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Introduction

Professional Development
Instructor Resources

About this Course

Welcome to **Algebra I—An Open Course**. This yearlong (two-semester) course is designed for learners taking algebra for the first time, as well as those looking for an alternative method of learning algebra. This course assumes learners have an understanding of both pre-algebra and basic arithmetic.

Algebra I—An Open Course begins with a basic description of algebra, explains the rules and conventions that apply to algebra, and then demonstrates the power of thinking in a new and abstract way.

Each lesson shows how algebra helps to explain the world around us, and how algebra is a practical tool for solving problems encountered in school, at work and in everyday life. By applying various strategies for approaching and solving problems, the course teaches logical thinking and encourages learners to explore multiple ways to solve problems.

This course covers the concepts, strategies, and skills of solving linear equations, functions and patterns; analyzing and graphing linear equations; function and relations; analyzing, solving and graphing linear inequalities; systems of linear equations and inequalities; radical expressions; polynomials; factoring; quadratic functions; rational expressions and equations; logical reasoning and number sets; and probability.

Upon completion of this course, learners will:
- Demonstrate basic computational and procedural skills
- Understand mathematical concepts
- Use mathematical reasoning
- Explain quantities, relationships, and unknown values using signs, symbols, models, graphs, and mathematical terms
- Apply logical thinking to analyze evidence and create arguments to test hypotheses
- Connect mathematical ideas with other disciplines
- Apply mathematics to everyday life
- Understand the world using mathematics
- Appreciate the utility, art and science of mathematics

A Portfolio Approach

The **Algebra I—An Open Course** provides a portfolio of pedagogical approaches to support teaching to the diverse needs and preferences of all algebra students. The course has been designed for a broad range of ability levels, from remedial to advanced, as stand-alone curriculum, or as an effective supplement to any algebra textbook.

The **12 units, 26 lessons, 68 topics, 108 learning objectives** and these Instructor Resources were created to help instructors introduce learners to mathematics concepts and procedure and develop mathematical reasoning and critical thinking skills in a supportive, engaging environment.

The **Learning Object Architecture** makes it possible for institutions and instructors to *adapt* the content to meet the needs of diverse programs and learners. Learning object architecture refers to the design and delivery of content in small cohesive blocks of concepts and activities that can be rearranged in any learning management system (LMS).

The course topics have been correlated to the **National Common Core Standards**, and all US state algebra frameworks. The Learning Objectives in each topic may serve as a guide for instructors to adapt the course to meet particular students' and institutional needs. All Learning Objectives have been specifically mapped to the topics, problems and assessment items throughout the course.

Course Features and Components

The following information may help you to understand the role each component plays in the portfolio.

Understanding Algebra shares many of the characteristics common to learning a new language. For example, learning algebra requires that learners find the motivation, context, tools, activities, and pace that fits the way they learn. To this end, we have provided videos with narration, illustrations, and a control bar for pausing and reviewing content, to help different learners connect with the material and find the approach that works best for them. Adaptive problems with immediate feedback, and integrative activities show different applications of the concepts. Persistence and repetition is key. The mix of personal connection, animated examples and paced narration are designed to keep students engaged in the subject. The variety of problems and activities provide targeted procedural and integrative practice.

For learners who benefit from reading along with the presentation, the narration text is available to turn on and off by clicking on the CC link in the lower right corner of the player window. The captions may be left on throughout the presentation or turned on as needed. This feature may be helpful for learners who grasp ideas best when viewing words while listening, and for those who are hearing impaired. The integrated online textbook, viewable under the topic text tab, covers all the essential information students need to master the topic.

The following pages provide an overview of the components and features of the course. The **Help** instructions available to throughout the course are shown above each screen shot below. The **Purpose** of each component is described for instructors after each screen shot.

Components and Features described below:

- Topic Home
- Warm Up
- Presentation
- Closed Captions
- Worked Examples
- Practice Problems
- Review
- Topic Text
- Tutor Simulation
- Projects
- Puzzles
- Unit Quizzes
- Readiness Exam
- Midterm and Final Exams

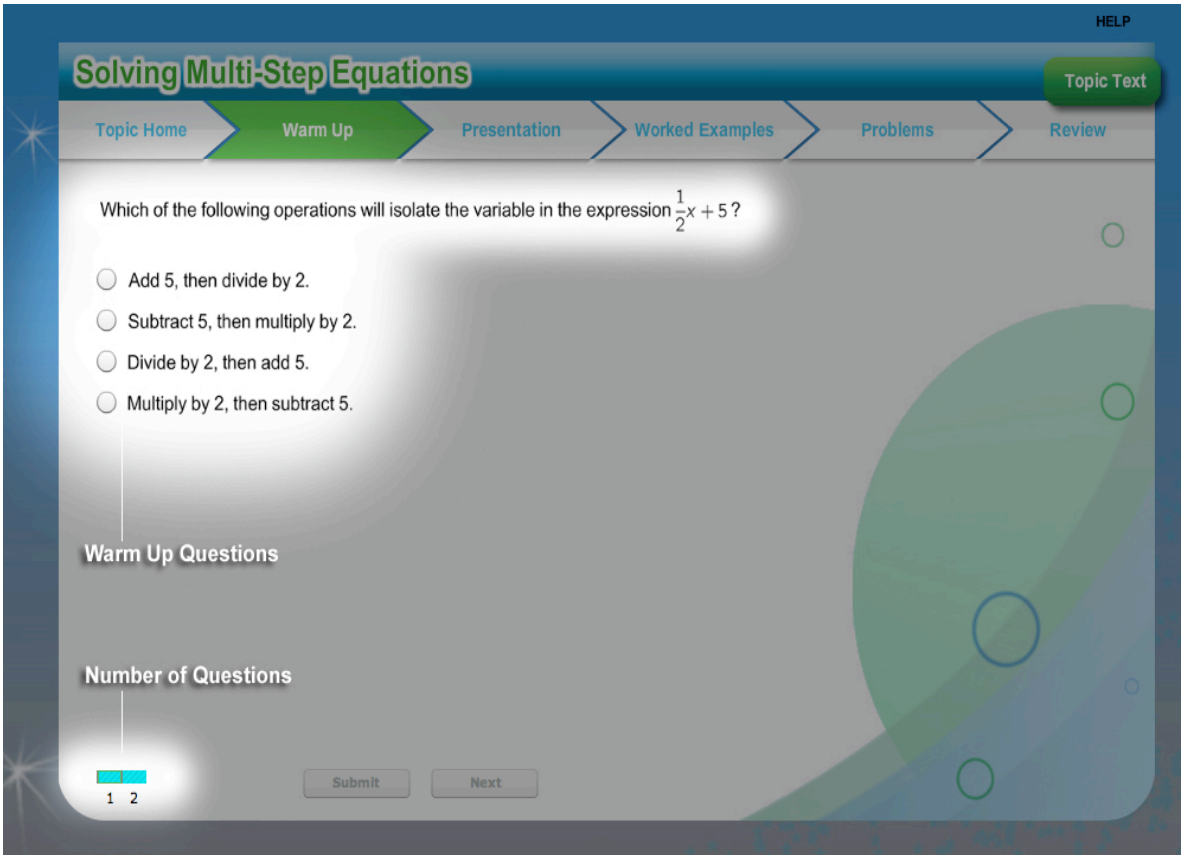
Topic Home

STUDENT HELP: Each **Topic** provides a number of different ways to learn the Topic concepts. Most topics contain a Warm Up, Presentation, Worked Examples, Problems, Review, and Topic Text. We suggest you work through the topic in the order presented, but you may skip around as you wish. Click on the menu bar to navigate through the topic.

PURPOSE: Each topic home page orients learners to the learning objectives and series of components available to master all the concepts and procedures within the topic. Cognitive science research inspired the design of these components and activities to help engage students in reflecting upon their own learning. Instructors can choose to assign students a particular order of activities, or allow each student to determine the order that best helps their progress.

