visually (artist, photographer, engineer, decorator) and visualize accurately (tour guide, scout, ranger)
Bodily-Kinesthetic Intelligence	touch, movement, physical self, athleticism	activities requiring strength, speed, flexibility, hand-eye coordination, and balance	use the hands to fix or create (mechanic, surgeon, carpenter, sculptor, mason) and use the body expressively (dancer, athlete, actor)
Musical Intelligence	tone, beat, tempo, melody, pitch, sound	listening, singing, playing an instrument	create music (songwriter, composer, musician, conductor) and analyze music (music critic)
Interpersonal Intelligence	body language, moods, voice, feelings	noticing and responding to other people's feelings and personalities	work with people (administrators, managers, consultants, teachers) and help people identify and overcome problems (therapist, psychologists)
Intrapersonal Intelligence	one's own strengths, weakness, goals, and desires	setting goal, assessing personal abilities and liabilities, monitoring one's own thinking	mediate, reflect, exhibit self-discipline, maintain composure, and get the most out of oneself
Naturalist Intelligence	natural objects, plants, animals, naturally occurring patters, ecological issues	identifying and classifying living things and natural objects	analyze ecological and natural situations and data (ecologist and rangers), learn from living things (zoologist, botanist, veterinarian) and work in natural settings (hunter, scout)

Why Hands-On Activities

When a student is asked if they enjoy math, they may say no because math is too hard, they do not understand, or it is boring (Tileston, 2005). Teachers only know what goes on in their classroom. There are so many other personal things going on in the lives of students where school may not be a priority to them. A student may walk in one day after an argument, at home with their family, the night before or experiencing a break up with a boyfriend or girlfriend. The classroom can be an escape, a place where they are in control of their life for a short amount of time. A classroom environment that gives students a sense of belonging, support for achievement, and a sense of empowerment could positively impact a student. Such goals can be achieved if the classroom incorporates more meaningful lessons, active engagement to help enrich student learning, and opportunities for growth in self-esteem and self-efficiency in students. Figure 1 illustrates proportions of various instructional materials implemented in three different countries. The United States uses a higher proportion of worksheets, textbooks and chalkboards than Japan which implements more hands-on instructional material such as computers, manipulatives, math tools and posters.

Through interviews of teachers and students on motivational aspects of mathematics, Middleton (1995) was lead to infer that hands-on activities played a key factor in their response. When comparing hands-on cooperative learning to teacher demonstration Biligin (2006) found that students develop more positive attitudes and skills. Hands-on activities can be a means of addressing multiple intelligences in the classroom. They help develop skills such as critical thinking, communication, collaboration and creativity (Silver, Strong, & Perini, 2000).

Figure 1: Percentage of lessons in which various instructional materials are used. (U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-95.)



The National Center of Education Evaluation and Regional Assistance found that student engagement correlates positively with achievement in school and success on standardized tests. Stohr-Hunt (1996) used data collected in the National Education Longitudinal Study of 1988 in support of a conjecture that students who engage in hands-on activities on a regular basis score significantly higher on tests than students who engage in more traditional learning and hands-on activities only once a month. Fleming and Levie (1979) found that when more senses were incorporated into learning, a higher level of cognitive development and retention was achieved. Any type of physical movement will generate a mental image and recall of information (Marzano, Pickering, & Pollock, 2001).

Great activities will…

1. prioritize importance of understanding
2. encourage them to link ideas and explore essential questions throughout design
3. state performance requirements and purpose clearly

When students are provided opportunities for hands-on activities, they build representations of mathematical ideas that develop or promote conceptual understanding. The neural system a student uses to complete a task will become stronger as the task is repeated. When one task is mastered another more complex task has a chance of being mastered. With each increasingly complex task there is a corresponding neural network allowing development. Educators must actively motivate and involve students in daily lessons with meaningful time spent throughout each task. To evaluate hands-on performance, the teacher can use direct observation, journal writings, activity checklists and worksheets.

Management

> I promise to be the best math teacher you have ever had; will you promise me to be the best math student you have ever been? 10 Best Teaching Practices by Donna Tileston

A major challenge with implementing hands-on activities is monitoring and checking engagement. This can be quite a challenging task when multiple students are not following directions or being a distraction to others. Start from the very beginning by setting clear expectations and spending time assigning students to cooperative learning groups. At the beginning, when teachers are getting to know their students, teachers should alter the cooperative groups to establish the most beneficial group environment for each student. If there are students who are off task and not cooperating after repeated encouragement and redirection, they need to be removed from the group. Have an independent assignment ready for them to complete on their own. This allows the other students in the classroom the opportunity for group work, rather than penalizing the entire class. Hopefully the student will see how working with other is more beneficial.

In 10 Best Teaching Practices, Tileston (2005) calls actively monitoring the student's “cruise control”. It is suggested that educators need to give students opportunities to be successful with clear guidelines and consequences for misbehavior. Students are capable of learning using different strategies. Give them a chance and do not let another student ruin it for everyone else. Take small breaks from group learning to give students guidance and encouragement. Call the class to one side of the room and work an example as a class if they are struggling. Educators can prepare independent work for those students not willing to follow procedures and stay on task. Perhaps there are three students not willing to learn cooperatively but twenty-seven others gaining great communication and critical thinking skills.

When students are going to engage in a hands-on activity, always have…

1. clear expectations posted
2. a set time limit
3. examples for them to look at
4. small classroom breaks to reteach if necessary
5. room to move

Cooperative Learning

Working collaboratively is a chance for students to communicate ideas in ways they might not have been communicated by an instructor (Tileston, 2005). Diamond (1998) studied dendritic branches formed when a rat was put in specific environments. A rat that was placed alone with a toy had more dendritic branches than a rat that did not have a toy. Three rats placed together without toys exceeded the number of dendritic branches of a single rat with the toy. To be successful in the real world of jobs and responsibilities, students must be able to communicate with others what they know, listen to other's ideas, and collectively make decisions. Hands on activities that involve collaborative learning can help students develop useful skills. This translates to gains in critical skills that are used not just in the classroom but outside in the real world.

Students have a strong need to interact with others, primarily their friends (Glasser, 1986). Cooperative groups allow them time to connect with others which can develop intrinsic motivation through group explorations. Students will develop more interest, curiosity, desire for understanding and a belief in their own abilities (Davidson, 1990). Cooperative groups can accommodate auditory, visual, kinesthetic, introverted and extroverted learners. Creative minds come alive when teachers allow the students to have some control and responsibility in the classroom. Dr. Ed Thomas identifies four types of math students, Table 2 below, in his book <u>Styles and Strategies for Teaching High School Mathematics</u>. By working cooperatively, each learner can benefit from being around different types of math students. Each different student can help others understand concepts or procedures in ways they may not see when working independently.

Table 2: The Four Types of Math Students

from Styles and Strategies for Teaching High School Mathematics by Dr. Ed Thomas

THE FOUR TYPES OF MATH STUDENTS'	
Mastery Math Students… *Want to… l*earn practical information and set procedures *Like math problems that … a*re like problems they have solved before and that use algorithm to produce a single solution *Approach problem solving… i*n a step-by-step manner *Experience difficulty when... m*ath becomes too abstract or when faces with non-routine problems *Want a math teach who... m*odels new skills, allows time for practice, and builds in feedback and coaching sessions	**Interpersonal Math Students…** *Want to…* learn math through dialogue, collaboration, and cooperative learning *Like math problems that …* focus on real-world applications and on how math helps people *Approach problem solving…* as an open discussion among a community of problem solvers *Experience difficulty when...* Instruction focuses on independent seatwork or when what they are learning seams to lack real-world application *Want a math teach who...* pays attention to their successes and struggles in math
Understanding Math Students… *Want to…* understand why the math they learn works *Like math problems that …* ask them to explain, prove, or take a position *Approach problem solving…* by looking for patterns and identifying hidden questions *Experience difficulty when...* there is a focus on the social environment of the classroom (e.g. on collaboration and cooperative problem solving) *Want a math teach who...* challenges them to think and who lets them explain their thinking	**Self-Expressive Math Students…** *Want to… u*se their imagination to explore mathematical ideas *Like math problems that … a*re non-routine, project-like in nature, and that allow them to think "outside the box" *Approach problem solving…* by visualizing the problem, generating possible solutions, and exploring among the alternatives *Experience difficulty when...* math instruction is focused on drill and practice and rote problem solving *Want a math teach who...* invites imagination and creative problem solving into the math classroom.

Guided math instruction in small groups can allow for a more personal environment in which to teach (Sammons, 2010). While other groups may be working on past information and reviewing, educators can sit with groups and monitor comprehension or provide strong support and extra challenges. Whole class instruction gives an opportunity to model problem solving strategies and introduces new concepts to the class all at once. However, it also creates the opportunity for students to be inattentive, bored or unable to keep up. Even the best teacher has difficulty engaging all students and creating opportunities to evaluate comprehension. The goal is to have students fully capable of solving problems on their own. Students who learn cooperatively and talk through problem solving and course material will learn more effectively (Johnson and Johnson, 1986).

> All significant learning involves abstract thinking….we do not really build a solid concept until we can talk about it-- until we can use the language of math. How to use math to build your child's abstract-thinking skills, Clements & Samara (2004)

There are multiple opportunities for discussion, accountability, feedback, support and encouragement when using cooperative learning, (Johnson, 2007), and the outcomes are substantial and well documented. In addition, the use of cooperative learning strategies has lead to development of greater long term retention, increased critical thinking, accurate and creative problem solving, perseverance, and willingness to take on difficult tasks (D.W. Johnson, & R. Johnson, 1989).

Cooperative Learning Strategies

Four strategies to incorporate cooperative learning are:

1. **Start Small;** Have clear expectations, well thought out and arranged groups of two or 3 with constant monitoring of effectiveness (Johnson, 1986). After students have more experience with cooperative groups, increase group size with the knowledge of how specific students work with others. Try and make groups heterogeneous: multiple backgrounds and skill levels.
2. **Use familiar material.** At first, use material in which students have shown success. Begin integrating new material as their skills have shown growth and cooperative learning has become more comfortable.
3. **Time each activity.** In the beginning, create cooperative learning activities that may only take up a small portion of the class. Students will develop their skills over time and will be able to manage more lengthy activities.
4. **Provide students with explanation.** Explain to each student the importance of learning to work cooperatively. Make cooperative learning an experience they can take outside the classroom.

Cooperative groups allow the opportunity for growth in interdependence, accountability, communication skills, and group processing. Cooperative learning helps students build self-esteem and learn effective social skills (Johnson, 1986). By integrating cooperative groups throughout learning environments, educators can promote life skills used outside the classroom.

Intentional Questioning

In order for students to develop the necessary thought process for fully understanding Algebra, they must develope specific habits of thinking. They have to be able to free their minds from the restrictions of the number values and narrow in on processes such as reversibility, recognizing patterns, and organizing data (Driscoll, 1999). Development of these kinds of habits begins at an early age. As such, educators should collaborate across grades to develop questioning habits and employ math terminology throughout the day to help students develop that cognitive skill (Sarama, 2006).

Teaching for understanding involves less teaching and more questioning (Wiggins, 1998). In order for students to understand, they need to create meaning from the context and not just be told the meaning. When students are working independently or cooperatively, specific questions aimed towards the growth and understanding of the new topic need to be available to guide their discussions. Designing a set of intentional questions for students to discuss during hands-on activities encourages growth beyond the mechanical actions of activities. Educators can input specific questions as a short response on the assignment or have the questions displayed in the classroom. Students demonstrate understanding when they are asking questions and generating ideas. Teachers should constantly be evaluating their teaching habits and questioning with intention.

Independent learning will be more natural if teachers help students create a line of questioning throughout their independent work. This is not something easily learned, but through guided questions by teachers, students can begin to think algebraically and revert to questioning their own actions. Intentional questioning can help broaden the minds of the learner to consider aspects they may not have considered naturally. Intentional questioning is also an excellent way to guide students to analyze and discuss the process they are taking to solve problems. This is another life skill students can take outside the classroom and use in their daily and professional lives.

Independent Learning

Good teachers control the classroom, are willing to help students, vary the classroom routine and take time to get to know their students (Corbett, 2002). Let us look at two different classrooms learning strategies and structures. Classroom A involves lecture with notes that are almost verbatim. The teacher asks questions as she leads the classroom in the new material and occasionally gives the students a chance to work on their own and review immediately afterwards. Classroom B involves cooperative groups with a self-guided lesson walking them through the steps of the new material with specific questions they discuss and answer. In this setting the teacher actively observes and is ready for questions at any time. After the short independent lesson has been completed, the teacher implements guided practice with the classroom to reinforce learning. The students are then out of their desks and moving around the room to complete an activity using their new gained knowledge. Which classroom would better foster creative learning and reinforce what was learned?

Consider the traditional classroom that most adults have experienced. The entire class participated in a teacher-lead lecture followed by independent seatwork. All students were to learn the material in this format. Whether the math class was engaging and energized was not an educational concern. Those students who may have been struggling to understand the new material or were unable to show the correct work on their worksheet would need to come in for extra help or take a lower grade. This type of classroom reaches the verbal-linguistic intelligence in some ways but does not reach the spatial intelligence nor other categories of intelligence. Active learning, whether cooperatively or independently, in a desk or around the room has the capacity to reach more styles of learners and to deepen understanding.

By giving up some control in the classroom, teachers allow students to initiate their own strategies to solve problems and closely monitor achievement (Stipek, 2001). It is important that students are self-regulated learners. Teachers have a daily effect on their student's ability to believe in what they are learning. Teachers need to be confident in their knowledge so students see that they too can be successful. Good teachers make sure students do their work and constantly hold them responsible for what is learned (Corbett, 2002).

The goal in independent learning is to create self-regulated learners who are building their self-efficiency (Mercadal, n.d). A self-regulated learner (SRL) takes control, is responsible for their own learning and focuses on their performance and self-reflection. They are capable of planning, organizing, controlling, evaluating, developing self-efficacy, knowing when to seek advice, and are not easily distracted. In order for students to be self-sufficient, students must believe in their own ability to successfully achieve tasks and goals. Collaborative learning uses many of the same aspects of a self-regulated learner, but researchers say it is not enough to just have collaborative learners.

The research suggests that educators should aim for students to become self-sufficient (Kuh, 2008). Having confidence is a crucial aspect of being successful in mathematics (Marzano, Pickering, & Pollock, 2001). Educators can build student self-esteem and confidence in the mathematics classroom in various ways. For example, complementing and praising students for their efforts and achievements produces a comfortable learning environment where challenges can be overcome and promote a motivation to learn.

Independent Learning Strategies

Four strategies to incorporate independent learning are:

1. **Clear guidelines and questioning.** The independent lesson needs to be scripted as if the teacher is in front of the room walking the students through the lesson themselves. Provide clear questioning and expectations throughout the lesson.
2. **Use familiar material at first.** Using familiar material can show the teachers the current level of independence each student has already developed. As students become more comfortable with learning on their own, they can build the skills necessary to successfully learn new material independently.
3. **Allow a timed discussion session with their peers.** This is another opportunity for cooperative learning and to build communication skills. Have specific questions ready they can ask their friends. Develop clear guidelines on what they can and cannot discuss.
4. **Make sure the time allotted is manageable.** Never plan an independent learning activity that takes the entire class time. Try to allow time for class or peer discussion at the end. This gives students a sense of accomplishment when they get to share their findings with others.

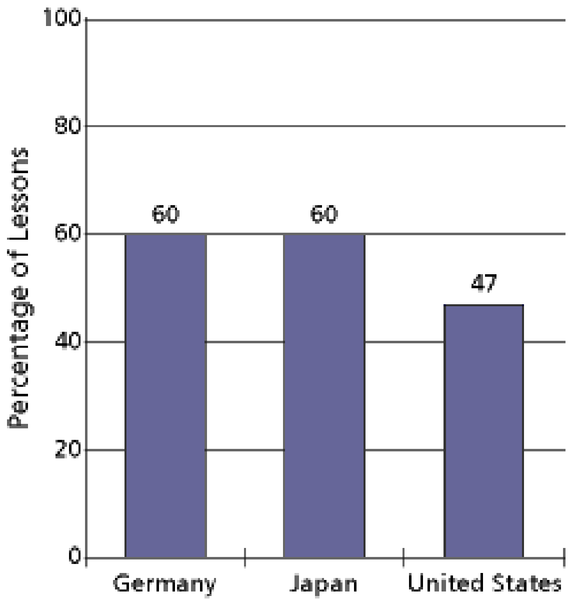
Technology

When introducing technology into the classroom a teacher must first explain the importance of information literacy and visual literacy (Wang, 2011) . The percentage of lessons, including use of the chalkboard or overhead projector, in which students came to the front of the room and used them is shown in Figure 2. These percentages reflect the use of what was available in regards to technology in the classroom over twenty years ago. While this type of equipment may not be used anymore in the classroom the figure suggests questions on the use of technology used today. Technology is all around us and available at our finger tips. Many classrooms are equipped with individual laptops, smart boards, projectors, and calculators that each student can utilize daily. Some classrooms may not have this technology but students carry cellular devices that can easy download a calculator or software through which a student could submit assignments.

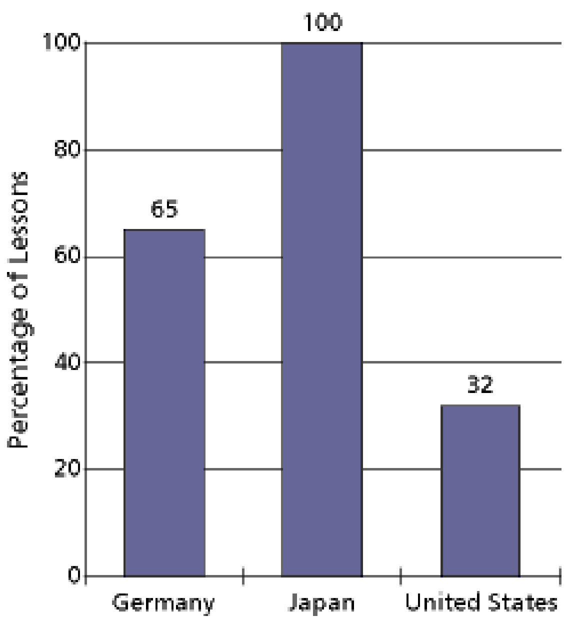
Technology should be used to increase, maintain or improve learning (Hitchcock, 2003). Technology is another option to engage students throughout their cooperative and independent learning with hands-on activities. Technology can also be an excellent source when developing initial questioning to use in the classroom and explore new creative outlooks for problem solving. Boothby & Alveman (1984) found that using visuals while teaching will increase comprehension and retention. In contrast the results displayed in Figure 2 how often do the students of today come to the front to use a smart board or projector? Beeland (2002) showed that interactive whiteboards increase student engagement during the learning process. Using interactive white boards and graphing calculators can increase student engagement and their desire to learn new material.

Figure 2: Percentage of lessons including (a) chalkboard or (b) overhead projector in which students come to the front and use it NOTE: The overhead projector was used in only three Japanese lessons.(U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Videotape Classroom Study, 1994-95.)

(a)



(b)



Allowing students to come to the front and interact with the lesson or input equations to see an instant visual can increase engagement. Korwin (1990) completed a study to determine if there was a measurable increase in knowledge when technology-based hands-on activities were used and if these activities established greater information retention in comparison to a traditional lesson. A result of the study was that the hands-on activities did enhance cognitive learning and did lead to a measurable increase in knowledge. Integration of technology into a classroom is enjoyable for students and is not difficult for educators to include in their lesson planning. Suggestions and examples on how to integrate the use of the smart board and calculators into daily classroom lesson plans are provided in the chapters to come.

Vocabulary

There is some evidence that using web-based tools to support learning new vocabulary will build motivation and interest (Liu, 2014). Use of vocabulary, on a daily basis, is essential in the procedures and comprehension of mathematics. Using the language of mathematics in the classroom can be challenging, especially with a culturally diverse classroom. Developing and reviewing vocabulary is critical to understanding and retention when learning new information. Without a true understanding of the vocabulary, students will not be successful in the mathematical classroom. In an English classroom, students are asked to write a paper given a specific topic. In a mathematics classroom, students are asked to solve a problem in a specific format. The problem solving skills begin with understanding what is asked of them, which means understanding the vocabulary of mathematics. Just writing the definition on their daily notes will not be enough for them to remember the meaning of a new mathematical term or direction.

Students must engage in vocabulary learning activities on a regular basis to help develop an understanding of them to later recall vocabulary terms. Below, eight ideas for integrating vocabulary into the classroom are delineated. These ideas can be used daily, weekly or even monthly. It is important to remember that students do not always learn new vocabulary terms and remember them throughout the year. Educators can encourage and promote vocabulary understanding by making vocabulary a part of the classroom instruction as often as possible.

Simple Ideas for Integrating Vocabulary

1. **Flashcards:** Create flashcards of key vocabulary words in the current unit and use them throughout the unit and in future units to help. Have a ring to connect them or a zip lock bag to keep them together. This allows students to use their hands when reviewing and gives them a sense of ownership when they create their own flashcards on index cards or cardstock paper.
2. **Vocabulary Wall:** Anytime a new vocabulary word is introduced, have it displayed somewhere in the room. Whether it is just the word or the definition and a picture, displaying vocabulary can get students more comfortable and become more familiar with new vocabulary terms.
3. **Vocabulary Crossword Puzzles:** Crossword puzzles are a great idea for a warm-up or closing. Have the students work together or individually and see what they can remember. Set a time limit to complete the crossword to keep students focused and on task.

4. **Vocabulary Quizzes:** Short five minute quizzes over vocabulary can allow educators the opportunity to see what vocabulary terms students are having difficulty remembering. Short assessments also show students the importance of understanding and memorizing vocabulary terms and definitions
5. **Vocabulary Matching:** Matching games on the smart board are a great way to get the entire class involved in memorizing vocabulary. Having matching games available for students to play during an activity is a great way to integrate them on a daily basis.
6. **Vocabulary Journals:** Have a way for students to easily access their vocabulary terms, whether it is visibly located in the classroom notes or in a journal.
7. **Vocabulary Brainstorm:** Give the students a topic and have them write all the vocabulary words that come to their mind. Encourage students to draw pictures and to use creativity.
8. **Integrated Vocabulary:** Integrate vocabulary into lessons and students work on a daily basis. Vocabulary can be used during a quick review, part of the topics activity, or a question on an assignment. Integrating vocabulary regularly is vital to learning and understanding new material.

Using hands-on activities and technology is a means of getting students involved in learning new vocabulary that can energize the classroom. Chapter IV, chapter V and chapter VIII include examples of how to integrate vocabulary using hands-on activities and technology into instructional model by topic. Vocabulary plays a major role in the instructional model by topic presented in the following chapter.

The instructional model, presented in chapter III, outlines a topic lesson plan and structure. The model involves hands-on activities, cooperative learning, effective questioning, independent learning, the use of technology and vocabulary development. Aspects of the instructional model are broken down and developed in Chapter III. The process illustrates how educators can fully prepare for a new topic by mapping out the TEKS alignment, developing objectives and creating a list of initial questions to ask students throughout the instruction. Student engagement can easily be heightened with one of the many cooperative or independent activities involving technology and vocabulary which are included throughout the remaining chapters. Each activity is equipped with an educators guide to TEKS alignment, intentional questioning and much more.

CHAPTER III

INSTRUCTIONAL MODEL FOR LESSON PLANNING BY TOPIC

When provided with appropriate resources and guidelines for addressing different learning styles, educators can readily structure their lessons to accommodate multiple types of intelligence to reach each learner. Through organized instruction by topic, educators of Algebra students can create an energized learning environment that will maintain student interest. This chapter will provide a guide for organizing instruction that will incorporate the diverse instructional methods of cooperative learning, independent learning, hands-on activities, and vocabulary.

Having multiple types of instruction within a topic let alone within a day, can become a challenge. Educators are encouraged to structure their lessons plans and activities in a way that allow opportunities for cooperative and independent learning activities. Incorporation of intentional questioning and the use of technology can create a learning environment filled with energized students who are engaged in what they are learning. The instructional model in the chapter informs the educator of what they may encounter throughout the lesson and exemplifies how to set expectations or goals throughout the learning process. This model indicates how to integrate the aspects of learning addressed in the literary review into the algebra curriculum.

When creating a lesson plan, educators must think through and record any helpful hints or questions that could guide students in the necessary direction. When creating lesson plans, as modeled in Table 3, educators will first identify the topic to cover within the next two days and calculate the amount of time they can spend on this topic. Next is to devise a scripted lesson plan that also identifies the alignment of any TEKS that apply to the topic they have chosen. After the TEKS have been recorded on the lesson plan, educators prepare for instruction by evaluating what prior knowledge students may have prerequisite to the topic. It will be helpful to identify concerns or suggestions of how to get the students engaged and to remain positive throughout the topic. Next, the educator will state the objectives in order to map out the direction and expectations for the learners. With the objectives identified, educators are ready to develop a list of intentional questions to ask students throughout the topic. Additional questions may be added as the lesson plan is being developed. Lastly, the educator will develop a structure for presentation of the topic with the integration of hands-on activities, cooperative learning, independent learning, technology, vocabulary, guided practice, independent practice and test practice. The lesson planning process just described is mapped out below.

<u>Steps to Creating an Educators Lesson Plan</u>

1. **Prepare for Instruction:** Discuss what students may know and what may be encountered as this topic progresses. Reflect on past experiences to guide this topic in order to create a positive classroom experience. Management is a large aspect of a positive classroom environment. Thus it is important to communicate classroom expectations on a daily basis and to bring positive energy to the classroom that the students can feed off of. Write some encouraging words on the

lesson plans to say as the students enter the room. This simple task can motivate students and get them excited for learning.

2. **Objectives:** What are the students responsible for learning? For the majority of Texas schools, the content and language objectives must be posted and clearly stated in the teacher's lesson plans. Some educators prefer short and sweet objectives while others use more descriptive ones to serve as a guideline for their lessons and activities. How will the students be required to transfer their new gained knowledge? It is vital that students are speaking and writing what they are doing. This can be as simple as telling the person sitting next to them what the lesson objective states. Having students clearly explaining their daily mathematical processes to one another can greatly affect their vocabulary and confidence.
3. **TEKS:** Have a clear goal on why the topic being taught has been chosen and try to cover as many TEKS as possible. Have many other educators interpret the TEKS so that there are different perspectives and input on what should be taught in the classroom.
4. **Intentional Questioning:** Compose a list of specific questions to use throughout the topic. Question with intent and encourage creativity with the student's answers. Students think and understand in different ways, so vary questions to allow for a wider spectrum of students to gain confidence through participation.
5. **Structure:** Most topics in Algebra are taught over a two day span for approximately fifty minutes per day. Each topic should involve instruction, guided practice, independent practice, test practice, a hands-on activity and

vocabulary. These six different learning styles do not stand alone. They all work together and can merge to create opportunities involving independent and cooperative learning.

Instruction: the introduction of a topic whether teacher, independent or cooperatively lead. Instruction may include the use of technology. Teacher lead instruction is when the teacher is presenting material and the students are following along. Try to keep teacher lead instruction as short as possible, no more than twenty minutes. If the lesson is going to be lengthy, give the students breaks in between information where they can practice their skills and then return to the instructor lead lesson. When students are sitting in their desk for a long amount of time without much movement they are losing energy and focus. By keeping the teacher lead instruction to a minimum, students will have the opportunity to engage in learning with their attentive minds and bodies. Student lead instruction is when the student is in control of their own independent learning. Pick topics that students may have pre-requisite knowledge of and make sure the independent lesson is well organized and easy to read through. Educators should be available to lend guidance while students are building their independent learning capabilities. Group lead instruction is when two or more students are conducting the cooperative learning together. This is an excellent opportunity for students to build communication skills and their Algebra vocabulary as they discuss and work cooperatively. Teachers should have clear instructions and spend time grouping students according to what is best for the classroom. If there is a student who is getting off task and distracting others it may be helpful to remove them from the group and have that student work independently. It is very important that the class understands that cooperative learning is a life skill and that learning to work collaboratively will boost their knowledge and skill inside as well as outside the classroom.

a) <u>Guided Practice</u>: when the teacher is aiding a student throughout the practice. Whether the student completed the practice independently and is asking the teacher for assistance or the teacher is directing students through intentional questioning, either can be considered guided practice. It is important at this stage for educators to evaluate the level of understanding for the topic being discussed and determine if there is a need for more guided practice before moving to independent practice. Guided practice can also provide an opportunity for students to work cooperatively and use questioning to deepen their understanding.

b) <u>Independent Practice:</u> when the student is practicing without the teacher's guidance. During independent practice teachers are on "cruise control". This includes encouraging students to ask each other questions before they seek guidance from the teacher. Independent practice can be used to aid students who may need one-on-one tutoring and to check students work as they progress through the assignment. Educators can assign a certain number of problems and then ask the students to check their answers before moving on. Independent practice can easily be turned into a hands-on activity with a cut and paste activity as modeled in chapter VI. Independent practice is a chance for students to show what they can achieve on their own.

c) Test Practice: when questions are phrased individually and may contain multiple choices. Always require work to be shown on multiple choice questions, whether they are showing how they solved for the answer or circling vocabulary in the context of the question. Building test questioning skills can give students confidence and a sense of comfort when they are taking assessments. By integrating test style practice in the classroom on a daily basis, students who may suffer from testing anxiety can perform better on assessments since they have practiced individualized test questions with multiple choices. Test practice can be utilized in any independent or cooperative learning activity. Activities with test practice questions may be found in chapter VI and chapter VII.

d) Hands-on Activity: use of manipulatives and/or movement. Activities may include matching a set of cards, cutting and pasting information into categories, working problems around the room, participating in station work, playing a bingo or jeopardy game, and many others. These activities can be done independently, cooperatively or as a class. Activities can be integrated anytime throughout the topic, whether for the entire class or a short warm-up at the beginning. There are no limits to the use of activities, especially when students are engaged in learning and practice. Educators can encourage a student to help others if they finish early and have extra independent practice or test practice available for students who complete the activity more than ten minutes before expected. Also, integrating technology and vocabulary into activities will allow for more review and engagement in the classroom.

e) Vocabulary: Vocabulary is words used throughout the current topic or previous topics. Daily vocabulary review can be an entrance warm up, located in the instructors lead notes, a station throughout the day's activity or even a closing at the end of the class. Vocabulary reviews can be completed independently or cooperatively with hands-on activities and smart board applications.

The model provided in Table 3 serves as a guideline for incorporating different learning methods. This layout outlines preparation for instruction, the establishment of content and language objectives, selection of specific TEKS to support the topic, development of questioning strategies and the integration of six learning methods for the topic being covered. By developing a lesson structure that incorporates multiple learning methods and learning opportunities, educators leave behind the normal classroom structure for a positive learning environment created to adhere to the multiple types of intelligences.

Table 3: Instructional Model by Topic

Lesson Plan: Topic

Duration: 2 days

Time: 100 min

TEKS
Set TEKS and make sure they are interpreted in different ways.

Prepare for Instruction
Discuss what students may know and possible encounters.

Objectives
What are the students responsible for learning and how are they required to transfer new knowledge?

Intentional Questions
Compose a list of specific questions to use.

Structure Total Time Spent	**Page Title** task
Instruction 20 min	**Notes or Lesson Page Title** choice of teacher lead, independent or cooperative lead learning
Guided Practice 10 min	**Assignment Page Title** independently or cooperative learning where teacher guides students working
Independent Practice 20 min	**Assignment Page Title** independent learning with opportunities for cooperative learning and hands-on activities
Test Practice 10 min	**Assignment Page Title** independent or cooperative learning opportunities with hands-on activities involving individualized multiple choice questions
Hands-On Activity 30 min	**Activity Page Title** independent or cooperative use of manipulatives and/or movement
Vocabulary 10 min	**Vocabulary Page Title** independent or cooperative learning with opportunity for hands-on activities and use of technology to learn words used in the current or previous topics

Educators are encouraged to focus a large amount of time of the student's development with activities and practice rather than instruction. More difficult and rigorous topics may cause a variation in the suggested amount of time to spend in each part of the structure. By using the guideline for topic instruction and structure lesson plan educators will be able to incorporate different learning methods such as cooperative and independent learning, hands-on activities, and vocabulary. In the following two chapters, this guideline is used to plan two chosen topics presented in an Algebra course. These examples show how the educator can vary the time needed throughout the structure of the lesson plan in order to accommodate the needs of each student. Independent and cooperative learning opportunities are incorporated in each component of the learning process. Each part of the instructional model provides suggestions to address objectives of the topic and a structure to utilize different learning methods.

CHAPTER IV

INSTRUCTIONAL MODEL BY TOPIC EXAMPLE I

This chapter provides an example of how to use the guideline provided in chapter III. It is important that the educator gathers what prior knowledge the students may have that could contribute to the learning of a given topic. When students are building off prior knowledge, there is an opportunity to create independent or cooperative learning lessons or activities. By following the guideline for topic instruction and to structure a lesson plan, educators can organize their instruction to meet the needs of the different math learners. A variation in the time scheduled for each learning method will occur according to the needs of the students in regards to the presented topic.

Table 4 is a lesson plan developed using the guideline presented in chapter III. Combining like terms and the distributive property are processes that students may know coming into Algebra. Providing students with a quick review, though introducing it as new knowledge, and allowing them time to work independently will keep them on task and focused on their learning objectives. Throughout the presentation of this topic, a teacher would encourage use of vocabulary and check for understanding. The outline in table 4 provides an example of how the time frame of each structure can easily be altered to fit the needs of a topic. Each figure provided throughout this chapter is designed to be utilized in the classroom. The margins are set to allow educators to print and use these examples without reconstruction.

Table 4: Instruction Model by Topic Example I

Lesson Plan: Combining Like Terms and Distributive Property

Duration: 2 days
Time: 100 min

TEKS

- A.10(A): add and subtract polynomials of degree one and degree two
- A.10(D): rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property
- A.11(B): simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents

Prepare for Instruction

Combining like terms is one of the first topics reviewed in Algebra. So creating an opportunity for a positive learning environment, starting off the first day of school, is vital to the progress throughout the year ahead. Students entering Algebra I have learned the basics of combining like terms and the distributive property from 8^{th} grade TEKS. Repeating statements such as, "you have seen this before." or "you learned this last year" may give the students a sudden urge to recall information and get discouraged when they do not remember what they have learned in the past. Ease into the lesson as if it is being presented for the first time and be ready to see eyes light up when the students begin to recall information. Go ahead and treat this topic as a presentation for new knowledge. Hopefully, students will say, "I remember this", or "this is easy". Always try to start off the year giving students a positive experience in the classroom and create lesson plans that will allow the positivity to last as long as possible.

Combining like terms and using the distributive property can be linked to three requirements of Algebra TEKS. Although this topic may not cover every aspect of each of these TEKS, combining like terms and using the distributive property are major fulfilling contributors. After listing the TEKS, the table gives the educator guidance for instruction by evaluating what challenges may arise during this topic and how to address those challenges. The objectives state the goals of the students to achieve throughout this topic and can be guided by the chosen TEKS. Using questions throughout the topic can allow student to develop deeper understanding while holding the educator accountable for asking intentional questions. If an integer is a whole number, what would be an

Table 4: cont.

Objectives

- use algebraic properties of addition and subtraction to simplify expressions
- simplify expressions using the distributive property
- communicate rules to combining like terms and using the distributive property
- use verbal explanations of the simplifying process
- interpret vocabulary and its importance throughout this topic

Questions

- How would you correctly say this expression given at the top of your lesson notes? Any others?
- What type of algebraic property is represented? Addition? Subtraction? Multiplication? Division?
- Where is the exponent located?
- Where is the base located?
- If an integer is a whole number, what would be an example of a number that is not an integer?
- Why is it important to know these vocabulary terms?
- Do you think you could teach another student who may not know these vocabulary terms their meaning?
- Which parts can I combine? Why?
- Which parts do not combine? Why?
- When distributing, what algebraic property is being used?
- How do I know when to stop simplifying?

example of a number that is not an integer? This type of questioning allows students to broaden their vocabulary understanding and allow opportunities for more enrichment. The combining like terms and distributive property lesson would first begin by asking students to partake in an independent or cooperative review over vocabulary terms. Since students have seen this topic, encouraging independent or cooperative learning may allow them to recall information and make a smooth transition into the instruction. After the instructor asks students for input over the vocabulary terms and definitions, the class will devise definitions with the guidance of the educator. Then the educator will begin instructing students on the combining like terms process and allow them to work a quick

Table 4: cont

Structure	
Day 1	
Vocabulary (3 minutes) Figure 3 page 1	**Combining Like Terms and Distributive Property** When students enter the room, ask them to start filling out what they know on the top of their lesson page. First ask them to work independently and then offer them an chance to discuss what they wrote with their neighbor in order to allow a quick cooperative learning experience.
Vocabulary (5 minutes) Figure 3 page 1	**Combining Like Terms and Distributive Property** Teacher lead discussion on what information they have gathered and come to a census on vocabulary definition and labels. All the while, the students are following along and correcting their vocabulary on their lesson page independently.
Instruction (7 minutes) Figure 3 page 1	**Combining Like Terms and Distributive Property** Teacher lead instruction for problems 1 through 4 where students are independently copying the teachers notes and beginning to ask questions for understanding.

guided practice problem before moving on to the distributive property. Within the guided practice, there are more opportunities for independent or cooperative learning. Educators can instruct students to work independently and then check for understanding cooperatively. Once the instruction over the distributive property has concluded, there is one more opportunity for guided practice either independently or cooperatively. Then students will begin to complete independent and test practice questions. It is suggested that students are encouraged to work independently on as many independent practice and test practice problems as possible during this time and only check for understanding with their peers as deemed necessary. Allow students to have a daily opportunity to see test

Table 4: cont.

Guided Practice (2 minutes) Figure 3 page 3	**Guided Practice** Allow time for students to work #1 independently and then have an instructor lead discussion to review the problem.
Instruction (5 minutes) Figure 3 page 1	**Combining Like Terms and Distributive Property** Teacher lead instruction for problems 5 and 6 where students are independently copying notes and asking questions for more understanding.
Guided Practice (2 minutes) Figure 3 page 3	**Guided Practice** Allow time for students to work #2 independently and then have an instructor lead discussion to review the problem.
Independent Practice (23 minutes) Figure 3 page 3	**Independent Practice with Test Practice** Have students finish there assignment independently while actively monitoring the room. Point out errors and offer one-on-one tutoring. When a student has completed their assignment, check that every problem has the necessary work shown and each problem is worked correctly. Encourage the students who have finished their work to offer any guidance to their neighbors for a cooperative learning opportunity.
Test Practice (3 minutes) (Optional Closing) Figure 3 page 4	**Test Practice** Choose a test practice question to review over cooperatively as a class.

practice questions in order to build their test taking skills and become more comfortable to individualize questioning. Educators should have more categorized test practice worksheets, topic activities, or independent practice problems available for the students that finish with over 10 minutes left before the end of class. To conclude the day, the educator will then review a test practice problem with the class. Finally, ask any additional questions that could help close the day with active and engaged minds. The second day for combining like terms and distributive property might begin with a vocabulary review with the use of the smart board. If the computer being used to view this document has smart board software installed to its hard drive, educators can

Table 4: cont.

Day 2	
Vocabulary (8 minutes) Figure 4 page 1	**Vocabulary Matching Smart Board** Work cooperatively as a class to complete this smart board vocabulary review. Call on students to come up to the smart board to drag the vocabulary terms to the correct location on the monomial and match them with their definition.
Hands-On Activity (39 minutes) Figure 5 page 1 through 4	**Combining Like Terms** This activity is best completed cooperatively. Make sure they record their answers on the answer document. During this time, call up each group to the white board to work on a designated distributing problem independently. Have each student verbally explain how they completed the problem. This is an excellent time to establish which students may need more one-on-one tutoring, help build their verbal vocabulary and the interpretation of their work.
Vocabulary (3 minutes) Figure 4 page 1	**Vocabulary Matching Smart Board** This is a great closing for the day to do cooperatively as a class or have each group complete the vocabulary review as they finish their activity.

download the activity by clicking on the link provided in the activity. This is a great opportunity to see if students are struggling and if they understand the terms covered the day before. The smart board allows the class an opportunity to work through the vocabulary matching cooperatively and lend aid to others. After the vocabulary activity, students will then begin working cooperatively on completing the matching hands-on activity. While students are working, the teacher will be calling students up to work independently on a distributive problem and practice using verbal explanation of the problem solving process. Once each group has completed the matching activity, if time permits, each group can participate in the vocabulary matching activity on the smart board used at the beginning of class.

