Common Core State Standards

Mathematics II

Integrated Pathway

Program Overview

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This program was developed and reviewed by experienced math educators who have both academic and professional backgrounds in mathematics. This ensures: freedom from mathematical errors, grade level appropriateness, freedom from bias, and freedom from unnecessary language complexity.

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PROGRAM OVERVIEW

Introduction to the Program

Introduction

The *Common Core State Standards Integrated Pathway: Mathematics II Program* is a complete set of materials developed around the Common Core State Standards (CCSS), the overview of the Integrated Pathway for the Common Core State Mathematics Standards, and the Mathematics II content map found in Appendix A of the Common Core State Standards. Topics are built around accessible core curricula, ensuring that the *CCSS Integrated Pathway: Mathematics II Program* is useful for striving students and diverse classrooms.

This program realizes the benefits of exploratory and investigative learning and employs a variety of instructional models to meet the learning needs of students with a range of abilities.

The *CCSS Integrated Pathway: Mathematics II Program* includes components that support problem-based learning, instruct and coach as needed, provide practice, and assess students' skills. Instructional tools and strategies are embedded throughout.

The program includes:

- More than 150 hours of lessons, addressing the six units of CCSS IP: Mathematics II
- Essential Questions for each instructional topic
- Vocabulary
- Instruction and Guided Practice
- Problem-based Tasks and Coaching questions
- Step-by-step graphing calculator instructions for the TI-Nspire and the TI-83/84
- Station activities to promote collaborative learning and problem-solving skills

Purpose of Materials

The *CCSS Integrated Pathway: Mathematics II Program* has been organized to coordinate with the CCSS Integrated Pathway: Mathematics II content map and specifications from Appendix A of the Common Core State Standards.

Each lesson includes activities that offer opportunities for exploration and investigation. These activities incorporate concept and skill development and guided practice, then move on to the application of new skills and concepts in problem-solving situations. Throughout the lessons and activities, problems are contextualized to enhance rigor and relevance.

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PROGRAM OVERVIEW
Introduction to the Program

This program includes all the topics addressed in the CCSS Integrated Pathway: Mathematics II content map. These include:

- Extending the Number System
- Quadratic Functions and Modeling
- Expressions and Equations
- Applications of Probability
- Similarity, Right Triangle Trigonometry, and Proof
- Circles With and Without Coordinates

The eight Mathematical Practices described in the Common Core are infused throughout:

- CCSS.MP.1: Make sense of problems and persevere in solving them.
- CCSS.MP.2: Reason abstractly and quantitatively.
- CCSS.MP.3: Construct viable arguments and critique the reasoning of others.
- CCSS.MP.4: Model with mathematics.
- CCSS.MP.5: Use appropriate tools strategically.
- CCSS.MP.6: Attend to precision.
- CCSS.MP.7: Look for and make use of structure.
- CCSS.MP.8: Look for and express regularity in repeated reasoning.

Structure of the Teacher Resource

The *CCSS Integrated Pathway: Mathematics II Program* is provided in an online, digital format, and/or in hard copy (Program Overview and six unit volumes). The materials, either online or hard copy, are completely reproducible. Online materials can be provided in your Learning Management System (such as Canvas or Schoolology) or in Walch's proprietary system, WalchConnect. The nested folder organization in WalchConnect allows you to access the materials quickly and easily. The digital format also facilitates printing and copying student pages and/or making assignments online.

The Program Overview is the first section. This section helps you to navigate the materials, offers a collection of graphic organizers and suggested strategies for their use, and shows the correlation between the Common Core State Standards and the CCSS Integrated Pathway: Mathematics II content map found in Appendix A of the Common Core State Standards.

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The remaining books focus on content, knowledge, and application of the six units in the CCSS Integrated Pathway Mathematics II curriculum: Extending the Number System; Quadratic Functions and Modeling; Expressions and Equations; Applications of Probability; Similarity, Right Triangle Trigonometry, and Proof; and Circles With and Without Coordinates. The units in the *CCSS Integrated Pathway: Mathematics II Program* are designed to be flexible so that you can mix and match activities as the needs of your students and your instructional style dictate.

The Station Activities correspond to the content in the units and provide students with the opportunity to apply concepts and skills, while you have a chance to circulate, observe, speak to individuals and small groups, and informally assess and plan.

Each lesson begins with a pre-assessment and ends with a progress assessment. These allow you to assess students' progress as you move from lesson to lesson, enabling you to gauge how well students have understood the material and to differentiate as appropriate.