Warm Up

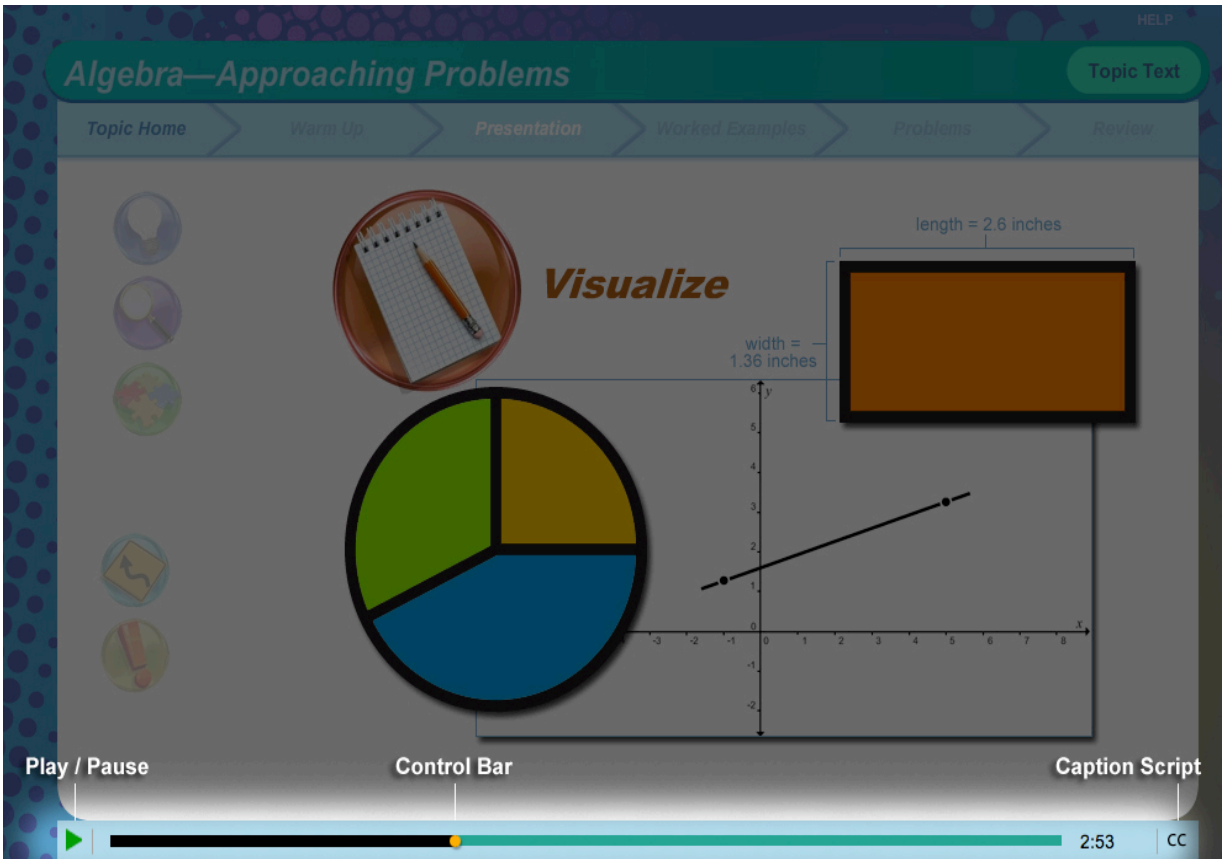
STUDENT HELP: In the **Warm Up**, you take a short test to help you decide if you are ready to study the topic or if you need to review another topic before moving forward.



PURPOSE: In a linear approach, learners start with a short set of Warm-up problems. This is a brief diagnostic test that determines whether the learner is "ready" to study the topic or whether she or he should study or review another topic prior to engaging with this one. Each question will test the student on a concept or procedure that is a necessary **prerequisite** to understanding the material in the topic. If, upon completion of the diagnostic test, it is determined that the learner has difficulty grasping a prerequisite concept or executing a prerequisite procedure, the learner will be pointed to a topic to review that concept or procedure. Research on formative assessment shows us that this activity is helpful to orient and motivate learners, as well as increase the chance of mastering the topic ahead.

Presentation

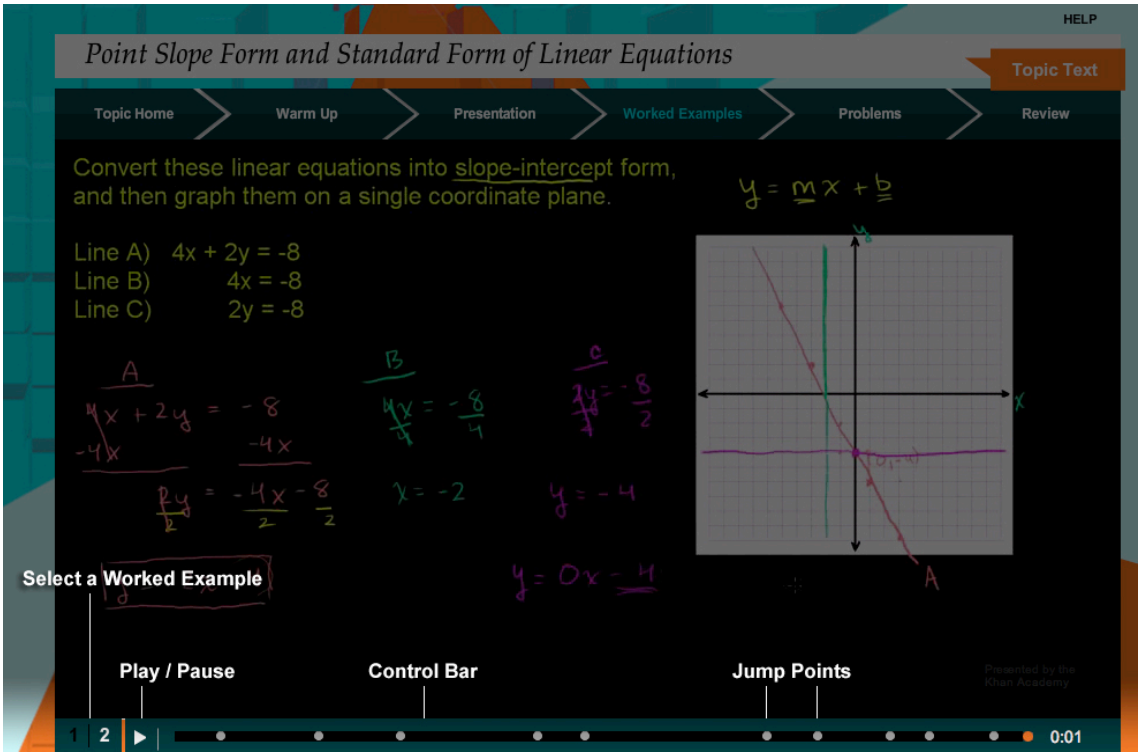
STUDENT HELP: The **Presentation** is a short video that explains and demonstrates the concept you will be learning. Once the **Presentation** begins, you may play, pause, and use the control bar or "slider" feature at the bottom of the screen to move forward and backward in the **Presentation**. You may also access an **optional caption text** if you would like to read along with the video. Simply click on the **CC** in the movie controller to show or hide the captions.



PURPOSE: The media-rich Presentations provide a conceptual introduction to each topic in three to six minutes. A mix of animated examples, real-world applications and specific strategies help students understand what and how each math topic is relevant. The presentations were created to be learner-centered. All students are different, so a variety of presenters and examples are used in an effort to keep learners engaged. The presentations may appeal to students who learn best when presented with a conceptual understanding of a given topic before learning procedures. The presentations selectively focus on one or two concepts that best utilize visualization to maximize the learning experience and illustrate algebraic properties.

Worked Examples

STUDENT HELP: When you select **Worked Examples**, a video will play that shows you how to solve a problem, step by step. The control bar or "slider" allows you to stop, start, and replay any portion of the Worked Example. Most topics have more than one worked example. Click on each number to the left of the control bar to view all the Worked Examples in the topic.