Each activity or resource provided begins with a cover page designed for educator use. The cover page is designed to allow the educator support when creating their lesson plan involving that specific resource and topic. First, each cover page has the topic title and number of pages following. A list of the Algebra TEKS that align with the material covered in the activity is then provided. After the TEKS are listed, the educator will find several objectives created for use in the classroom. Next, the cover page includes intentional questions to integrate thought out the topic. These questions are helpful when introducing a new topic and allowing student's opportunities to reach the objectives set. After the list of suggested questions the cover page shows an educator where to integrate the activity or resource in the structure section of the lesson plan. The resource can either be used as instruction, guided practice, independent practice, test practice, a hands-on activity or vocabulary review. In chapter II, the literary review first identified eight types of intelligences and their associated learning types. The cover page relates which of the different intelligences the resource mostly supports and then indicates which type of learning opportunity the students will use; cooperative learning, independent learning, use of technology or vocabulary enrichment. Following the learning method, the cover includes a list of vocabulary terms used throughout the topic being covered. Lastly, educators are given the directions for the activity or resource immediately preceding the cover page.

The instructional model by topic example shown in Table 4 gives educators an example of how to implement the instructional model for lesson planning. Combining like terms is one of the first topics covered in Algebra and can be a challenge to educators with new students in a new school year. Educators can start the year off with engaging activities and create a positive experience for students by allowing their classroom to include different learning opportunities. Each figure begins with a cover page that provides the educator with vital information for lesson planning and allows an easy transition into integrating more cooperative learning, independent learning, use of technology and vocabulary enrichment into their classroom. Another example of a lesson plan created using the instructional model is provided in the next chapter. Unlike combining like terms and distributive property, the next topic example is completely new to Algebra students and will guide the educator in the adjustment of the structure to accommodate new topics.

Figure 3: Combining Like Terms and Distributive Property Cover Page

Combining Like Terms and Distributive Property
6 page

TEKS

- A.10(A): add and subtract polynomials of degree one and degree two
- A.10(D): rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property
- A.11(B): simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents

Objective

- use algebraic properties of addition and subtraction to simplify expressions
- simplify expressions using the distributive property
- use vocabulary to make relations when combining like terms
- use verbal explanations of the simplifying process

Intentional Questions

- How would you correctly say this expression given at the top of your lesson notes? Any others?
- What type of algebraic property is represented? Addition? Subtraction? Multiplication? Division?
- Where is the exponent located?
- Where is the base located?
- If an integer is a whole number, what would be an example of a number that is not an integer?
- Why is it important to know these vocabulary terms?
- Do you think you could teach another student who may not know these vocabulary terms their meaning?
- How do I know when to stop simplifying?

Structure

- Instruction
- Guided Practice
- Independent Practice
- Test Practice
- Vocabulary

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method

- Cooperative
- Independent
- Vocabulary

Vocabulary

- like terms
- variable
- coefficient
- base
- exponent
- integer
- distributive property
- simplify
- expression

Directions

- Complete page 1 with the students and have them complete pages 3 and 4.
- Review over problems as necessary.

Combining Like Terms and Distributive Property (page 1)

$$\_\_\_\_\_\_ 2x^{3} \_\_\_\_\_\_$$

Vocabulary

like terms:____

variable:____

coefficient:______________________________________

base:____

exponent:_______________________________________

integer:____

distributive property: ________________________________

Directions: Simplify each expression.

1. $y+y+y$

2. $x+x+y$

3. $a-7a$

4. $5b^2-2b+1+2b^2-4b-1$

Directions: Use the distributive property to simplify.

5. $3(n-2)-2n$

6. $5-(t-6)-t$

Combining Like Terms and Distributive Property (page 2)

$$2x^3$$

Vocabulary

like terms: Same base and same exponent

variable: A letter/symbol that represents a quantity that can change

coefficient: The number in front of a variable

base: A number or variable raised to a power base

exponent: The number of times you multiply the base; the power

integer: A positive or negative whole number

distributive property: To multiply a number throughout a group

Directions: Simplify each expression.

1. $y+y+y$

$1y+1y+1y$

$3y$

If the variable is alone, the coefficient is 1

2. $x+x+y$

$1x+1x+1y$

$2x+1y$

$2x+y$

3. $a-7a$

$1a-7a$

$-6a$

4. $5b^2-2b\cancel{+1}+2b^2-4b\cancel{-1}$

$5b^2-2b+2b^2-4b$

$7b^2-2b-4b$

$5b^2-6b$

Since the numbers will add to make zero, they cancel each other out.

Directions: Use the distributive property to simplify.

5. $3(n-2)-2n$

$3n-6-2n$

$5n-6$

6. $5-(t-6)-t$

$-5-t+6-t$

$-5-1t+6-1t$

$-2t+1$

The variable has a -1 as a coefficient

Guided Practice (page 3)

1. $2x^2-2x+5-8x-3x^2-11$	2. $-2(4-y)+7y$

Independent Practice

3. $9a-8a$	4. $b+2-b$
5. $12c+1-5c$	6. $1-6p-1-2p$
7. $-x+8x^2-4+2-6x^2+4$	8. $5y^2+y+1-2y+4y^2-1$
9. $4(5z-6)+10z$	10. $-(t-3)+2t$

Test Practice (page 4)

11. A pentagon is a geometric shape with 5 sides. Which equation below describes the perimeter, P, of a pentagon with the side lengths $(x+1)$, $(3x)$, $(2x+3)$, $(x-4)$, and $(5x-1)$ if x is measured in meters?

A. $P=(13x+9)$ where x is in meters.

B. $P=(13x^2+x+4)$ where x is in meters.

C. $P=(13x^2+x-4)$ where x is in meters.

D. $P=(13x-1)$ where x is in meters.

12. Simplify the expression completely: $-(2x-3)-2(x+1)$

A. $-2x+3-2x-1$

B. $-4x+3$

C. $-4x-2$

D. $-2x-3-2x+1$

13. Simplify the expression completely: $2(4-x)-6$

A. $8-2x-12$

B. $2-2x$

C. $8-2x-6$

D. $-2x-2$

Guided Practice (page 5)

1. $2x^2-2x+5-8x-3x^2-11$ $-2x^2-2x+5-8x-11$ $-2x^2-10x+5-11$ $-2x^2-10x-6$ **Combine Like Terms**	2. $-2(4-y)+7y$ $-8+2y+7y$ $9y-8$ **Distribute then Combine Like Terms**

Independent Practice

3. $9a-8a$ a	4. $\cancel{b}+2-\cancel{b}$ 2
5. $12c+1-5c$ $7c+1$	6. $\cancel{1}-6p-\cancel{1}-2p$ $-6p-2p$ $-8p$
7. $-x+8x^2-\cancel{4}+2-6x^2+\cancel{4}$ $-x+8x^2+2-6x^2$ $2x^2-x+2$	8. $5y^2+y+\cancel{1}-2y+4y^2-\cancel{1}$ $5y^2+y-2y+4y^2$ $9y^2+y-2y$ $9y^2-y$
9. $4(5z-6)+10z$ $20z-24+10z$ $30z-24$	10. $-(t-3)+2t$ $-t+3+2t$ $-1t+3+2t$ $1t+3$ $t+3$

Test Practice (page 6)

11. A pentagon is a geometric shape with 5 sides. Which equation below describes the perimeter, P, of a pentagon with the side lengths $(x+1)$, $(3x)$, $(2x+3)$, $(x-4)$, and $(5x-1)$ if x is measured in meters?

A. $P=(12x+9)$ where x is in meters.

B. $P=(12x^2+x+4)$ where x is in meters.

C. $P=(12x^2+x-4)$ where x is in meters.

D. $P=(12x-1)$ where x is in meters.

$(x+1)+(3x)+(2x+3)+(x-4)+(5x-1)$

$x+1+3x+2x+3+x-4+5x-1$

$12x+1+3-4-1$

$12x-1$

12. Simplify the expression completely: $-(2x-3)-2(x+1)$

A. $-2x+3-2x-2$

B. $-4x+1$

C. $-4x-2$

D. $-2x-3-2x+1$

$-2x+3-2x-2$

$-4x+3-2$

$-4x+1$

13. Simplify the expression completely: $2(4-x)-6$

A. $8-2x-12$

B. $2-2x$

C. $8-2x-6$

D. $-2x-2$

$8-2x-6$

$2-2x$

Figure 4: Vocabulary Matching Smart Board Cover Page

Vocabulary Matching
1 page

TEKS
- Category 1: Number and Algebraic Methods

Objective
- correctly identify key vocabulary on a monomial
- correctly relate vocabulary words and their definitions

Intentional Questions
- How would you correctly say this expression given at the top of the screen?
- What type of algebraic property is represented? Addition? Subtraction? Multiplication? Division?
- Where is the exponent located?
- Where is the base located?
- If an integer is a whole number, what would be an example of a number that is not an integer?
- Why is it important to know these vocabulary terms?
- Do you think you could teach another student who may not know these vocabulary terms their meaning?

Structure
- Vocabulary
- Hands-On Activity: Matching

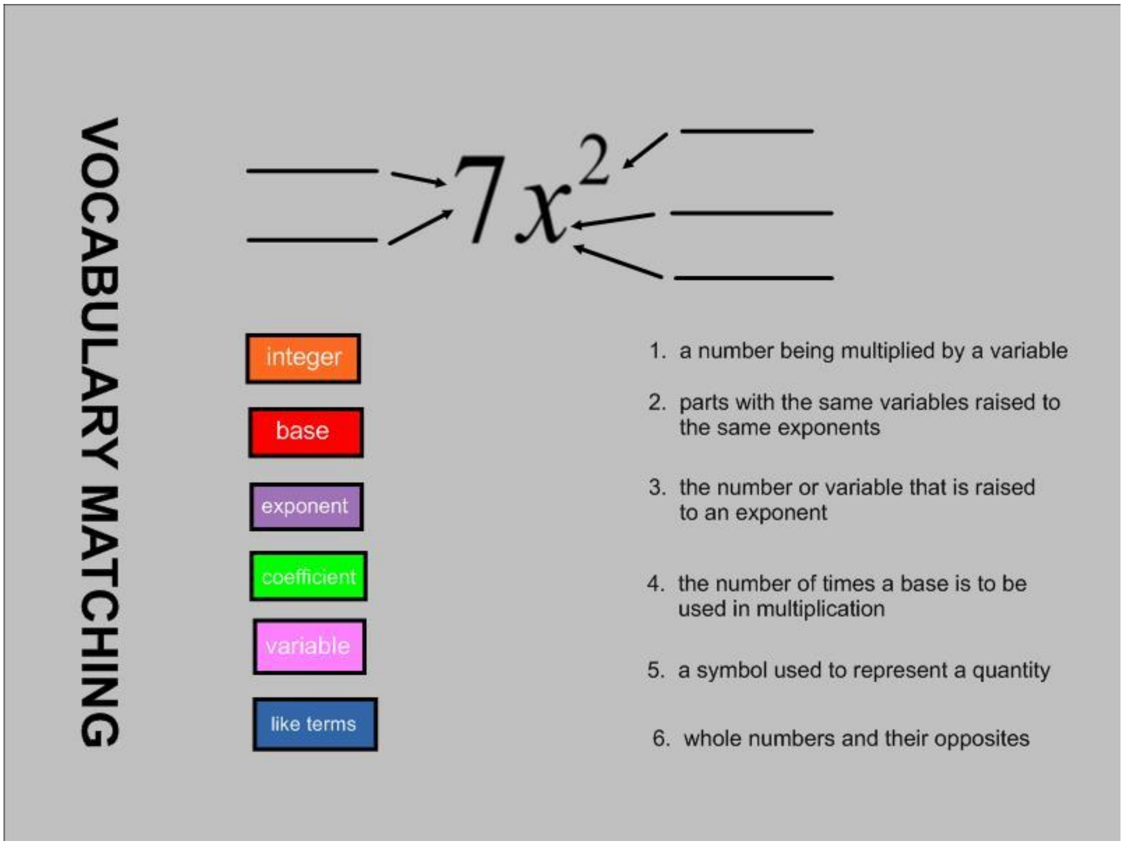
Types of Intelligence
- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method
- Cooperative
- Independent
- Technology

Vocabulary
- like terms
- variable
- coefficient
- base
- exponent
- integer

Directions
- Match vocabulary terms to their definition using the smart board pen.
- Drag the vocabulary terms to the correct location on the monomial.

Vocabulary Matching Smart Board (page 1)



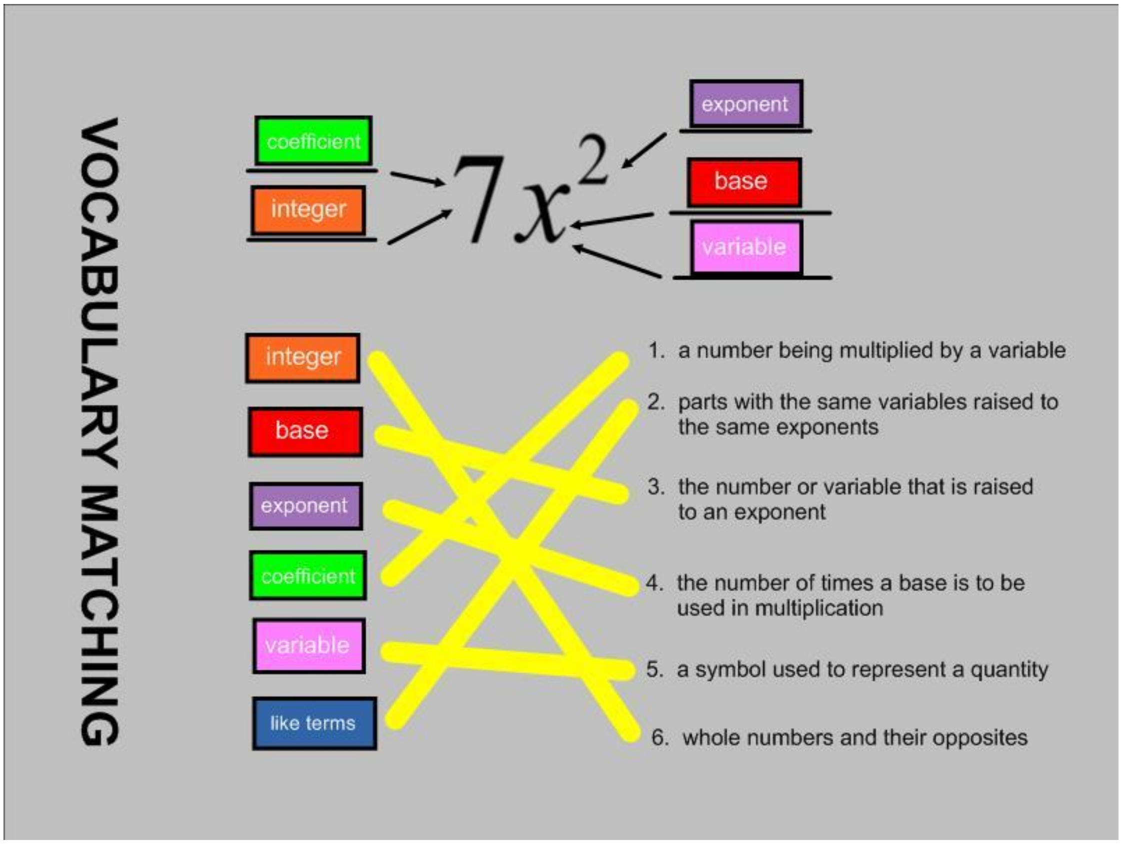


Figure 5: Combining Like Terms Cover Page

Combining Like Terms

5 pages

TEKS

- A.10(A): add and subtract polynomials of degree one and two
- A.10(D): rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property
- A.11(B): simplify numeric and algebraic expressoions using the laws of exponents, including integral and rational exponents

Objective

- correctly match a given expression with its simplified form
- use the distributive property to simplify

Intentional Questions

- What terms can you combine?
- Why can you combine those terms?
- What does it mean to be "like terms"?
- What does it mean to simplify?
- How would you explain the process you took in simplifying?

Structure

- Hands-On Activity: Matching

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Cooperative
- Independent

Vocabulary

- like terms
- variable
- coefficient
- base
- exponent
- integer
- distributive property
- simplify
- expression

Directions

- The goal is to match each original expression (red) with a simplified form (yellow) and a fully simplified (green).
- Start with number 1 and combine like terms.
- Find the yellow square that matches the simplified form of the original.
- Then, find the green card that represents the fully simplified form of the original expression.
- Record each step on the answer document provided.
- Place card back in envelope when complete.

Combining Like Terms (page 1)

1

$2x+3-x+4$

$x+3+4$

$x+7$

2

$4+x-x-1$

$4-1$

3

3

$5x+6-3x+4$

$2x+6+4$

$2x+10$

4

$2x^2+x+1-x^2+5$

$x^2+x+1+5$

x^2+x+6

5

$2-x^2-3x+1+4x+8x^2$

$2+7x^2-3x+1+4x$

$7x^2+x+3$

6

$10+2x+4x^2-3x-2$

$10+4x^2-x-2$

$4x^2-x+8$

(page 2)

7

$2(x+3)-x$

$2x+6-x$

$x+6$

8

$4(x-1)-1$

$4x-4-1$

$4x-5$

9

$5+6(-3x+4)$

$5-18x+24$

$-18x+29$

10

$-(x-2)+3$

$-x+2+3$

$-x+5$

11

$2-(x+5)$

$2-x-5$

$-x-3$

12

$6-2(3x-4)$

$6-6x+8$

$-6x+14$

(page 3)

13

$2(x+2)-2(x-2)$

$2x+4-2x+4$

8

14

$3(2x+1)-2(3x-1)$

$6x+3-6x+2$

5

15

$2(x)+(x-3)$

$2x+x-3$

$3x-3$

16

$0.25(x+4)+0.75(x+8)$

$0.25x+1+0.75x+6$

$x+7$

17

$0.4-2(3x-1.2)$

$0.4-6x+2.4$

$-6x+2.8$

18

$6.5(2x-3)-2(3x-4.5)$

$13x+19.5-6x+9$

$7x+28.5$

Combining Like Terms Answer Document (page 4)

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18

Combining Like Terms Key (page 5)

1

$2x+3-x+4$
$x+3+4$
$x+7$

2

$4+x-x-1$
$4-1$
3

3

$5x+6-3x+4$
$2x+6+4$
$2x+10$

4

$2x^2+x+1-x^2+5$
$x^2+x+1+5$
x^2+x+6

5

$2-x^2-3x+1+4x+8x^2$
$2+7x^2-3x+1+4x$
$7x^2+x+3$

6

$10+2x+4x^2-3x-2$
$10+4x^2-x-2$
$4x^2-x+8$

7

$2(x+3)-x$
$2x+6-x$
$x+6$

8

$4(x-1)-1$
$4x-4-1$
$4x-5$

9

$5+6(-3x+4)$
$5-18x+24$
$-18x+29$

10

$-(x-2)+3$
$-x+2+3$
$-x+5$

11

$2-(x+5)$
$2-x-5$
$-x-3$

12

$6-2(3x-4)$
$6-6x+8$
$-6x+14$

13

$2(x+2)-2(x-2)$
$2x+4-2x+4$
8

14

$3(2x+1)-2(3x-1)$
$6x+3-6x+2$
5

15

$2(x)+(x-3)$
$2x+x-3$
$3x-3$

16

$0.25(x+4)+0.75(x+8)$
$0.25x+1+0.75x+6$
$x+7$

17

$0.4-2(3x-1.2)$
$0.4-6x+2.4$
$-6x+2.8$

18

$6.5(2x-3)-2(3x-4.5)$
$13x+19.5-6x+9$
$7x+28.5$

CHAPTER V

INSTRUCTIONAL MODEL BY TOPIC EXAMPLE II

This chapter provides another example of how to use the guideline provided in chapter III. Unlike the topic of combining like terms and distributive property, solving systems of equations by graphing includes two aspects learned earlier in the Algebra course. This allows the opportunity to implement the independent or cooperative learning for a student or group lead lesson. Since the prior knowledge they will be using to learn the new topic is recent, this allows opportunity for student growth in self-confidence and independent learning ability. By following the guideline for topic instruction and structure lesson plan, educators can organize their instruction to meet the needs of the different math learners. A variation in the time scheduled for each learning method will occur according to the needs of the students in regards to the presented topic.

Table 5 shows a lesson plan using the guideline presented in chapter III. The topic instruction and structure example II, table 5, gives a description and guide to utilizing each figure provided in this chapter. Solving systems by graphing involves two aspects students have learned previously in the Algebra course. This provides educators an opportunity to create an independent or cooperative learning opportunity. When a student has the necessary pre-requisite knowledge, they can thrive from learning material independently and build self-confidence in their learning capabilities.

Table 5: Instructional Model by Topic Example II

Lesson Plan: Solving Systems of Equations By Graphing

Duration: 2 days
Time: 100 min

TEKS

- A.2(B): write linear equations in various forms
- A.3(A): determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including
  $$y = mx + b \text{ , } Ax + By = C \text{ , and } y - y_1 = m(x - x_1)$$
- A.3(C): graph linear functions on the coordinate plane and identify key features, including-intercept, y-intercept, zeros and slope, in mathematical and real-world problems
- A.3(F): graph systems of two linear equations in two variables on the coordinate plane and determine the solutions if they exist

Prepare for Instruction

Systems of equations are a completely new concept learned in Algebra. When introducing systems there are many different outlines to follow. Whether students first learn to solve system by graphing or whether solving systems by graphing is taught after substitution and elimination, this is a topic that they are very capable of learning independently. The students are well prepared for solving by graphing because of their previous knowledge of solving for y and graphing linear functions. When student walk into the room greet them with encouraging statements reassuring them that today's lesson will be built off of previous knowledge that they have already mastered.

Solving systems of equations by graphing is part of multiple TEKS. Each of the TEKS listed in Table 5 are utilized throughout this topic. When preparing for instruction, educators can see that this topic is one that students can take control and owner ship of. Solving systems of equations uses two aspects that students have learned and practiced prior to this instruction. Since they have the pre-requisite knowledge, allowing students and opportunity to learn this new topic independently can build their independent learning skills and help build their confidence in their mathematical ability. The objects set for the class stare the use of previous knowledge in the topic new to Algebra students and that may comfort students and give them motivation to learn the new material

Table 5: cont.

Objectives

- use previous knowledge of graphing lines
- find the solution to a system of equations
- use technology to support my findings
- explain the process of solving for y
- state the steps in graphing
- explain how to find the solution to a system of equations

Intentional Questions

- Why must you re-write the equation in slope-intercept for?
- Where is the slope located in the equation?
- What does the constant number on the end of the equation represent?
- What is the first step in graphing a line?
- After you plot the y-intercept, what is the next step in graphing the line?
- After you determine the direction of the line, how do you know where to place the other coordinate on your graph?
- Did you check to see if your graph was sketched correctly?
- Where is the solution to the system located?
- What are some other words you can use to describe where the solution is located?
- Can you name what quadrant the solution is located in?
- When you plug those equations into your graph, do you see them cross?
- When you plug those equations into your graph, what do you see?

knowing they have some of the skills used throughout this particular topic. The first aspect of the structure for this lesson plan involved students cooperatively working on the smart board to arrange vocabulary, definitions and representations into the correct location of an equation. This allows them to review key terms they will soon be using in their independent and cooperative instruction. After the educator and the students have discussed the vocabulary review, student can then beginning their independent learning activity. This activity provides detailed descriptions and examples of how to solve systems of equations by graphing. Have students work in independent and cooperative intervals. Give time for student to learn independently but check for understanding cooperatively with their peers. This allows students to use the language of math and

Table 5: cont.

Structure	
Day 1	
Vocabulary (3 minutes) Figure 6 page 1	$y = mx + b$ **Vocabulary Sort** When students enter your room and ask them to start working cooperatively and discussing where the difference vocabulary and illustrations will be place on the smart board.
Vocabulary (5 minutes) Figure 6 page 1	$y = mx + b$ **Vocabulary Sort** Call on students to come up to the smart board and drag the vocabulary terms and description to the correct location on the vocabulary sort smart board activity.
Instruction (10 minutes) Figure 7 page 1-6	**Solving Systems of Equations by Graphing** Use this self-guided lesson initially for independent learning but seat students in groups of three to allow an opportunity for cooperative learning later throughout the lesson. Encourage them to get as far as they can and to always work backwards if they get stuck. Walk around the room during this time lending advice and encouragement.
Instruction (5 minutes) Figure 7 page 1-6	**Solving Systems of Equations by Graphing** Allow time for a cooperative discussion and learning. Have the student asses what each group member has completed and compare work. If one has fallen behind and doesn't quite understand, it is up to the group to walk them through the process and guide their group members to understanding. This is where the verbal communication of vocabulary and explaining the mathematical process comes in handy.

vocabulary to explain the process taken to solve or graph. By allowing opportunities to discuss, students who may fall behind others can catch up while the ones who are ahead can deepen their skills by providing explanation and tutoring to others. The goal is to build students confidence and self-efficiency during their independent learning. There are challenge questions at the end of the independent learning activity which make for a great cooperative classroom discussion to close up the day. An exit slip, a short problem for students to work independently to provide the teacher with a clear view on who is

Table 5: cont.

Instruction (10 minutes) Figure 7 page 1-6	**Solving Systems of Equations by Graphing** Have the student return to the independent learning and be available to students who are still in need of aid while they are building their independent learning skills.
Instruction (5 minutes) Figure 7 page 1-6	**Solving Systems of Equations by Graphing** Allow another opportunity for cooperative learning and discussion. Have the students compare results and lend assistance to any student who has fallen behind.
Guided Practice (4 minutes) Figure 7 page 6	**Challenge** Check to see how far students have gotten on the lesson. If students have not finished the challenge section, work cooperatively as a class. If the majority of the students have finished the challenge, read the questions and have a cooperative classroom discussion on what type of responses they wrote. Encourage students to add any response they like to their paper.
Independent Practice (6 minutes) Figure 8	**Solving Systems Exit Slip** Each student must independently complete the solving systems exit slip. Asses each students exit slip and group them for tomorrow's activity where students who may be struggling have a member who can easy explain and lend support.

understanding, can be given to evaluate the days achievements and to help organize the cooperative groups for the next day's hands-on activity. The second day of this topic starts out with a cooperative review over what was learned independently. Choosing a problem from their independent learning activity they can review over their work and guide the teacher throughout reviewing over the procedures to solving systems by graphing. This gives the teacher opportunity to re-teach and have students provide verbal explanations and directions. The educator can lead the class and call students up to assist in the process. Once the review is completed, students will then be placed in groups to complete a cooperative learning activity with eight different stations. Each station is focused on solving systems of equations by graphing all generating from the knowledge

Table 5: cont.

Day 2	
Guided Practice (6 minutes) Figure 9	**Solving Systems of Equations by Graphing Guided Practice** Have students get out their independent lesson they worked yesterday and review over what was learned yesterday. Practice #2 on the solving systems by graphing section using the smart board. Call on students to come up to the smart board and graph or have students give verbal directions on how to solve the system by graphing.
Hands-On Activity Test Practice Vocabulary (42 minutes) Figure 10 page 1-10	**Graphing Systems** Have the students complete the stations cooperative learning activity which incorporates all material learned on the previous day. Be on "cruise control" as they complete the test practice problems and vocabulary. Offer encouragement and guidance as they work cooperatively. This activity is designed to be timed with five minutes allowed per station with a few minutes to gather material before class ends.

students gained from the previous days independent activity. The station may include test practice questions, vocabulary enrichment, matching or the use of a graphing calculator. Each figure of an activity or resource for solving systems of equations by graphing was designed for educators to use in their classroom without having to alter the margins or re-format. If the computer being used has the smart board software, educators can downloaded the activity by clicking on the link provided in the activity.

This model example in Table 5 provides an example of how the time frame of each structure can easily be altered to fit the needs of each topic, even when the topic's lesson is student or group lead. The teacher is encouraging use of vocabulary and checking for understanding throughout every topic covered in the classroom. Extra time was used in the lesson structure for solving systems of equations by graphing since the lesson was independently lead. Although some time was taken from other parts of the structure, this lesson still incorporated all six learning methods. Educators can easily adjust the time throughout the guideline in order for students to get the best possible experience from learning. Remember, each activity is provided with a cover page to help educators easily create lesson plans using the instructional model by topic shown in chapter III. The next chapter provides multiple cooperative and independent learning activities to incorporate throughout the Algebra course. Like the figures presented in this chapter and chapter IV, these activities allow educators to print and utilize them immediately in the classroom.

Figure 6: Vocabulary Sort $y = mx + b$ Cover Page

Vocabulary Sort $y = mx + b$
1 Page

TEKS
- Category 2: Describing and Graphing Linear Functions, Equations and Inequalities

Objective
- determine the terms and descriptions used to represent the variables of $y = mx + b$

Intentional Questions
- Where is the slope located in the equation?
- What are some other terms used to define slope?
- What does the constant number on the end of the equation represent?
- What are some other term that could be used to represent the y-intercept?
- Which of the picture represents the y-intercept?
- What values on the graph represent the range?
  What values on the graph represent the domain?

Structure
- Hands-On Activity
- Vocabulary

Types of Intelligence
- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

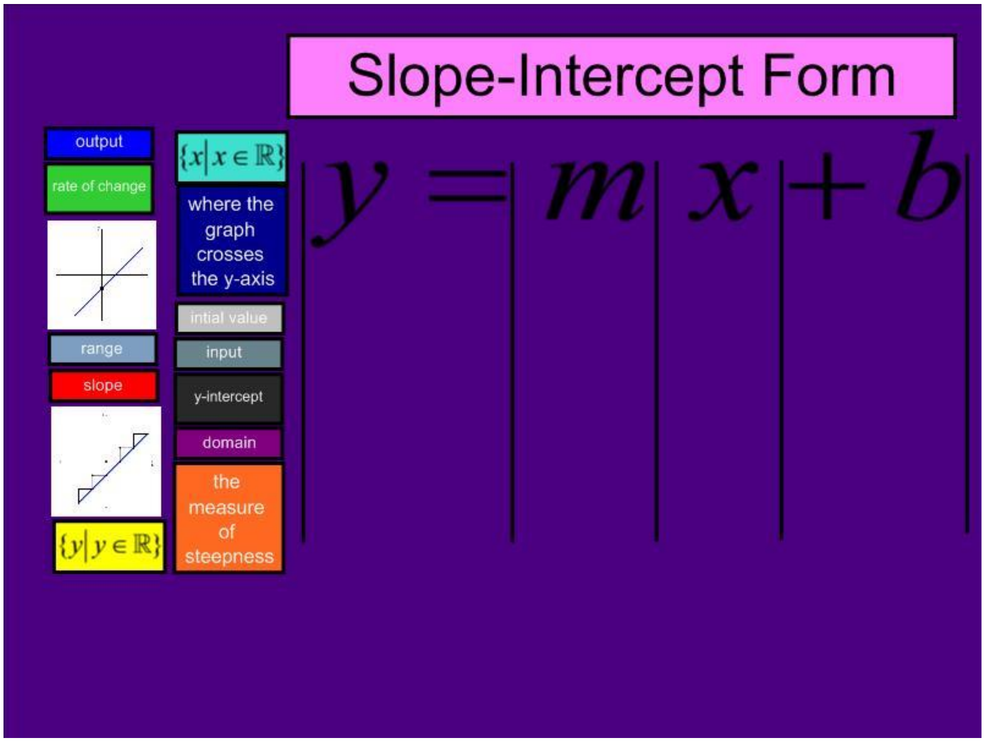
Learning Method
- Cooperative
- Independent
- Technology

Vocabulary
- range
- domain
- input
- output
- slope
- rate of change
- y-intercept
- initial value

Directions
- Correctly sort key vocabulary and descriptions to represent each part of the equation.
- Drag the vocabulary terms to the correct location on the equation.

Vocabulary Sort $y = mx + b$ (page 1)

y=mx+b.notebook



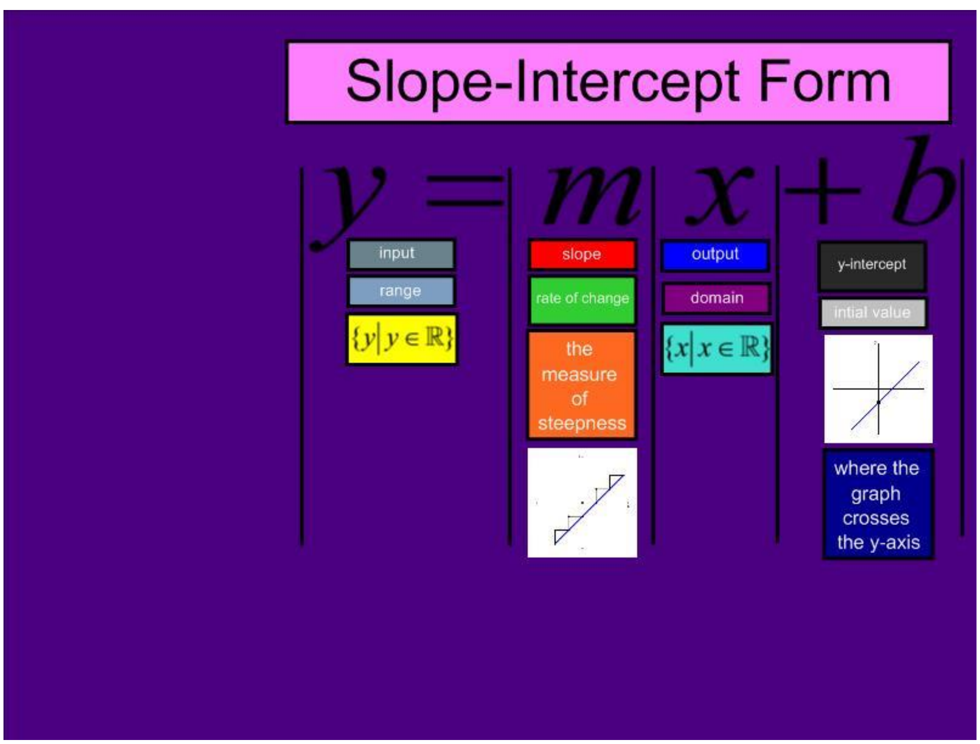


Figure 7: Solving Systems of Equations by Graphing Cover Page

Solving Systems of Equations by Graphing
6 pages

TEKS
- A.2(B): write linear equations in various forms
- A.3(A): determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$
- A.3(C): graph linear functions on the coordinate plane and identify key features, including-intercept, y-intercept, zeros and slope, in mathematical and real-world problems
- A.3(F): graph systems of two linear equations in two variables on the coordinate plane and determine the solutions if they exist

Objective
- find the solution to a system of equations
- use technology to support my findings
- explain how to find the solution to a system of equations

Intentional Questions
- Did you check to see if your graph was sketched correctly?
- Where is the solution to the system located?
- What are some other words you can use to describe where the solution is located?
- Can you name what quadrant the solution is located in?
- Where you bale to find the solution in your calculator?

Structure
- Instruction

Types of Intelligence
- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method
- Cooperative
- Independent
- Technology

Vocabulary
- system
- slope-intercept form
- slope
- y-intercept
- variable
- solution to a system
- parallel

Directions
- Read through the given material and use examples to work the practice problems.

Solving Systems of Equations by Graphing (page 1)

OBJECTIVE In this lesson you will be able to solve a system: two or more equations, by graphing.

MATERIALS NEEDED pencil, graphing calculator

REVIEW There are two aspects of solving a system by graphing that we have previously learned.

The first aspect is taking an equation and solving for y: isolating the y to one side of the equation. Below shows an example of how to solve for y. Look over the example and practice independently.

EXAMPLE OF SOLVING FOR Y

$$2x - 3y = 6$$
$$-2x \qquad\qquad -2x$$

$$\frac{-3y}{-3} = \frac{-2x}{-3} + \frac{6}{-3}$$

$$\boxed{y = \tfrac{2}{3}x - 2}$$

Solving for y

The objective is to rewrite the equation in slope-intercept form: $y = mx + b$

1. **Circle** the y and its coefficient. It needs to stay still while any remaining parts must be relocated.

2. **Move** the left overs to the other side of the equation. Remember, when you want to relocate a value, you must perform the opposite operation.

2. **Rewrite** the equation and perform the last relocation.

PRACTICE Complete the following two practice problems using the example above.

1. $3x - 4y = 8$

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

The second aspect is taking an equation in slope-intercept form: $y = mx + b$, and creating the graph.

EXAMPLE OF GRAPHING A LINE

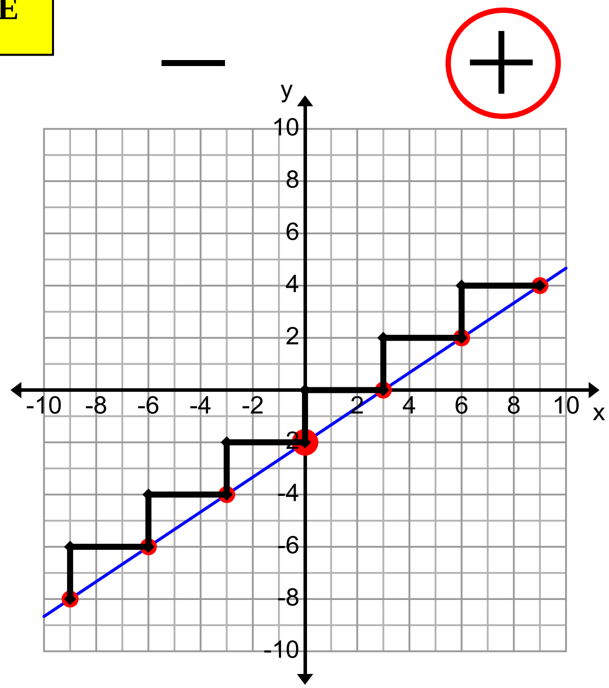
$y = \frac{2}{3}x - 2$

1. Plot the y-intercept of -2 .

2. The slope is $\frac{2}{3}$ so the graph will be increasing to the right.

3. $\frac{\Delta\, y}{\Delta\, x} = \frac{2 \text{ change in } y}{3 \text{ change in } x}$

4. Check your sketch using your graphing calculator.



Graphing a Line

The objective is to correctly graph a line on a coordinate plane: an x-axis and a y-axis.

1. Plot the y-intercept. The y-intercept: where the line touches the y-axis, is represented by the constant number on your equation. Locate that value on the y-axis and create a coordinate point on your graph.

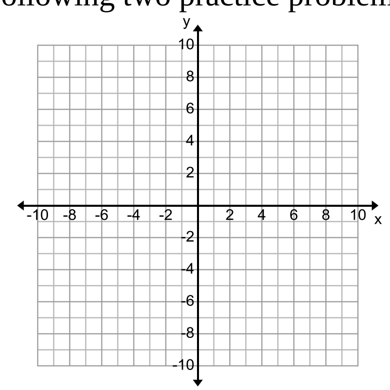
2. Positive/Negative? Use the value of the slope: measurement of the steepness, m, to determine if the line will be increasing to the right or decreasing from the left.

3. $\frac{\Delta\, y}{\Delta\, x}$ **.** Starting from your y-intercept, make additional points on the graph using your slope.

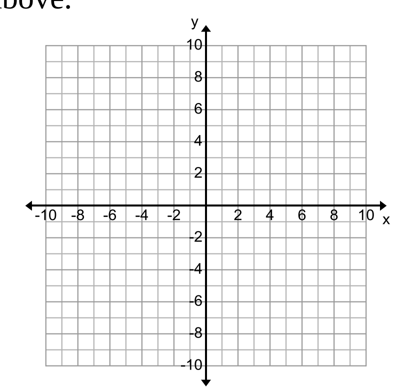
4. Check it! Using your calculator input the equation into the equation editor and push graph. Make sure your sketch matches the one on the graph.