Glossary

The Glossary contains vocabulary terms and formulas from throughout the program, organized alphabetically. Each listing provides the term and the definition in both English and Spanish.

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Unit Structure

All of the instructional units have common features. Each unit begins with a list of all the standards addressed in the lessons and a list of one or more conceptual activities. Each unit also begins with a pre-assessment. Each lesson begins with an overview of the standards addressed in the lesson; Essential Questions; vocabulary (titled "Words to Know"); and a list of recommended websites to be used as additional resources.

Each sub-lesson begins with a list of identified prerequisite skills that students need to have mastered in order to be successful with the new material in the upcoming sub-lesson. This is followed by an introduction, key concepts, common errors/misconceptions, scaffolded practice problems, guided practice examples, a problem-based task with coaching questions and sample responses, a closure activity, and practice. Each lesson ends with a progress assessment to evaluate students' learning.

All of the components are described below and on the following pages for your reference.

Pre-Assessment

This can be used to gauge students' prior knowledge and to inform instructional planning.

Common Core State Standards for the Lesson

All standards that are addressed in the entire lesson are listed.

Essential Questions

These are intended to guide students' thinking as they proceed through the lesson. By the end of each lesson, students should be able to respond to the questions.

Words to Know

Vocabulary terms and formulas are provided as background information for instruction or to review key concepts that are addressed in the lesson.

Recommended Resources

This is a list of websites that can be used as additional resources. Some websites are games; others provide additional examples and/or explanations. (*Note*: Links will be monitored and repaired or replaced as necessary.) Each Recommended Resource is also accessible through Walch's cloud-based Curriculum Engine Learning Object Repository as a separate learning object that can be assigned to students.

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Conceptual Activities

Conceptual understanding serves as the foundation on which to build deeper understanding of mathematics. In an effort to build conceptual understanding of mathematical ideas and to provide more than procedural fluency and application, links to interactive open education and Desmos resources are included. (*Note*: These website links will be monitored and repaired or replaced as necessary.) These and many other open educational resources (OERs) are also accessible through the Learning Object Repository as separate objects that can be assigned to students.

Warm-Up

Each warm-up takes approximately 5 minutes and addresses either prerequisite and critical-thinking skills or previously taught math concepts.

Common Core State Standards for the Sub-lesson

When lessons are broken down into sub-lessons, the specific standard or standards that are addressed are presented at the beginning of the instructional portion of the sub-lesson.

Warm-Up Debrief

Each debrief provides the answers to the warm-up questions, and offers suggestions for situations in which students might have difficulties. A section titled Connection to the Sub-lesson is also included in the debrief to help answer students' questions about the relevance of the particular warm-up activity to the upcoming instruction. Warm-Ups with debriefs are also provided in PowerPoint presentations.

Identified Prerequisite Skills

This list cites the skills necessary to be successful with the new material.

Introduction

This brief paragraph gives a description of the concepts about to be presented and often contains some Words to Know.

Key Concepts

Provided in bulleted form, this instruction highlights the important ideas and/or processes for meeting the standard.

Graphing Calculator Directions

Step-by-step instructions for using a TI-Nspire and a TI-83/84 are provided whenever graphing calculators are referenced.

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Common Errors/Misconceptions

This is a list of the common errors students make when applying Key Concepts. This list suggests what to watch for when students arrive at an incorrect answer or are struggling with solving the problems.

Scaffolded Practice (Printable Practice)

This set of 10 printable practice problems provides introductory level skill practice for the sub-lesson. This practice set can be used during instruction time.

Guided Practice

This section provides step-by-step examples of applying the Key Concepts. The three to five examples are intended to aid during initial instruction, but are also for individuals needing additional instruction and/or for use during review and test preparation.

Enhanced Instructional PowerPoint (Presentation)

Each sub-lesson includes an instructional PowerPoint presentation with the following components: Warm-Up, Key Concepts, and Guided Practice. Selected Guided Practice examples include GeoGebra applets. These instructional PowerPoints are downloadable and editable.

Problem-Based Task

This activity can serve as the centerpiece of a problem-based sub-lesson, or it can be used to walk students through the application of the standard, prior to traditional instruction or at the end of instruction. The task makes use of critical-thinking skills.

Optional Problem-Based Task Coaching Questions with Sample Responses

These questions scaffold the task and guide students to solving the problem(s) presented in the task. They should be used at the discretion of the teacher for students requiring additional support. The Coaching Questions are followed by answers and suggested appropriate responses to the coaching questions. In some cases answers may vary, but a sample answer is given for each question.