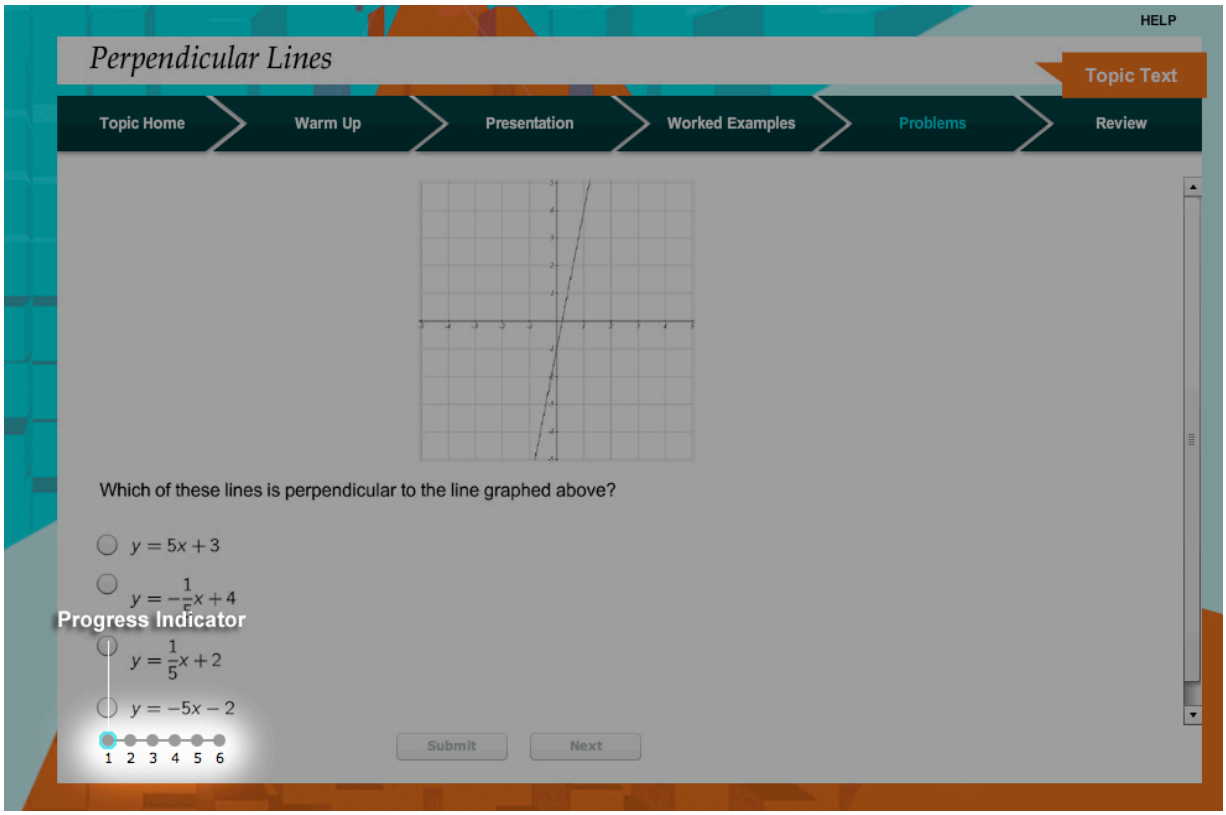


PURPOSE: **Worked Examples.** The Worked Examples are demonstrations of problems solved. Students go through problems step by step in the two to four Worked Examples for each topic. Strategies and procedures are explained as they appear on the virtual blackboard. Sal Kahn, of Kahn Academy, recorded these Worked Examples specifically to address the objectives covered in this course. The Worked Examples run up to eight minutes each and provide clear, approachable explanations, using changes in color to help students take note of each step as they work through each problem.

Major problem-solving steps are marked with a bullet and rollover title on the progress bar so that students can back up and repeat as needed. These practical, explicit word problems may be preferred over presentations by learners who learn by first understanding the mechanics of math. Nearly every focus group re-confirmed these as very useful devices for teaching.

Problems

STUDENT HELP: In the **Problems**, you will answer questions to help practice your understanding of the topic. If you get one wrong, you will be given some feedback and you can try again. If you are still having trouble, you will be given an easier version of the problem. When you get one right you may get a harder version of the problem or move on to the next question. A progress indicator on the lower left will show you when you have finished all the problems in a set and how many sets are left.

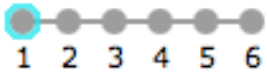


PURPOSE: Adaptive Practice Problems for each topic offer students immediate feedback as they work toward mastering the topic. The problems are organized in groups (easy – medium – hard) that provide students easier or more difficult problems depending on their performance. Each group of problems is tied to an objective and illustrates the concepts, procedures, and skills in the topic. Problem types include multiple choice, fill in the blank, fill in the table, matching, plot points in one dimension, plot points in two dimensions, plot lines in one dimension, and plot lines in two dimensions.

There are generally six groups of problems in each topic (topics in Unit 1 do not always include six groups). Each objective will have at least one group of problems. Each topic may have up to six groups (depending on how many objectives are in that topic).

The progress indicator at the bottom left of the screen indicates how many problem groups

there are in the Practice and which group of problems they are working on at any given time.



A student is initially presented with the first "medium" level problem from the first group of problems.

For **medium** level problems:

- Correct Answer – student is given correct answer feedback, and then moves on to hard problem in the same group
- First wrong answer – student is given wrong answer feedback, and they are asked to try again (selected answer is not available)
- Second wrong answer – student is given wrong answer feedback, and then moves on to the easy problem in the same group

For **easy** level problems:

- Correct Answer – student is given correct answer feedback, and then moves on to medium problem in the same group if they have not attempted it or medium problem of the next group if they have
- First wrong answer – student is given wrong answer feedback, and they are asked to try again (selected answer is not available)
- Second wrong answer – student is given wrong answer feedback, and then moves on to then next easy problem of the next group

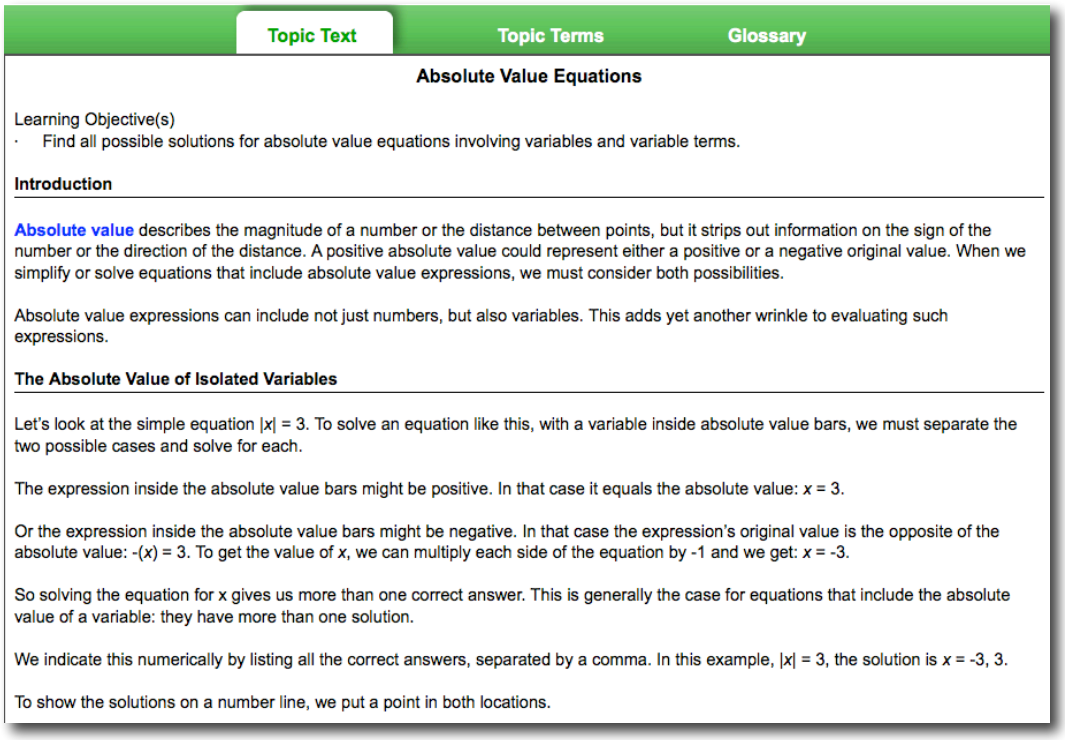
For all **hard** level problems:

- Correct Answer – student is given correct answer feedback, and then moves on to the medium problem of the next group
- First wrong answer – student is given wrong answer feedback, and they are asked to try again (selected answer is not available)
- Second wrong answer – student is given wrong answer feedback, and then moves on to medium problem of the next group

Once a student has worked through all of the groups of problems, they are presented with a Summary Screen that shows any objectives the learner should study before taking the Topic Review quiz. On the summary screen the learner can click on an objective to review the related content in the Topic Text.