PRACTICE Complete the following two practice problems using the example above.

1. $y = \frac{3}{4}x - 2$



2. $y = -3x - 4$



Now that we have reviewed over two key aspects lets learn to solve a system by graphing.

EXAMPLE OF SOLVING A SYSTEM BY GRAPHING

$$\begin{cases} y = 2x \\ x + 3y = 21 \end{cases}$$

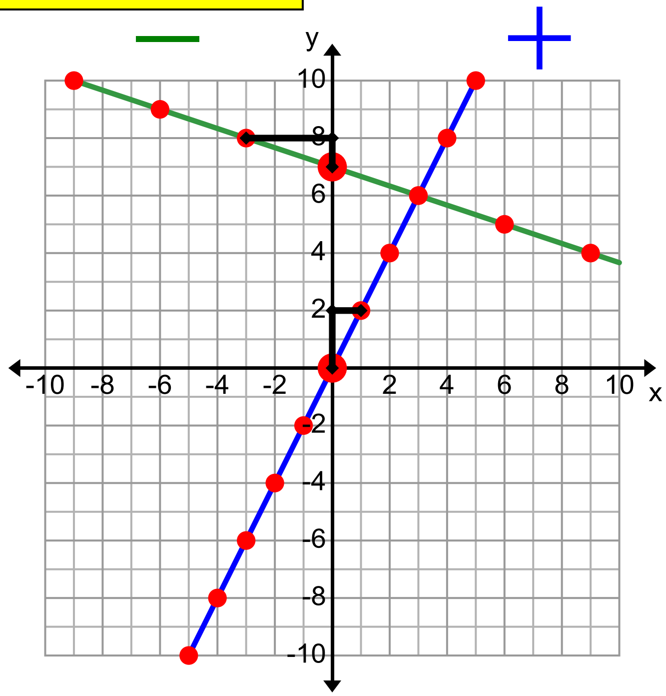
1. Solve for y on both equations.

$$\boxed{y = 2x}$$

$$x + 3y = 21$$
$$-x \qquad -x$$

$$\frac{3y}{3} = \frac{-x}{3} + \frac{21}{3}$$

$$\boxed{y = -\frac{1}{3}x + 7}$$



Solving a System by Graphing
The objective is to find the solution to a set of equations.

1. Solve for y on both equations. Both equations need to be in slope-intercept form: $y = mx + b$

2. Graph both equations. Start by graphing one line at a time.

3. Find the solution. The solution to a system: the point of intersection or where the two lines cross. The single x value and the single y value that occur on both lines.

2. Graph both equations.

$$\boxed{y = 2x}$$

1. Plot the y-intercept of 0 .

2. The slope is 2 so the graph will be increasing to the right.

3. $\dfrac{\Delta\, y}{\Delta\, x} = \dfrac{2 \text{ change in } y}{1 \text{ change in } x}$

$$\boxed{y = -\frac{1}{3}x + 7}$$

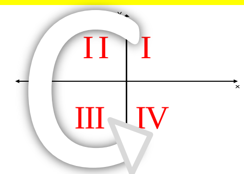
1. Plot the y-intercept of 7 .

2. The slope is $-\dfrac{1}{3}$ so the graph will be decreasing from the left.

3. $\dfrac{\Delta\, y}{\Delta\, x} = \dfrac{-1 \text{ change in } y}{3 \text{ change in } x}$

3. Find the solution.

The solution to the system $\begin{cases} y = 2x \\ x + 3y = 21 \end{cases}$ is $(3,6)$ and is located in quadrant I.

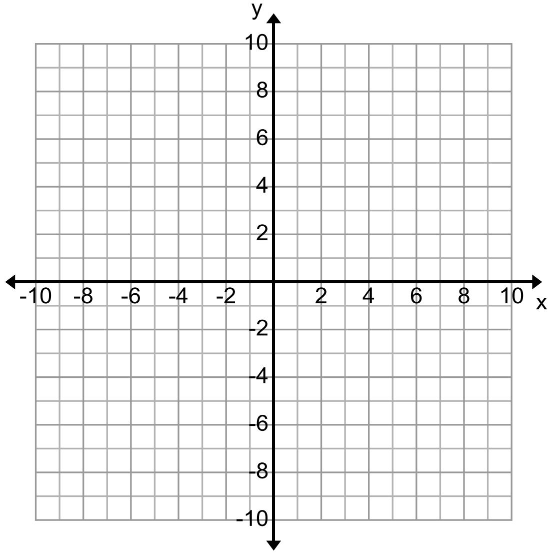


(page 4)

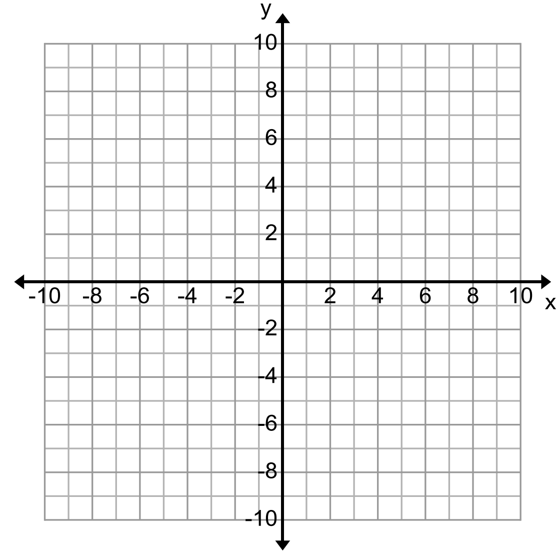
PRACTICE

Find the solution for each system below. Use the above example as a guide and answer the questions.

1. $\begin{cases} y = x \\ 2x + y = 3 \end{cases}$



2. $\begin{cases} y = \frac{1}{2}x + 1 \\ x + 2y = -10 \end{cases}$



What is the y-intercept of $y = x$?______

Is the slope positive or negative? ______

What is the slope of $y = x$? ______

What is the y-intercept of $2x + y = 3$? ______

Is the slope positive or negative? ______

What is the slope of $2x + y = 3$? ______

After you graph both lines, find the solution to this system. ______

What is the y-intercept of $y = \frac{1}{2}x + 1$?______

Is the slope positive or negative? ______

What is the slope of $y = \frac{1}{2}x + 1$? ______

What is the y-intercept of $x + 2y = -10$?______

Is the slope positive or negative? ______

What is the slope of $x + 2y = -10$? ______

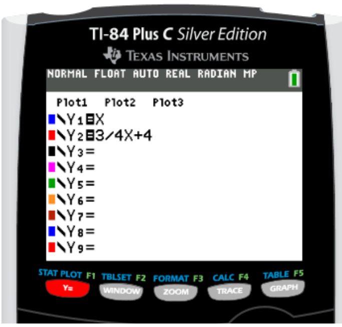
After you graph both lines, find the solution to this system. ______

(page 5)

Now that we have learned how to find a solution to a system by graphing, let's use our calculators to support our answers.

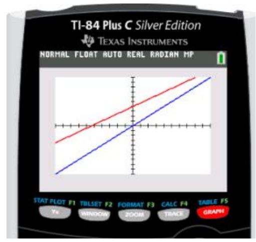
USING YOUR CALCULATOR TO SOLVE SYSTEMS

1. In the equation editor, input both equations of the system $\begin{cases} y = x \\ y = \dfrac{3}{4}x + 4 \end{cases}$



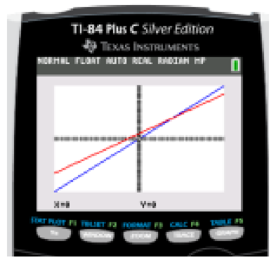
you see the intersection?

If you see the intersection, go to the next step.



If you do not see the intersection, you must push zoom, #3: Zoom Out and enter.

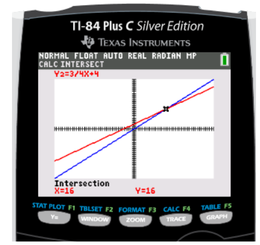
Wait for the screen to adjust and the lines will re-graph. If you see the intersection you may go to the next step.



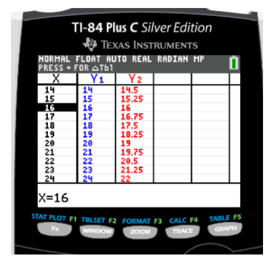
If you do not see the intersection push enter until you see the intersection, while pausing and giving your graph time to sketch in between each enter.

3. When looking at the graph it is easy to see what quadrant the solution is in but it may not be easy to see the numbers at which the two lines intersect.

To find the intersection push 2^{nd} , trace, # 5: intersection, enter, enter and enter.



The Solution will be on the bottom of the screen.



You can also check your solution in your table. Notice the only value where when $y_1 = y_2$ in the table is at (16,16)

PRACTICE

Use your calculator to find the solutions.

1. $\begin{cases} y = 3x + 4 \\ y = -2x - 1 \end{cases}$

The solution is __________.

2. $\begin{cases} y = x + 9 \\ y = -\dfrac{1}{2}x - 9 \end{cases}$

The solution is __________.

3. $\begin{cases} y = 4x + 12 \\ y = 5x - 2 \end{cases}$

The solution is __________.

(page 6)

CHALLENGE

1. What would you say is the solution to the system $\begin{cases} y = 2x \\ y = 2x - 5 \end{cases}$?

Write a response to this question using your previous knowledge of lines.

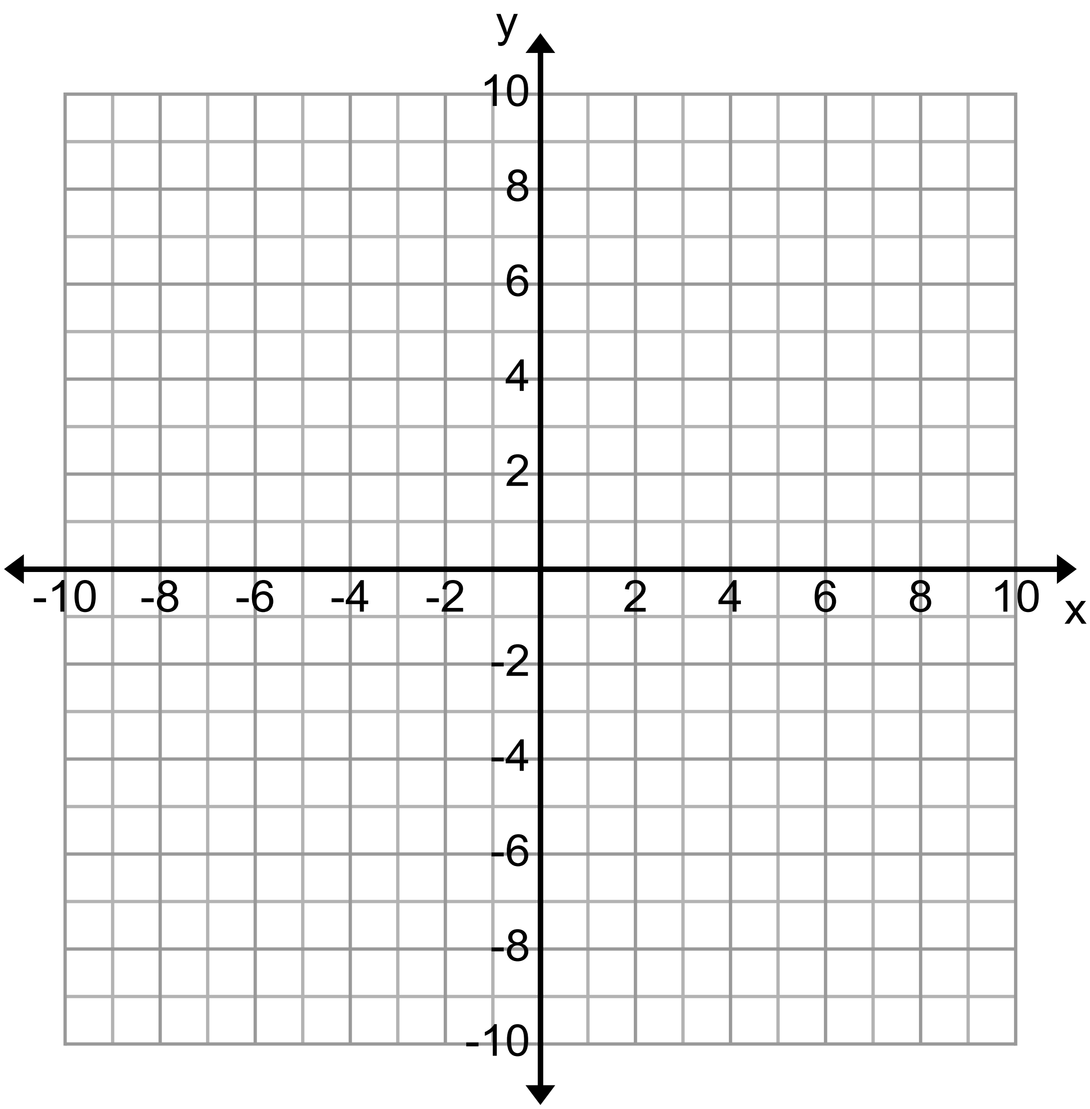
2. What would you say is the solution to the system $\begin{cases} y = 4 - \dfrac{1}{3}x \\ y = -\dfrac{1}{3}x + 4 \end{cases}$?

Write a response to this question using your previous knowledge of lines.

Figure 8: Solving Systems Exit Slip

Solving Systems Exit Slip

Graph and find the solution for the system $\begin{cases} y = x+1 \\ y = -x-10 \end{cases}$.



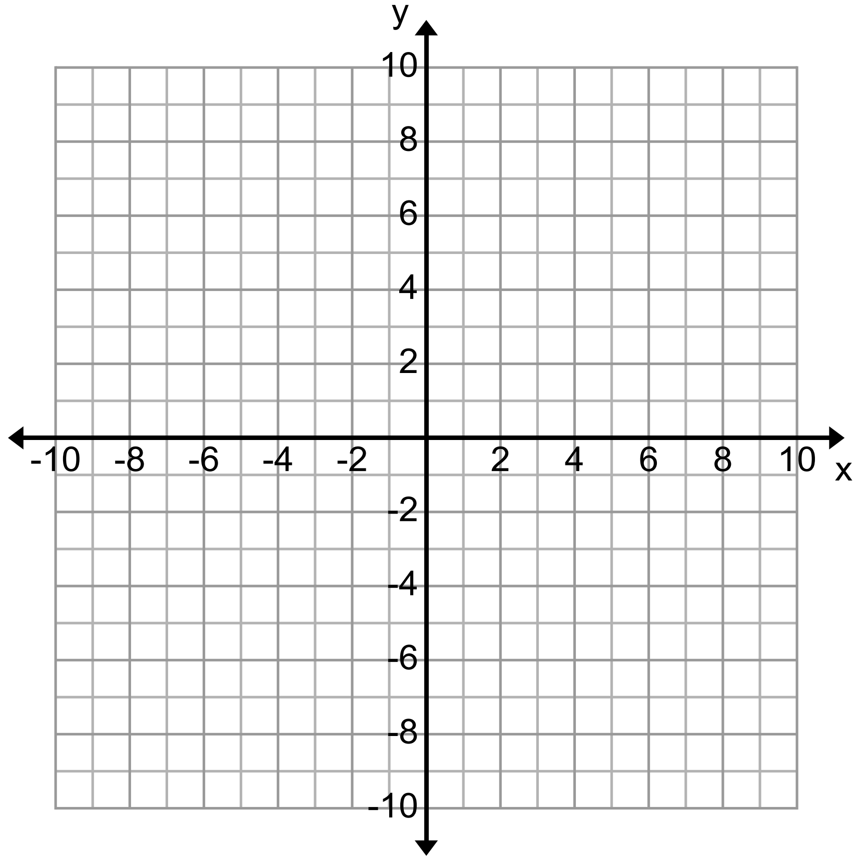
Solution:_______________

Figure 9: Solving Systems of Equations by Graphing Guided Practice

Solving Systems of Equations by Graphing Guided Practice

Graph the system show below and answer the following questions.

$$\begin{cases} y = \dfrac{1}{2}x + 1 \\ x + 2y = -10 \end{cases}$$



What is the y-intercept of $y = \frac{1}{2}x + 1$?______

Is the slope positive or negative? ______

What is the slope of $y = \frac{1}{2}x + 1$? ______

What is the y-intercept of $x + 2y = -10$?______

Is the slope positive or negative? ______

What is the slope of $x + 2y = -10$? ______

After you graph both lines, find the solution to this system. ______

Figure 10: Graphing Systems Cover Page

Graphing Systems

11 pages

TEKS

- A.3(F): graph systems of two linear equations in two variables on the coordinate plane and determine the solutions if they exist.

Objective

- find the solution to a system of equations
- use technology to support my findings
- explain how to find the solution to a system of equations

Intentional Questions

- Why must you re-write the equation in slope-intercept for?
- Where is the slope located in the equation?
- What does the constant number on the end of the equation represent?
- What is the first step in graphing a line?
- After you plot the y-intercept, what is the next step in graphing the line?
- After you determine the direction of the line, how do you know where to place the other coordinate on your graph?
- When you plug those equations into your graph, what quadrant is the solution located in?

Structure

- Test Practice
- Hands-On Activity: Stations
- Vocabulary

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method

- Cooperative
- Independent
- Technology

Vocabulary

- system
- solutions to a system
- slope
- equation
- parallel
- y-intercept

Directions

- Each station will be placed around the room for students in groups of three or more. Rotate every five minutes. Directions are included with each station.
- Cut out all material and place in stations.
- Station 1: Is it a solution?
- Station 2: Systems Matching with Graphs
- Station 3:Technology
- Station 4:Test Practice
- Station 5:Vocabulary Fill in the Blank
- Station 6:Graphing By Hand
- Station 7: How Many Solutions?
- Station 8:Solving Systems Matching

Station 1: Is it a solution?

Determine whether the given coordinate point is the solution to the system. Record your answers on your answer document and show all work if necessary.

1. Is $(0,1)$ the solution for the system $\begin{cases} y = x+1 \\ y = -x+1 \end{cases}$?

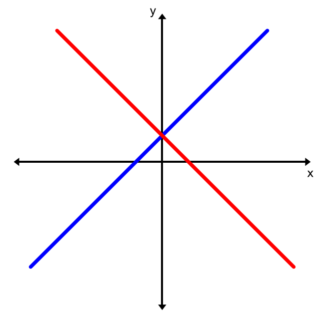
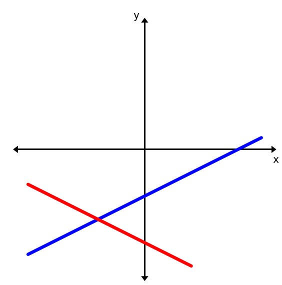
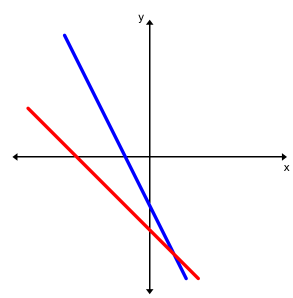
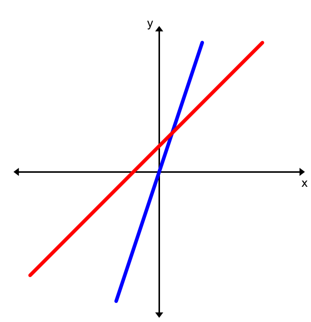
2. Is $(1,3)$ the solution for the system $\begin{cases} y = 3x \\ y = x+1 \end{cases}$?

3. Is $(1,-4)$ the solution for the system $\begin{cases} y = -2x-2 \\ x-y = -3 \end{cases}$?

4. Is $(-4,-4)$ the solution for the system $\begin{cases} y = \dfrac{1}{2}x-2 \\ x+y = -8 \end{cases}$?

Station 2: Systems Matching with Graphs

Match each system with its graph. Record your answers on your answer document and show all work if necessary.

5. $\begin{cases} y = x+1 \\ y = -x+1 \end{cases}$	
6. $\begin{cases} y = \dfrac{1}{2}x - 2 \\ x + 2y = -8 \end{cases}$	
7. $\begin{cases} y = -2x - 2 \\ x + y = -3 \end{cases}$	
8. $\begin{cases} y = 3x \\ y = x+1 \end{cases}$	

Station 3: Technology

Use your calculator to find the solution and round to the nearest tenth. Record your answers on your answer document and show all work if necessary.

9. $$\begin{cases} y = 2x + 11 \\ y = -2x - 1 \end{cases}$$

10. $$\begin{cases} y = -\dfrac{5}{2}x + 2 \\ y = \dfrac{1}{2}x - 1 \end{cases}$$

11. $$\begin{cases} 4x + y = 13 \\ 3x + y = -1 \end{cases}$$

12. $$\begin{cases} y = x \\ y = \dfrac{1}{3}x - 9 \end{cases}$$

Station 4: Test Practice

Read the questions below and select the correct answer choice.
Record your answers on your answer document and
show all work if necessary.

13. Which of the following represents the x-value for the solution to the system $\begin{cases} y = 2x + 11 \\ y = -\frac{2}{3}x - 3 \end{cases}$ rounded to the nearest tenth?

a. $.5$

b. -5

c. -5.3

d. -5.2

14. Which system has the same solution as the system $\begin{cases} 5x + 2y = 2 \\ 2x - y = -1 \end{cases}$?

a. $\begin{cases} y = x - 1 \\ y = -x + 1 \end{cases}$

b. $\begin{cases} y = x + 1 \\ y = -x - 1 \end{cases}$

c. $\begin{cases} y = x - 1 \\ y = -x - 1 \end{cases}$

d. $\begin{cases} y = x + 1 \\ y = -x + 1 \end{cases}$

Station 4: cont. (page 5)

15. What quadrant does the solution for the following system occur within?

$$\begin{cases} 2x - y = 13 \\ 3x + 2y = 1 \end{cases}$$

a. Quadrant I

b. Quadrant II

c. Quadrant III

d. Quadrant IV

16. The county fair charges a $5 entrance fee and $2 per ride. The state fair charges $8 entrance fee and $1 per ride. Write a system of equations to represent the total amount paid per ride the county and state fair.

a. $\begin{cases} y = 2x + 5 \\ y = x + 8 \end{cases}$

b. $\begin{cases} y = 5x + 2 \\ y = 8x + 1 \end{cases}$

c. $\begin{cases} y = 5x + 1 \\ y = 8x + 2 \end{cases}$

d. $\begin{cases} y = 2x + 1 \\ y = 5x + 8 \end{cases}$

Station 5: Vocabulary

Read the questions below and fill in the blank with one of the given vocabulary words. Record your answers on your answer document and show all work if necessary.

Word Bank

line	system	infinite	adjacent
graph	one	two	slope
equation	none	parallel	y-intercept

17. A __________consists of two or more equations.

18. In order to graph a line you must first plot the __________.

19. When two equations in a system are identical, they will have __________ solutions.

20. Two lines that will never cross are called __________ lines.

Station 6: Graphing By Hand

Solve the system of equations by graphing. Record your answers on your answer document and how all work if necessary.

21. Find the solution to the following system by graphing.

$$\begin{cases} y = 2x + 3 \\ y = -x - 3 \end{cases}$$

22. Find the solution to the following system by graphing.

$$\begin{cases} x - 2y = 8 \\ x + 4y = -4 \end{cases}$$

Station 7: How Many Solutions?

Determine whether the given system has one, none or infinite solutions. Record your answers on your answer document and show all work if necessary.

23. $$\begin{cases} y = 3 - x \\ y = -x - 3 \end{cases}$$

24. $$\begin{cases} y = 2x + 3 \\ y = -x + 3 \end{cases}$$

25. $$\begin{cases} y = 1 - 4x \\ y = -4x - 1 \end{cases}$$

26. $$\begin{cases} y = -2x + 3 \\ y = 3 - 2x \end{cases}$$

Station 8: Solving Systems Matching

Match the given systems with their solution.
Record your answers on your answer document
and show all work if necessary.

27. $\begin{cases} y = \frac{1}{2}x - 10 \\ y = -2x - 5 \end{cases}$	$(2, -9)$
28. $\begin{cases} x + 4y = -8 \\ x + 2y = 6 \end{cases}$	$(20, -7)$
29. $\begin{cases} 4x + y = 2 \\ y = 2x - 4 \end{cases}$	$(1, -2)$
30. $\begin{cases} 3x + y = -9 \\ x + y = 5 \end{cases}$	$(-7, 12)$

Graphing Systems (page 10)

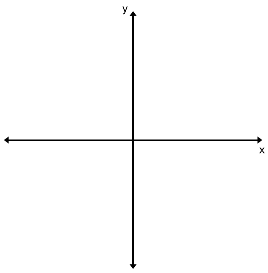
1.

2.

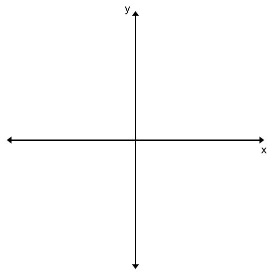
3.

4.

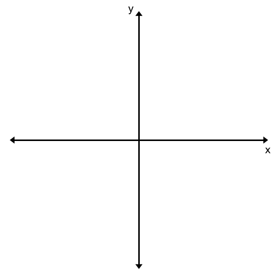
5.



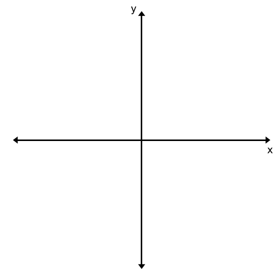
6.



7.



8.



9. (,)

10. (,)

11. (,)

12. (,)

13.

14.

15.

16.

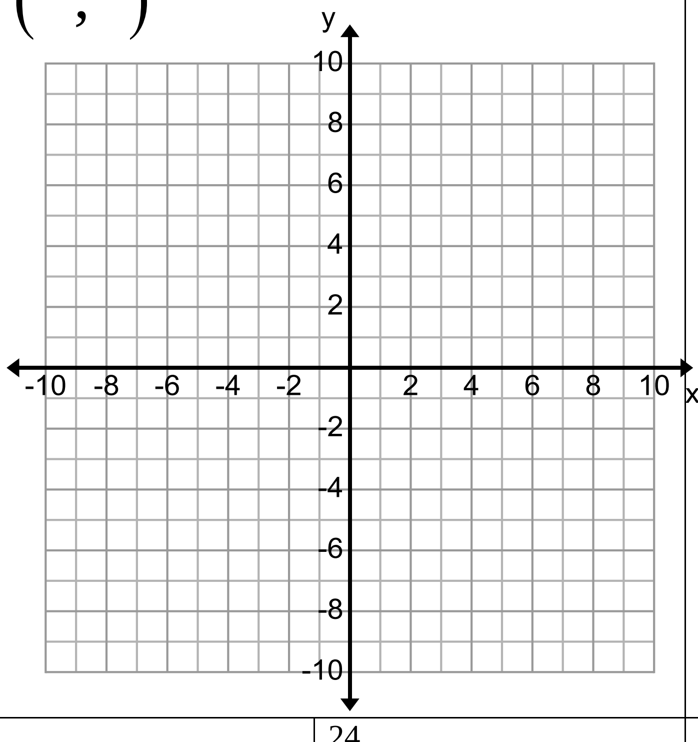
17.

18.

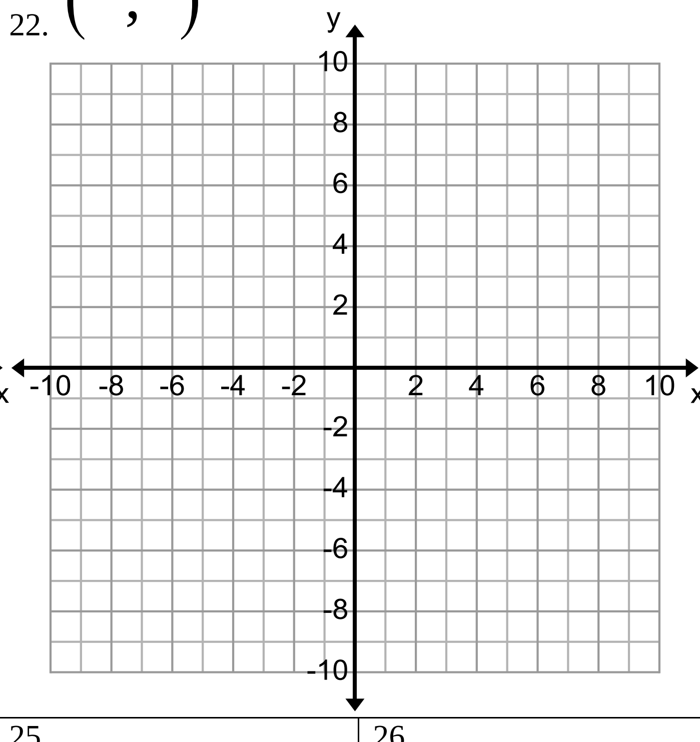
19.

20.

21. (,)



22. (,)



23.

24.

25.

26.

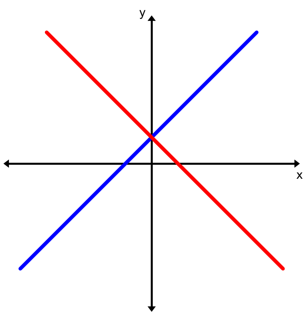
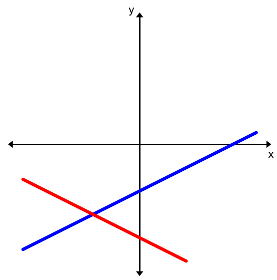
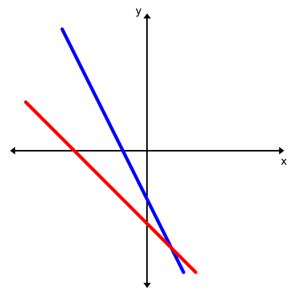
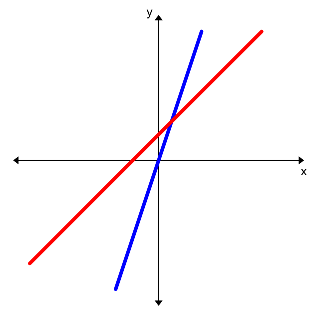
27. (,)

28. (,)

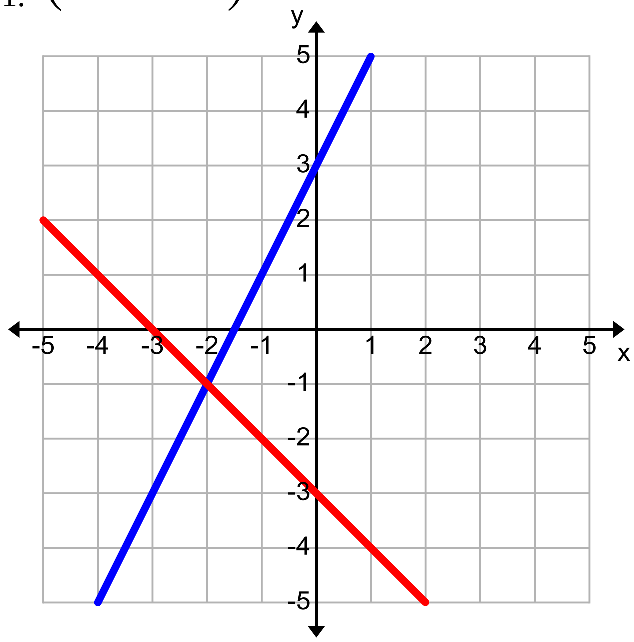
29. (,)

30. (,)

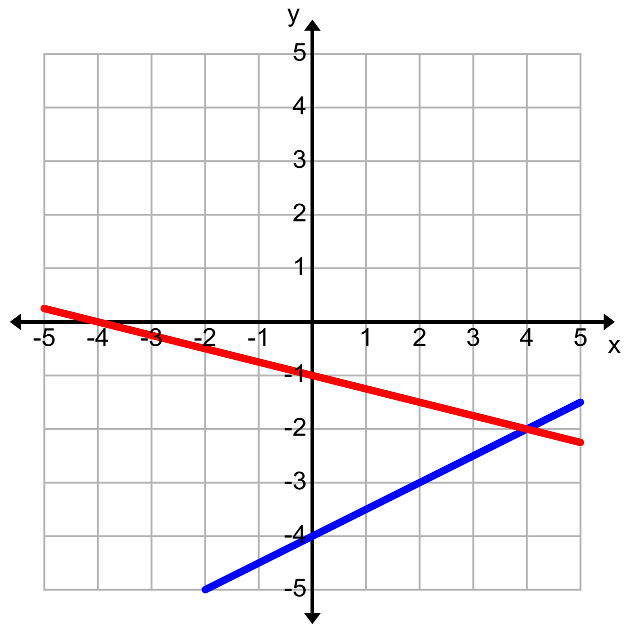
Graphing Systems Key (page 11)

1. yes	2. no	3. no	4. yes
5. 	6. 	7. 	8. 
9. $(-3,5)$	10. $(1,-.5)$	11. $(14,-43)$	12. $(-13.5,-13.5)$
13. c	14. d	15. d	16. b
17. system	18. y-intercept	19. infinite	20. parallel

21. $(-2,-1)$



22. $(4,-2)$



23. none	24. one	25. none	26. infinite
27. $(2,-9)$	28. $(20,-7)$	29. $(1,-2)$	30. $(-7,12)$

CHAPTER VI

COOPERATIVE AND INDEPENDENT LEARNING ACTIVITIES

This chapter provides several activities that are currently applicable to the Algebra course. They have been designed to fit different Algebra classrooms, classrooms with ten students or classrooms with thirty, these activities will incorporate many of the Algebra TEKS and be applicable to multiple types of intelligences. Table 6 shows a quick guide to activities and resources developed and presented in this chapter. The margins of these activities are set to allow educators to print and use these examples without having to adjust or reformat.

Educators have a huge advantage with the growing availability of materials to use in the classroom. Searching for an activity over the World Wide Web can be overwhelming especially when looking for an activity to use in the Algebra classroom that focuses on a specific topic and incorporates different learning styles. Activities can often come from several different sources and usually need to be altered to fit the Algebra classroom. Also, creating activities can be very time consuming where educators find themselves working overtime to create meaningful activities. The activities, within this chapter and following chapters, support and integrate cooperative learning, independent learning, hands-on activities, use of technology and vocabulary enrichment. These activities allow immediate assistance in integrating the instructional model by topic. They incorporate multiple intelligences such as verbal-linguistic, logical-mathematical, spatial, bodily-kinesthetic and intrapersonal.

Table 6: List of Cooperative and Independent Activities

Activity	TEKS 2015-2016	Intelligence	Learning Method	Page
Solving Equations	A.5(B)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative	90
Exponential Rules of Multiplication	A. 10(B) A.11(B)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	93
Finding the Slope or Y-Intercept	A.3(A) A.3(B)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	97
Factoring and Distribution	A.7(B) A.8(A) A.10(B) A.10(D) A.10(E)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	118
Inequality Graphs and Equations	A.3(D)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	139
Simplifying Exponents	A.11(B)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	147
Linking Situations to Systems	A.2(I) A.3(G) A.5(C)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	156
Simplifying Radicals	A.11(A) A.11(B)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	163
Vertex Form	A.7(A)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent	170

Figure 11 is a classroom cooperative activity involving solving one and two step equations through a BINGO game. Teachers are encouraged to place students in teams where each student contains a white board to show work throughout the activities. Have this bingo card printed to give to students who are causing a distraction and ask them to complete the activity on their own. This type of activity is a great way to monitor the entire class and immediately see their progress on a specific topic.

Figure 12 is an example of an independent activity involving exponential rules of multiplication. Giving the students a change of pace and allowing them to simply cut and paste objects on their worksheet is an easy way to bring hands-on into a lesson. Allowing them the opportunity to cut and paste gets their body moving and brings energy to the classroom. This hands-on activity can also be used to introduce the new material. Allow students to work together to try and figure out where each piece should be placed. Have the students draw conclusions on the rules that apply when multiply exponents.

Figure 13 and Figure 14 are examples of an around the room activity. This cooperative activity allows student to be out of their desk and moving around the room. Teachers can be on "cruise control" continuously walking around the room to lend aid to any student who is struggle. The around the room activity really allows teachers to spend time with students who need more instruction and guided practice. It is immediately aware to the teacher when a student is unable to progress to the next question. On simple worksheets, students have the ability to skip problems when they are not completely understood. On the around the room activity, students are required to finish a specific problem before they can advance to the next.

Figure 15 through Figure 19 are activities involving matching manipulatives.

These manipulatives can be cut out and sorted for students to work independently or cooperatively. Teachers can color coat each section to make it easier for students to sort and they can also be magnetized and used on the white board for all-year-round use.

Each figure provided gives educators a printable resource to use immediately in the classroom. With the updated TEKS and changing curriculum, resources for Algebra can be difficult to locate. From matching, cut and paste to around the room, students are moving and creating energy that can allow for positive learning experiences. These activities are based off of the TEKS used in the Algebra course and provide an opportunity for teachers to easily implement independent and cooperative activities throughout the course. These activities can also serve as a format and can altered to fit any classroom need. The next chapter provides educators with more resources to use in the classroom. These resources are created for students to integrate technology in the classroom.

Figure 11: Solving Equations Cover Page

Solving Equations

2 pages

TEKS

- A.5(A): solve linear equations in one variable, including those for which the application of the distributive property is necessary and for which variables are included on both sides

Objectives

- solve equations with one variable
- solve equations with variables on both sides
- solve equations using the distributive property
- explain the process of solving mutli-step equations

Intentional Questions

- What are we solving for?
- What is the first step in solving this equation?
- Do we need to distribute?
- When distributing, what mathematical property are we using? Addition? Subtraction? Multiplication? Division?
- Is there a way to check your work?

Structure

- Hands-On Activity: BINGO

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-On
- Cooperative
- Independent

Vocabulary

- Solve
- Distribute
- Linear
- Variable

Directions

- Each Student will be given a blank bingo card.
- Display answer card and tell them to write the numbers all over their bingo card in a different order than what is seen on the bored. The equations card has the corresponding equations to each solution on the answer card.
- Randomly select and equation and have each student solve the equation on a small white board or scratch piece of paper.
- Once they have solved, they will mark the box with that solution.
- Five in a row wins.
- Alternate forms of bingo include; working in groups or teams, x marks the spot bingo, one vertical and one horizontal bingo, etc.

Solving Equations (page 1)

Answer Card

B	I	N	G	O
-8	-6	-4	-2	0
$-\frac{1}{8}$	$-\frac{1}{6}$	$-\frac{1}{4}$	$-\frac{1}{2}$	$-\frac{7}{2}$
$-\frac{5}{2}$	$-\frac{3}{2}$	**FREE**	$\frac{8}{3}$	$\frac{4}{3}$
$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{7}$	$\frac{1}{9}$
1	3	5	7	9

Equations Card

B	I	N	G	O
$3x+1=x-15$	$4x+15=2x+3$	$x+8=-2x-4$	$5x+7=1+2x$	$-3x+2=2-7x$
$8x+5=4$	$12x+6=4$	$4x+7=6$	$6x-4=-7$	$2x+5=-2$
$-2(2x-1)=8$	$-2(x+4)=-5$	**FREE**	$-(3x-5)=-3$	$2(-3x+7)=6$
$-9x=-6$	$3x=1$	$-10x=-2$	$21x=3$	$-81x=-9$
$0.25x+7.5=7.75$	$0.6x+2.8=4.6$	$-1.2x-6=-12$	$-1.4x-.2=-10$	$-0.5x+3=-1.5$

Solving Equations (page 2)

B	I	N	G	O
		FREE		

Solving Equations

B	I	N	G	O
		FREE		

Figure 12: Exponential Rules of Multiplication Cover Page

Exponential Rules of Multiplication

3 pages

TEKS

- A.11(B): simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents

Objectives

- simplify exponential expressions
- discuss the laws of exponents

Intentional Questions

- Should you add the exponents?
- Should you multiply the exponents?
- What happens to the coefficients?
- How many different variables are in this expression?

Structure

- Instruction
- Hands-On Activity: Cut & Paste

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-on
- Cooperative
- Independent

Vocabulary

- variable
- expression
- exponent
- base
- integer
- simplify

Directions

- Have each student cut out each piece and paste them on their worksheet in the correct category.

Exponential Rules of Multiplication (page 1)

1. $(x^3)(x^4)$	$-4\cdot 4\cdot 2\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot y\cdot y\cdot y\cdot y$	$27y^5$
2. $(xy^2)(x^5y^3)$	$-1\cdot -2\cdot 5\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x$	$30x^5y^6$
3. $-3(x^2)(x^3)(x^4)$	$2\cdot 3\cdot 5\cdot x\cdot x\cdot x\cdot x\cdot x\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y$	$10x^{10}$
4. $(-2x^2)(x^2)(4x^3)(x)$	$-3\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x$	x^6y^5
5. $-(-2x^7)(5x^3)$	$x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot y\cdot y\cdot y\cdot y\cdot y$	$12x^3y^2z^7$
6. $(-3y)(-3y^2)(3y^2)$	$3\cdot -4\cdot -1\cdot x\cdot x\cdot x\cdot y\cdot y\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z\cdot z$	$27x^3y^9$
7. $2(3x^2y^4)(5x^3y^2)$	$3\cdot 3\cdot 3\cdot x\cdot x\cdot x\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y\cdot y$	x^7
8. $-4(4xy^2)(x^4y)(2xy)$	$-2\cdot 4\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x$	$-3x^9$
9. $(3xy^3)(xy^3)(3x)(3y^3)$	$x\cdot x\cdot x\cdot x\cdot x\cdot x\cdot x$	$-32x^6y^4$
10. $3(-4x^2yz^3)(-xz^3)(yz)$	$-3\cdot -3\cdot 3\cdot y\cdot y\cdot y\cdot y\cdot y$	$-8x^8$

Exponential Rules of Multiplication (page 2)

Directions: Cut out each piece and correctly paste them in the correct category below.

Problem	Expanded Form	Simplified Form
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Exponential Rules of Multiplication Key (page 3)

Problem	Expanded Form	Simplified Form
1. $(x^3)(x^4)$	$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	x^7
2. $(xy^2)(x^5y^3)$	$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y$	x^6y^5
3. $-3(x^2)(x^3)(x^4)$	$-3 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$-3x^9$
4. $(-2x^2)(x^2)(4x^3)(x)$	$-2 \cdot 4 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$-8x^8$
5. $-(-2x^7)(5x^3)$	$-1 \cdot -2 \cdot 5 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$	$10x^{10}$
6. $(-3y)(-3y^2)(3y^2)$	$-3 \cdot -3 \cdot 3 \cdot y \cdot y \cdot y \cdot y \cdot y$	$27y^5$
7. $2(3x^2y^4)(5x^3y^2)$	$2 \cdot 3 \cdot 5 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$	$30x^5y^6$
8. $-4(4xy^2)(x^4y)(2xy)$	$-4 \cdot 4 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y$	$-32x^6y^4$
9. $(3xy^3)(xy^3)(3x)(3y^3)$	$3 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$	$27x^3y^9$
10. $3(-4x^2yz^3)(-xz^3)(yz)$	$3 \cdot -4 \cdot -1 \cdot x \cdot x \cdot x \cdot y \cdot y \cdot z \cdot z \cdot z \cdot z \cdot z \cdot z \cdot z$	$12x^3y^2z^7$

Figure 13: Finding the Slope or Y-Intercept

Finding the Slope or Y-intercept

20 pages

TEKS

- A.3(A): determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$
- A.3(B): calculate the rate of change of a linear function represented tabularly, graphically, or algebraically in context of mathematical and real-world problems

Objectives

- determine the slope/y-intercept given a table, graph, equation or situation
- discuss the process of finding slope/y-intercept from different given information

Intentional Questions

- How do you calculate the slope/y-intercept given a table?
- How do you find the slope/y-intercept given a graph?
- Where is the slope/y-intercept in an equation in slope-intercept form?
- What are other terms used to represent slope/-intercept?

Structure

- Hands-On Activity: Around the Room

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

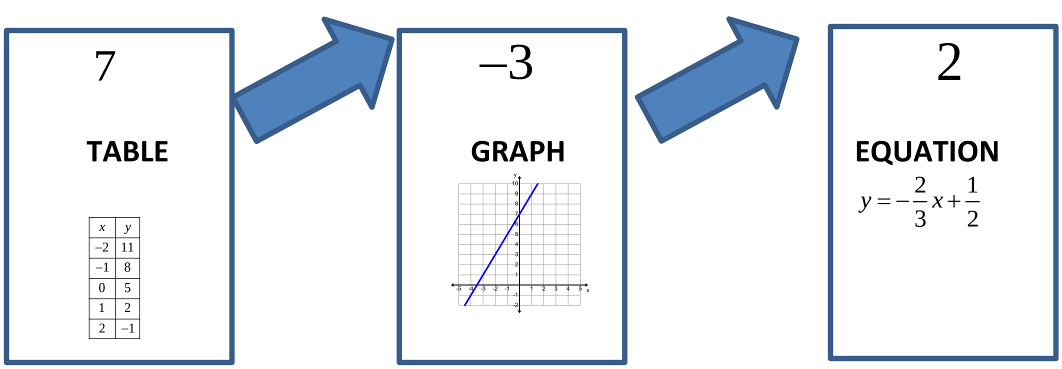
- Hands-on
- Cooperative
- Independent

Vocabulary

- slope, rate of change, m
- y-intercept, initial value, b

Directions

- Each separate sheet below will be placed all around the room.
- To make the activity easier, place the pages in order. To make the activity more difficult do not put the sheets around the room in the order below, mix them up.
- The students can be told to find the slope OR y-intercept of a given a table, graph, or situation.
- Once they have found the slope/y-intercept they will locate the sheet around the room with the corresponding answer. They will then go to that station and repeat finding the slope of the given a table, graph, or situation.



(page 1)

7

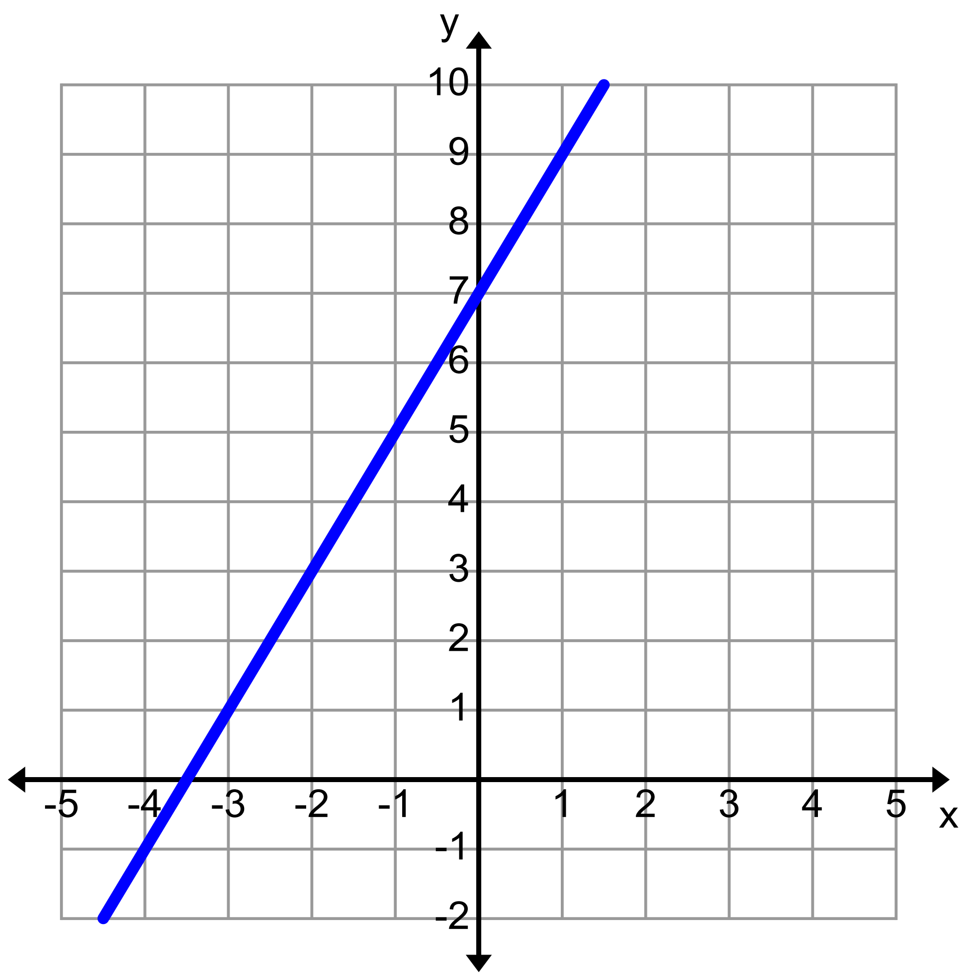
TABLE

x	y
–2	11
–1	8
0	5
1	2
2	–1

(page 2)

-3

GRAPH



(page 3)

2

EQUATION

$$y = -\frac{2}{3}x + \frac{1}{2}$$

(page 4)

$$-\frac{2}{3}$$

SITUATION

Johnny is going to attend the local fair with some friends. The entrance fee is \$8 per person and it costs \$3 per ride.

(page 5)

3

TABLE

x	y
–5	–5
–4	–6
–3	–7
–2	–8
–1	–9

(page 6)

-1

SITUATION

Lidia is purchasing t-shirts from Amazon. Each t-shirt cost $8 and Amazon charges their customers a flat ship rate of $4.

(page 7)

8

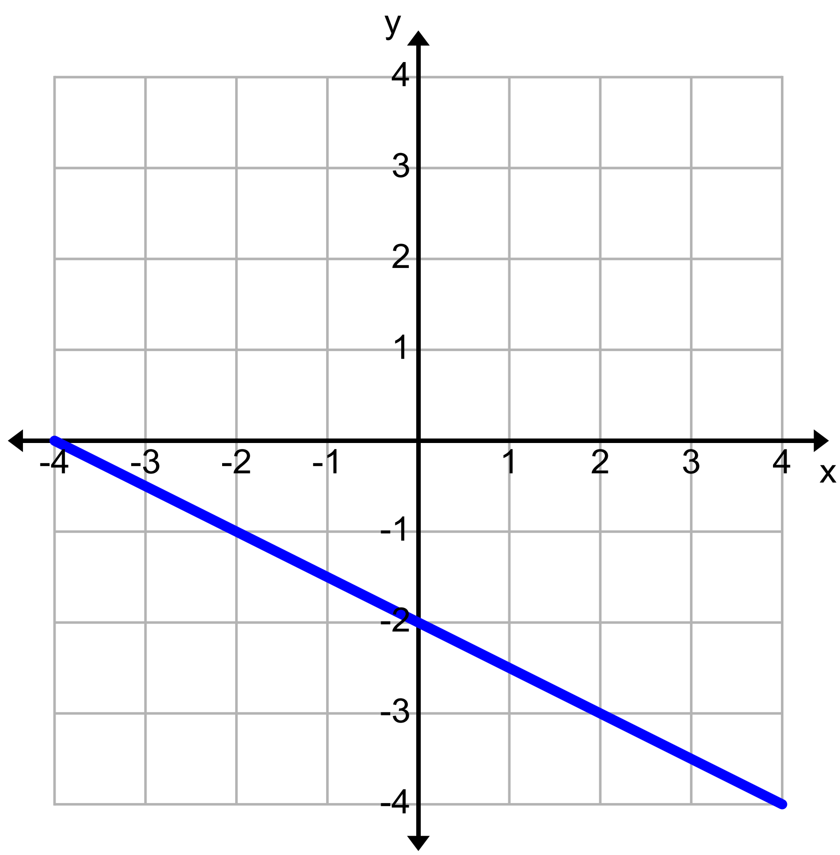
EQUATION

$$y = -5x - \frac{1}{4}$$

(page 8)

-5

GRAPH



(page 9)

$$-\frac{1}{2}$$

SITUATION

James is taking his car to get washed at the local Scrubbley Bubbley. The basic wash cost \$3 and an additional \$1 for each add on such as; tire shine, bumper shine, wax, etc.

(page 10)

1

TABLE

x	y
4	–1
6	0
8	1
10	2
14	4

(page 11)

$$\frac{1}{2}$$

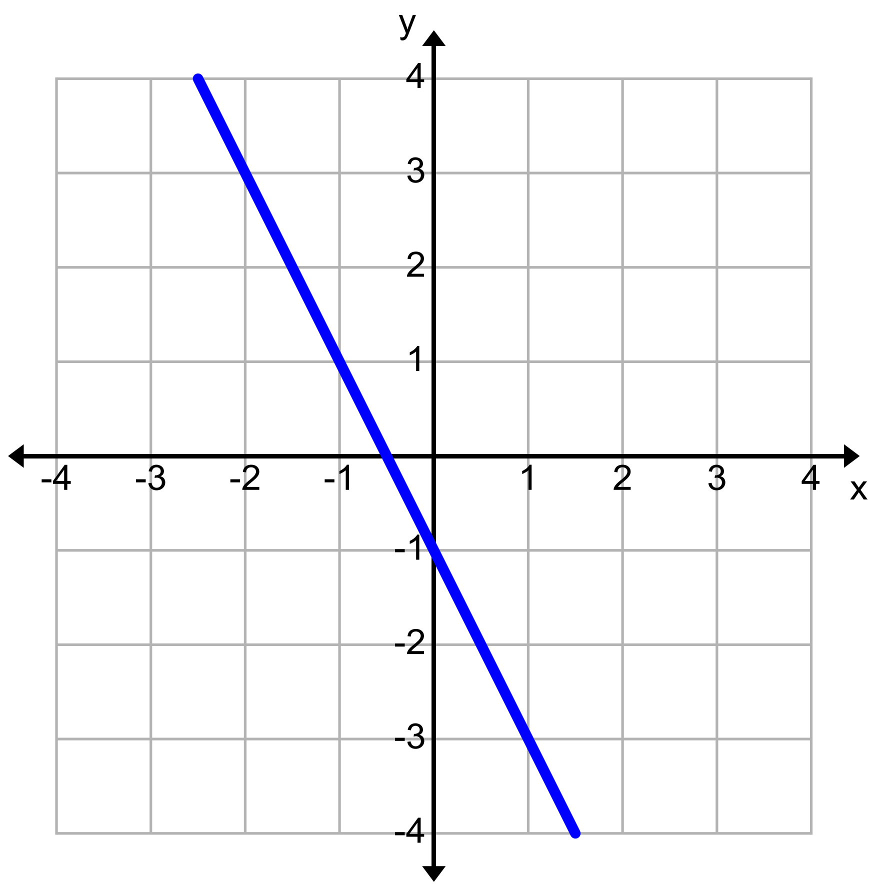
EQUATION

$$y = -10x - \frac{2}{3}$$

(page 12)

–10

GRAPH



(page 13)

–2

TABLE

x	y
–2	–6
1	6
2	10
3	14
6	26

(page 14)

4

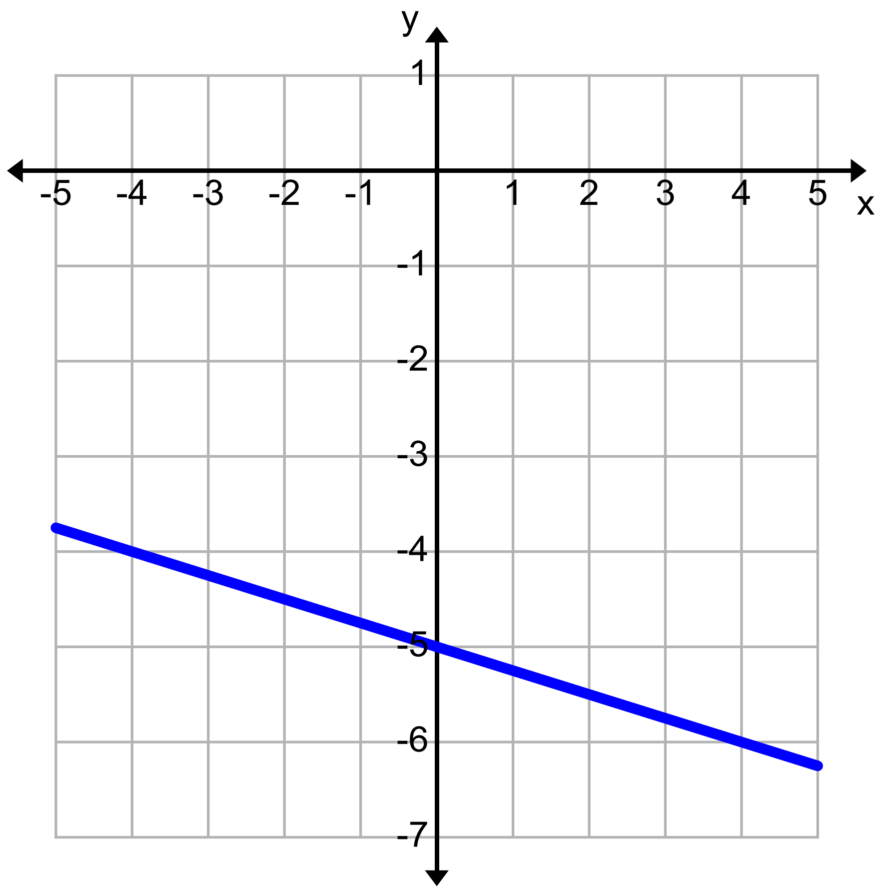
SITUATION

Monica has $1 in her savings jar. She decides to start saving $5 each month.

(page 15)

5

GRAPH



(page 16)

$$-\frac{1}{4}$$

EQUATION

$$y = 7x - \frac{1}{2}$$

Finding Slope (page 17)

1.
2.
3.
4.
5.
6.
7.
8.

(page 18)

9.
10.
11.
12.
13.
14.
15.
16.

Slope Key (page 19)

7 →	-3 →	2 →	$-\frac{2}{3}$
↑			↓
$-\frac{1}{4}$			3
↑			↓
5			-1
↑			↓
4			8
↑			↓
-2			-5
↑			↓
-10	← $\frac{1}{2}$	← 1	← $-\frac{1}{2}$

Y-intercept Key (page 20)

7	→	5	→	-5	→	-2
↑						↓
-3						2
↑						↓
1						$\frac{1}{2}$
↑						↓
4						$-\frac{2}{3}$
↑						↓
-1						8
↑						↓
-10	←	3	←	$-\frac{1}{2}$	←	$-\frac{1}{4}$

Figure 14: Factoring or Distribution Cover Page

Factoring or Distribution

20 pages

TEKS

- A.7(B): describe the relationship between the linear factors of quadratic expressions and the zeroes of their associated quadratic functions
- A.8(A): solve quadratic equations having real solutions by factoring, taking the square root, completing the square, and applying the quadratic formula
- A.10(B): multiply polynomials of degree one and degree two
- A.10(D): rewrite polynomial expressions of degree one and degree two in equivalent forms using the distributive property
- A.10(E): factor, if possible, trinomials with real factors in the form $ax^2 + bx + c$, including perfect square trinomials of degree two

Objectives

- determine the factors of a quadratic expression and write in factored form
- distribute in order to write in standard form

Intentional Questions

- What is the first step in factoring a quadratic?
- Is there another way of writing your factored form?
- How do you check your answer?

Structure

- Hands-On Activity: Around the Room

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-on
- Cooperative
- Independent

Vocabulary

- distribute
- factor
- quadratic

Directions

- Each separate sheet below will be placed all around the room.
- To make the activity easier, place the pages in order. To make the activity more difficult do not put the sheets around the room in the order below, mix them up.
- The students can be told to factor OR distribute.
- Once they have solved for their answer they will locate the sheet around the room with the corresponding answer. They will then go to that station and repeat factoring or distributing.

$(x+6)^2$		$(x-9)(x-4)$		$(x-4)(x+3)$
$x^2 - 13x + 36$	$\rightarrow$	$x^2 - x - 12$	$\rightarrow$	$x^2 - 7x + 12$

(page 1)

$$(x+6)^2$$

$$x^2-13x+36$$

(page 2)

$$(x-9)(x-4)$$

$$x^2 - x - 12$$

(page 3)

$$(x-4)(x+3)$$

$$x^2-7x+12$$

(page 4)

$$(x-4)(x-3)$$

$$x^2+5x-36$$

(page 5)

$$(x+9)(x-4)$$

$$x^2-3x-10$$

(page 6)

$$(x-5)(x+2)$$

$$x^2+2x-8$$

(page 7)

$$(x+4)(x-2)$$

$$x^2+11x+30$$

(page 8)

$$(x+6)(x+5)$$

$$x^2+2x-3$$

(page 9)

$$(x+3)(x-1)$$

$$x^2 - 9x + 18$$

(page 10)

$$(x-6)(x-3)$$

$$x^2+20x+100$$

(page 11)

$$(x+10)^2$$

$$x^2+8x+16$$

(page 12)

$$(x+4)^2$$

$$x^2-3x+2$$

(page 13)

$$(x-2)(x-1)$$

$$x^2+3x-4$$

(page 14)

$$(x+4)(x-1)$$

$$x^2 - x - 72$$

(page 15)

$$(x-9)(x+8)$$

$$x^2-2x-35$$

(page 16)

$$(x-7)(x+5)$$

$$x^2+12x+36$$

Factoring or Distribution (page 17)

1.
2.
3.
4.
5.
6.
7.
8.

(page 17)

9.
10.
11.
12.
13.
14.
15.
16.

Distribution Key (page 19)

$(x+6)^2 \Rightarrow$	$(x-9)(x-4) \Rightarrow$	$(x-4)(x+3) \Rightarrow$	$(x-4)(x-3)$
$\Uparrow$			$\Downarrow$
$(x-7)(x+5)$			$(x+9)(x-4)$
$\Uparrow$			$\Downarrow$
$(x-9)(x+8)$			$(x-5)(x+2)$
$\Uparrow$			$\Downarrow$
$(x+4)(x-1)$			$(x+4)(x-2)$
$\Uparrow$			$\Downarrow$
$(x-2)(x-1)$			$(x+6)(x+5)$
$\Uparrow$			$\Downarrow$
$(x+4)^2 \Leftarrow$	$(x+10)^2 \Leftarrow$	$(x-6)(x-3) \Leftarrow$	$(x+3)(x-1)$

Factoring Key (page 20)

$x^2 - 13x + 36$ $x^2 - x - 12$ $x^2 - 7x + 12$ $x^2 + 5x - 36$

$x^2 + 12x + 36$ $x^2 - 3x - 10$

$x^2 - 2x - 35$ $x^2 + 2x - 8$

$x^2 - x - 72$ $x^2 + 11x + 30$

$x^2 + 3x - 4$ $x^2 + 2x - 3$

$x^2 - 3x + 2$ $x^2 + 8x + 16$ $x^2 + 20x + 100$ $x^2 - 9x + 18$

Figure 15: Inequality Graphs and Equations

Inequality Graphs and Equations

7 pages

TEKS

- A.3(D): graph the solution set on linear inequalities in two variables on the coordinate plane

Objectives

- graph linear inequalities and their solution set

Intentional Questions

- What is the y-intercept?
- Is the slope positive or negative?
- What is the slope?
- Will the line be solid or dashed?
- Do we shade above the line or below the line?
- What does the shaded area represent?

Structure

- Hands-On Activity: Matching

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-on
- Cooperative
- Independent

Vocabulary

- slope
- y-intercept
- inequality

Directions

- Place the first graph in the center where each group member can participate.
- Use the following questions to find the corresponding equation that matches the graph.
- Individually record findings by making an accurate sketch of the graph and writing the corresponding equation on your answer sheet
- Questions for to guide and assist students during the activity:
  1. What is the y-intercept?
  2. Is the slope positive or negative?
  3. What is the slope?
  4. Will the line be solid or dashed?
  5. Do we shade above the line or below the line?

(page 1)

Inequality Graphs and Equations

Object Goals: As a group, correctly match each graph with it corresponding equation. Individually record your findings as you go by making an accurate sketch of the graph and writing the corresponding equation on your answer sheet.
Directions. Place the first graph in the center where each group member can participate. Use the following questions to find the corresponding equation that matches the graph.

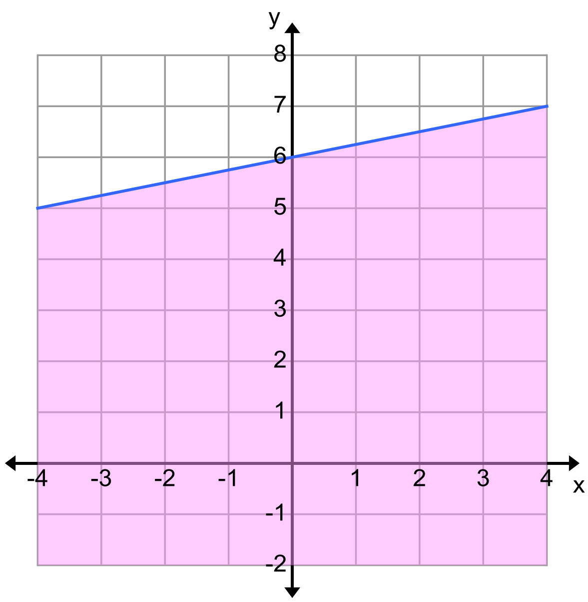
1. What is the y-intercept?
2. Is the slope positive or negative?
3. What is the slope?
4. Will the line be solid or dashed?
5. Do we shade above the line or below the line?

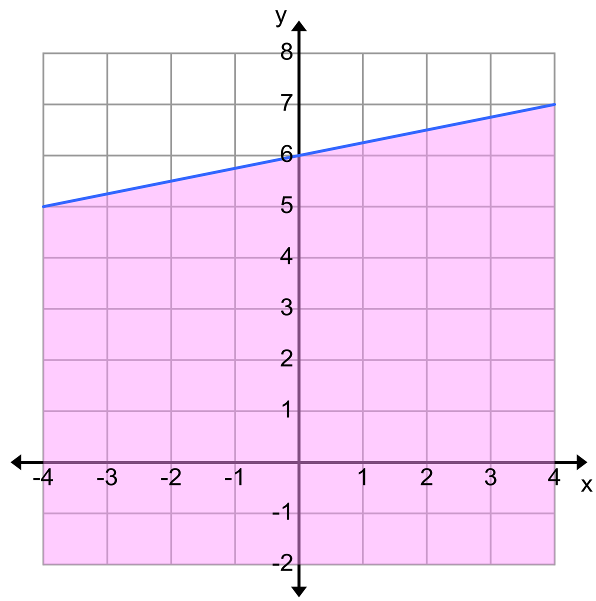
CUT OUT EQUATIONS

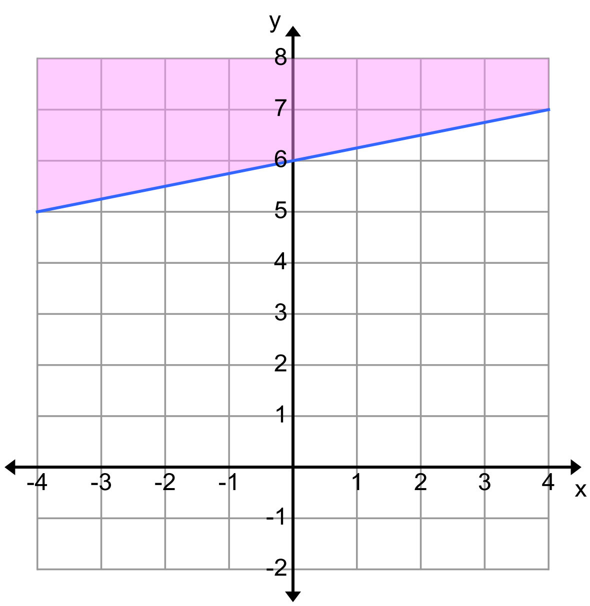
$y<\frac{1}{4}x+6$	$y<-4x-8$	$y<4x-8$	$y<-\frac{1}{4}x+6$
$y>\frac{1}{4}x+6$	$y>-4x-8$	$y>4x-8$	$y>-\frac{1}{4}x+6$
$y\le\frac{1}{4}x+6$	$y\le-4x-8$	$y\le 4x-8$	$y\le-\frac{1}{4}x+6$
$y\ge\frac{1}{4}x+6$	$y\ge-4x-8$	$y\ge 4x-8$	$y\ge-\frac{1}{4}x+6$

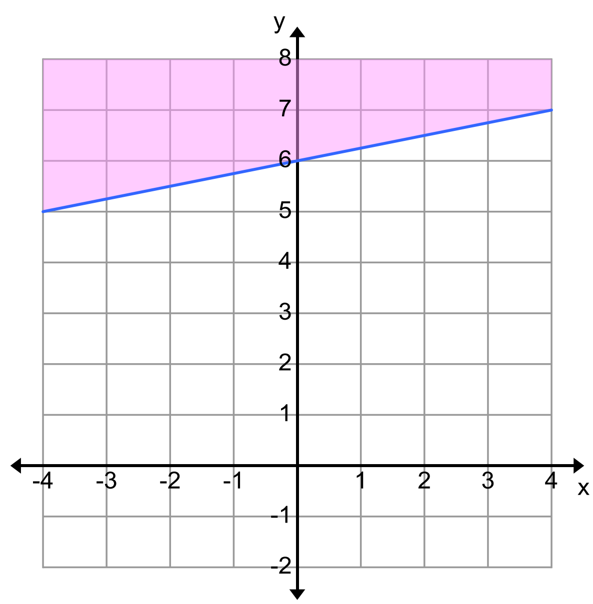
(page 2)

GRAPHS









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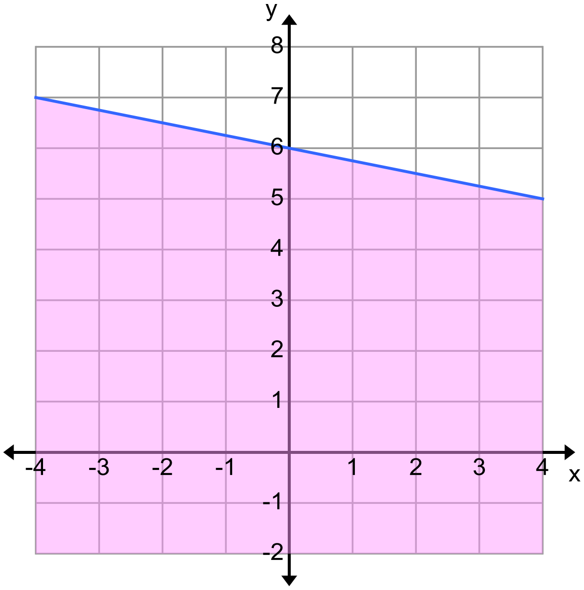

y
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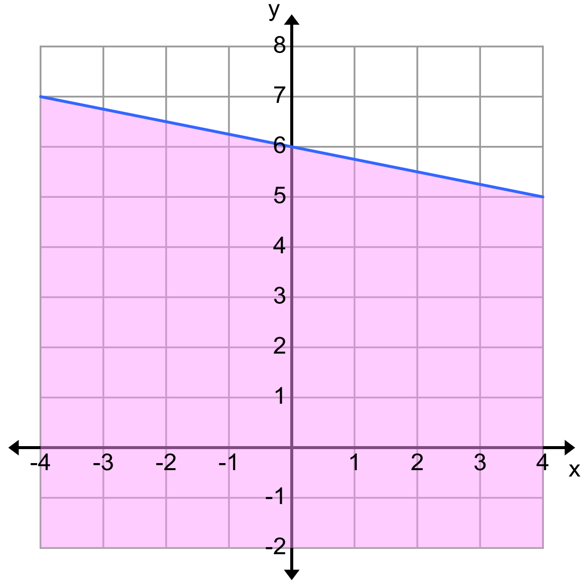

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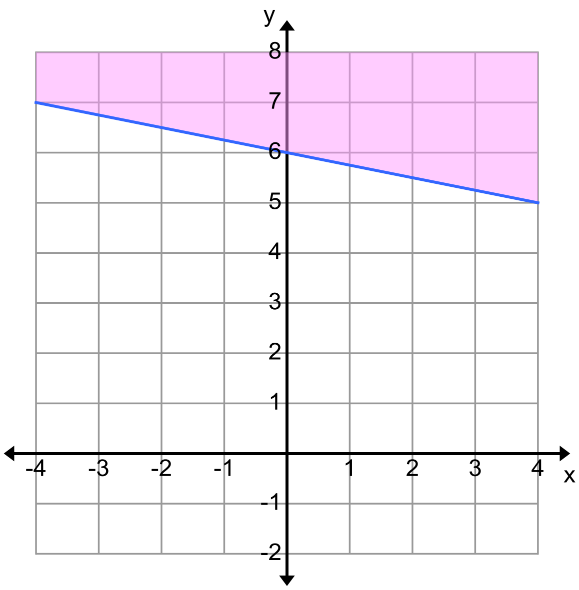

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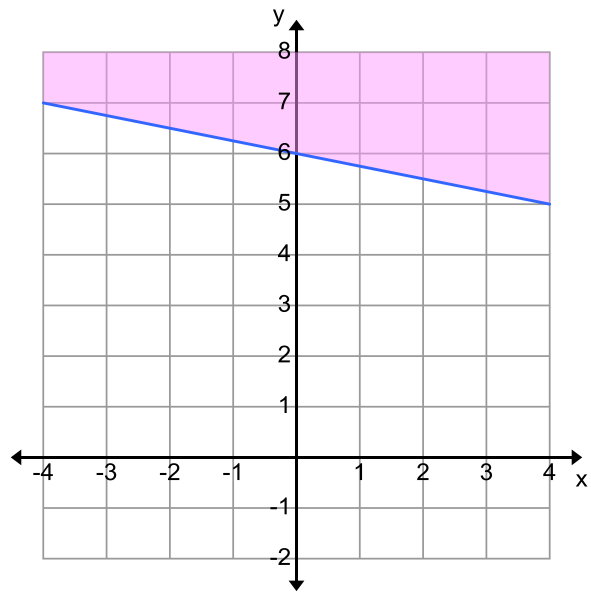

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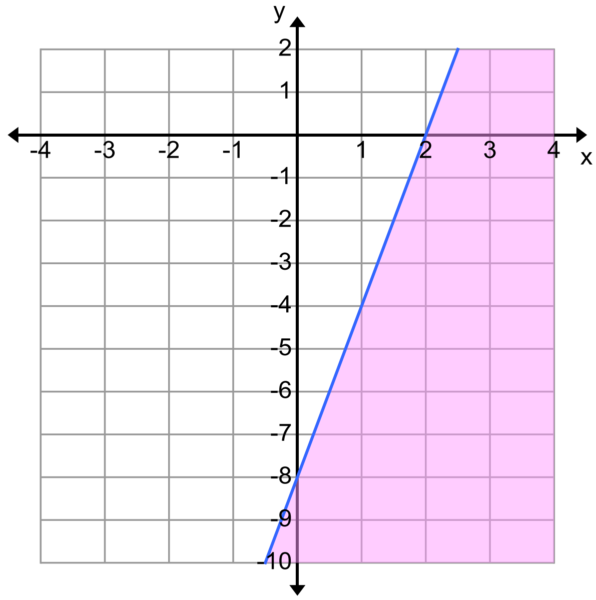
(page 4)



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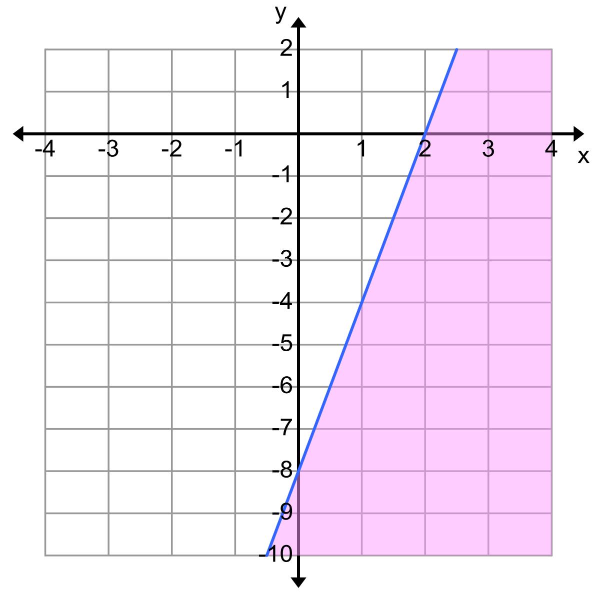

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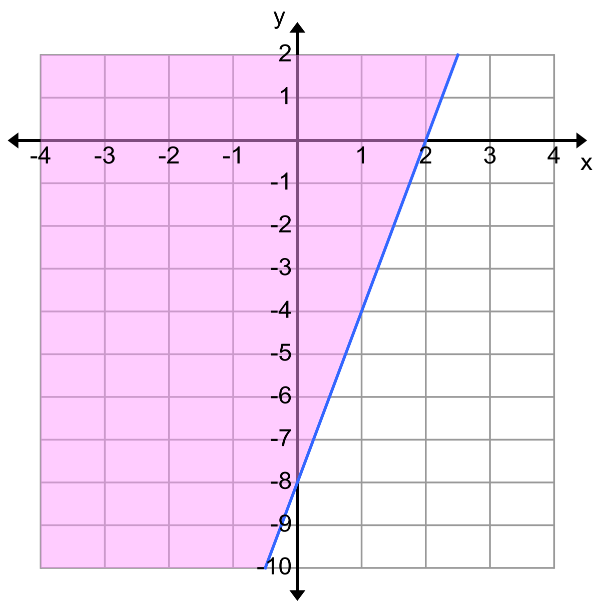

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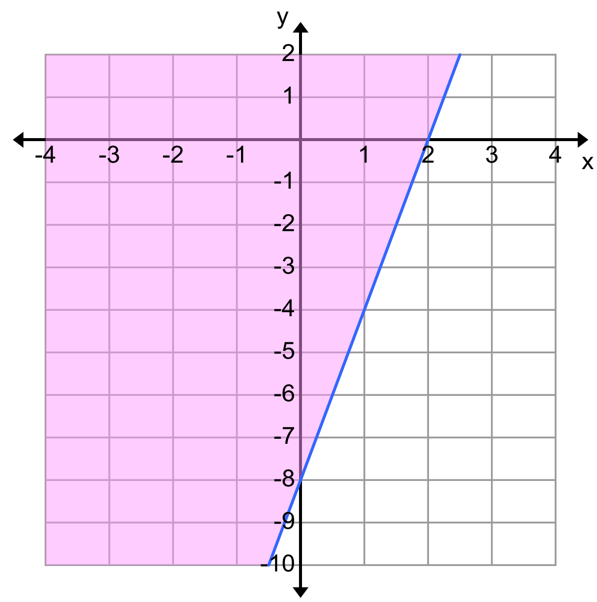