Topic Text

STUDENT HELP: When you select the **Topic Text**, a new window will open and show the Text for the topic you are in. **Glossary** terms will appear in blue font, and you can click on them to view the definition. As you read the **Text**, you may discover **questions** in a gray box. These are for you to check your understanding of what you just read. Try to answer the question, and then click "Show/Hide Answer" to check your self. You will also discover helpful **interactive graphs** to play with to practice your skills and helpful **examples** highlighted in green boxes.

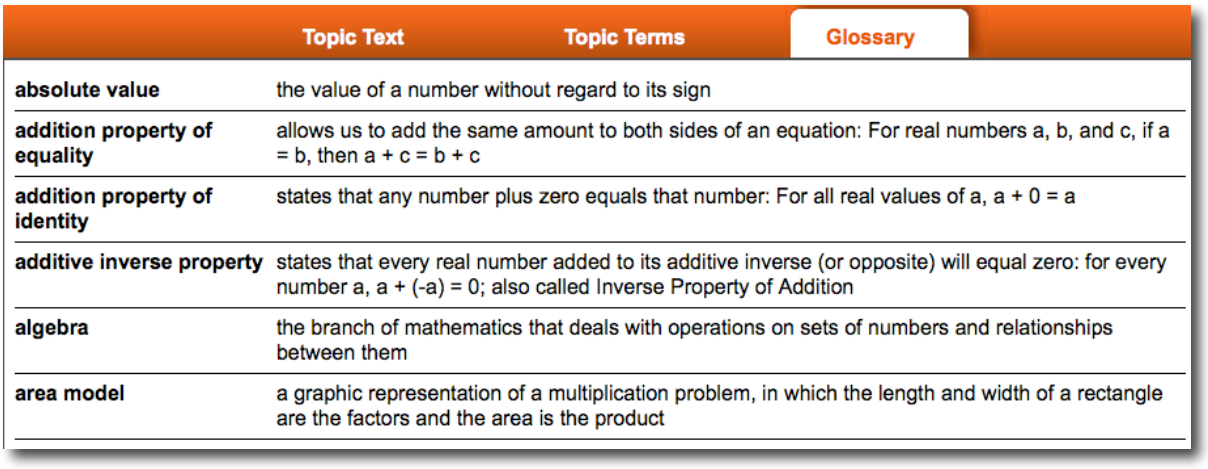


PURPOSE: **Integrated Open Textbook.** The Topic Text provides concise and comprehensive coverage of each topic and includes additional explanations, manipulatives and example problems. The key terms for each topic and complete course glossary are also found here. The text is purposefully conversational in tone, and is comprehensive and focused. Images appear only if they reinforce the math. Printing the text screens may be helpful for students to read off-line or use as worksheets. A PDF version is available to print by Unit.

There is a role for textbooks in a portfolio of learning material. Texts can be used to study offline. Some learners benefit from reading text on paper—, from holding it in their hands; others may benefit from multiple and varied explanations and examples; and still others may benefit from highlighting, underlining, or writing in margins to absorb the information and assist in their review.

Glossary

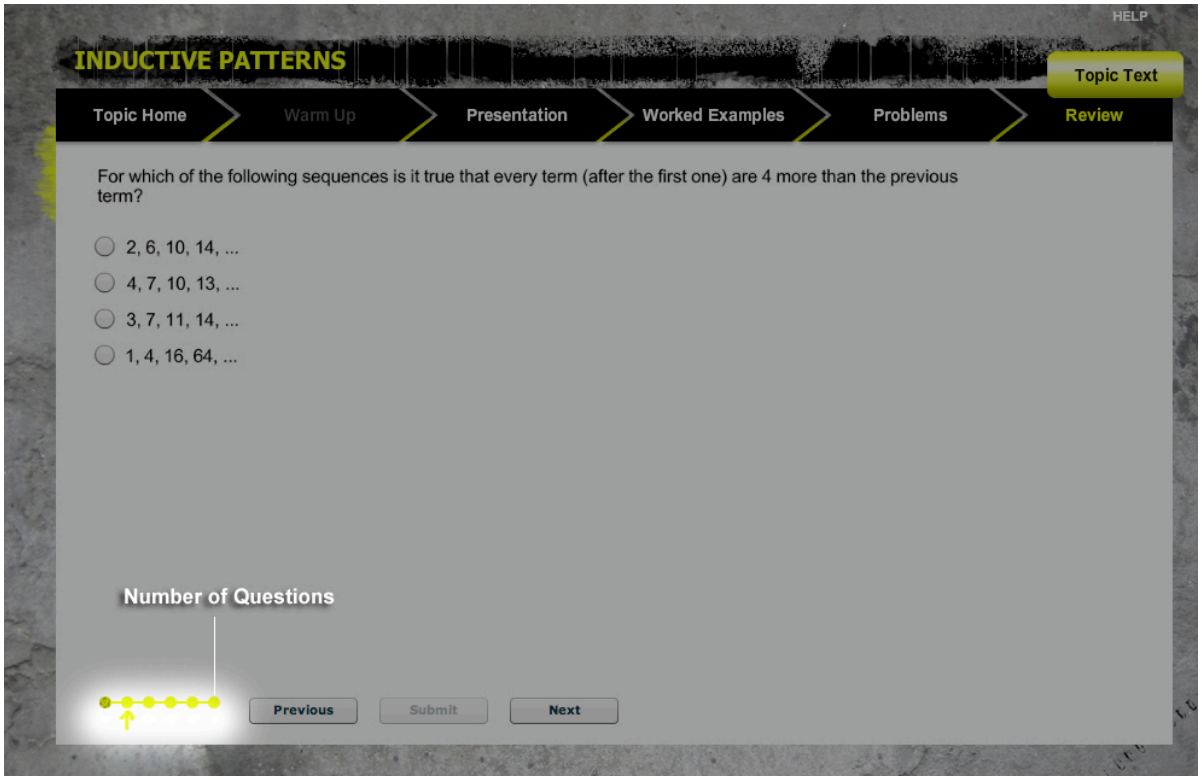
STUDENT HELP: When viewing the Topic Text, you can find the important terms to learn about the topic by clicking on **Topic Terms** at the top of the screen. To view all the important terms in the course, click on the **Glossary** link on the far right. Printing the Glossary gives you another good study tool.



PURPOSE: The Glossary serves as a study tool to help students identify and focus on learning key concepts and definitions. Writing out definitions can reinforce recall for many students. The glossary is also available to print at the Unit level to use as a study aid.

Review

STUDENT HELP: In the **Review**, you will take a practice test to see if you understand the topic. This will help you know if you are prepared to take a graded assessment. Answer all of the questions, and then check your results. If you miss some, you may want to review the topic or take a graded assessment. Each topic has its own review exercise intended to allow you to determine if you have sufficiently studied the topic to feel confident taking a formal summative assessment. After completing all the questions, you can view their results and follow the links back to the correct answers and explanation for review.