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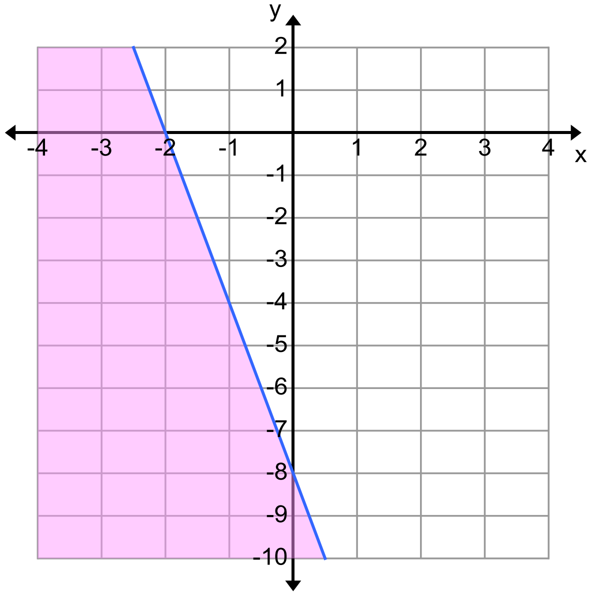
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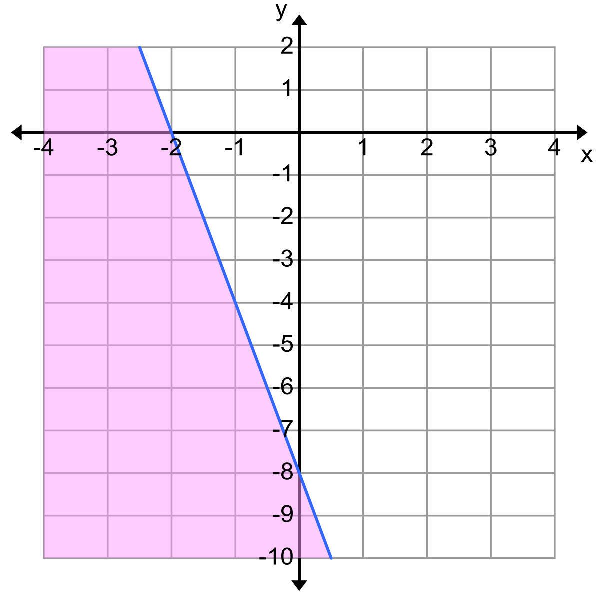
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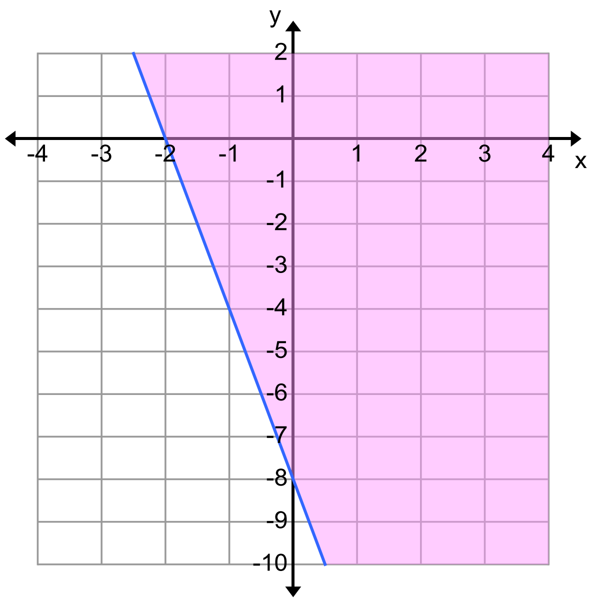
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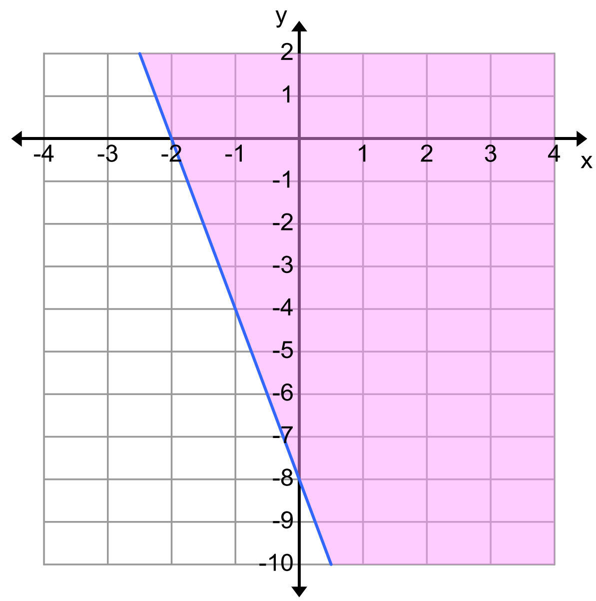
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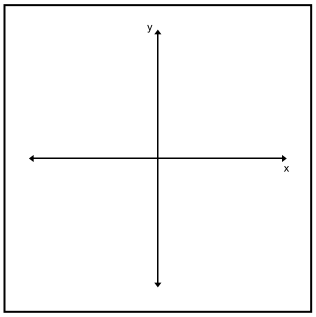
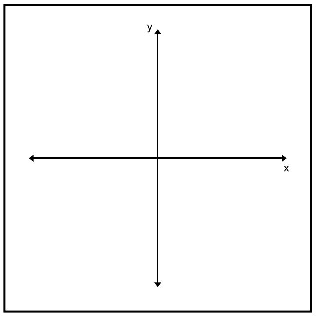
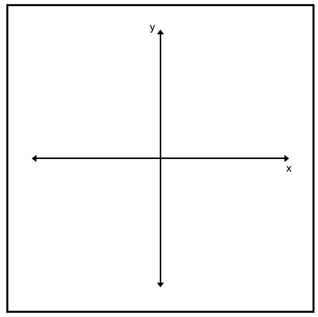
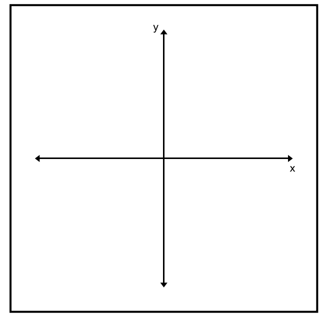
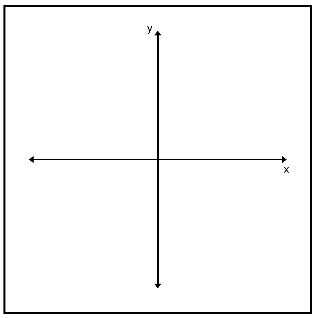
Inequality Graphs and Equations (page 6)

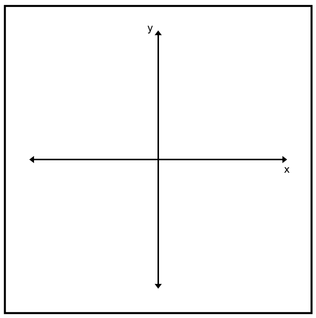


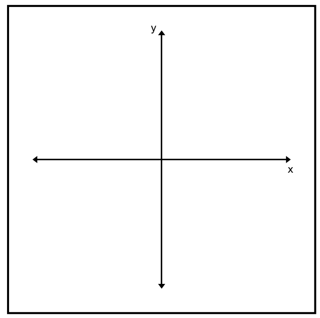


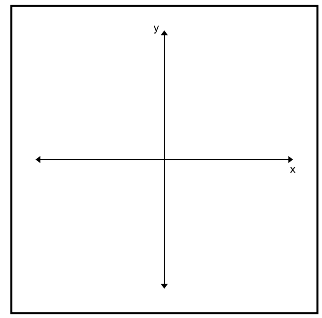


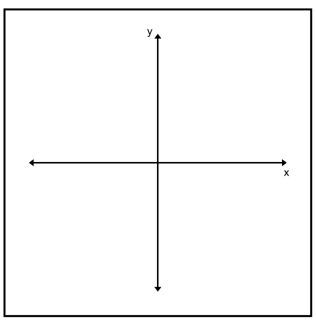


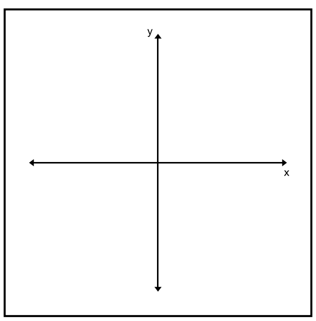


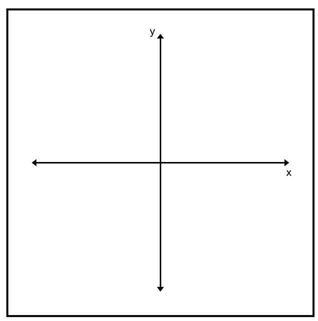


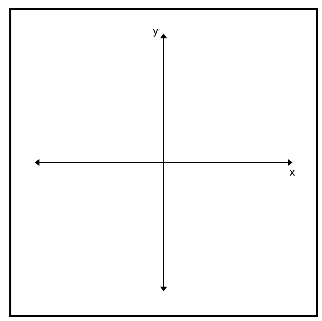


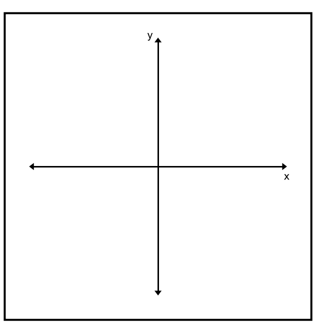


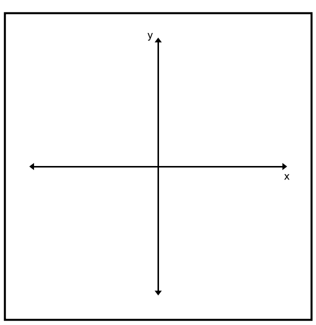


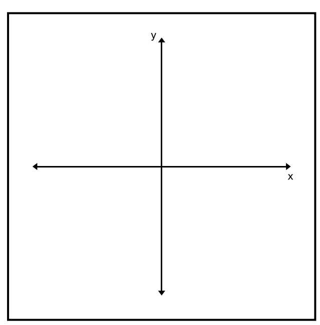


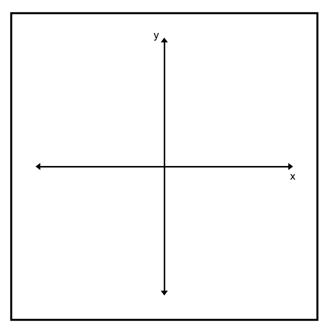




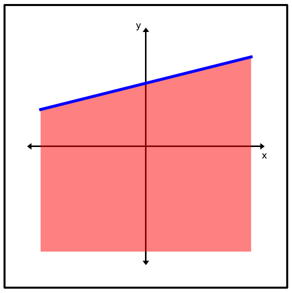




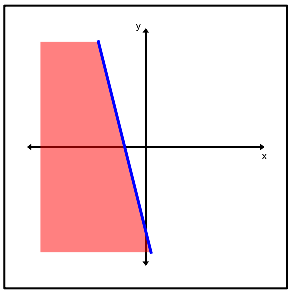




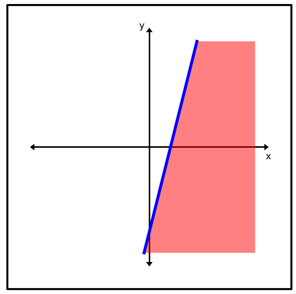
Inequality Graphs and Equations Key (page 7)



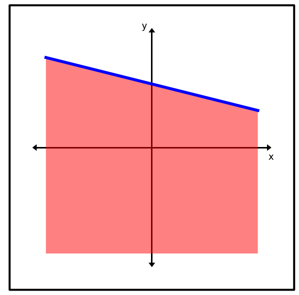
$y < \frac{1}{4}x + 6$



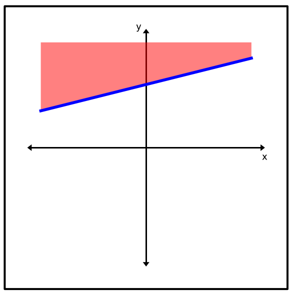
$y < -4x - 8$



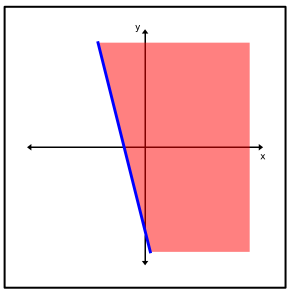
$y < 4x - 8$



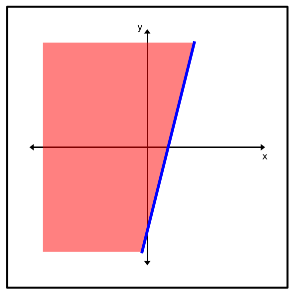
$y < -\frac{1}{4}x + 6$



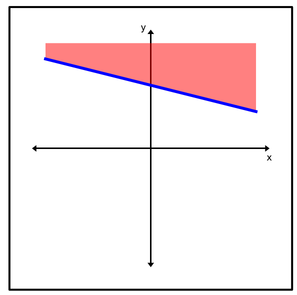
$y > \frac{1}{4}x + 6$



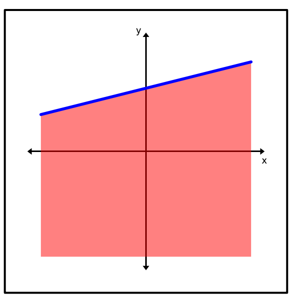
$y > -4x - 8$



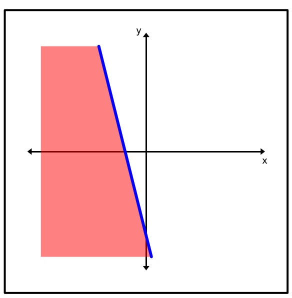
$y > 4x - 8$



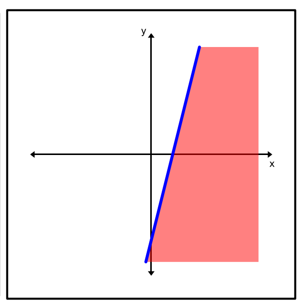
$y > -\frac{1}{4}x + 6$



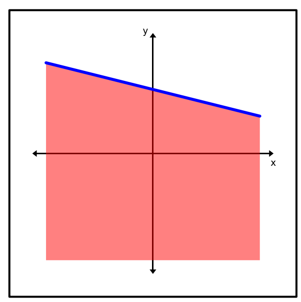
$y \leq \frac{1}{4}x + 6$



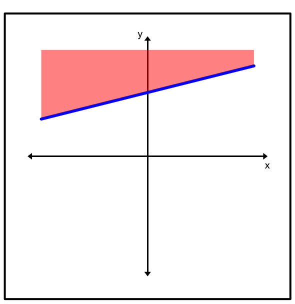
$y \leq -4x - 8$



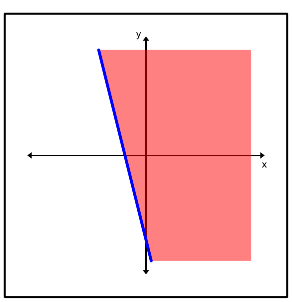
$y \leq 4x - 8$



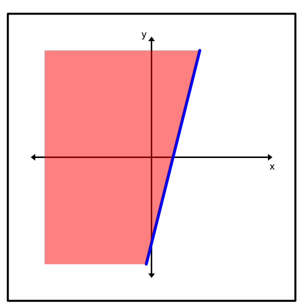
$y \leq -\frac{1}{4}x + 6$



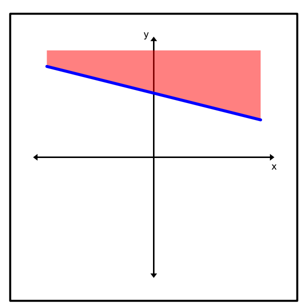
$y \geq \frac{1}{4}x + 6$



$y \geq -4x - 8$



$y \geq 4x - 8$



$y \geq -\frac{1}{4}x + 6$

Figure 16: Simplifying Exponents Cover Page

Simplifying Exponents

8 pages

TEKS

- A.11(B): simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents

Objectives

- simplify exponential expressions
- discuss the laws of exponents

Intentional Questions

- Should you add the exponents?
- Should you multiply the exponents?
- What happens to the coefficients?
- How many different variables are in this expression?

Structure

- Hands-On Activity: Matching

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-on
- Cooperative
- Independent

Vocabulary

- variable
- expression
- exponent
- base
- integer
- simplify

Directions

- Cut out the cards.
- Students may work individually or in groups.
- Correctly match the original expression with the simplified expression.
- Write the letter in the box that represents the simplified form of each number on your answer document.

Simplifying Exponents (page 1)

1. $(-2x)^0$	**6.** $x^4 \bullet x^6$
2. $5x^0$	**7.** $3x \bullet -7x^6$
3. $7x^0y$	**8.** $-2(x^4)^3$
4. $5x^{-7}$	**9.** $(7x^2)(2x^{-5})$
5. x^{-4}	**10.** $2x^6 \bullet 5x^3$

(page 2)

11. $(3xy^3)^4$	**16.** $-2(-4x^2yz^3)^3$
12. $(-3x^3y)^2$	**17.** $-4x^2y^2 \cdot 6x^2 \cdot 9xy$
13. $(12x^5)^2$	**18.** $5xy^2 \cdot 7x^2y \cdot x^3y^6$
14. $-12x^6y^0x^0$	**19.** $\dfrac{34x^2}{2x^{-2}}$
15. $-2(x^5)^0$	**20.** $\dfrac{12x^5}{3y^{-6}}$

(page 3)

21. $\dfrac{3x^{-5}}{9y^{6}}$	**26.** $\dfrac{16x^5y^7}{4x^7y^5}$
22 . $\left(\dfrac{x^8}{y^6}\right)^3$	**27.** $\dfrac{6x^5y^5z^3}{2x^2y^7z^3}$
23. $\dfrac{-2x^{-2}}{y^{-3}}$	**28.** $\dfrac{(-2x^2y^2)^2\cdot(6x)^0}{4x^3y^4}$
24. $\dfrac{-2x^6y^7}{x^2y^5}$	**29.** $\dfrac{-5x^4y^2}{-10x^5y^4}$
25. $\dfrac{x^2y^5}{xy}$	**30.** $\left(\dfrac{x^9y^2}{z^8}\right)^{-5}$

(page 4)

A -2	**G** $-2x^4y^2$	**M** x^{10}	**S** $4x^5y^6$	**Y** $\frac{14}{x^3}$
B 1	**H** $\frac{-2y^3}{x^2}$	**N** xy^4	**T** $\frac{4y^2}{x^2}$	**Z** $17x^4$
C 5	**I** $-2x^{12}$	**O** $\frac{1}{x^4}$	**U** $\frac{5}{x^7}$	**AA** $35x^6y^9$
D $-216x^5y^3$	**J** $10x^9$	**P** $\frac{1}{3x^5y^6}$	**V** $7y$	**BB** $81x^4y^{12}$
E $-21x^7$	**K** $\frac{x^{24}}{y^{18}}$	**Q** $\frac{1}{2xy^2}$	**W** $9x^6y^2$	**CC** $144x^{10}$
F $-12x^6$	**L** $\frac{z^{40}}{x^{45}y^{10}}$	**R** $\frac{3x^3}{y^2}$	**X** x	**DD** $128x^6y^3z^9$

(page 5)

Simplifying Exponents

Directions: Write the letter in the box that represents the simplified form of each number.

1.	**8.**
2.	**9.**
3.	**10.**
4.	**11.**
5.	**12.**
6.	**13.**
7.	**14.**

(page 6)

15.	**23.**
16.	**24.**
17.	**25.**
18.	**26.**
19.	**27.**
20.	**28.**
21.	**29.**
22.	**30.**

Simplifying Exponents Key (page 7)

1. B $(-2x)^0 = 1$	**8. I** $-2(x^4)^3 = -2x^{12}$
2. C $5x^0 = 5$	**9. Y** $(7x^2)(2x^{-5}) = \frac{14}{x^3}$
3. V $7x^0y = 7y$	**10. J** $2x^6 \bullet 5x^3 = 10x^9$
4. U $5x^{-7} = \frac{5}{x^7}$	**11. BB** $(3xy^3)^4 = 81x^4y^{12}$
5. O $x^{-4} = \frac{1}{x^4}$	**12. W** $(-3x^3y)^2 = 9x^6y^2$
6. M $x^4 \bullet x^6 = x^{10}$	**13. CC** $(12x^5)^2 = 144x^{10}$
7. E $3x \bullet -7x^6 = -21x^7$	**14. F** $-12x^6y^0x^0 = -12x^6$

(page 8)

15. A $-2(x^5)^0 = -2$	**23. H** $\dfrac{-2x^{-2}}{y^{-3}} = \dfrac{-2y^3}{x^2}$
16. DD $-2(-4x^2yz^3)^3 = 128x^6y^3z^9$	**24. G** $\dfrac{-2x^6y^7}{x^2y^5} = -2x^4y^2$
17. D $-4x^2y^2 \cdot 6x^2 \cdot 9xy = -216x^5y^3$	**25. N** $\dfrac{x^2y^5}{xy} = xy^4$
18. AA $-4x^2y^2 \cdot 6x^2 \cdot 9xy = 35x^6y^9$	**26. T** $\dfrac{16x^5y^7}{4x^7y^5} = \dfrac{4y^2}{x^2}$
19. Z $\dfrac{34x^2}{2x^{-2}} = 17x^4$	**27. R** $\dfrac{6x^5y^5z^3}{2x^2y^7z^3} = \dfrac{3x^3}{y^2}$
20. S $\dfrac{12x^5}{3y^{-6}} = 4x^5y^6$	**28. X** $\dfrac{(-2x^2y^2)^2 \cdot (6x)^0}{4x^3y^4} = x$
21. P $\dfrac{3x^{-5}}{9y^6} = \dfrac{1}{3x^5y^6}$	**29. Q** $\dfrac{-5x^4y^2}{-10x^5y^4} = \dfrac{1}{2xy^2}$
22. K $\left(\dfrac{x^8}{y^6}\right)^3 = \dfrac{x^{24}}{y^{18}}$	**30. L** $\left(\dfrac{x^9y^2}{z^8}\right)^{-5} = \dfrac{z^{40}}{x^{45}y^{10}}$

Figure 17: Linking Situations to Systems

Linking Situations to Systems

6 pages

TEKS

- A.2(I): write systems of two linear equations given a table of values, a graph, and a verbal description
- A.3(G): estimate graphically the solutions to systems of two linear equations with two variable in real-world problems
- A.5(C): solve systems of two linear equations with two variables for mathematical and real-world problems

Objectives

- write systems given a situation
- determine which method to use when solving

Intentional Questions

- What is the first equation you can create from the situation?
- What should the two variables in your system represent?
- What method of solving a system would you use given these equations?
-

Structure

- Hands-On Activity: Matching

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-on
- Cooperative
- Independent

Vocabulary

- system
- variable
- methods to solving a system

Directions

- Match each situation with its correct system of equations, variables and method of solving.
- After matching all four parts together, record the number in the designate box on the answer document.

Linking Situations to Systems (page 1)

1. The admission fee for Splash Park is \$2.00 for children and \$5.00 for adults. One super soaker Saturday, 2154 people entered the park and \$7134 was collected at the entrance. Write a system to find how many children and adults attended the Splash Park.	32. $x = \text{Adults}$ $y = \text{Children}$
13. $x + y = 2154$ $5x + 2y = 7134$	A. Elimination

2. Two long distance runners ran a total of 66 miles one summer. One ran 3 times as many yards as the other. What system of equations can be used to find the number of miles ran by each runner?	36. $x = \text{Runner 1}$ $y = \text{Runner 2}$
16. $x + y = 66$ $x = 3y$	B. Substitution

3. Luke received a hand full of quarters and dimes from his grandmother. The total value of the quarters and dimes was \$6.40. Write a system of equations to find the total number of each coin if there was a total of 40 coins?	29. $x = \text{Quarters}$ $y = \text{Dimes}$
14. $x + y = 40$ $0.25x + .10y = 6.40$	A. Elimination

(page 2)

4. There were 212 seats sold at a theater show hosted by the Actors of Mason County. Some attendees paid \$11.75 for their seats close to the front while others only paid \$5.50 for the seats more towards the back. If the total revenue was \$1441, which system can be used to calculate to total number of each type of seat?	30. $x = \text{Close Seats}$ $y = \text{Far Seats}$
15. $x + y = 212$ $11.25x + 5.50y = 1441$	A. Elimination

5. Sam has 120 songs and movies on his iPad. He has 4 times as many songs as videos. What system of equations can be used to find the number of songs and videos Sam has on his iPad?	31. $x = \text{Songs}$ $y = \text{Videos}$
19. $x + y = 120$ $x = 4y$	B. Substitution

6. You have \$11.25 in your piggy bank made up of only quarters and dimes. If there are a total of 57 coins, write a system of equations that can be used to find the total number of quarters and dimes in your piggy bank.	28. $x = \text{Quarters}$ $y = \text{Dimes}$
17. $x + y = 57$ $0.25x + 0.10y = 11.25$	A. Elimination

(page 3)

7. You went school supply shopping for notebooks and a backpack. You bought 2 notebooks and a backpack for \$19.00. Each notebook cost \$10 less than the backpack. Write a system of equations to calculate the cost of the backpack and each notebook.	26. $x = \text{Backpack}$ $y = \text{Notebook}$
18. $x + 2y = 19$ $x - 10 = y$	B. Substitution

8. You are having a family cookout and buy 14 packages of buns for \$22 total. If the hotdog buns cost \$1.25 per package and the hamburger buns cost \$2 per package, write a system of equations to find the cost of each package of buns.	34. $x = \text{Hamburger}$ $y = \text{Hot Dog}$
23. $x + y = 14$ $2x + 1.25y = 22$	A. Elimination

9. The local convenient store is having a sale on candy bars. You purchased 3 candy bars from shelf A and 2 from shelf B for \$3.85. Your friend gets 2 candy bars from shelf A and 3 from shelf B for \$4.15. Write a system of equations to calculate the cost of each candy bar on shelf A and shelf B.	25. $x = \text{Shelf A}$ $y = \text{Shelf B}$
21. $3x + 2y = 3.85$ $2x + 3y = 4.15$	A. Elimination

(page 4)

10. You are trying to decide what game center you want to go to. One game center cost \$5 to enter and \$1 per game. Another game center cost \$3 to enter and \$2 per game. Write a system of equations to represent this situation.	33. $x = \text{Games Played}$ $y = \text{Total Spent}$
24. $y = x + 5$ $y = 2x + 3$	C. Graphing

11. You have been searching for the perfect pair of shoes online. Amazon sells each pair of shoes for \$22 with a \$5 flat shipping fee. EBay sells each pair of shoe for \$27 and free shipping. Write a system of equations to represent the total price when purchasing each pair of shoes from the different retailers.	27. $x = \text{Pairs of Shoes}$ $y = \text{Total Cost}$
20. $y = 22x + 5$ $y = 27x$	C. Graphing

12. Maribel works for Buckle every Saturday and makes \$35 plus \$3 each pair of jeans she sells. Jossey works for Aeropostal every Saturday and makes \$28 plus \$4 each pair of jeans she sells. Write a system of equations that models the total pay per pair of jeans sold for Maribel and Jossey.	35. $x = \text{Pairs of Jeans Sold}$ $y = \text{Total Pay}$
22. $y = 3x + 35$ $y = 4x + 28$	C. Graphing

Linking Situations to Systems (page 5)

Directions: After matching all four parts together, record the number in the designate box below.

Situation	Variables
System of Equations	Method of Solving

1	

2	

3	

4	

5	

6	

7	

8	

9	

10	

11	

12	

Linking Situations to Systems Key (page 6)

Situation	Variables
System of Equations	Method of Solving

1	32
13	A

7	26
18	B

2	36
16	B

8	34
23	A

3	29
14	A

9	25
21	A

4	30
15	A

10	33
24	C

5	31
19	B

11	27
20	C

6	28
17	A

12	35
22	C

Figure 18: Simplifying Radicals Cover Page

Simplifying Radicals

6 pages

TEKS

- A.11(A): simplify numerical radical expressions involving square roots
- A.11(B): simplify numeric and algebraic expressions using the laws of exponents, including integral and rational exponents

Objectives

- simplify expressions involving square roots
- discuss the laws of exponents

Intentional Questions

- What is the first step in simplifying radical expressions?
- Can that square root be simplified any further?
- How can you check your answer?

Structure

- Hands-On Activity: Matching

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-on
- Cooperative
- Independent

Vocabulary

- expression
- simplify
- cake method

Directions

- Cut out the cards.
- Students may work individually or in groups.
- Correctly match the original expression with the simplified expression.
- Write the letter in the box that represents the simplified form of each number on your answer document and show work if necessary.

Simplifying Radicals (page 1)

1. $\sqrt{4} \bullet \sqrt{36} + \sqrt{121}$	**7.** $-4\sqrt{225} + 5\sqrt{144}$	**13.** $-4\sqrt{10} \bullet 3\sqrt{5}$	**19.** $\sqrt{50}$	**25.** $-2\sqrt{90}$
2. $2\sqrt{49} \bullet 3\sqrt{9}$	**8.** $\sqrt{16} \bullet 3\sqrt{4}$	**14.** $\dfrac{\sqrt{24}}{\sqrt{2}}$	**20.** $\sqrt{160}$	**26.** $3\sqrt{38}$
3. $6\sqrt{225} \div \sqrt{81}$	**9.** $-5\sqrt{3} \bullet 6\sqrt{3}$	**15.** $\dfrac{3\sqrt{20}}{\sqrt{5}}$	**21.** $\sqrt{27} \bullet \sqrt{3}$	**27.** $-\sqrt{68}$
4. $5\sqrt{225} - 6\sqrt{169} + 7\sqrt{4}$	**10.** $\dfrac{\sqrt{80}}{\sqrt{5}}$	**16.** $\dfrac{12\sqrt{96}}{2\sqrt{3}}$	**22.** $3\sqrt{14}\left(-2\sqrt{21}\right)$	**28.** $10\sqrt{18}$
5. $-2\sqrt{144} \bullet -4\sqrt{121}$	**11.** $\left(3\sqrt{5}\right)^2$	**17.** $3\sqrt{2}\left(3\sqrt{8}\right)$	**23.** $\dfrac{6\sqrt{15}}{\sqrt{5}}$	**29.** $\sqrt{125}$
6. $\sqrt{4} \bullet \sqrt{1}$	**12.** $\sqrt{\dfrac{121}{225}}$	**18.** $\dfrac{\sqrt{150}}{\sqrt{2}}$	**24.** $\left(6\sqrt{3}\right)^2$	**30.** $\sqrt{135}$

(page 2)

A -90	**G** 9	**M** 45	**S** $24\sqrt{2}$	**Y** $5\sqrt{5}$
B 0	**H** 10	**N** 108	**T** $30\sqrt{2}$	**Z** $-42\sqrt{6}$
C $\frac{11}{15}$	**I** 11	**O** 126	**U** $2\sqrt{3}$	**AA** $4\sqrt{10}$
D 2	**J** 23	**P** 1056	**V** $5\sqrt{3}$	**BB** $-6\sqrt{10}$
E 4	**K** 24	**Q** $-60\sqrt{2}$	**W** $6\sqrt{3}$	**CC** $3\sqrt{15}$
F 6	**L** 36	**R** $5\sqrt{2}$	**X** $12\sqrt{2}$	**DD** $-2\sqrt{17}$

Simplifying Radicals (page 3)

Directions: Write the letter in the box that represents the simplified form of each number.

1.	**8.**
2.	**9.**
3.	**10.**
4.	**11.**
5.	**12.**
6.	**13.**
7.	**14.**

(page 4)

15.	**23.**
16.	**24.**
17.	**25.**
18.	**26.**
19.	**27.**
20.	**28.**
21.	**29.**
22.	**30.**

Simplifying Radicals Key (page 5)

1. **J** $\sqrt{4}\bullet\sqrt{36}+\sqrt{121} = 23$	**8.** **K** $\sqrt{16}\bullet 3\sqrt{4} = 24$
2. **O** $2\sqrt{49}\bullet 3\sqrt{9} = 126$	**9.** **A** $-5\sqrt{3}\bullet 6\sqrt{3} = -90$
3. **H** $6\sqrt{225}\div\sqrt{81} = 10$	**10.** **E** $\dfrac{\sqrt{80}}{\sqrt{5}} = 4$
4. **I** $5\sqrt{225}-6\sqrt{169}+7\sqrt{4} = 11$	**11.** **M** $\left(3\sqrt{5}\right)^2 = 45$
5. **P** $-2\sqrt{144}\bullet -4\sqrt{121} = 1056$	**12.** **C** $\left(3\sqrt{5}\right)^2 = \dfrac{11}{15}$
6. **D** $\sqrt{4}\bullet\sqrt{1} = 2$	**13.** **Q** $-4\sqrt{10}\bullet 3\sqrt{5} = -60\sqrt{2}$
7. **B** $-4\sqrt{225}+5\sqrt{144} = 0$	**14.** **U** $\dfrac{\sqrt{24}}{\sqrt{2}} = 2\sqrt{3}$

(page 6)

15. $\dfrac{3\sqrt{20}}{\sqrt{5}} = 6$ **F**	**23.** $\dfrac{6\sqrt{15}}{\sqrt{5}} = 6\sqrt{3}$ **W**
16. $\dfrac{12\sqrt{96}}{2\sqrt{3}} = 24\sqrt{2}$ **S**	**24.** $\left(6\sqrt{3}\right)^2 = 108$ **N**
17. $3\sqrt{2}\left(3\sqrt{8}\right) = 36$ **L**	**25.** $-2\sqrt{90} = -6\sqrt{10}$ **BB**
18. $\dfrac{\sqrt{150}}{\sqrt{2}} = 5\sqrt{3}$ **V**	**26.** $3\sqrt{38} = 12\sqrt{2}$ **X**
19. $\sqrt{50} = 5\sqrt{2}$ **R**	**27.** $-\sqrt{68} = -2\sqrt{17}$ **DD**
20. $\sqrt{160} = 4\sqrt{10}$ **AA**	**28.** $10\sqrt{18} = 30\sqrt{2}$ **T**
21. $\sqrt{27} \bullet \sqrt{3} = 9$ **G**	**29.** $\sqrt{125} = 5\sqrt{5}$ **Y**
22. $3\sqrt{14}\left(-2\sqrt{21}\right) = -42\sqrt{6}$ **Z**	**30.** $\sqrt{135} = 3\sqrt{15}$ **CC**

Figure 19: Vertex Form Cover Page

Vertex Form

4 pages

TEKS

- A.7(A): graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x-intercepts, y-intercepts, zeroes, maximum value, minimum values, vertex and the equation of the axis of symmetry.

Objectives

- find the vertex of a quadratic function given vertex form
- find the axis of symmetry of a quadratic function given the equation

Intentional Questions

- What is the equation for vertex form?
- Where is the x-coordinate of the vertex located on a quadratic equation written in vertex form?
- Where is the y-coordinate of the vertex located on a quadratic equation written in vertex form?
- How would you write the equation of the axis of symmetry given the equation?
- Can you write the equation for the axis of symmetry given the vertex?

Structure

- Hands-On Activity: Matching

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-on
- Cooperative
- Independent

Vocabulary

- vertex form
- quadratic
- vertex
- axis of symmetry

Directions

- Cut out the cards.
- Students may work individually or in groups.
- Correctly match the equation with the corresponding vertex and axis of symmetry.
- Write out each answer in the box that represents each category

Vertex Form (page 1)

Equations

1. $f(x)=3(x+3)^2-12$	6. $f(x)=2(x+8)^2+10$
2. $f(x)=5(x-1)^2$	7. $f(x)=-(x-3)^2+36$
3. $f(x)=13(x-2)^2+15$	8. $f(x)=(x-6)^2+2$
4. $f(x)=-2(x+4)^2$	9. $f(x)=-\frac{1}{2}(x+128)^2+4$
5. $f(x)=\frac{1}{2}(x+1)^2-\frac{9}{2}$	10. $f(x)=\frac{1}{4}(x)^2-1$

Vertex and Axis of Symmetry (page 2)

$(h,k)=(-3,12)$	$(h,k)=(0,-1)$	$x=-3$	$x=-1$
$(h,k)=(1,0)$	$(h,k)=(3,36)$	$x=1$	$x=3$
$(h,k)=(2,15)$	$(h,k)=(-8,10)$	$x=2$	$x=-8$
$(h,k)=(-4,0)$	$(h,k)=(-128,4)$	$x=-4$	$x=-128$
$(h,k)=\left(-1,-\frac{9}{2}\right)$	$(h,k)=(6,2)$	$x=0$	$x=6$

Vertex Form (page 3)

Match each given equation with its corresponding vertex and axis of symmetry. Record your findings below.

Equation	Vertex	Axis Of Symmetry
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Vertex Form with Vertex and Axis of Symmetry Key (page 4)

Equation	Vertex	Axis Of Symmetry
1. $f(x)=3(x+3)^2-12$	$(h,k)=(-3,12)$	$x=-3$
2. $f(x)=5(x-1)^2$	$(h,k)=(1,0)$	$x=1$
3. $f(x)=13(x-2)^2+15$	$(h,k)=(2,15)$	$x=2$
4. $f(x)=-2(x+4)^2$	$(h,k)=(-4,0)$	$x=-4$
5. $f(x)=\frac{1}{2}(x+1)^2-\frac{9}{2}$	$(h,k)=\left(-1,-\frac{9}{2}\right)$	$x=-1$
6. $f(x)=2(x+8)^2+10$	$(h,k)=(-8,10)$	$x=-8$
7. $f(x)=-(x-3)^2+36$	$(h,k)=(3,36)$	$x=3$
8. $f(x)=(x-6)^2+2$	$(h,k)=(6,2)$	$x=6$
9. $f(x)=-\frac{1}{2}(x+128)^2+4$	$(h,k)=(-128,4)$	$x=-128$
10. $f(x)=\frac{1}{4}(x)^2-1$	$(h,k)=(0,-1)$	$x=0$

CHAPTER VII

TECHNOLOGY ACTIVITIES

Studies have shown that using a smart board or interactive technology can increase learning. Technology allows another opportunity to engage students throughout their cooperative and independent learning. The use of visuals while teaching vocabulary or a new topic can enhance cognitive learning. This chapter provides several activities that involve technology. Table 7 shows a quick guide to what actives will be shown in this chapter.

At first, students can be uncomfortable with using their calculator especially if they have never used one before. Algebra teachers are encouraged to allow the students to use their calculator daily and instruct them how to use the functions. The hands-on activity shown in Figure 20 provides students an opportunity to write linear functions and determine the line of best fit using major functions in their calculator. Educators are required by the TEKS to integrate technology into their lessons over topics that may involve data and graphing. Every lesson involving a calculator does not have to be as intense as the activity in Figure 20. The activities shown in Figure 21, Figure 22, and Figure 23 integrate a very slight use of the calculator. Asking students to match equations with their graphs can be quick way to integrate technology into daily learning. The calculator provides students with another opportunity to widen their understanding and check their answers. Orchestrating a lesson or review on the smart board can also be a great use of technology in the classroom. Figure 24 and Figure 25 give specific jeopardy games aimed towards linear and quadratic review. Since Jeopardy is usually a timed game, questions throughout these games allow students the opportunity to use their calculator for quick and precise answers. The activity shown in Figure 26 integrates the use of the smart board into practice for the students to do independently or cooperatively. Any activity or resource using a smart board application or Microsoft power point can be downloaded by clicking on the first visual or link provided in the activity. The software must be downloaded to the computer in use in order to download and use the activities immediately.

The daily use of an interactive whiteboard or calculator can increased student engagement and student motivation to learn. When educators allow time for students to practice using their calculator, students can become more comfortable and knowledgeable of the calculator functions and aid it provides throughout the course. This generation of students has often been labeled the technology generation and with integrated technology throughout the course, the need of technology usage will be met. The next chapter encourages the daily planning and implementing of vocabulary activities and review. It also provides examples of how to integrate vocabulary activities or assessments into the Algebra classroom.

Table 7: List of Technology Activities

Activity	TEKS 2015-2016	Intelligence	Learning Method	Page
Writing Linear Functions and Line of Best Fit	A.4(C)	Verbal-Linguistic Logical-Mathematical Spatial Intrapersonal	Cooperative Independent Technology Vocabulary	179
Linear Review	A.2(A) A.3(A) A.3(C)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent Technology	183
Quadratic Review	A.6(A) A.7(A)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent Technology	186
Exponential Review	A.9(A) A.9(D)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent Technology	189
Linear Properties and Equations Review	A.2(C) A.3(A) A.3(B)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Cooperative Technology Vocabulary	194
Quadratics Graphs and Equations Review	A.6(A) A.7(A) A.7(B) A.8(B)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Cooperative Technology Vocabulary	199
Parallel, Perpendicular or Neither	A.2(E) A.2(F) A.2(G)	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-on Cooperative Independent Technology	206

Figure 20: Writing Linear Functions and Line of Best Fit Cover Page

Writing Linear Functions and Line of Best Fit

4 pages

TEKS

- A.4(C): write, with and without technology, linear functions that provide a reasonable fit to data to estimate solutions and make predictions for real-world problems

Objectives

- find the vertex of a quadratic function given vertex form
- find the axis of symmetry of a quadratic function given the equation

Intentional Questions

- What is the equation for vertex form?
- Where is the x-coordinate of the vertex located on a quadratic equation written in vertex form?
- Where is the y-coordinate of the vertex located on a quadratic equation written in vertex form?
- How would you write the equation of the axis of symmetry given the equation?
- Can you write the equation for the axis of symmetry given the vertex?

Structure

- Instruction

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method

- Cooperative
- Independent
- Technology
- Vocabulary

Vocabulary

- vertex form
- quadratic
- vertex
- axis of symmetry

Directions

- Read through the given material and use examples to work the practice problems.

Writing Linear Functions and Line of Best Fit (page 1)

OBJECTIVE In this lesson you will be able write a linear function using technology.

MATERIALS NEEDED pencil, graphing calculator

REVIEW When given two points, there is only one line that will cross through both of those points.

Below shows an example of how write a linear function given two coordinate points. Look over the example and practice independently.

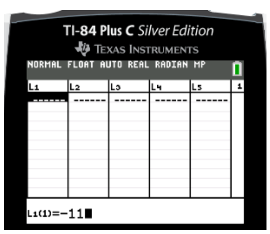
EXAMPLE OF WRITING AN EQUATION GIVEN TWO POINTS

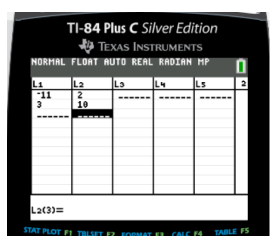
Write the linear function containing the points $(-11,2)$ and $(3,10)$.
Round to the nearest tenth.

1. Make Table:

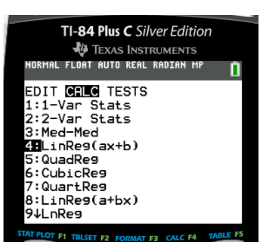
x	y
-11	2
3	10

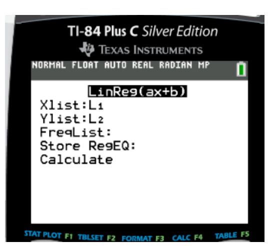
2. Insert Table:





3. Calculate:





4. Write Equation: $\boxed{y = .6x + 8.3}$

Writing Linear Functions:
the objective is to write an equation in slope-intercept form: $y = mx + b$ that contains the specific values given.

1. **Make Table:** create a table given the values so you can correctly identify the x and y coordinates.

2. **Insert Table:** use your calculator to input all of the values into the STAT, EDIT 1:Edit…, enter the given values under the correct list with the x-values on the left column and the y-values to the right of the x-values. You will only use L1 and L2 and pushing enter after each value you type.

3. Calculate: to calculate the equation you will push STAT, scroll to the right > and choose the option of 4:LinReg(ax+b). Use the down arrow to highlight Calculate and push enter.

4. Write Equation: using the formula on your screen, write the equation of the line.

(page 2)

PRACTICE Complete the following two practice problems using the example above.

1. Write the linear function containing the points $(-5,-3)$ and $(2,8)$. Round to the nearest tenth.

2. Write the linear function containing the points $(-7,15)$ and $(1,-1)$. Round to the nearest tenth.

What if we are given multiple points? We can use the points to write a linear function like in the previous example but the function may not go through every point.

As you can see, table 1 gives us values that line up and will allow a linear function to run through each point. Table 1 is considered to be a linear set of data.

Table 1:

x	y
-4	1
-2	2
0	3
2	4
4	5

Graph 1:

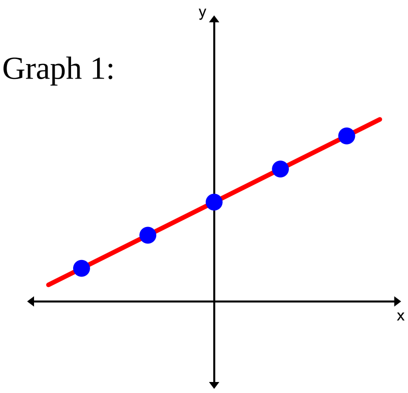
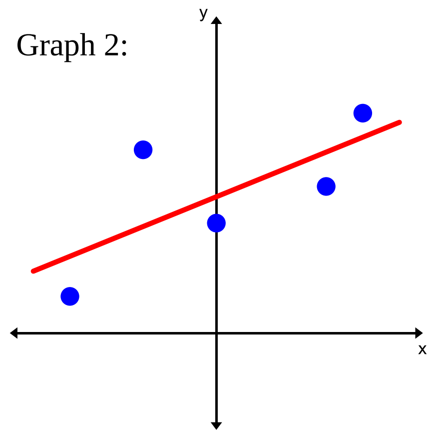


Table 2 two gives us values that will not allow us to have a straight line running through each point. Table 2 is considered to be nonlinear. When you have a nonlinear set of data, you can still write a linear function called a line of best fit. The line of best fit will allow you to make predictions on future values. It may not go through any of the data values but it will be drawn right through the center of all of the values. In order to find the line of best fit, you will use the same calculator functions.

Table 2:

x	y
-4	1
-2	5
0	3
3	4
4	6

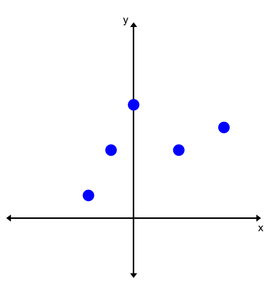
Graph 2:



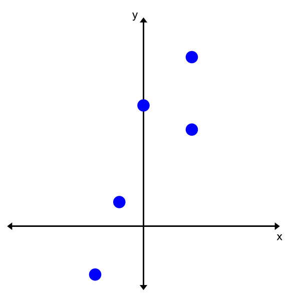
First, let's practice sketching a line of best fit.

PRACTICE Sketch a line of best fit given the following graphs.

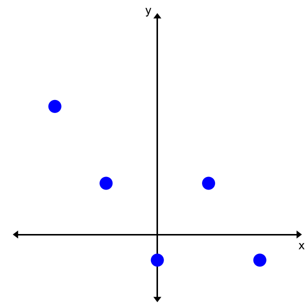
1.



2.



3.



(page 3)

EXAMPLE OF WRITING AN EQUATION GIVEN MULTIPLE POINTS

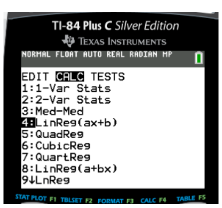
Tamera opened a refurbishing business for old furniture. She collected data over the last 5 years of her profit. Write an linear function that will best fit her data collected.

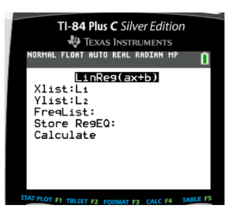
Time (yrs)	Total Profit ($)
1	8,256
2	15,512
3	28,358
4	38,579
5	45,634

1. Make Table: the table has been provided for us.

2. Insert Table:

3. Calculate:





4. Write Equation: $\boxed{y = 9782.3x - 2079.1}$

MAKING A PREDICTION

Predict what Tamera's profit will be in 10 years.

$$y = 9782.3x - 2079.1$$

$$y = 9782.3(10) - 2079.1$$

$$y = 95743.9$$

Tamera will have a profit of $95,743.90 in ten years.

Writing Linear Functions: the objective is to write an equation in slope-intercept form: $y = mx + b$ that contains the specific values given.

1. **Make Table:** create a table given the values so you can correctly identify the x and y coordinates.

2. **Insert Table:** use your calculator to input all of the values into the STAT, EDIT 1:Edit…, enter the given values under the correct list with the x-values on the left column and the y-values to the right of the x-values. You will only use L1 and L2 and pushing enter after each value you type.

3. Calculate: to calculate the equation you will push STAT, scroll to the right > and choose the option of 4:LinReg(ax+b). Use the down arrow to highlight Calculate and push enter.

4. Write Equation: using the formula on your screen, write the equation of the line.

PRACTICE Complete the following two practice problems using the example above.

1. The summer is over and Tom is draining his swimming pool. There is a lot of debree in the pool so Tom has to keep checking to make sure it is draining properly. Write a linear function that will best fit the data of the draining pool and round to the nearest tenth.

Time (min)	Remaining (gal)
0	1500
15	1400
40	1200
60	1150
80	800

Prediction: Predict about how long it will take for the pool to be completely emptied.

2. Julia is running on a treadmill. She recorded her progress below. Write a linear function that will best fit the data of Julia's workout and round to the nearest hundreth.

Time (min)	Distance (mi)
10	1
20	1.75
40	3
60	5
90	7.5

Prediction: About how many miles will Julia run in 120 minutes?

Challenge: Will Julia reach 15 miles if she runs for only 3 hours?

Figure 21: Linear Properties and Equations Review Cover Page

Linear Review

2 pages

TEKS

- A.2(A): determine the domain and range of a linear function in mathematical problems
- A.3(A): determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$
- A.3(C): graph linear functions on the coordinate plane and identify key features, including-intercept, y-intercept, zeros and slope, in mathematical and real-world problems

Objectives

- determine the domain and range of a linear function
- determine key features of linear functions
- graph linear functions and identify their corresponding equation

Intentional Questions

- Where is the y-intercept located on the equation?
- Is the slope a positive or negative value? How does this affect your graph?
- Can you locate the x-intercept on the graph?
- What can you conclude about the domain and range for all linear functions?

Structure

- Independent Practice
- Hands-On Activity: Cut & Paste

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-On
- Cooperative
- Independent
- Technology

Vocabulary

- linear
- x-intercept
- y-intercept
- domain
- range
- slope

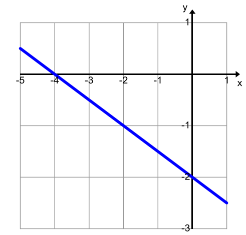
Directions

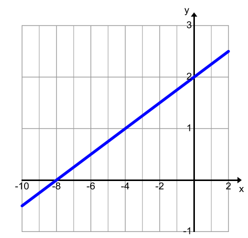
- Cut out each graph on the right and correctly match the graph with each equation.
- Find all the key features.

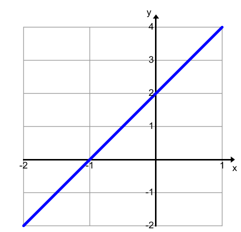
Linear Review (page 1)

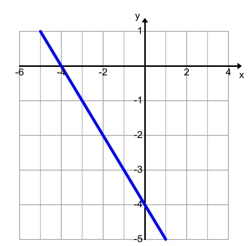
Cut out each graph on the right and correctly match the graph with each equation and find all the key features.

Equation	Graph	Slope m=	y-int b=	x-int (x,y)	Domain	Range
1. $f(x)=\frac{1}{4}x+2$						
2. $f(x)=-x-4$						
3. $f(x)=2x+2$						
4. $f(x)=-\frac{1}{2}x-2$						









Linear Review Key (page 2)

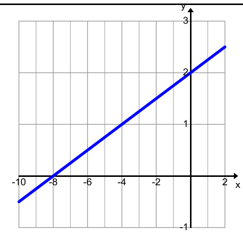
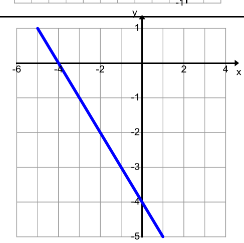
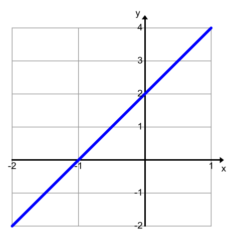
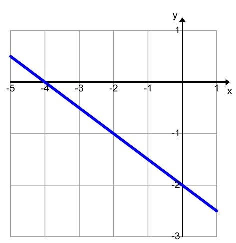
Equation	Graph	Slope m=	y-int b=	x-int (x,y)	Domain	Range
1. $f(x)=\frac{1}{4}x+2$		$m=\frac{1}{4}$	$b=2$	$(-8,0)$	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y\in\mathbb{R}\}$ or $\{y\mid -\infty<y<\infty\}$
2. $f(x)=-x-4$		$m=-1$	$b=4$	$(-4,0)$	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y\in\mathbb{R}\}$ or $\{y\mid -\infty<y<\infty\}$
3. $f(x)=2x+2$		$m=2$	$b=2$	$(-1,0)$	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y\in\mathbb{R}\}$ or $\{y\mid -\infty<y<\infty\}$
4. $f(x)=-\frac{1}{2}x-2$		$m=-\frac{1}{2}$	$b=-2$	$(-4,0)$	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y\in\mathbb{R}\}$ or $\{y\mid -\infty<y<\infty\}$

Figure 22: Quadratic Review Cover Page

Quadratic Review

2 pages

TEKS

- A.6(A): determine the domain and range of quadratic functions and represent the domain and range using inequalities
- A.7(A): graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x-intercepts, y-intercepts, zeroes, maximum value, minimum values, vertex and the equation of the axis of symmetry.

Objectives

- determine the domain and range of quadratic functions
- determine key features of quadratic functions
- graph quadratic functions and identify their corresponding equation

Intentional Questions

- Where is the y-intercept located on the equation?
- Will the graph be a maximum or a minimum?
- Can you locate the x-intercept(s) on the graph?
- What can you conclude about the domain for all quadratic functions?

Structure

- Independent Practice
- Hands-On Activity: Cut & Paste

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-On
- Cooperative
- Independent
- Technology

Vocabulary

- quadratic
- x-intercepts
- y-intercept
- domain
- range
- vertex
- axis of symmetry
- maximum/minimum

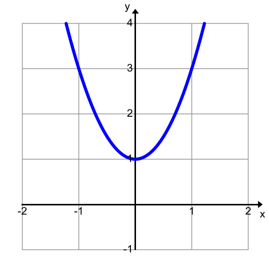
Directions

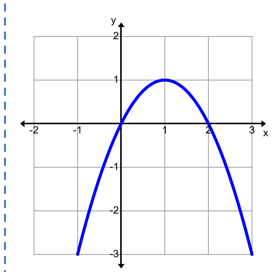
- Cut out each graph on the right and correctly match the graph with each equation.
- Find all the key features.

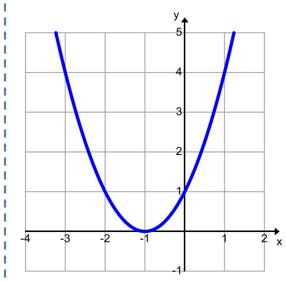
Quadratics Review (page 1)

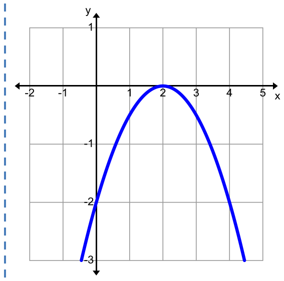
Cut out each graph on the right and correctly match the graph with each equation and find all the key features.

Equation	Graph	Vertex	AOS	Zeros	Max/Min	Domain	Range
1. $f(x)=x^2+2x+1$							
2. $f(x)=-\frac{1}{2}x^2+2x-2$							
3. $f(x)=-x^2+2x$							
4. $f(x)=2x^2+1$							









Quadratics Review Key (page 2)

Cut out each graph on the right and correctly match the graph with each equation and find all the key features.

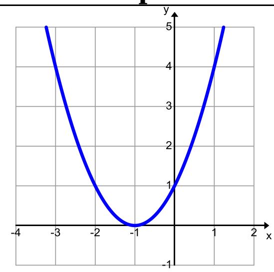
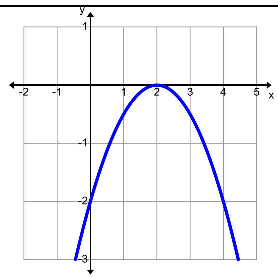
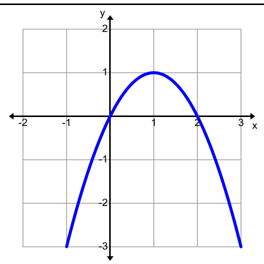
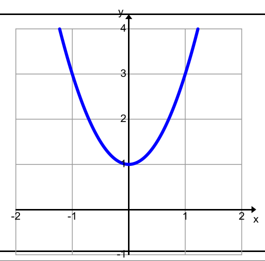
Equation	Graph	Vertex	AOS	Zeros	Max/Min	Domain	Range
1. $f(x)=x^2+2x+1$		$(-1,0)$	$x=-1$	$(-1,0)$	min @ $y=0$	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y\ge 0\}$
2. $f(x)=-\frac{1}{2}x^2+2x-2$		$(2,0)$	$x=2$	$(-1,0)$	max @ $y=0$	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y\le 0\}$
3. $f(x)=-x^2+2x$		$(1,1)$	$x=1$	$(0,0)$ $(2,0)$	max @ $y=1$	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y\le 1\}$
4. $f(x)=2x^2+1$		$(0,1)$	$x=0$	None	min @ $y=1$	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y\ge 1\}$

Figure 23: Exponential Review Cover Page

Exponential Review

4 pages

TEKS

- A.9(A): determine the domain and range of exponential functions of the form $f(x) = ab^x$ and represent the domain and range using inequalities
- A.9(D): interpret the meaning of the values of a and b in exponential functions of the form $f(x) = ab^x$ in real-world problems

Objectives

- determine the key features of an exponential function
- graph exponential functions and identify their corresponding equation

Intentional Questions

- Where is the y-intercept located on the equation?
- Will this function be exponential growth or decay?
- How can you determine growth or decay from an equation?

Structure

- Independent Practice
- Hands-On Activity: Cut & Paste

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-On
- Cooperative
- Independent
- Technology

Vocabulary

- initial value
- variance
- growth
- decay
- exponential function
- domain
- range

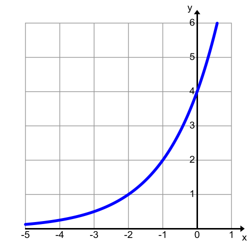
Directions

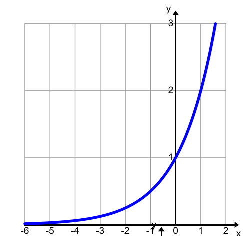
- Cut out each graph on the right and correctly match the graph with each equation.
- Find all the key features.

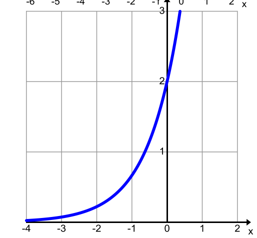
Exponential Review (page 1)

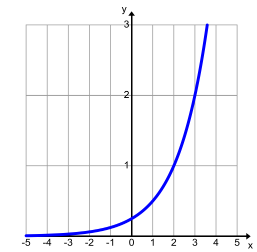
Cut out each graph on the right and correctly match the graph with each equation and find all the key features.

Equation	Graph	Initial a=	Variance b=	Growth or Decay	Domain	Range
1. $f(x)=4(2)^x$						
2. $f(x)=2(3)^x$						
3. $f(x)=\frac{1}{4}(2)^x$						
4. $f(x)=2^x$						



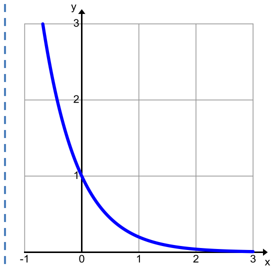


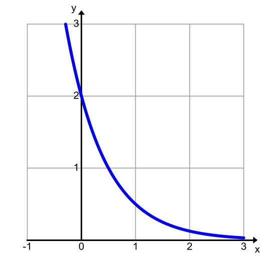


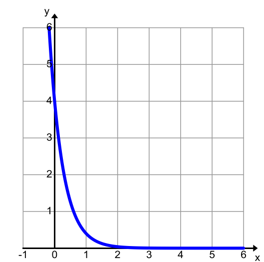


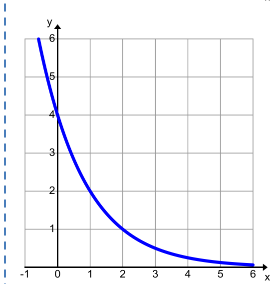
(page 2)

Equation	Graph	Initial a=	Variance b=	Growth or Decay	Domain	Range
5. $f(x) = 4(\frac{1}{2})^x$						
6. $f(x) = 4(\frac{1}{4})^x$						
7. $f(x) = 0.2^x$						
8. $f(x) = 2(\frac{1}{4})^x$						



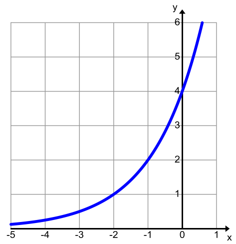
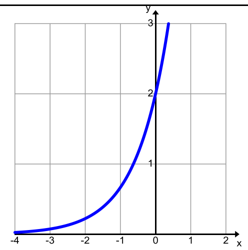
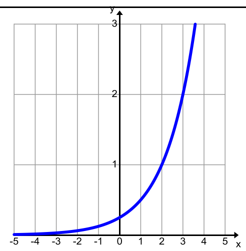
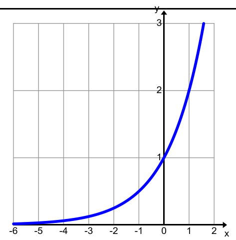






Exponential Review Key (page 1)

Cut out each graph on the right and correctly match the graph with each equation and find all the key features.

Equation	Graph	Initial a=	Variance b=	Growth or Decay	Domain	Range
1. $f(x)=4(2)^x$		$a=4$	$b=2$	Growth	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y>0\}$
2. $f(x)=2(3)^x$		$a=2$	$b=3$	Growth	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y>0\}$
3. $f(x)=\frac{1}{4}(2)^x$		$a=\frac{1}{4}$	$b=2$	Growth	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y>0\}$
4. $f(x)=2^x$		$a=1$	$b=2$	Growth	$\{x\mid x\in\mathbb{R}\}$ or $\{x\mid -\infty<x<\infty\}$	$\{y\mid y>0\}$

(page 2)

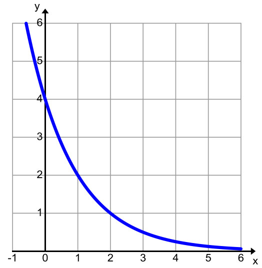
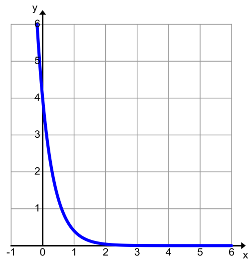
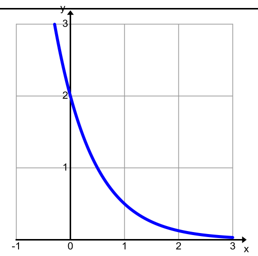
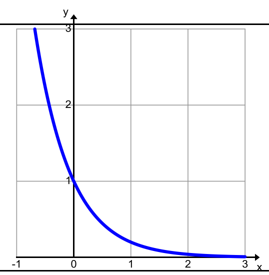
Equation	Graph	Initial a=	Variance b=	Growth or Decay	Domain	Range
5. $f(x)=4(\tfrac{1}{2})^x$		$a=4$	$b=\tfrac{1}{2}$	Decay	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y>0\}$
6. $f(x)=4(\tfrac{1}{4})^x$		$a=4$	$b=\tfrac{1}{4}$	Decay	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y>0\}$
7. $f(x)=0.2^x$		$a=1$	$b=0.2$	Decay	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y>0\}$
8. $f(x)=2(\tfrac{1}{4})^x$		$a=2$	$b=\tfrac{1}{4}$	Decay	$\{x \mid x\in\mathbb{R}\}$ or $\{x \mid -\infty<x<\infty\}$	$\{y \mid y>0\}$

Figure 24: Parallel, Perpendicular or Neither Cover Page

Linear Properties and Equations Review

4 pages

TEKS

- A.2(C): write linear equations in two variables given a table of values, a graph, and a verbal description.
- A.3(A): determine the slope of a line given a table of values, a graph, two points on the line, and an equation written in various forms, including $y = mx + b$, $Ax + By = C$, and $y - y_1 = m(x - x_1)$
- A.3(B): calculate the rate of change of a linear function represented tabularly, graphically, or algebraically in context of mathematical and real-world problems

Objectives

- determine the slope/y-intercept of a given a table, graph, equation or situation
- write a linear equation that represents a given a table, graph, equation or situation
- use vocabulary terms to define aspects of linear equations

Intentional Questions

- What is the linear parent function?
- What is the first step in finding the slope from a table?
- How do you find the slope from a graph?
- Where is the slope located in an equation in slope-intercept form?
- How do you find the y-intercept from a table?
- How do you find the y-intercept from a graph?
- Where is the y-intercept located in an equation in slope-intercept form?

Structure

- Hands-On Activity: Jeopardy
- Vocabulary

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method

- Hands-On
- Cooperative
- Technology
- Vocabulary

Vocabulary

- slope
- parent function
- y-intercept
- standard form of a line
- slope-intercept form

Directions

- Arrange students in groups of three to five students.
- Give students a white board and dry erase marker or some scratch paper to show their work.
- The team who selects the category will receive the indicate points for correctly answering the jeopardy question allowed and have it written on their white board. If they do not answer it correctly, the next team in line can steal and receive the points if answered correctly.
- The team who has the most points wins.
- The answers are embedded under the question. You can reveal the question by clicking below the question.

Linear Properties and Equations Review (page 1)

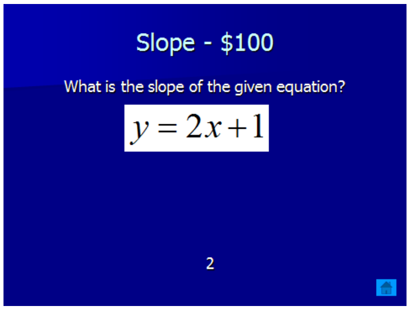
Linear Review

Slope	y-intercept	Equations	Vocabulary	STAAR
$100	$100	$100	$100	$100
$200	$200	$200	$200	$200
$300	$300	$300	$300	$300
$400	$400	$400	$400	$400
$500	$500	$500	$500	$500

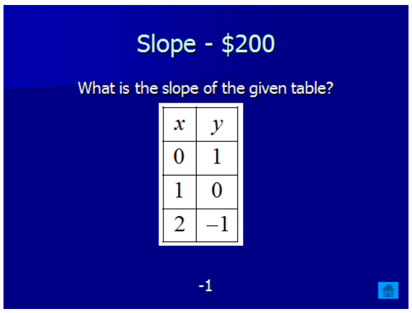
(page 2)

Slope

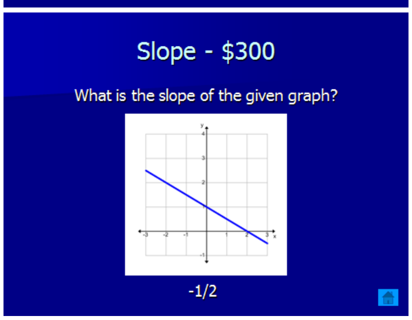
$100



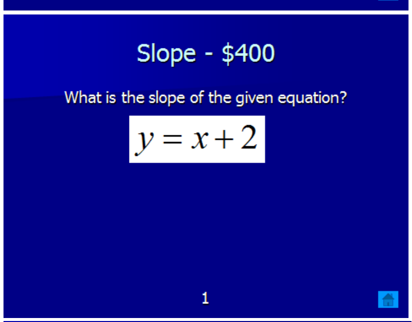
$200



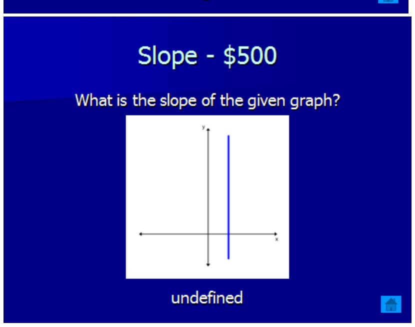
$300



$400

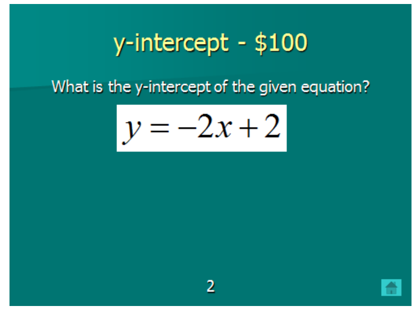


$500



y-intercept

$100



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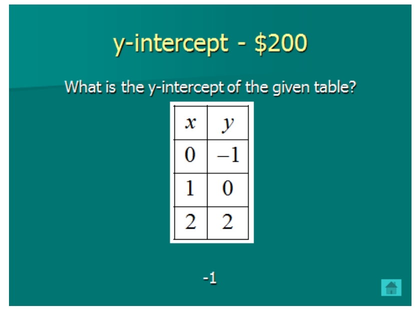

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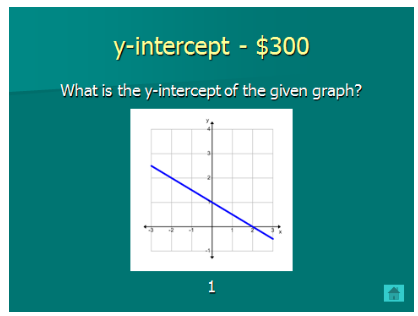

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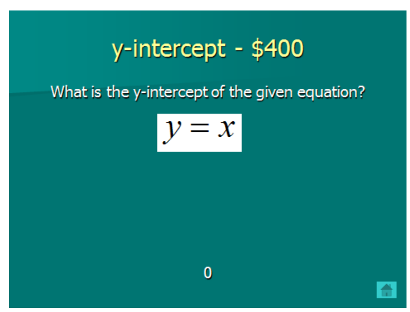

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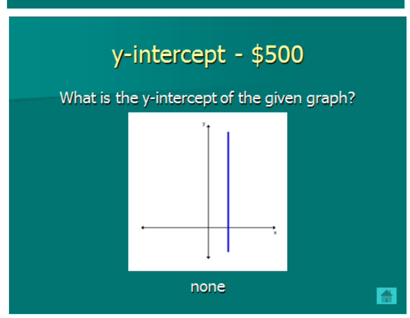
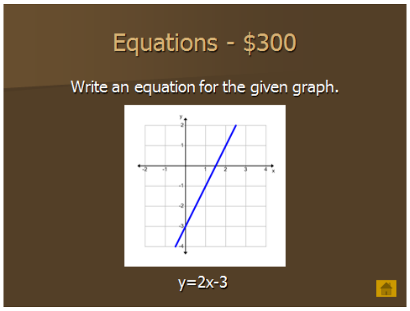


(page 3)

Equations

$100



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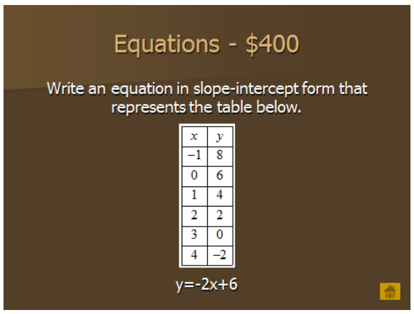

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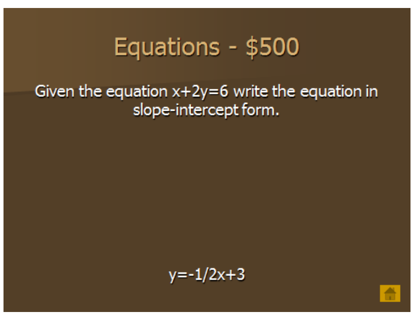

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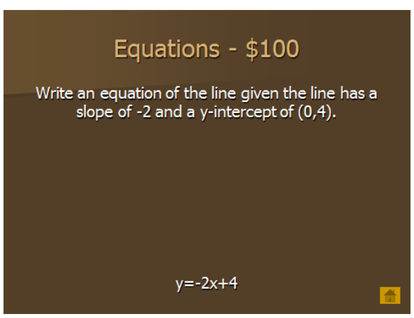

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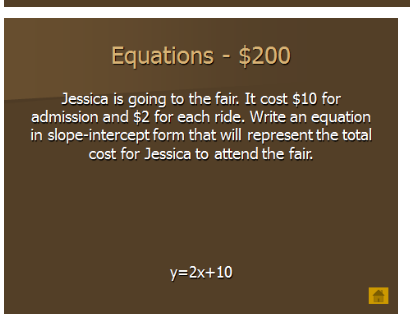
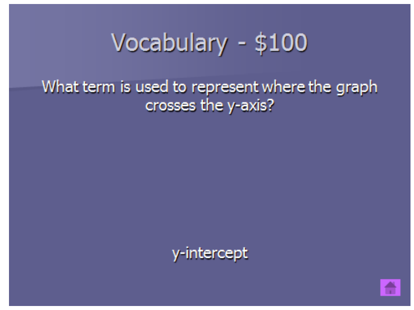


Vocabulary

$100



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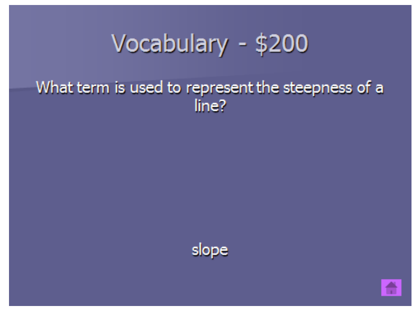

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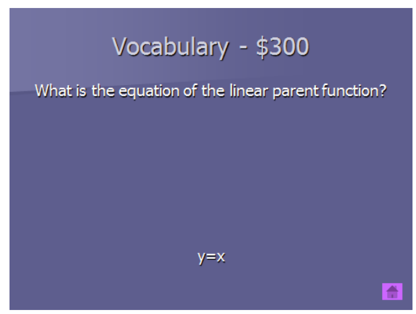

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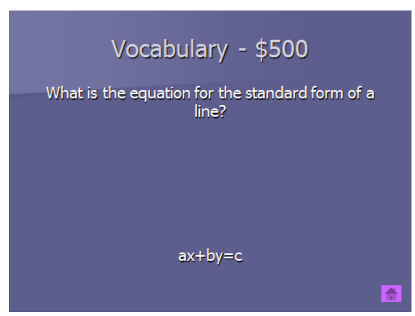
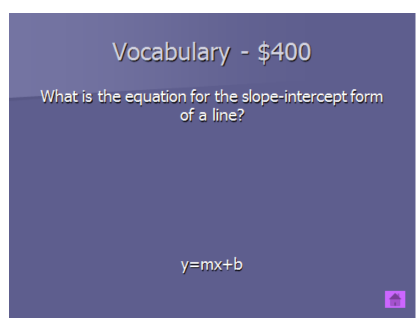


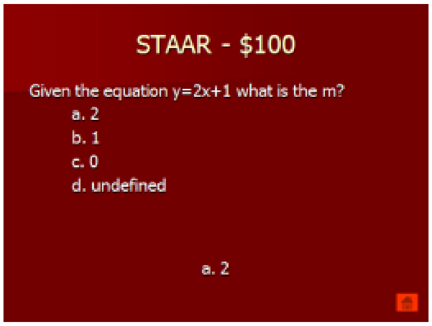
$500



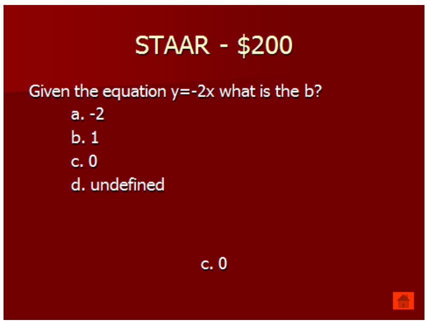
(page 4)

STAARR

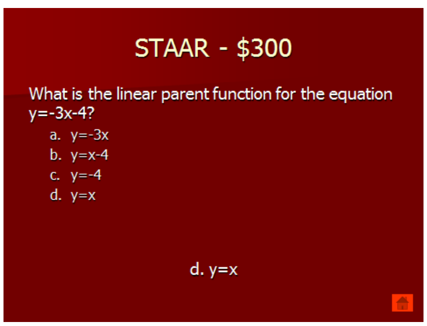
$100



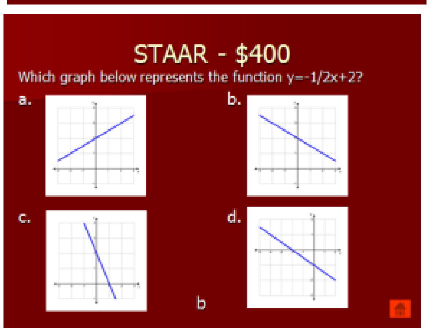
$200



$300



$400



$500

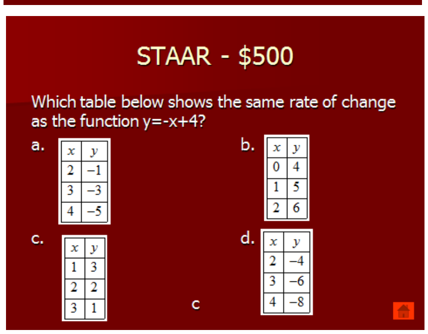


Figure 25: Quadratic Graphs and Equations Review Cover Page

Quadratic Graphs and Equations Review

6 pages

TEKS

- A.6(A): determine the domain and range of quadratic functions and represent the domain and range using inequalities
- A.7(A): graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x-intercepts, y-intercepts, zeroes, maximum value, minimum values, vertex and the equation of the axis of symmetry.

Objectives

- determine the domain and range of a quadratic function
- find key attributes of a quadratic function

Intentional Questions

- What is the equation of the quadratic parent function?
- True or False: The graph if a quadratic is a straight line.
- What is the highest power of a quadratic function?
- What is another word used to describe the graph of a quadratic function?
- Where is the vertex located?

Structure

- Hands-On Activity: Jeopardy
- Vocabulary

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method

- Hands-On
- Cooperative
- Vocabulary
- Technology

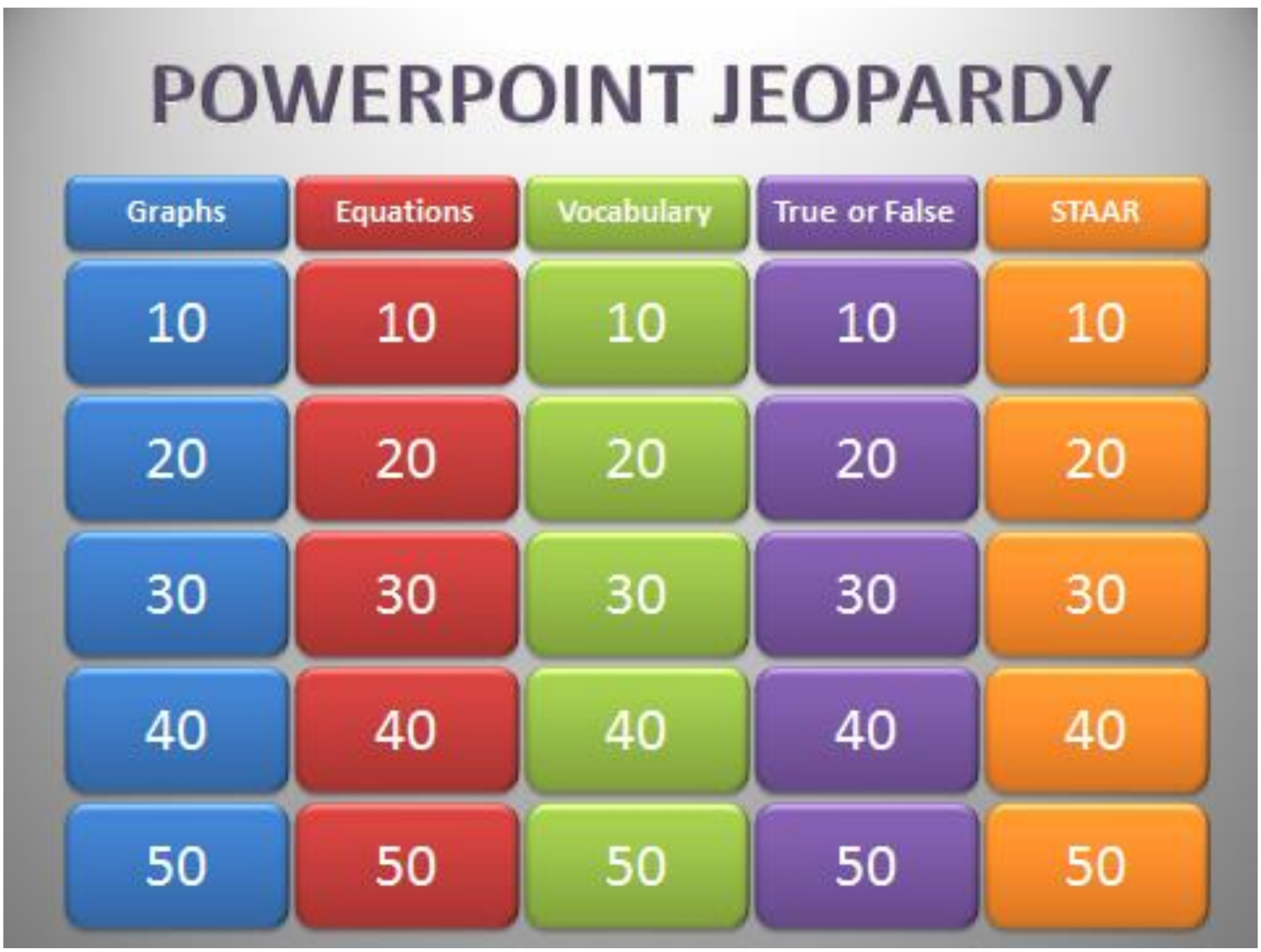
Vocabulary

- Quadratic
- parent function
- vertex
- x-intercepts, roots, zeros, solutions
- maximum/minimum
- domain/range

Directions

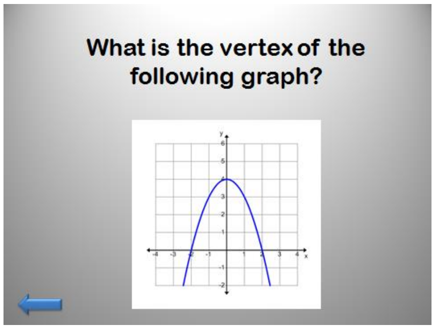
- Arrange students in groups of three to five students.
- Give students a white board and dry erase marker or some scratch paper to show their work.
- The team who selects the category will receive the indicate points for correctly answering the jeopardy question allowed and have it written on their white board. If they do not answer it correctly, the next team in line can steal and receive the points if answered correctly.
- The team who has the most points wins.
- The answers are embedded under the question. You can reveal the question by clicking below the question.