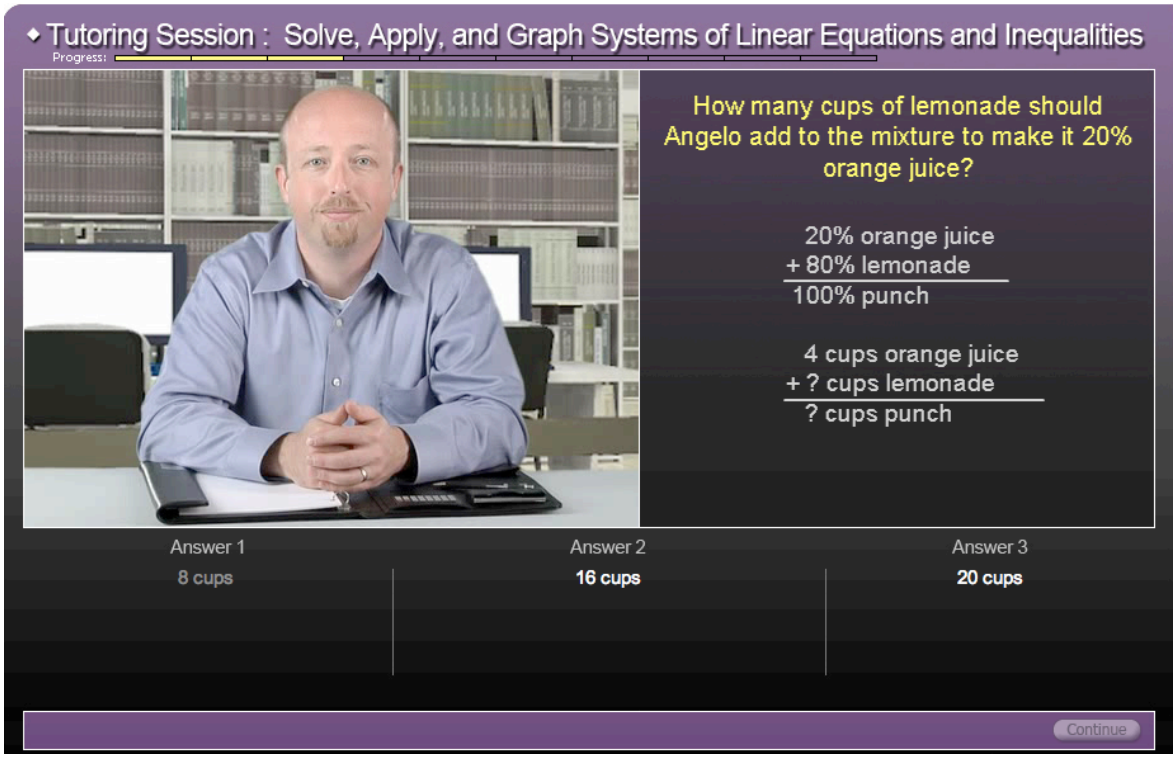
PURPOSE: The Review section is a short assessment that gives learners an opportunity to self-test their understanding before moving on to the next topic or taking a graded assessment. Each topic has its own review exercise intended to allow learners to determine if they have sufficiently studied the topic to feel confident taking a formal summative assessment. After completing all the questions, students can view their results and follow the links back to the correct answers and explanation for review.

Warm-Up, Practice, Topic Text and Review problems provide ongoing practice and self-checks as students work through every topic. The mix of problem types and frequent feedback are designed to help students self-check their understanding at each step.

Integrative Unit Activities

At the Unit level, there are four **integrative activities** that challenge students' understanding, integration and application of the topics in the Unit. Each type is an alternative approach and challenge to mastering the content. Student instructions are included in each activity.

Tutor Simulation

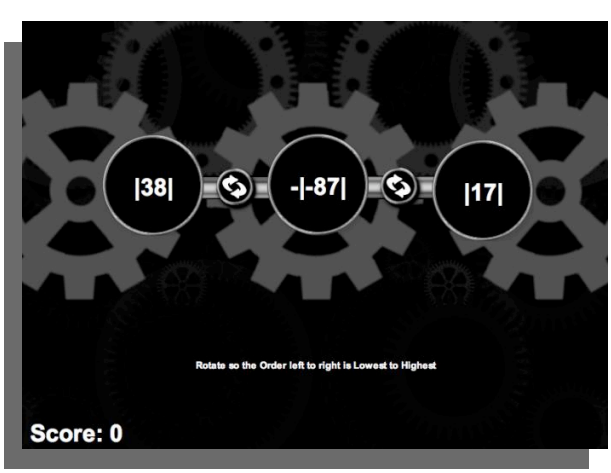


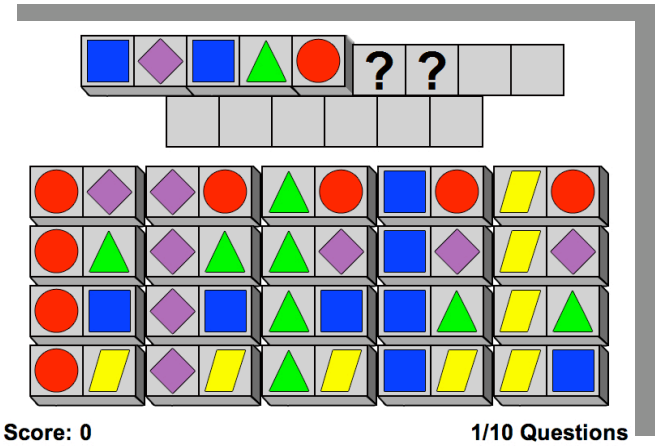
PURPOSE: These interactive summative activities offer students directed guidance in learning how to think through problem-solving strategies. The seven to ten minute Tutor Simulation in each unit allows students to work through up to six steps in a word problem, which requires students to apply their understanding of all the topics in the unit. The tutor provides feedback and hints based upon the choices students select at each stage of the activity.

Learning research has shown that engaging with an agent – such as a virtual tutor – can help motivate students. The Tutor Simulation also provides an effective way to extend task time and calls upon higher-order thinking skills to succeed.

Puzzles

PURPOSE: The Puzzle in each Unit provides learners with a chance to *play* with and reinforce math concepts in a positive, no-fault environment. They are based upon a subtle, different view of some key concepts from the Unit. Drawing upon learning research, each puzzle is based on classic game mechanics and is designed to provide motivation and subtle reinforcement of fundamental math concepts. The puzzles will ordinarily have three or more levels so that each instance can be played in a minute or two, and also may be re-played indefinitely. Research suggests that games and puzzles can help sustain student interest, increase task-time, lower anxiety and build learner confidence.