Quadratic Graphs and Equations Review (page 1)



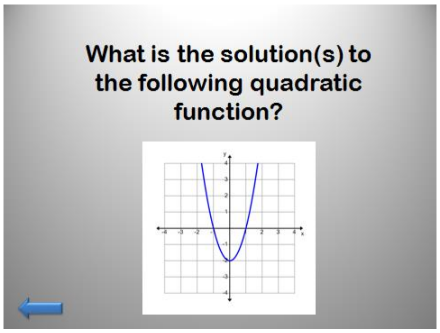
Graphs (page 2)

10 points



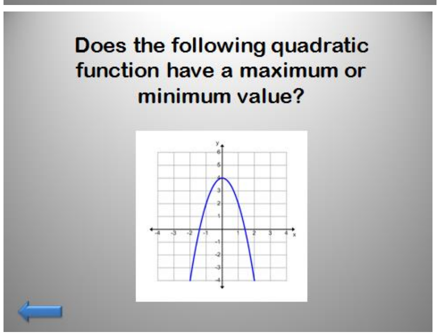
Answer: $(0,4)$

20 Points



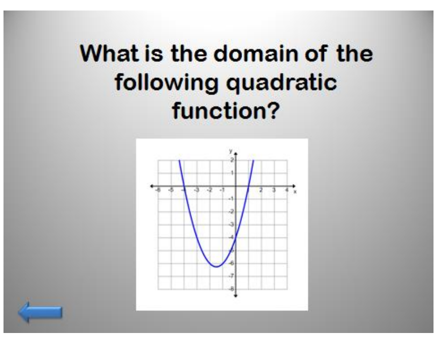
Answer: $(-1,0)\ \&\ (1,0)$

30 Points



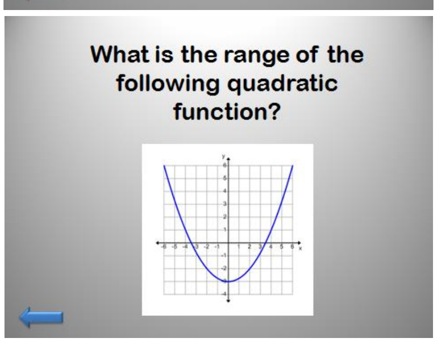
Answer: maximum value

40 Points



Answer: $\{x \mid x \text{ is All Real Numbers}\}$

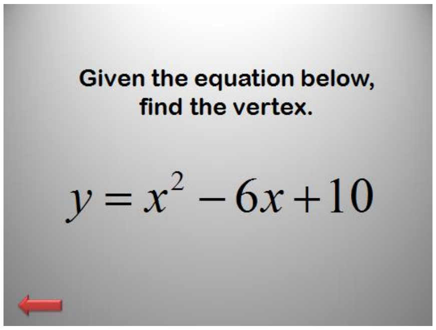
50 Points



Answer: $\{y \mid y \geq -3\}$

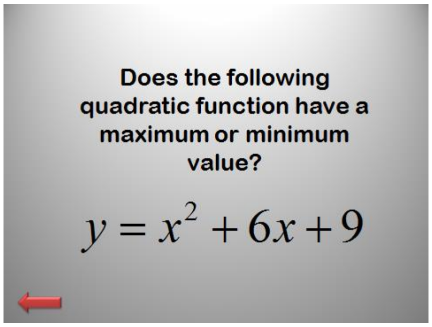
<u>Equations</u> (page 3)

10 points



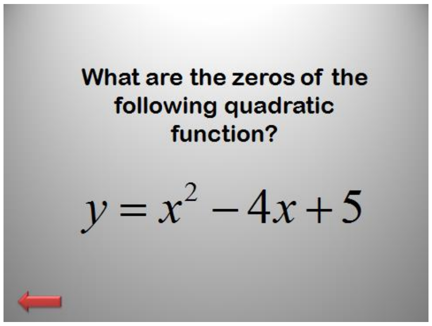
Answer: $(3,1)$

20 Points



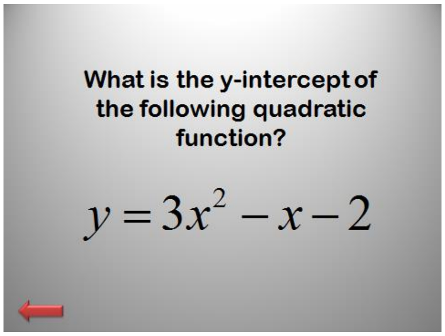
Answer: minimum value

30 Points



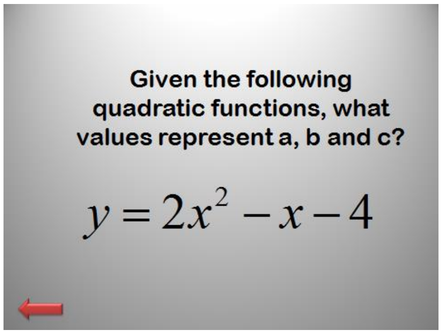
Answer: none

40 Points



Answer: $(0, -2)$

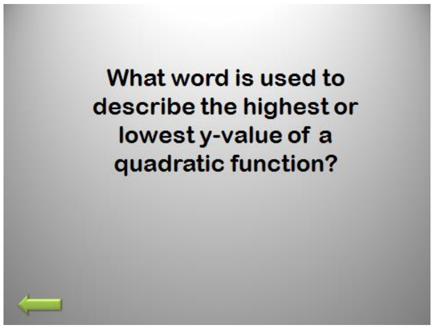
50 Points



Answer: $a = 2,\ b = -1,\ c = -4$

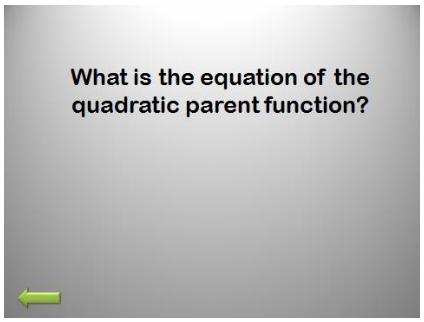
Vocabulary (page 4)

10 points



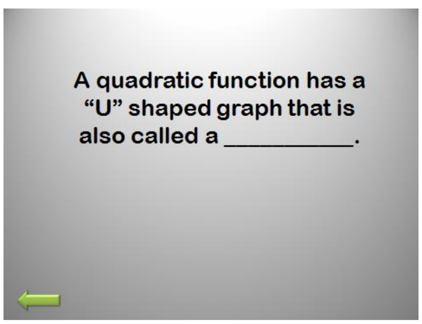
Answer: vertex

20 Points



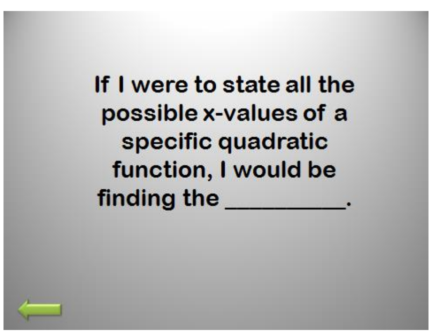
Answer: $y = x^2$

30 Points



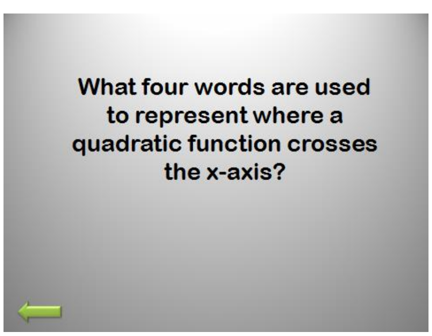
Answer: parabola

40 Points



Answer: domain

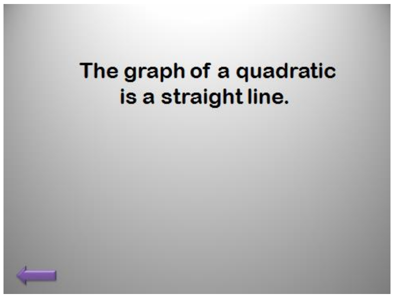
50 Points



Answer: zeros, roots, solutions and x-intercepts

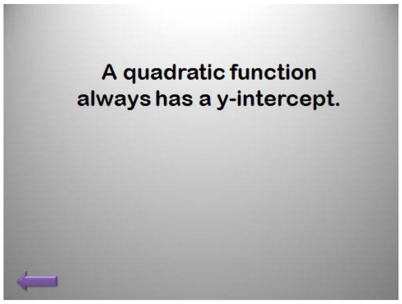
<u>True or False</u> (page 5)

10 points



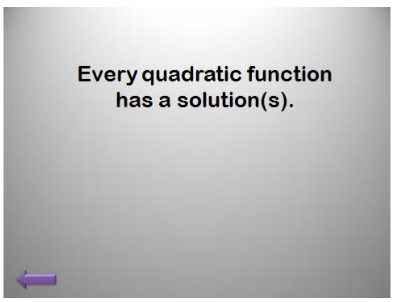
Answer: False

20 Points



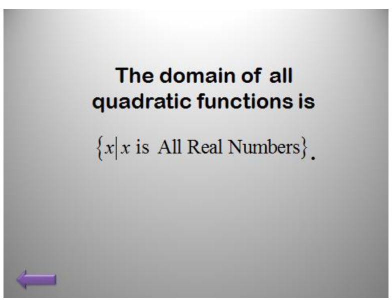
Answer: True

30 Points



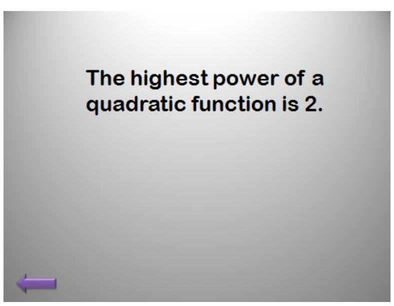
Answer: False

40 Points



Answer: True

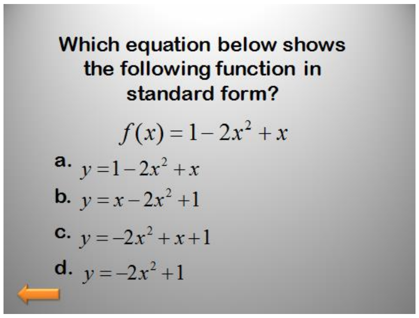
50 Points



Answer: True

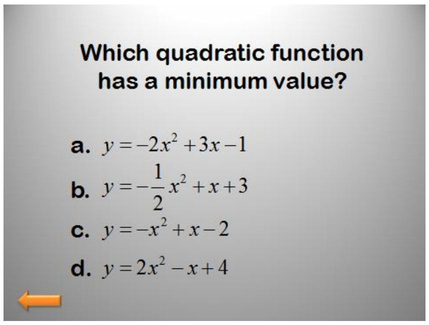
STAARS (page 6)

10 points



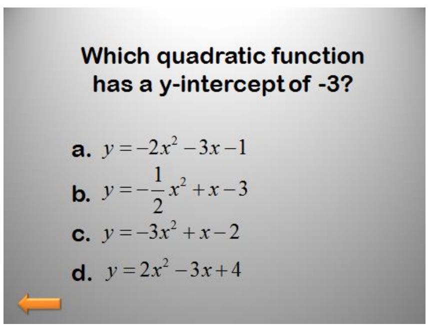
Answer: c. $y = -2x^2 + x + 1$

20 Points



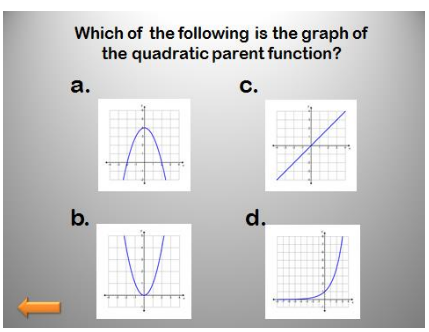
Answer: d. $y = 2x^2 - x + 4$

30 Points

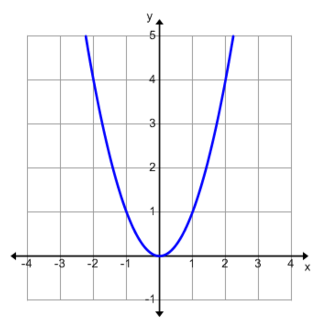


Answer: b. $y = -\frac{1}{2}x^2 + x - 3$

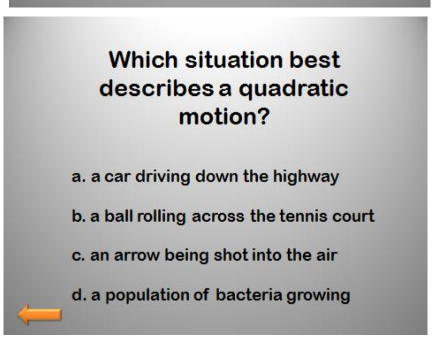
40 Points



Answer: b.



50 Points



Answer: c. an arrow being shot into the air

Figure 26: Linear Review Cover Page

Parallel, Perpendicular or Neither

3 pages

TEKS

- A.2(E): write the equation of a line that contains a given point and is parallel to a given line
- A.2(F): write the equation of a line that contains a given point and is perpendicular to a given line
- A.2(G): write the equation of a line that is parallel or perpendicular to the x- or y-axis and determine whether the slope of the line is zero or undefined

Objectives

- determine whether two equations are parallel, perpendicular or neither
- determine whether a slope is zero or undefined

Intentional Questions

- How do you know when two equations are parallel?
- How do you know when two equations are perpendicular?
- What would the graph of an undefined slope look like?
- What would the graph of a zero slope look like?

Structure

- Hands-On Activity: Smart Board

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Hands-On
- Cooperative
- Independent
- Technology

Vocabulary

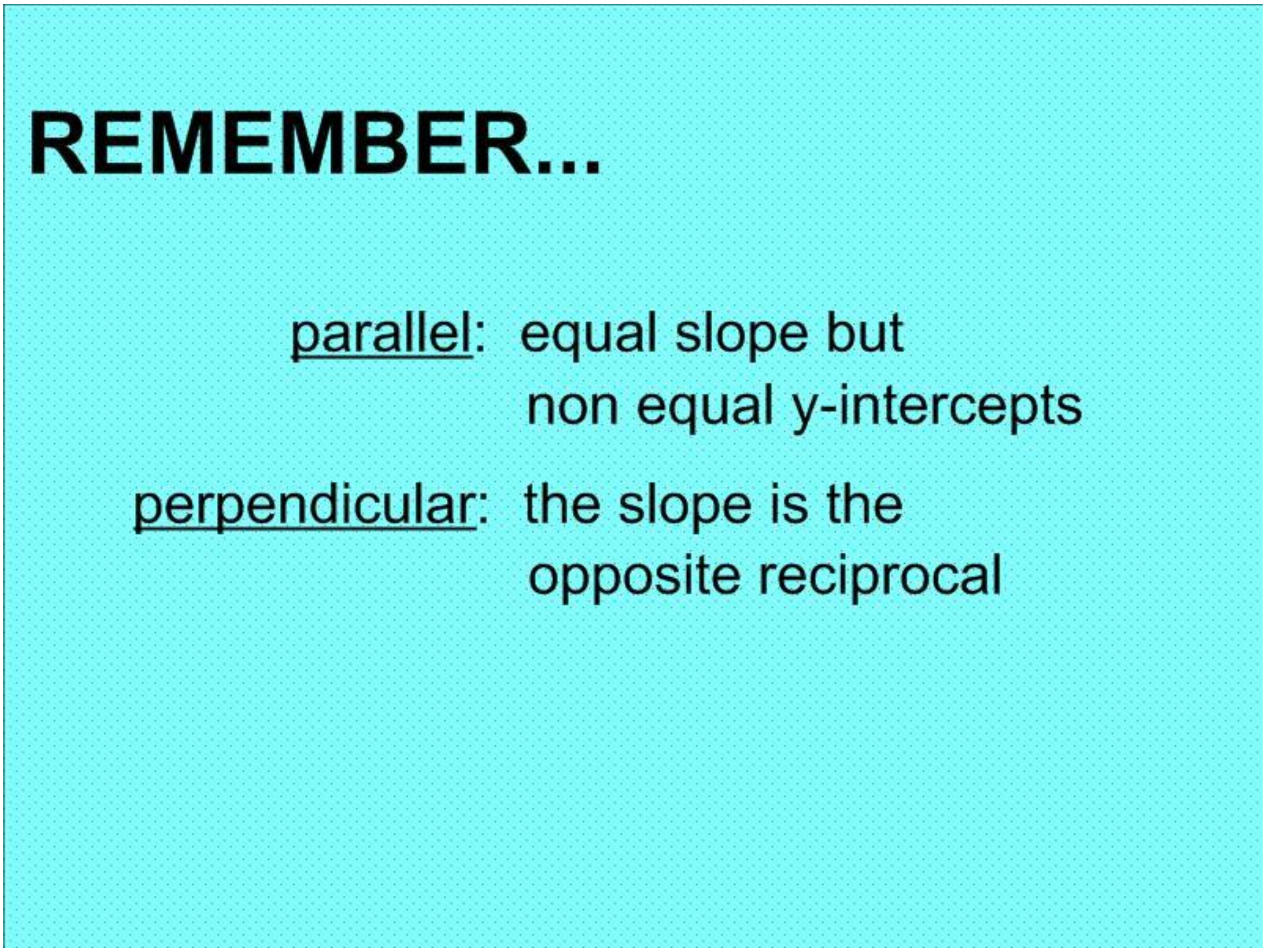
- parallel
- perpendicular
- slope
- y-intercept
- four types of slope

Directions

- Once a student has chosen whether the equations are parallel perpendicular or neither, use the eraser to allow the check mark to appear in the chosen box.
- In the last slide, student will determine what type of slope each line has. Use the eraser to allow the check mark to appear in the chosen box.
- If an x-mark appears, they have answered incorrectly and they can discuss and then correctly identify which answer is correct.

Parallel, Perpendicular or Neither (page 1) $y = x$

Parallel, Perpendicular, Neither Smartboard.notebook



(page 2)

1. $y = 2x + 3$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y = -2x + 3$			
$y = 2x + 1$			
$y = -\frac{1}{2}x + 2$			
$y = 3 + 2x$			
$y = \frac{1}{2}x - 3$			

1. $y = 2x + 3$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y = -2x + 3$	X	X	✓
$y = 2x + 1$	✓	X	X
$y = -\frac{1}{2}x + 2$	X	✓	X
$y = 3 + 2x$	X	X	✓
$y = \frac{1}{2}x - 3$	X	X	✓

2. $y = \frac{1}{3}x - 1$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y = -\frac{1}{3}x + 3$			
$y = \frac{1}{3}x + 1$			
$y = 3x + 5$			
$y = -3x - 2$			
$y = -1 + \frac{1}{3}x$			

2. $y = \frac{1}{3}x - 1$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y = -\frac{1}{3}x + 3$	X	X	✓
$y = \frac{1}{3}x + 1$	✓	X	X
$y = 3x + 5$	X	X	✓
$y = -3x - 2$	X	✓	X
$y = -1 + \frac{1}{3}x$	X	X	✓

3. $y = x - 7$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y = -x + 3$			
$y = x + 7$			
$y = x - 7$			
$y = -7x + 1$			
$y = x$			

3. $y = x - 7$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y = -x + 3$	X	✓	X
$y = x + 7$	✓	X	X
$y = x - 7$	X	X	✓
$y = -7x + 1$	X	X	✓
$y = x$	✓	X	X

(page 3)

4. $y=-\frac{2}{3}x+3$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y=-x+3$			
$y=\frac{2}{3}x+3$			
$y=\frac{3}{2}x-1$			
$y=2-\frac{2}{3}x$			
$y=3-\frac{2}{3}x$			

4. $y=-\frac{2}{3}x+3$

Directions: Using the given equation, determine whether the following equations are parallel, perpendicular or neither.

EQUATION	PARALLEL	PERPENDICULAR	NEITHER
$y=-x+3$	X	X	✓
$y=\frac{2}{3}x+3$	X	X	✓
$y=\frac{3}{2}x-1$	X	✓	X
$y=2-\frac{2}{3}x$	✓	X	X
$y=3-\frac{2}{3}x$	X	X	✓

5.

Directions: Using the given equation, determine whether the slope is positive, negative, zero or undefined.

EQUATION	POSITIVE	NEGATIVE	ZERO	UNDEFINED
$y=-x+3$				
$y=\frac{2}{3}x+3$				
$y=2$				
$x=-1$				
$y=3-\frac{2}{3}x$				

5.

Directions: Using the given equation, determine whether the slope is positive, negative, zero or undefined.

EQUATION	POSITIVE	NEGATIVE	ZERO	UNDEFINED
$y=-x+3$	X	✓	X	X
$y=\frac{2}{3}x+3$	✓	X	X	X
$y=2$	X	X	✓	X
$x=-1$	X	X	X	✓
$y=3-\frac{2}{3}x$	X	✓	X	X

6.

Directions: Using the given equation, determine whether the slope is positive, negative, zero or undefined.

EQUATION	POSITIVE	NEGATIVE	ZERO	UNDEFINED
$y=0$				
$y=x$				
$y=x-3$				
$y=2-3x$				
$x=4$				

6.

Directions: Using the given equation, determine whether the slope is positive, negative, zero or undefined.

EQUATION	POSITIVE	NEGATIVE	ZERO	UNDEFINED
$y=0$	X	X	✓	X
$y=x$	✓	X	X	X
$y=x-3$	✓	X	X	X
$y=2-3x$	X	✓	X	X
$x=4$	X	X	X	✓

CHAPTER VIII

VOCABULARY ACTIVITIES AND SUGGESTED TERMS

The use of vocabulary in the classroom is essential in the process and understanding of math learners. Reviewing over vocabulary does not have to be time consuming. Using vocabulary review at the beginning of class, in the daily lesson or as a closing can be a quick and simple way to integrate vocabulary daily. Students need to have a deep understanding of their vocabulary terms. Without vocabulary comprehension students will struggle reaching the goals and being successful in the Algebra course. In this chapter there are different types of vocabulary activities and assessments to use throughout the Algebra course. Table 8 shows a quick guide to what actives and assessment will be shown in this chapter. Table 9 is a comprehensive guide to the vocabulary used throughout the Algebra course. Each vocabulary term has a definition and a representation. This guide can be used to help educators or it can be given to students to use throughout the Algebra course.

Table 8: List of Vocabulary Activities and Assessments

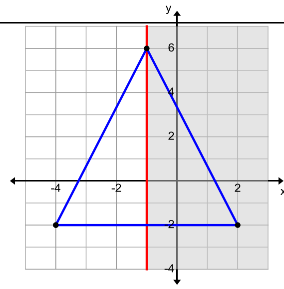
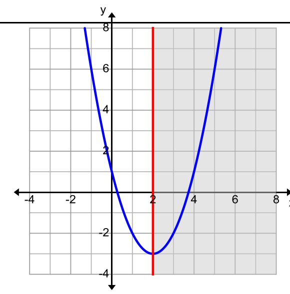
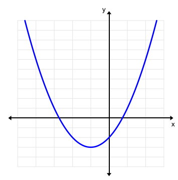
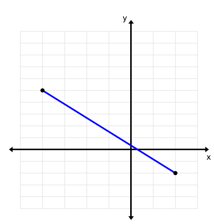
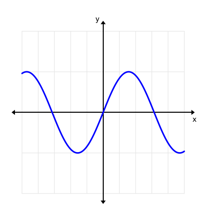
Vocabulary	Intelligence	Learning Method	Page
Crossword 1	Verbal-Linguistic Logical-Mathematical Spatial Intrapersonal	Cooperative Independent Vocabulary	213
Crossword 2	Verbal-Linguistic Logical-Mathematical Spatial Intrapersonal	Cooperative Independent Vocabulary	222
Quiz 1 through 4	Verbal-Linguistic	Independent Vocabulary	225
Erase and Reveal	Verbal-Linguistic Logical-Mathematical Spatial Bodily-Kinesthetic Intrapersonal	Hands-On Cooperative Independent Technology Vocabulary	237

Writing the definition on their daily notes will not give students the necessary practice to remember and memorize vocabulary terms. Students must engage in vocabulary learning activities and have vocabulary assessments on a regular basis. Figure 27 and Figure 28 are crossword puzzles created to allow students review over vocabulary. Crossword puzzles do not have to be an independent worksheet where students fill in quietly, sitting in their desks. Students can be instructed to move around the room and work together on filling out the crossword. Educators can set a timer to make sure students work quickly and stay on task. Quizzing students over vocabulary terms at the end of class or the next day can re-iterate the importance of learning Algebra vocabulary. Crosswords are a fun way to allow creativity and cooperative learning.

It is essential that educators have regular assessments involving vocabulary. Vocabulary can be placed throughout a topics assessment or designed to allow the students to strictly focus on the terms they have learned and their definitions. Figure 29 provides four different vocabulary assessments applicable to different reporting categories throughout the Algebra course. These assessments can be timed and used repeatedly throughout the course. The last hands-on activity shown in Figure 30 is and erase and reveal smart board application to vocabulary. Educators can easily convert the terms and definitions into a quick and fun technology activity. These types of vocabulary activities are great to use when students are working in stations. They also provide the educator with a great hands-on activity to fill any time at the end of class if a lesson is finished earlier than planned.

Using math language in the classroom can be challenging. Creating and using vocabulary activities, puzzles and assessments show students the importance of learning and memorizing vocabulary. By assessing students understanding of vocabulary terms, teachers can know when to re-teach and lend aid to students who do not understand. The Algebra course is filled with new topics and vocabulary that students are required to know all year round. With cycling the vocabulary into daily lesson planning, educators allow students the opportunity to fully understand vocabulary and retain the definitions months after first introducing the term. More examples of ways to integrate vocabulary was discussed near the end of the literary review. Using flashcard and displaying vocabulary throughout the classroom is one of many ways to show the importance of vocabulary throughout the Algebra course.

Table 9: Algebra Suggested Vocabulary

(page 1) **arithmetic sequence** a set of values that increase or decrease by a constant value using addition or subtraction	$0, 5, 10, 15, 20, \ldots$ The above sequence is arithmetic where each term increases by five to get to the next term.
axis of symmetry a vertical line that cuts a graph into 2 equal halves	  Triangle AOS: $x = -1$ Parabola AOS: $x = 2$
base a number or variable raised to a power	$9^3 = 729$ The number 9 is the **base** and is raised to the power of 3.
binomial two monomials separated by addition or subtraction	$3x^2 - x$ This expression is a **binomial** because it has two terms.
coefficient the number in front of a variable	$2x^2 + 3x - 1$ The number 2 is the **coefficient** of x^2 and the number 3 is the **coefficient** of x
continuous connected values of a set that can take on an infinite amount	**Temperature, time and distance are a few examples that are continuous.**    These graphs are **continuous** because you can draw then without lifting your pencil.

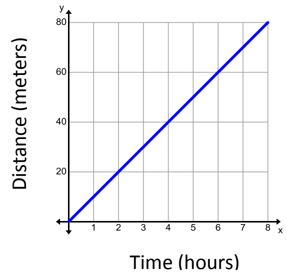
direct variation

a relation where two quantities change in the same way

1. Goes through $(0,0)$

2. Has a constant rate $y = kx$

The distance increases as time increases. **Direct variation** on a graph will always be linear.



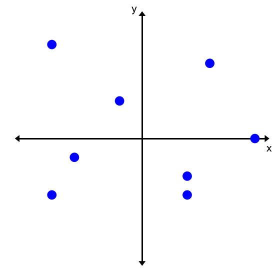
---

discrete

disconnected values of a set that take on specific values.

Objects, people and animals are a few examples that are discrete.

A **discrete** graph is a series of unconnected points; dots.



---

distribute

to multiply a number by a group of numbers

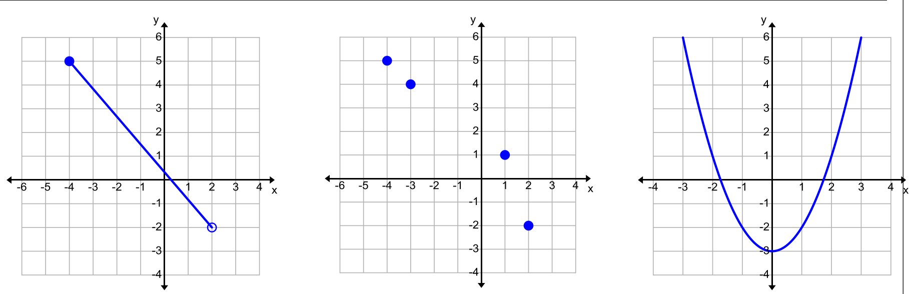
$3x(x-2) = 3x^2 - 6x$

In order to **distribute**, you must take the monomial of $3x$ and multiply it by both x and -2.

---

domain

all possible x-values



D: $\{x \mid -4 \le x < 2\}$ **D:** $\{x \mid x = -4, -3, 1, 2\}$ **D:** $\{x \mid x \in \mathbb{R}\}$

---

equation

two expressions with an equal sign between them

$2x - 3 = 11$

$3a + 1 = a - 5$

Both sides of an **equation** have equal value. **Equations** can have numbers and variables.

---

evaluate

to calculate the value

Find $f(3)$ when $f(x) = -2x^2 + x - 1$

$f(3) = -2(3)^2 + (3) - 1$

$f(3) = -16$

When you **evaluate**, you substitute a number in for a variable.

(page 3)

exponent

the number of times you multiply a base; the power

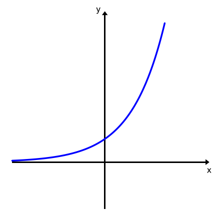
$$3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$$

The number 4 represents the **exponent** belong to the base of 3.

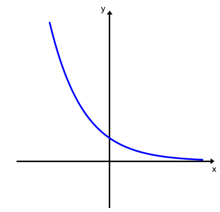
---

exponential growth & decay

a population that is increasing or decreasing rapidly



exponential growth



exponential decay

---

factoring

to break down into parts of multiplication

$$(2x+1)(x-3) = 2x^2 - 5x - 3$$

$2x+1$ and $x-3$ are **factors** of $2x^2 - 5x - 3$

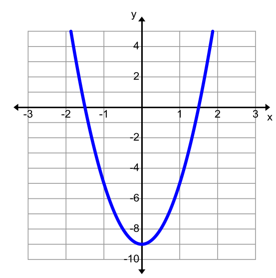
---

function

each input has only one output

$y = 4x^2 - 9$

x	y
-2	7
-1	-5
0	-9
1	-5
2	7



These examples are all **functions** because they have different x-values.

---

function notation

a way of writing an equation using $f(x)$ instead of y

$y = 2x + 5$

$f(x) = 2x + 5$ This equation is written in **function notation**.

---

geometric sequence

a set of values that increase or decrease by a constant ratio using multiplication or division

$$-2, 8, -16, 32, -64, \ldots$$

The above **sequence is geometric** where each term increases by a ratio of negative two.

(page 4)

greatest common factor

the largest value that divides evenly into all parts

$24: 1, 2, 3, 4, 6, 8, 12, 24$

$32: 1, 2, 4, 8, 16, 32$

The **greatest common factor** of 24 and 32 is 8.

$3x^3 + 6x^2 + 9x$

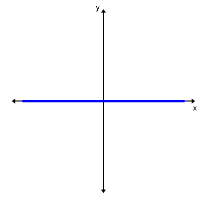
The **greatest common factor** of $3x^3 + 6x^2 + 9x$ is $3x$.

---

horizontal

parallel to the horizon; side to side

The x-axis is a **horizontal** line.



---

inequality

an equation that uses the symbols that may represent two quantities that are not equal

$>$ greater than

$<$ less than

$\geq$ greater than or equal to

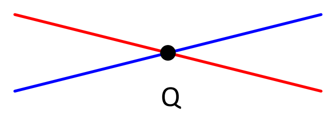
$\leq$ less than or equal to

---

intersect

to cross; to share a point

The point Q represents the **intersection**.



---

initial

the beginning value

The fair cost $5 to enter and $2 for every ride.

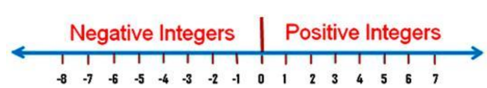
The **initial** cost is $5 to enter the fair grounds. Also known as starting value, y-intercept and initial value.

---

integer

a positive or negative whole number

Any whole number, whether positive or negative, is an **integer**.



---

like terms

same base, same exponent

$4x^2 + x + 6 - 2x^2 + 3x - 5$

You can combine **like terms** to simplify this expression.

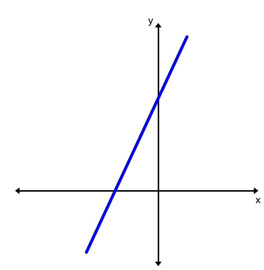
---

linear

a straight line on a graph, a function that has a constant rate and can be written in the from $y = mx + b$

$y = 3x + 3$

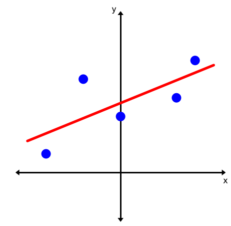
The graph is **linear** because it increases by a constant rate.



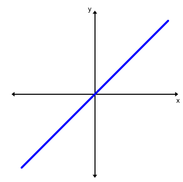
(page 5)

line of best fit
a function at which data values average towards

The **line of best fit** is drawn through the center of the data values

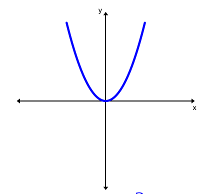


parent function
the original function before transformations



$y = x$

linear **parent function**

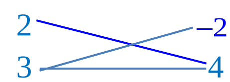


$y = x^2$

quadratic **parent function**

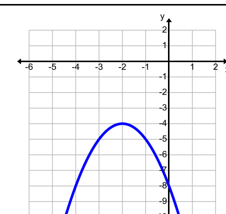
mapping
a way to relate each member of one set to a member of another

A **mapping** can be used to display a relation.



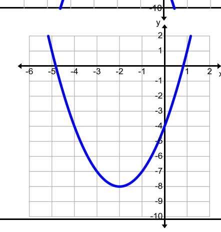
maximum
the greatest possible number

The **maximum** value occurs at $y = 4$.



minimum
the lowest or least number

The **minimum** value occurs at $y = -8$.



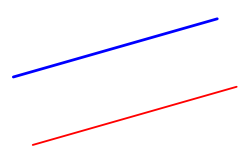
monomial
a signal term

$3x^2$

A **monomial** is all by itself without any addition or subtraction.

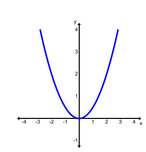
parallel
lines that never intersect or meet

These two lines are **parallel** because they will never cross.



parabola
a U-shaped graph

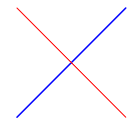
The shape of this quadratic graph is called a **parabola**.



(page 6)

perpendicular
lines that intersect at a right angle

These two lines are **perpendicular** because they intersect at a $90°$ angle.



---

point-slope formula
$y - y_1 = m(x - x_1)$

Point: $(2,3)$

Slope: $m = -2$

$y - y_1 = m(x - x_1)$

$y - 3 = -2(x - 2)$

When given a point and a slope, you can write an equation of a line using the **point-slope formula.**

---

polynomial
more than two terms

$-3x^3 + 2x^2 - x + 5$

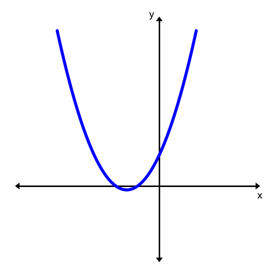
More than two monomials added or subtracted together make a **polynomial**

---

quadratic
a “u” shaped graph, a function that can be written in the form
$y = ax^2 + bx + c$

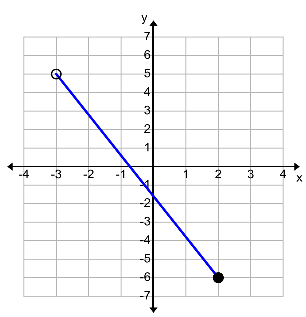
$y = 2x^2 + 3x + 1$

The graph is quadratic because it’s graph is a “u” shape.

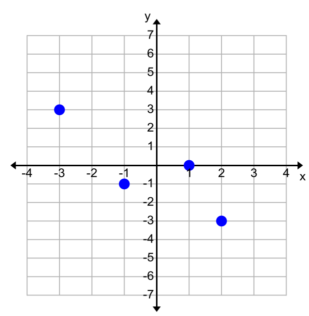


---

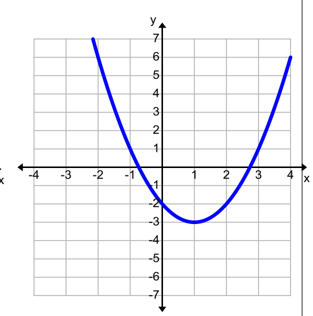
range
all possible y-values



R: $\{y \mid -6 \le y < 5\}$



R: $\{y \mid y = -3, -1, 0, 3\}$



R: $\{y \mid y \ge -3\}$

---

simplify
to rewrite using shorter terms that have the same value

$4x^2 + x + 6 - 2x^2 + 3x - 5$

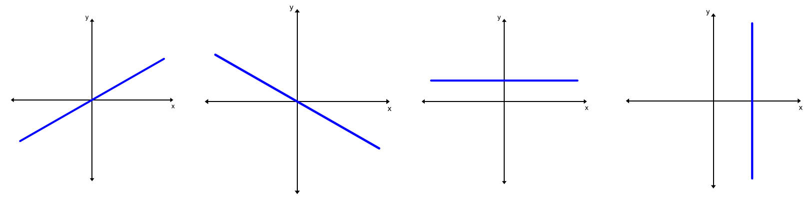
$2x^2 + 4x + 1$

When **simplifying** an expression you will combine like terms.

(page 7)

slope

to measure the steepness



positive negative zero undefined

There are four types of **slope** for a linear function. Slope may also be known as the rate of change, m, speed, pattern and $\frac{\Delta y}{\Delta x}$.

---

slope-intercept form of a line

$y = mx + b$

$y = mx + b$ where $m = \text{slope}$ and $b = \text{y-intercept}$

In order to graph a line, the equation must be in **slope-intercept form**.