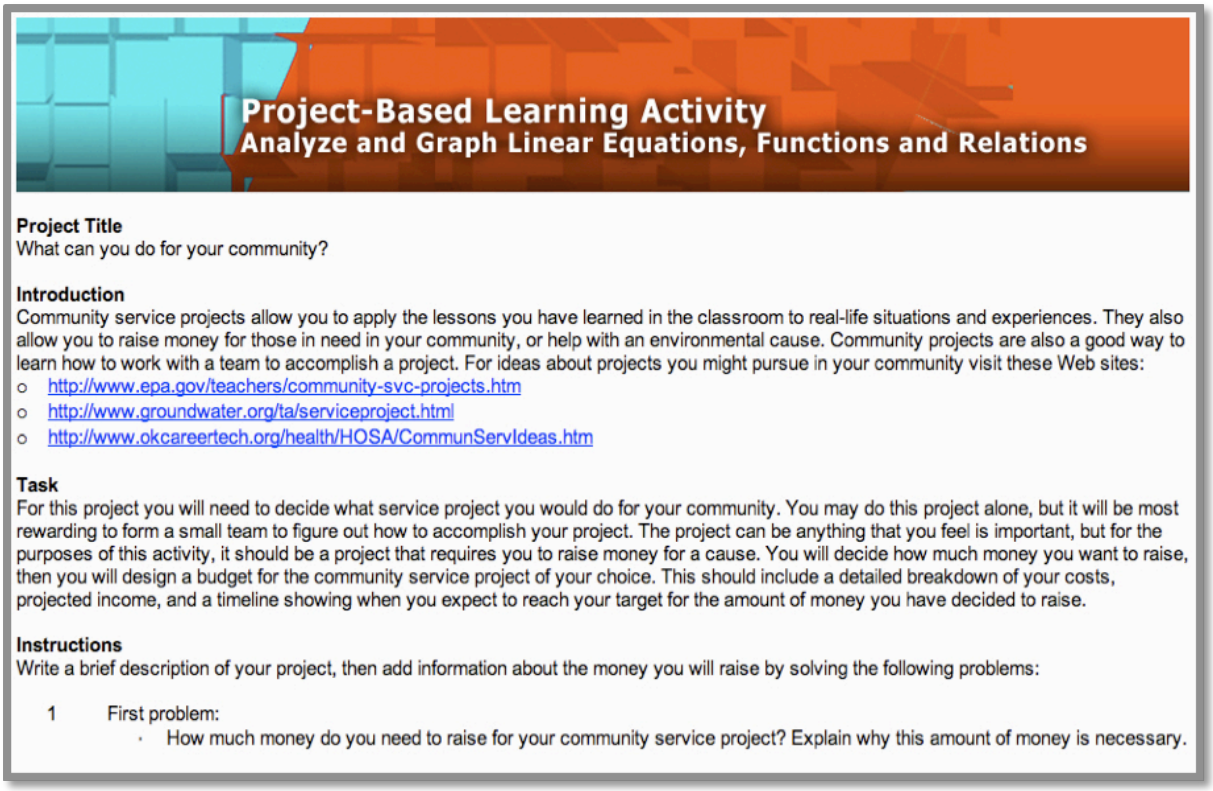




Projects

PURPOSE: Projects are collaborative assignments, designed in the project-based learning tradition to promote metacognition, inquiry and collaboration using authentic learning activities. Each assignment includes a set of related multi-step problems that stimulate deep learning among students. As an integral part of the activity, projects encourage students to help each other, reflect together, express their own ideas, and make decisions to achieve project outcomes.

Research has shown that collaborative assignments help students learn that sharing new knowledge with others is a skill that improves their memory of the concepts. Basic instructions, student resources and a rubric for success are included to assist the team. The project activities are designed for use by groups in the classroom, as a hybrid assignment, or completely online. Depending on the class environment and available technologies, students might use chat, a forum or other online communication and social media tools to communicate with each other and the instructor and to present their results to the class.



Project-Based Learning Activity
Analyze and Graph Linear Equations, Functions and Relations

Project Title
What can you do for your community?

Introduction
Community service projects allow you to apply the lessons you have learned in the classroom to real-life situations and experiences. They also allow you to raise money for those in need in your community, or help with an environmental cause. Community projects are also a good way to learn how to work with a team to accomplish a project. For ideas about projects you might pursue in your community visit these Web sites:

- http://www.epa.gov/teachers/community-svc-projects.htm
- http://www.groundwater.org/ta/serviceproject.html
- http://www.okcareertech.org/health/HOSA/CommunServIdeas.htm

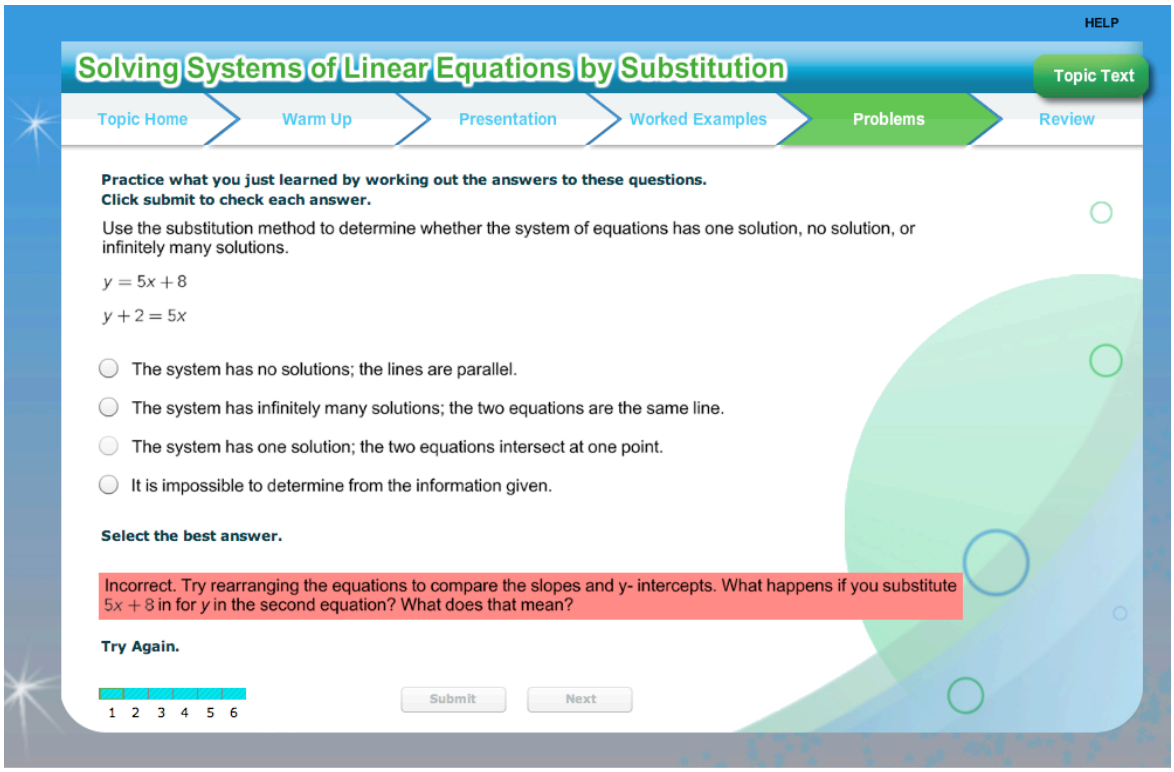
Task
For this project you will need to decide what service project you would do for your community. You may do this project alone, but it will be most rewarding to form a small team to figure out how to accomplish your project. The project can be anything that you feel is important, but for the purposes of this activity, it should be a project that requires you to raise money for a cause. You will decide how much money you want to raise, then you will design a budget for the community service project of your choice. This should include a detailed breakdown of your costs, projected income, and a timeline showing when you expect to reach your target for the amount of money you have decided to raise.

Instructions
Write a brief description of your project, then add information about the money you will raise by solving the following problems:

1. First problem:
   - How much money do you need to raise for your community service project? Explain why this amount of money is necessary.

Assessment

PURPOSE: LMS-based Unit level quizzes challenge and track students' learning. Instructors can modify the order of questions and the parameters for the number of times a student may take the quiz and record a score in their school's LMS.



Readiness, Midterm and Final Assessment

Secure LMS-based readiness, midterm and final exams for each semester are provided to track each student's readiness, mastery and progress. The readiness exam contains 28 questions that a student should be able to answer correctly to show they have the prerequisite knowledge to be successful in the course.

Midterm and final exam questions have been designed to cover all course learning objectives and correlate to state and National Common Core standards.

Using Calculators in Algebra 1

Instructor Notes

There are many different perspectives about the appropriateness of using calculators in Algebra. In this course we have included activities, such as the project-based learning activity in Unit 10, where the use of calculators is necessary, but there are other course components such as the assessments and many of the practice materials where calculators are not used.

In general, once students are in Algebra 1, there is an expectation that they are proficient with arithmetic. This is, of course, far from universally true. While working on problems in Algebra 1, students may "get stuck," bogged down in arithmetic issues, or lose sight of the overall problem goal, and are then unable to complete the algebra problem they were trying to solve. There is a very specific neuro-scientific reason for this. Most problem solving uses short-term memory. If the student has basic arithmetic facts memorized, the short-term memory is not used for this and can continue to focus on solving the larger problem at hand. However, if the student is not fluent at arithmetic, and the short-term memory is now having to be used to work on the arithmetic solutions, the larger Algebra problem is effectively "pushed out" of this memory space and the student loses sight of where they were going within the context of the problem.