---

standard form

the most basic form of a line

$ax + by = c$

linear standard form

$f(x) = ax^2 + bx + c$

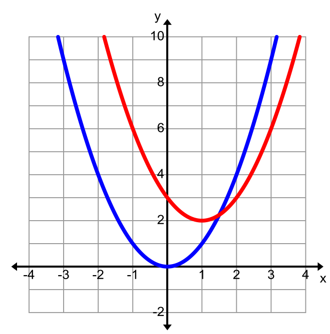
quadratic standard form

---

transformation

to move a figure in a particular way

The original function of $y = x^2$ was **transformed** into the equation $y = (x-1)^2 + 2$ by shifting the vertex horizontally and vertically.



---

trinomial

three terms

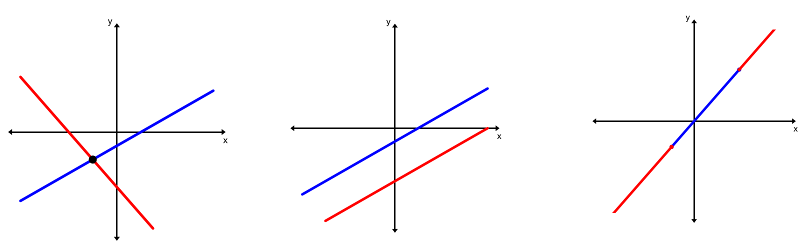
$2x^2 - 4x + 3$

Three monomials added or subtracted together make a **trinomial**.

---

solutions to a system

one solution, no solution, infinitely many solutions



one solution no solution infinite solution

(page 8)

system

two or more equations
on one coordinate plane

$$\begin{cases} y = 2x + 1 \\ 3x + 2y = 4 \end{cases}$$

Methods to solving a **system** include, graphing, substitution and elimination.

---

variable

a letter or symbol that represents
a quantity that can change

$3y + 2 = 11$

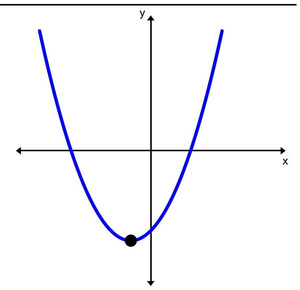
The **variable** in this equation is y.

---

vertex

the point where the parabola
changes direction

The **vertex** of this quadratic function is $(-1, 4)$.



---

vertex form

$y = a(x - h)^2 + k$

Given $y = 2(x-3)^2 + 5$ the vertex is $(3, 5)$.

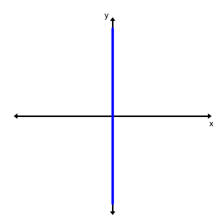
When an equation is written in **vertex form**, the vertex is (h, k).

---

vertical

perpendicular to the horizon;
up and down

The y-axis is a **vertical** line.



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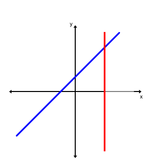
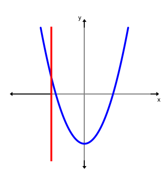
vertical line test

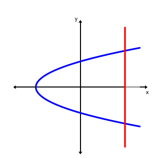
a test to determine if a
graph is a function



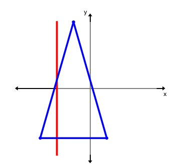
pass



pass



fail



fail

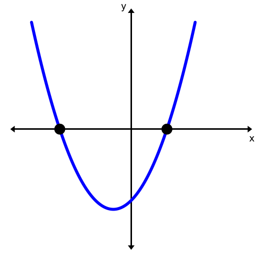
To use the **vertical line test**, draw a vertical line through your graph. If the line you have drawn crosses the graph only once, the graph is a function.

(page 9)

x-intercept

where the graph crosses the x-axis

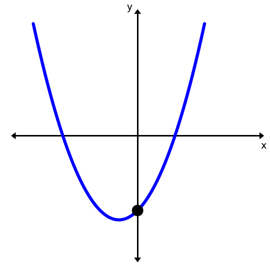
The **x-intercepts** can also be called the roots, zeros, and solutions.



y-intercept

where the graph crosses the y-axis

The y-intercept can also be called the starting value, b, initial amount or initial fee.



Symbol	Name	Example
$+$	addition	$2+2$
Δ	change in	Δy
$\circ$	degrees	98°
$\div$, $/$, $-$	divide	$6\div 2$, $6/2$, $\frac{6}{2}$
$\neq$	does not equal to	$2\neq 3$
$	dollars	$25.00
$=$	equals	$4=4$
∞	infinity	$-\infty < x < \infty$
$<$	less than	$5<10$
$>$	greater than	$10>5$
$\leq$	less than or equal to	$3\leq 2x+1$
$\geq$	greater than or equal to	$2x+1\geq 3$
$\times$, $\cdot$, ( ) , *	multiply	2×3 , $2\cdot 3$, $2(3)$, $2*3$
$-$	negative	-3
$\parallel$	parallel	$m \parallel n$
%	percent	100%
$\perp$	perpendicular	$x\perp y$
$+$	plus	$2+2$
$\pm$	plus or minus	-3 ± 4
$+$	positive	$+3$
$\sqrt{\ }$	square root	$\sqrt{25}$
$-$	subtraction	$2-2$

Figure 27: Vocabulary Crossword 1 Cover Page

Vocabulary Crossword 1

2 pages

TEKS

- Category 1: Number and Algebraic Methods
- Category 2: Describing and Graphing Linear Functions, Equations and Inequalities
- Category 3: Writing and Solving Linear Functions, Equations, and Inequalities

Objectives

- correctly identify key vocabulary

Intentional Questions

- What is another term use to represent the power above a base?
- What term is used to represent a symbol or letter?
- When the graph consists of disconnected dots, what type of data is presented?
- When the graph consists of connected values, what type of data is presented?

Structure

- Vocabulary

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method

- Cooperative
- Independent

Vocabulary

- exponent
- coefficient
- like terms
- base
- discrete
- continuous
- inequality
- integer
- equation
- variable
- distribute

Directions

- Fill in the crossword with the correct vocabulary term.

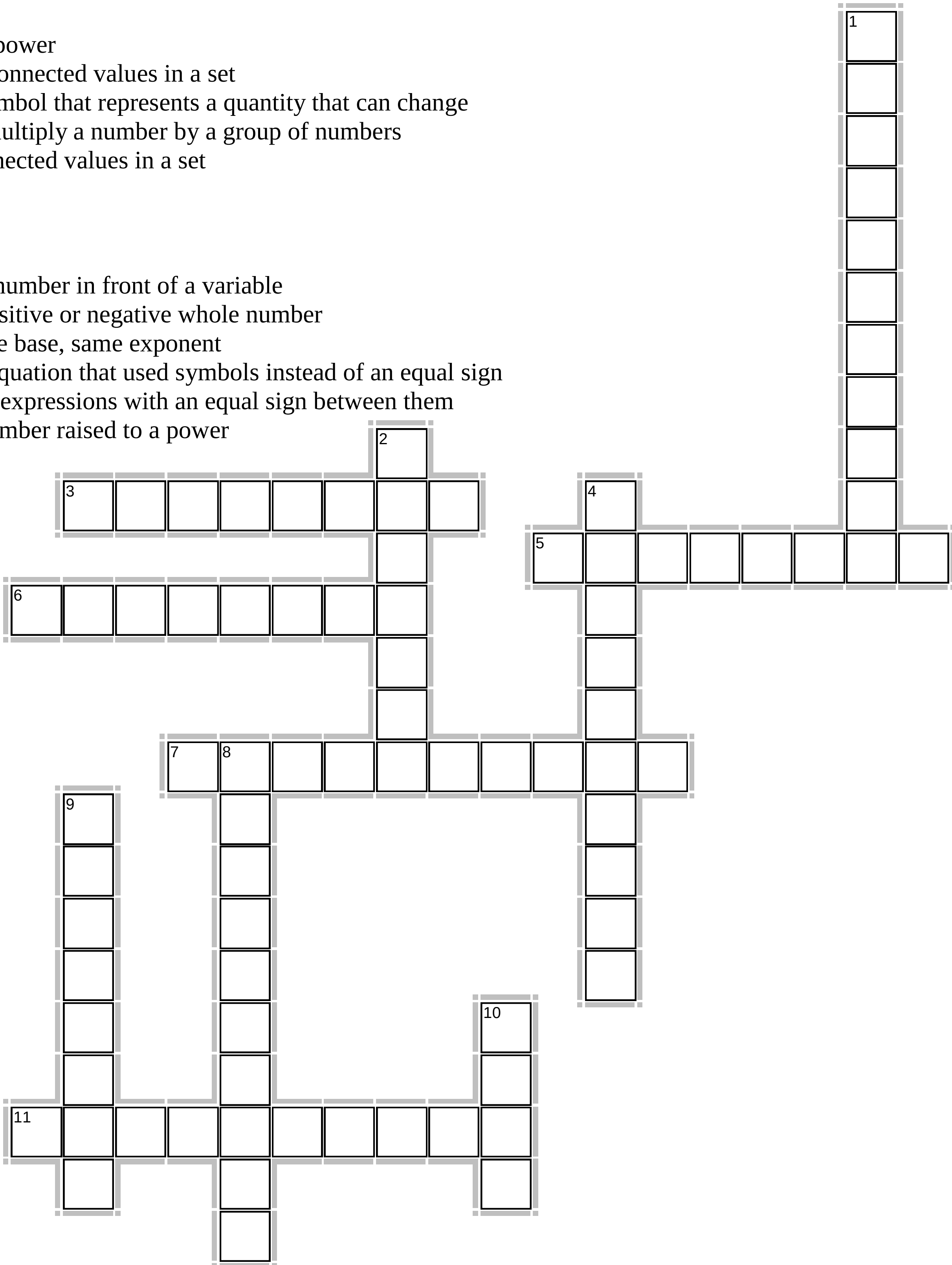
Vocabulary Crossword 1 (page 1)

Across

3. the power
5. disconnected values in a set
6. a symbol that represents a quantity that can change
7. to multiply a number by a group of numbers
11. connected values in a set

Down

1. the number in front of a variable
2. a positive or negative whole number
4. same base, same exponent
8. an equation that used symbols instead of an equal sign
9. two expressions with an equal sign between them
10. a number raised to a power



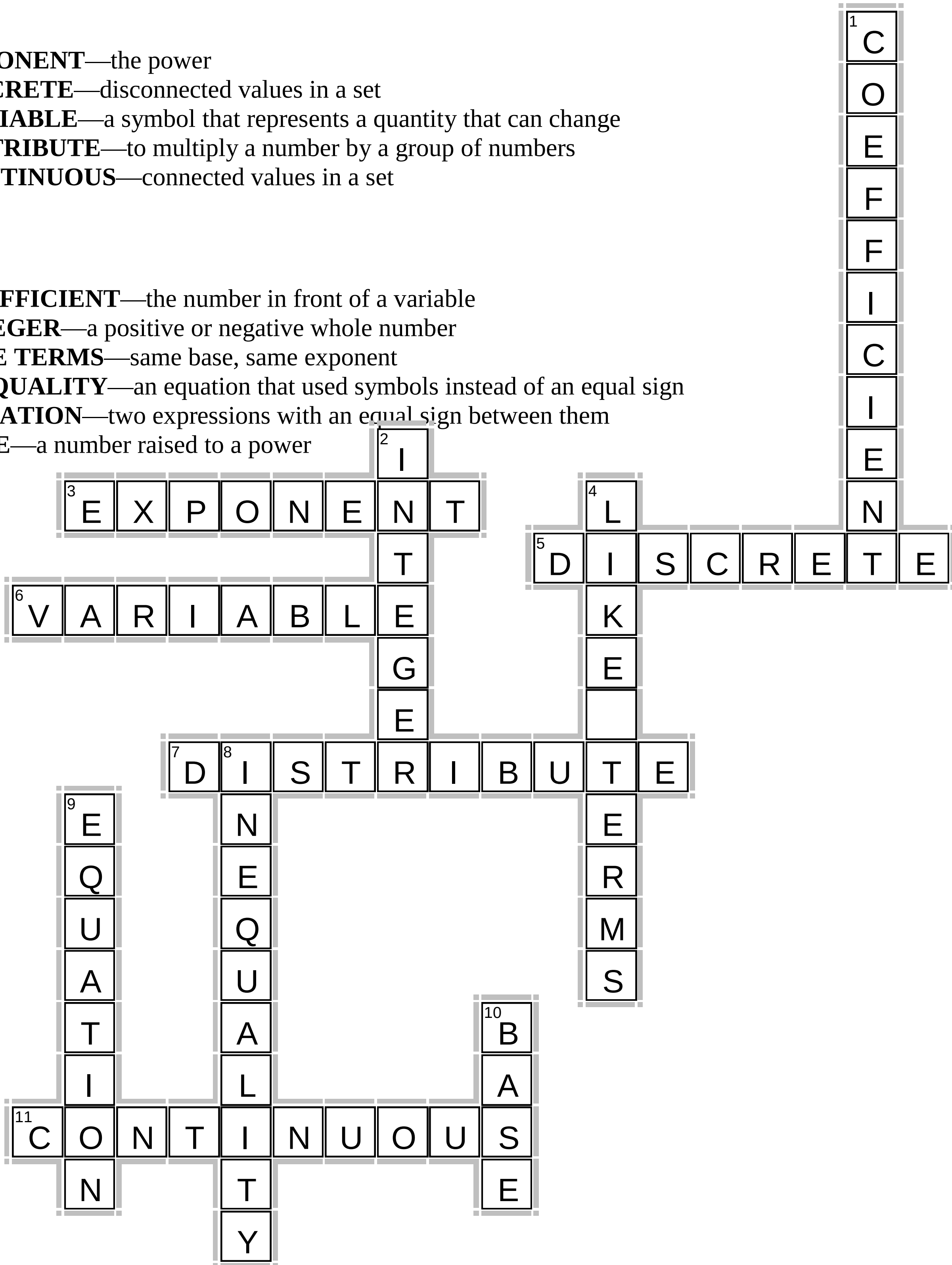
Vocabulary Crossword 1 Key (page 2)

Across

3. **EXPONENT**—the power
5. **DISCRETE**—disconnected values in a set
6. **VARIABLE**—a symbol that represents a quantity that can change
7. **DISTRIBUTE**—to multiply a number by a group of numbers
11. **CONTINUOUS**—connected values in a set

Down

1. **COEFFICIENT**—the number in front of a variable
2. **INTEGER**—a positive or negative whole number
4. **LIKE TERMS**—same base, same exponent
8. **INEQUALITY**—an equation that used symbols instead of an equal sign
9. **EQUATION**—two expressions with an equal sign between them
10. **BASE**—a number raised to a power



EclipseCrossword.com

Figure 28: Vocabulary Crossword II Cover Page

Vocabulary Crossword II

2 pages

TEKS

- Category 1: Number and Algebraic Methods
- Category 2: Describing and Graphing Linear Functions, Equations and Inequalities
- Category 3: Writing and Solving Linear Functions, Equations, and Inequalities

Objectives

- correctly identify key vocabulary

Intentional Questions

- What term is used to describe all the x-values?
- What term is used to describe all the y-values?
- What term is used to describe where the function crosses the x-axis?
- What term is used to describe where the function crosses the y-axis?

Structure

- Vocabulary

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Intrapersonal

Learning Method

- Cooperative
- Independent

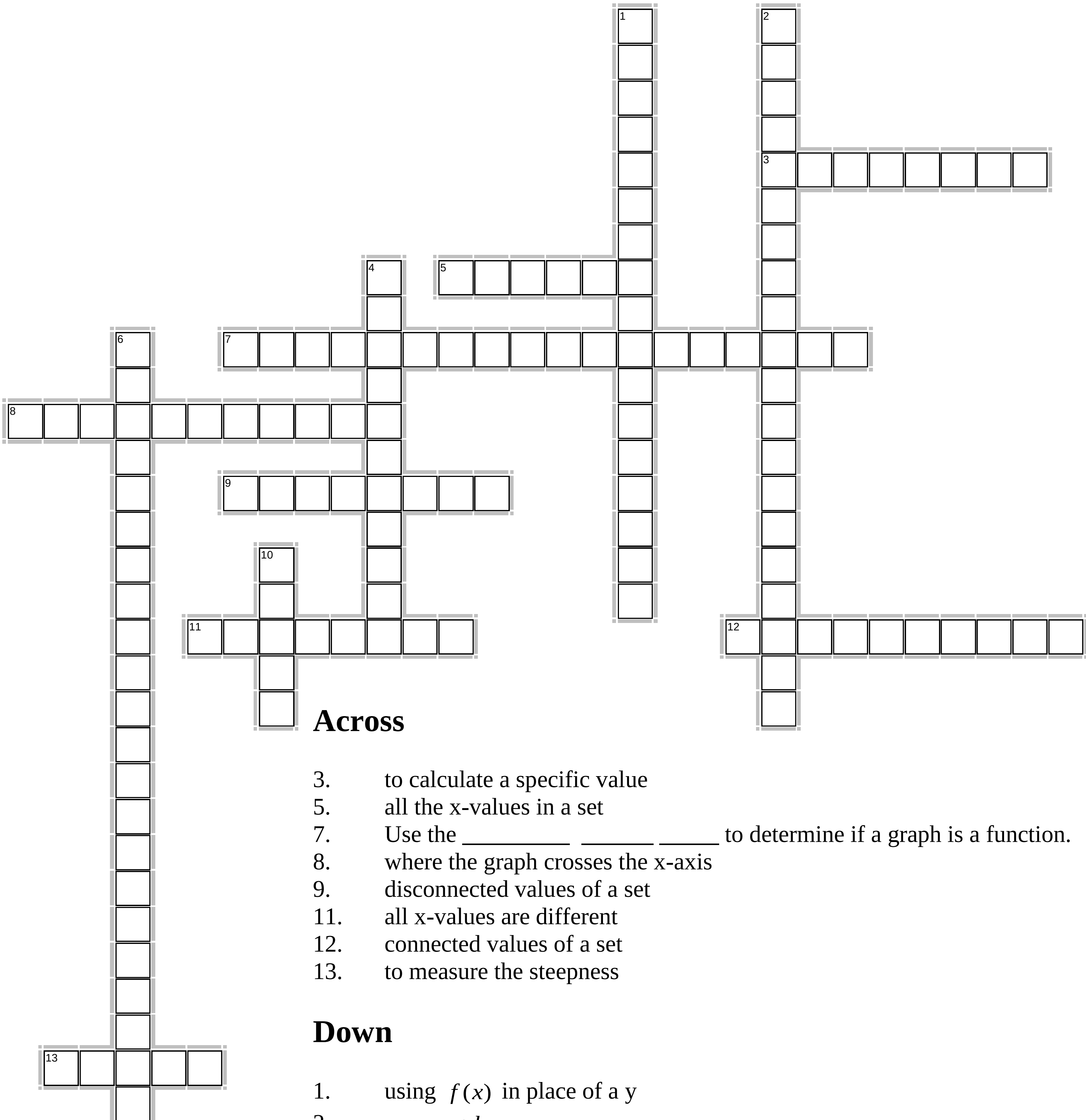
Vocabulary

- evaluate
- function
- domain
- range
- discrete
- continuous
- linear parent function
- x-intercept
- y-intercept
- slope
- slope-intercept form
- function notation
- vertical line test

Directions

- Fill in the crossword with the correct vocabulary term.

Vocabulary Crossword 2 (page 1)



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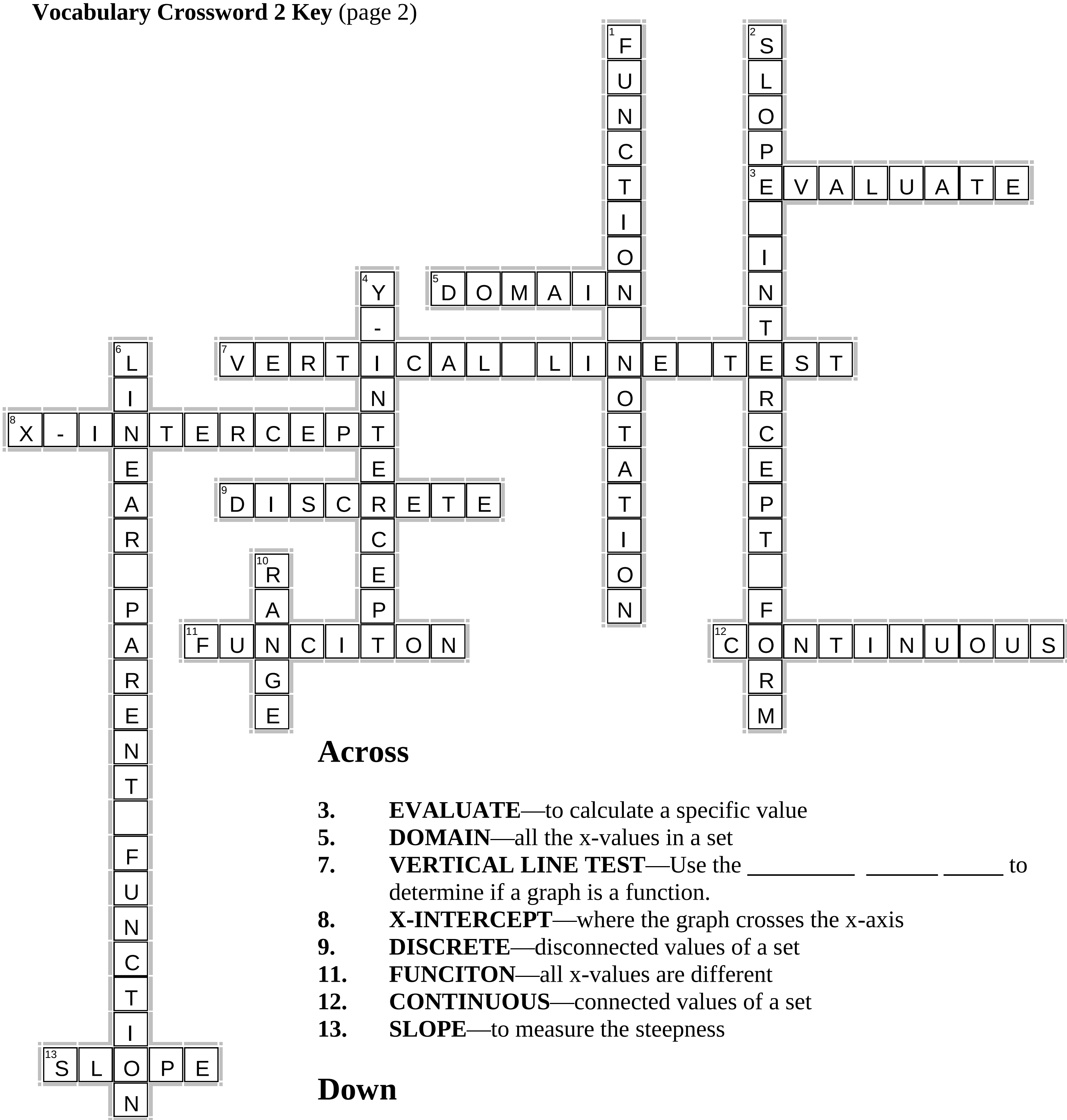
Across

3. to calculate a specific value
5. all the x-values in a set
7. Use the _________ _______ _____ to determine if a graph is a function.
8. where the graph crosses the x-axis
9. disconnected values of a set
11. all x-values are different
12. connected values of a set
13. to measure the steepness

Down

1. using $f(x)$ in place of a y
2. $y = mx + b$
4. where the graph crosses the y-axis
6. $y = x$
10. all the y-values in a set

Vocabulary Crossword 2 Key (page 2)



EclipseCrossword.com

Across

3. **EVALUATE**—to calculate a specific value
5. **DOMAIN**—all the x-values in a set
7. **VERTICAL LINE TEST**—Use the _________ ______ _____ to determine if a graph is a function.
8. **X-INTERCEPT**—where the graph crosses the x-axis
9. **DISCRETE**—disconnected values of a set
11. **FUNCITON**—all x-values are different
12. **CONTINUOUS**—connected values of a set
13. **SLOPE**—to measure the steepness

Down

1. **FUNCTION NOTATION**—using $f(x)$ in place of a y
2. **SLOPE INTERCEPT FORM**— $y = mx + b$
4. **Y-INTERCEPT**—where the graph crosses the y-axis
6. **LINEAR PARENT FUNCTION**— $y = x$
10. **RANGE**—all the y-values in a set

Figure 29: Vocabulary Quizzes

Vocabulary Quizzes

8 pages

TEKS

- Category 1: Number and Algebraic Methods
- Category 2: Describing and Graphing Linear Functions, Equations and Inequalities
- Category 3: Writing and Solving Linear Functions, Equations, and Inequalities
- Category 4: Quadratic Functions and Equations

Objectives

- correctly identify key vocabulary

Intentional Questions

- What type of correlation does a set of data have if both quantities are increasing in value?
- What type of correlation does a set of data have if one of the quantities is decreasing while the other is increasing in value?

Structure

- Vocabulary

Types of Intelligence

- Verbal-Linguistic

Learning Method

- Independent

Vocabulary

- point-slope formula: $y - y_1 = m(x - x_1)$
- slope-intercept form : $y = mx + b$
- standard form: $ax + by = c$
- parallel
- perpendicular
- direct variation
- vertical
- horizontal
- inequality
- system
- graphing
- elimination
- intersection
- substitution

Directions

- Quiz 1: Fill in the blank using the options in the given word bank.
- Quiz 2: Circle the correct response for each question.
- Quiz 3: Circle the correct response for each question.
- Quiz 4: Match the vocabulary term with its description by placing the appropriate **letter** in the blank given.

Vocabulary Quiz 1 (page 1)

Directions: Fill in the blank using the options in the given word bank.

Word Bank

$y - y_1 = m(x - x_1)$
$y = mx + b$
$ax + by = c$
parallel
perpendicular

1. The equation for slope intercept form is ______________________.

2. The standard form of a line is ______________________.

3. I can use the formula ______________________to write an equation of the line contain a specific point and slope.

4. When lines are ______________________they will never intersect.

5. When lines are ______________________ they cross at a right angle.

Vocabulary Quiz 2 (page 2)

Multiple Choice Directions: Circle the correct response for each question.

1. A line that has _______________ goes through the origin and has a constant rate.

   A. linear trend
   B. direct variation
   C. linear variation
   D. constant variation

2. A line that shows that will allow you to make future predictions on a set of data?
   A. Horizontal
   B. Vertical
   C. Trend Line
   D. Angle

Short Answer & Sketch Directions: State the correct type of correlation for each of the following questions and sketch an example of what a set of data with that correlation may look like.

3. What type of correlation does a set of data have if both quantities are increasing in value?

4. What type of correlation does a set of data have if one of the quantities is decreasing while the other is increasing in value?

5. What type of correlation does a set of data have if there appears to be no relationship between both quantities?

Vocabulary Quiz 3 (page 3)

Multiple Choice Directions: Circle the correct response for each question.

1. Which is not a type of correlation?

   A. Positive
   B. Negative
   C. All Correlation
   D. No Correlation

2. What type of straight line is side-to-side?

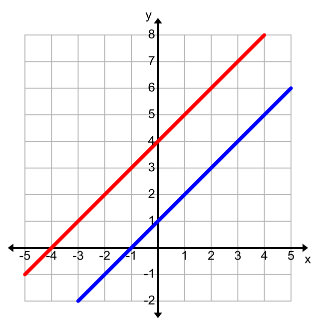
   A. Horizontal
   B. Vertical
   C. Trend Line
   D. Angle

3. What type of straight line is drawn up and down?

   A. Horizontal
   B. Vertical
   C. Trend Line
   D. Angle

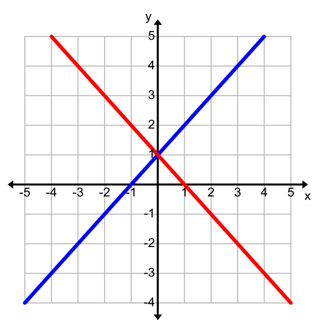
4. What type of lines are shown?

   A. Horizontal
   B. Vertical
   C. Parallel
   D. Perpendicular



5. What type of lines are shown?

   A. Horizontal
   B. Vertical
   C. Parallel
   D. Perpendicular



Vocabulary Quiz 4 (page 4)

Matching Directions: Match the vocabulary term with its description by placing the appropriate **letter** in the blank given.

1. ________:two or more equations
2. ________:where two lines cross
3. ________:the method to solving a system that involves replacing a variable
4. ________:the method to solving a system that is used when both equations are in slope-intercept form
5. ________:the method to solving a system that involves canceling out a variable
6. ________:an equation that uses symbols instead of an equal sign
7. ________:greater than
8. ________:less than
9. ________:greater than or equal to
10. ________:less than or equal to

Vocabulary Terms

A. inequality

B. system

C. graphing

D. elimination

E. intersection

F. substitution

G. $<$

H. $\leq$

I. $>$

J. $\geq$

Vocabulary Quiz 1 Key (page 5)

Directions: Fill in the blank using the options in the given word bank.

Word Bank

$y - y_1 = m(x - x_1)$
$y = mx + b$
$ax + by = c$
parallel
perpendicular

1. The equation for slope intercept form is $\underline{y = mx + b}$.

2. The standard form of a line is $\underline{ax + by = c}$.

3. I can use the formula $y - y_1 = m(x - x_1)$ to write an equation of the line contain a specific point and slope.

4. When lines are _parallel_ they will never intersect.

5. When lines are ____perpendicular____ they cross at a right angle.

Vocabulary Quiz 2 Key (page 6)

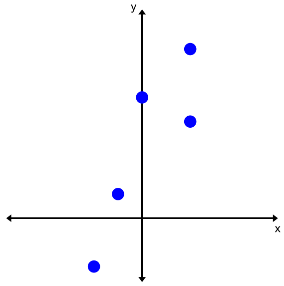
Multiple Choice Directions: Circle the correct response for each question.

1. A line that has ______________ goes through the origin and has a constant rate.
    - E. linear trend
    - F. direct variation
    - G. linear variation
    - H. constant variation

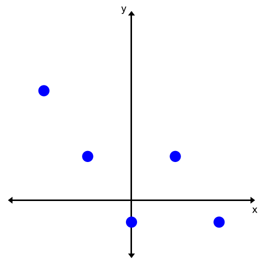
2. A line that shows that will allow you to make future predictions on a set of data?
    - E. Horizontal
    - F. Vertical
    - G. Trend Line
    - H. Angle

Short Answer & Sketch Directions: State the correct type of correlation for each of the following questions and sketch an example of what a set of data with that correlation may look like.

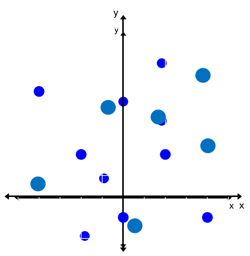
3. What type of correlation does a set of data have if both quantities are increasing in value?
Positive correlation



4. What type of correlation does a set of data have if one of the quantities is decreasing while the other is increasing in value?
Negative correlation



5. What type of correlation does a set of data have if there appears to be no relationship between both quantities?
No correlation



Vocabulary Quiz 3 Key (page 7)

Multiple Choice Directions: Circle the correct response for each question.

1. Which is not a type of correlation?

   E. Positive
   F. Negative
   G. All Correlation
   H. No Correlation

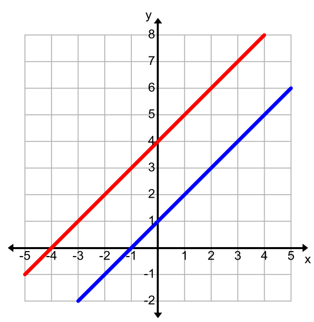
2. What type of straight line is side-to-side?

   E. Horizontal
   F. Vertical
   G. Trend Line
   H. Angle

3. What type of straight line is drawn up and down?

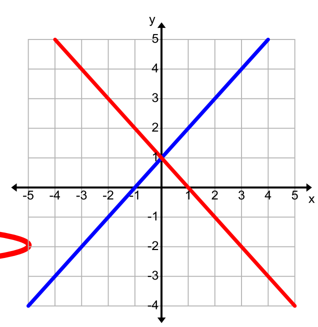
   E. Horizontal
   F. Vertical
   G. Trend Line
   H. Angle

4. What type of lines are shown?



   E. Horizontal
   F. Vertical
   G. Parallel
   H. Perpendicular

5. What type of lines are shown?



   E. Horizontal
   F. Vertical
   G. Parallel
   H. Perpendicular

Vocabulary Quiz 4 Key (page 8)

Matching Directions: Match the vocabulary term with its description by placing the appropriate **letter** in the blank given.

1. __L__: two or more equations
2. __O__: where two lines cross
3. __P__: the method to solving a system that involves replacing a variable
4. __M_: the method to solving a system that is used when both equations are in slope-intercept form
5. __N_: the method to solving a system that involves canceling out a variable
6. _K___: an equation that uses symbols instead of an equal sign
7. __S__: greater than
8. __Q__: less than
9. __T___: greater than or equal to
10. __R____: less than or equal to

Vocabulary Terms

K. inequality

L. system

M. graphing

N. elimination

O. intersection

P. substitution

Q. $<$

R. $\leq$

S. $>$

T. $\geq$

Figure 30: Erase and Reveal Cover Page

Erase and Reveal

1 page

TEKS

- Category 1: Number and Algebraic Methods

Objectives

- correctly identify key vocabulary

Intentional Questions

- What word is used to describe a positive or negative whole number?
- What vocabulary term is used to represent an unknown quantity?

Structure

- Vocabulary

Types of Intelligence

- Verbal-Linguistic
- Logical-Mathematical
- Spatial
- Bodily-Kinesthetic
- Intrapersonal

Learning Method

- Independent
- Cooperative
- Vocabulary
- Technology

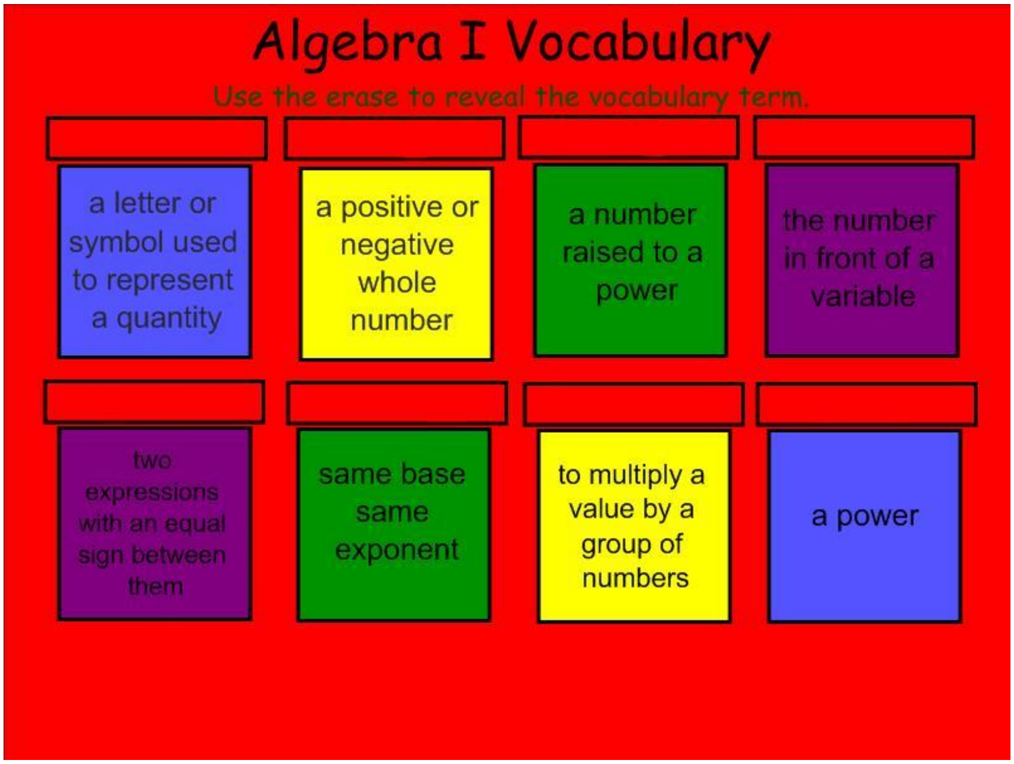
Vocabulary

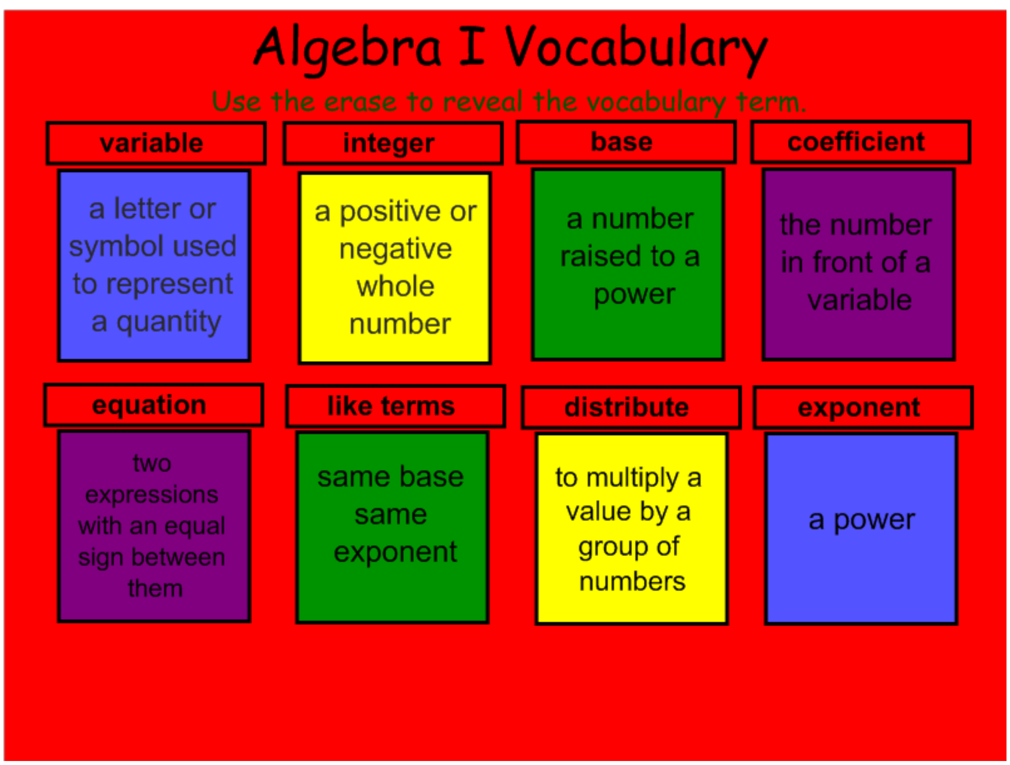
- variable
- integer
- base
- coefficient
- exponent
- equations
- like terms
- distribute

Directions

- Use the erase to reveal the vocabulary term located in the box above the definition.

Vocabulary Erase and Reveal Smart Board (page 1)





CHAPTER IX

CONCLUSION

The amount of interest a student shows can directly influence their level of learning and academic performance (Holstermann, 2009). Hands-on Activities can evoke student's interest and create motivation to learn (Bergin, 1999). Interest will develop and strengthen when an experience is an enjoyable and stimulating. It is important that educators alter the traditional learning environment to meet the needs of a full range of students (Hitchcock, 2003). In order to achieve an engaged and learning environment, the goals, materials, methods and assessments must be designed to be flexible for the diverse styles and abilities in the classroom. Since classrooms are filled with diverse learners, educators must provide students with multiple ways to express and demonstrate learning. Today's society has become more diverse and it is time that the instruction and learning adapt to this change. Why is incorporating different learning methods, such as cooperative and independent learning with hands-on activities, as well as daily vocabulary review important in today's Algebra classroom ? Provided a guideline for integration of multiple learning structures, educators can grab the attention of students and engage them throughout each and every topic. By creating more engaging actives to use during learning, students will have a more positive view of learning in the Algebra classroom.

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Crosswords Designed by
http://www.eclipsecrossword.com/