Calculators can provide considerable assistance in this case. A scientific or arithmetic calculator can perform the calculations and allow the student to stay focused on solving the Algebra problem, and hence build their understanding of the Algebra concepts and standards in this course. However, the student will ultimately need to remedy their lack of fluency with arithmetic, and should probably be given additional intervention time specifically targeted at arithmetical fluency. During this intervention, the use of a calculator would be completely inappropriate since the objective is to build the student's own competency at performing arithmetic calculations.

The objective of any lesson should determine whether or not calculators should be used: if the objective is solving equations, then students using calculators to check arithmetical operations is entirely appropriate as this supports the students as they build their understanding of using the properties of equality to isolate variables. However, if a teacher wanted to use a lesson on solving equations as a review of both the students' ability with arithmetic and the methods needed to solve equations, then calculators would not be appropriate.

Similarly with graphing calculators, teachers need to think about the objective of any lesson and determine if a graphing calculator is an appropriate tool. Students must be able to draw graphs by hand using a straight edge, but they also need to be able to solve problems set in real world situations with systems of linear equations, where drawing the graphs by hand would be a time-consuming, and concept-obscuring process. In this situation, using a graphing calculator would allow students to demonstrate and practice their knowledge of the Algebra standard.

The following is information about various graphing calculators:

GraphCalc - http://www.graphcalc.com/ **FREE**

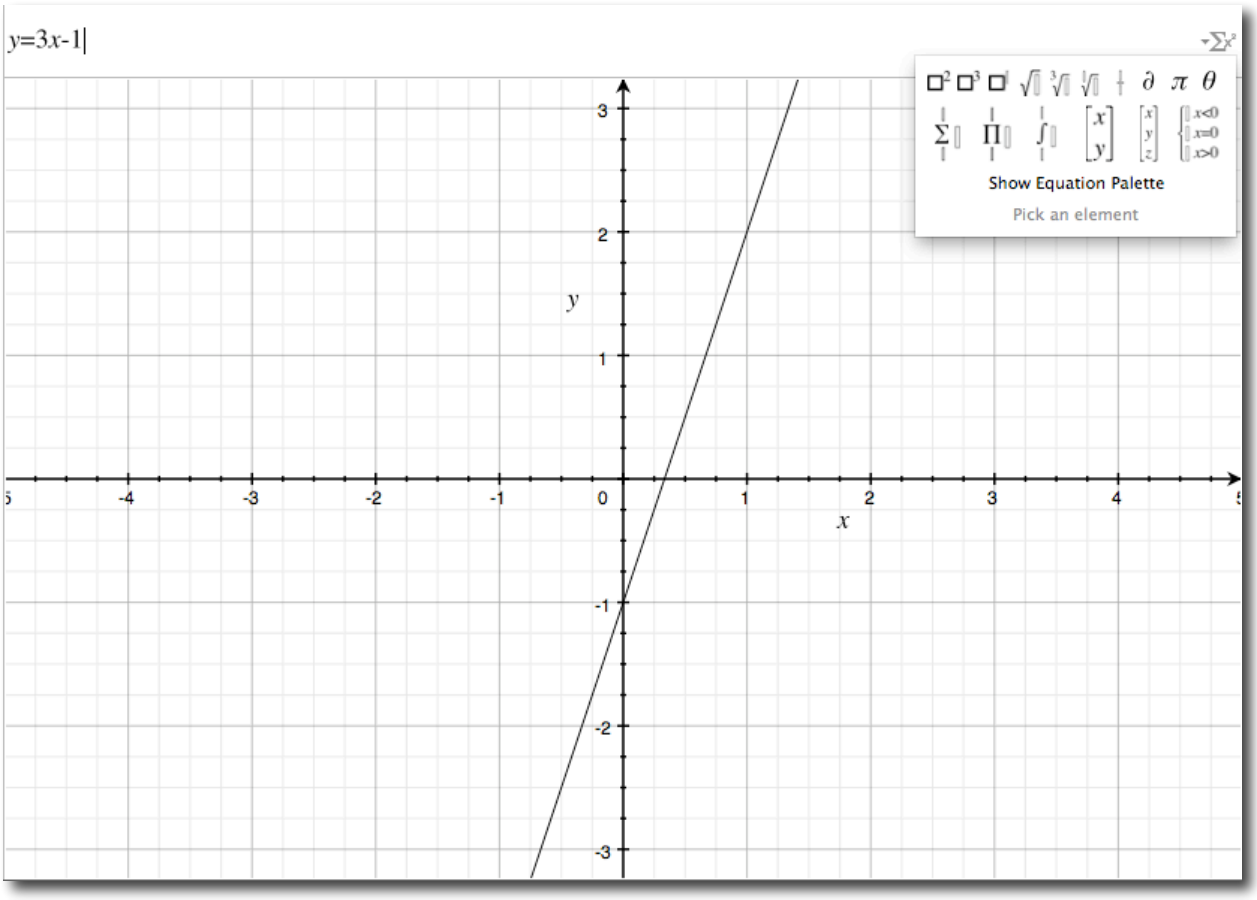
GraphCalc is an all-in-one solution to everything from everyday arithmetic to complex equations. GraphCalc combines all the features of a professional mathematics package with the simplicity of an easy-to-learn Windows interface. It provides user-friendly help and tutorials to guide you through the process of mastering GraphCalc. ***Note: this is Windows- only***

Graph 4.3 - http://www.padowan.dk/graph/ **FREE**

Graph is an open source application used to draw mathematical graphs in a coordinate system. Anyone who wants to draw graphs of functions will find this program useful. The program makes it very easy to visualize a function and paste it into another program. It is also possible to do some mathematical calculations on the functions.

Grapher

All Mac computers come with an application called “Grapher” in which it is possible to easily create 2D and 3D graphs such as the one below:

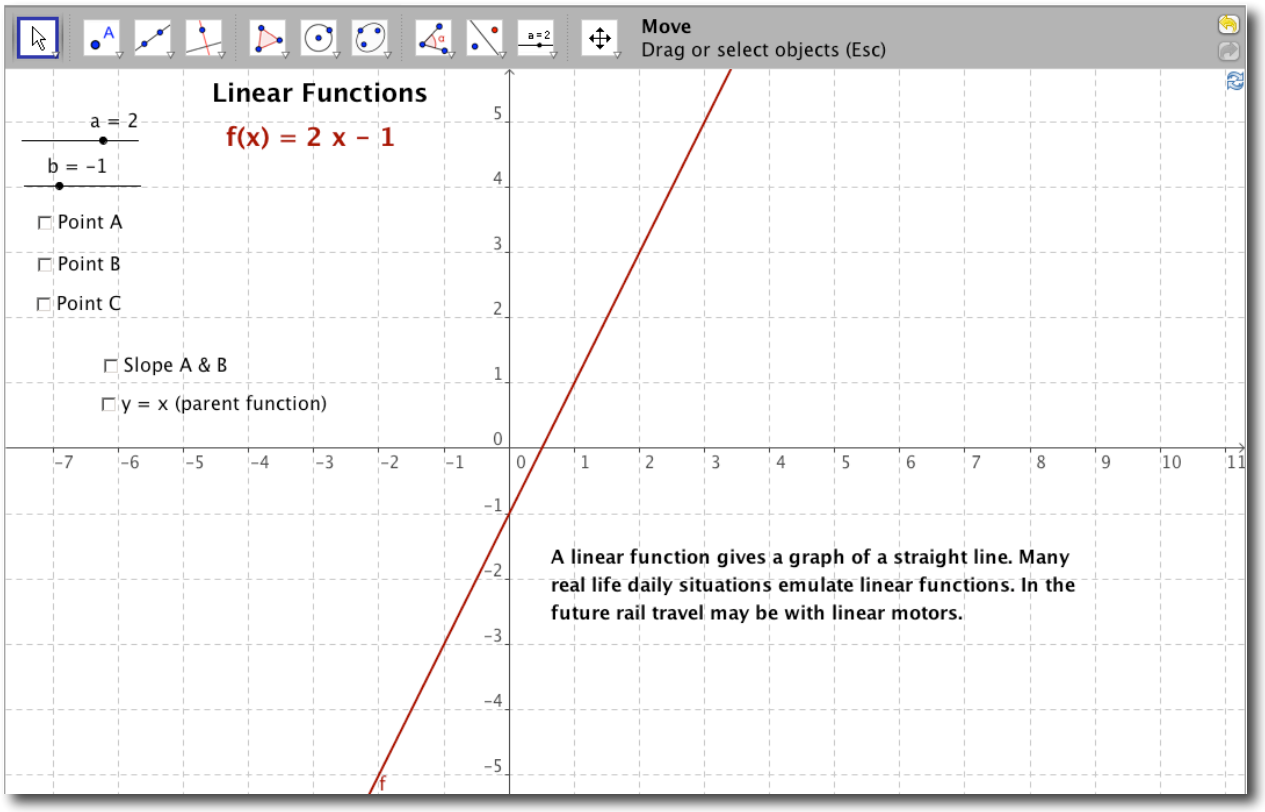


TI-84: Many classrooms may have sets of TI calculators. There is an excellent online tutorial for these calculators at
http://media.mivu.org/mvu_pd/a4a/resources/calculator/index.html

The use of GeoGebra in Algebra 1

Instructor Notes

GeoGebra is free educational mathematics software that joins dynamic geometry, algebra and calculus. It allows teachers and students to build their own virtual manipulatives which can be used in the classroom to model and test concepts. For example, it is possible to build a manipulative that graphs the equation $y = mx + b$, and to have sliders for the values m and b which can be moved to demonstrate the relationship between the variables and the resulting graph of a linear equation.



The software is relatively easy to learn to use. The creation of dynamic learning tools can be a very powerful addition to the set of classroom resources. Students could also be tasked with creating an appropriate manipulative as an end-of-unit project. Note – to be able to create one of these objects, a good understanding of the mathematics is essential, hence it is a good way of using technology to enable students to engage in an activity that forces them to apply their newly acquired knowledge in a fun and exciting way.

The main GeoGebra website homepage where you can download the free software is here: http://www.geogebra.org/cms/

There are also very extensive introductory materials at http://www.geogebra.org/book/intro-en/, including a series of YouTube videos that discuss how to use GeoGebra for different mathematics topics.

While many of the uses of GeoGebra are focused on Geometry, there are many examples of virtual manipulatives that are already created that are excellent for Algebra: http://www.geogebra.org/en/wiki/index.php/English#Algebra

About NROC

The **National Repository of Online Courses (NROC)** is a growing library of high-quality online course content for students and faculty in higher education, high school and Advanced Placement*. NROC is a project of the non-profit Monterey Institute for Technology and Education (MITE), and is supported by grants from The William and Flora Hewlett Foundation, The Bill and Melinda Gates Foundation, and by sustaining institutional members of the NROC Network.

NROC is an Open Educational Resource (OER) and facilitates collaboration among a community of content developers, subject matter experts, and education professionals to serve students and teachers worldwide.

Courses in the NROC library have been developed in conjunction with leading academic institutions across the United States. All courses are designed and assessed to ensure they meet high standards of scholarship, instructional value, and presentational impact. NROC courses are designed to cover the breadth and depth of topics based on generally accepted national curricula and can be customized within a learning management system. With contributions from the NROC Network membership community, NROC offers continuous improvement and maintenance of the courses over time.

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What are OER?

Open Educational Resources (OER) are teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge *(from The William and Flora Hewlett Foundation).*

NROC Course Design and Development

One of the first projects launched at NROC was the creation of a set of *design* and *development guidelines* that captured what is known about effective learning in online education. The staff of the Monterey Institute for Technology and Education (MITE), who launched and maintain NROC, wanted the NROC guidelines to be flexible enough to evolve as the technologies, environments, and practices in teaching and learning shift. And shift they have. The emergent field of research on "digital media and learning" now embraces the ubiquity of digital media and its influences on learning inside and outside of the classroom. The NROC guidelines have held up through these changes.

The long-term goal of National Repository of Online Courses is to create a robust digital library of high-quality course content to provide the best learning experiences possible for instructors and students. The NROC Development Guidelines help to bridge the gap between what research has shown about learning, with the current practices in education and rapidly changing technologies. The NROC guidelines help to continually improve the quality, interoperability, and availability of quality online course content.

Learning Theory Framework. There are many approaches to defining learning theories, philosophies and best practices. The various philosophies of learning have tended to create silos, camps, and market niches, inspiring debates about what is most effective or essential to learners' achievement. NROC has found it most productive to take a "**systems approach**" to learning and teaching in which the theories and philosophies, with their relevant applications and data, are integrated and aligned into a unified framework of learning. The NROC Development Guidelines are designed within a comprehensive framework that assumes *alignment and reinforcement between theories of learning – as elements of an ecosystem that requires reinforcing relationships between elements to succeed as a whole.*

Thus the NROC development approach is an integration of learning theories focused around four major themes: learner-centered, knowledge-centered, assessment-centered, and community-centered approaches (see *How People Learn*, The National Research Council). NROC has derived a list of significant attributes under each approach to inform the guidelines. NROC asserts that the best online, hybrid, or blended learning experiences involve a mix of these attributes, and that they should reinforce and harmonize with one another. The NROC development process engages subject matter experts, teachers, and students to truth test and refine this approach.

Learner-Centered
o multiple learning styles
o metacognition
o feedback
o interaction
o relevance

Assessment-Centered
o multiple types
o understanding
o concepts, principles
o problem solving
o transfer

Knowledge-Centered
o subject expertise
o concepts, principles
o subject pedagogy
o structure, scaffolding
o applied, connected

Community-Centered
o social context
o cultural context
o real world connection
o relevance
o interaction

Research Informing Course Design

This Algebra course is designed to *support teachers as they rethink teaching next-generation algebra students.* The course design and development were informed by an extensive survey of the research on, and the practice of, teaching mathematics. This research informed the Algebra 1 prototypes and iterated the design based on focus groups with students, teachers and administrators across the country.

The investigation started with insights from scholars, teachers, educators and technologists who have been studying learning, learning with media and technology, and the teaching and learning of mathematics. A review of the "*state of the shelf*" of scholarly articles, institutional studies, textbooks, educational software, and online resources went into informing the design of a new generation of learner-centered, online mathematics courses. The review of the literature covered several areas:

Curriculum and Standards. The Algebra curriculum is based upon the strategic plans of institutions, districts, states, and nationwide efforts to provide students the mathematical understanding they need to advance in the field of their choice.

Pedagogy and Assessment. To understand what it is that enables students to master particular material and measure their progress, the literature in *cognitive science, pedagogy, and assessment* was reviewed.

Technology and Interaction. Our design is also informed by decades of work in the use of *information technology* to teach mathematics, and on new forms of online interaction enabled by technology and *social media*.

Play and Games. We explored the literature on *play* as it re-emerges as a respected form of learning, examining the growing literature on *games and learning*.

Textbooks and Online Mathematics. And finally we examined the spectrum of standard and progressive *textbooks* and an array of *websites and software* dedicated to helping people learn math.

Student, Teacher and Administrator Feedback. Following the research and analysis, we convened focus groups with students, teachers, and administrators and engaged subject matter experts to review the work throughout the design and development process. We continually refined our designs based on their feedback.

More Information
To find out more about this project go to: NROCMath.org

Additional information and bibliographies from the NROC course development approach, mathematics focus groups, and mathematics research may be found here:

NROC Guidelines

Focus Group Summary

Mathematics Development Research

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Algebra 1—An Open Course

This course is the result of three years of collaboration among educators, researchers, subject matter experts, and an experienced team of educational media producers. The project was designed and developed by the non-profit educational foundation, Monterey Institute for Technology and Education (MITE).

MITE manages the National Repository of Online Courses (NROC), with the intellectual and financial support of The William and Flora Hewlett Foundation and sustaining institutional members of the NROC Network.

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❖ Funding Provided by

The William and Flora Hewlett Foundation
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