Recommended Closure Activity

Students are given the opportunity to synthesize and reflect on the sub-lesson through a journal entry or discussion of one or more of the Essential Questions.

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Problem-Based Task Implementation Guide

This instructional overview, found with selected Problem-Based Tasks in each unit, highlights connections between the task and the sub-lesson's key concepts and Mathematical Practices. The Implementation Guide also offers suggestions for facilitating and monitoring, and provides alternative solutions.

Printable Practice (Sets A and B) and Interactive Practice (Set A)

Each sub-lesson includes two sets of practice problems to support students' achievement of the learning objectives. They can be used in any combination of teacher-led instruction, cooperative learning, or independent application of knowledge. Each Practice A is also available as an interactive Learnosity activity with Technology-Enhanced Items.

Progress Assessment

Each sub-lesson ends with 10 multiple-choice questions, as well as one extended-response question that incorporates critical thinking and writing components. This can be used to document the extent to which students grasp the concepts and skills addressed during instruction.

Unit Assessment

Each unit ends with 12 multiple-choice questions and three extended-response questions that incorporate critical thinking and writing components. This can be used to document the extent to which students grasped the concepts and skills of each unit.

Answer Key

Answers for all of the Warm-Ups and practice problems are provided at the end of each unit.

Station Activities

Most units include a collection of station-based activities to provide students with opportunities to practice, reinforce, and apply mathematical skills and concepts. The debriefing discussions after each set of activities provide an important opportunity to help students reflect on their experiences and synthesize their thinking.

Conceptual Tasks

These engaging tasks provide opportunities for students to deepen their understanding and develop their conceptual knowledge of math concepts. These tasks provide multiple entry points and are accessible for ALL learners.

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Standards Correlations

Each lesson in this Integrated Pathway: Mathematics II program was written specifically to address the Common Core State Standards. Each lesson lists the standards covered in all the sub-lessons, and each sub-lesson lists the standards addressed in that particular section. In this section, you'll find a comprehensive list mapping the sub-lessons to the CCSS.

Guide to Common Core State Standards Annotation

As you use this program, you will come across a symbol included with the Common Core standards for some of the lessons and activities. These symbols are explained below.

Symbol: ⋆

Denotes: Modeling Standards

Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (⋆).

From http://www.walch.com/CCSS/00003

Symbol: (+)

Denotes: College and Career Readiness Standards

Advanced mathematics standards that are required in higher-level courses such as advanced statistics may also be included in lower-level courses. These additional standards are denoted by (+). According to the Common Core State Standards Initiative, "the evidence concerning college and career readiness shows clearly that the knowledge, skills, and practices important for readiness include a great deal of mathematics prior to the boundary defined by (+) symbols in these standards. Indeed, some of the highest priority content for college and career readiness comes from Grades 6–8."

From http://www.walch.com/CCSS/00004

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Unit 1: Extending the Number System			
Lesson	**Sub-lesson number**	**Title**	**Standard(s)**
Lesson 1	**Working with the Number System**		
	1.1.1	Defining, Rewriting, and Evaluating Rational Exponents	N–RN.1 N–RN.2
	1.1.2	Rational and Irrational Numbers and Their Properties	N–RN.2 N–RN.3
Lesson 2	**Operating with Polynomials**		
	1.2.1	Adding and Subtracting Polynomials	A–APR.1
	1.2.2	Multiplying Polynomials	A–APR.1
Lesson 3	**Operating with Complex Numbers**		
	1.3.1	Defining Complex Numbers, i, and i^2	N–CN.1
	1.3.2	Adding and Subtracting Complex Numbers	N–CN.2
	1.3.3	Multiplying Complex Numbers	N–CN.2

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Unit 2: Quadratic Functions and Modeling			
Lesson	**Sub-lesson number**	**Title**	**Standard(s)**
Lesson 1	**Analyzing Quadratic Functions**		
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	2.1.2	Interpreting Various Forms of Quadratic Functions	F–IF.7a★ F–IF.8a
Lesson 2	**Interpreting Quadratic Functions**		
	2.2.1	Interpreting Key Features of Quadratic Functions	F–IF.4★
	2.2.2	Identifying the Domain of a Quadratic Function	F–IF.5★
	2.2.3	Identifying the Average Rate of Change	F–IF.6★
Lesson 3	**Building Functions**		
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	2.3.2	Operating on Functions	F–BF.1b★
Lesson 4	**Graphing Other Functions**		
	2.4.1	Square Root and Cube Root Functions	F–IF.7b★
	2.4.2	Absolute Value and Step Functions	F–IF.7b★
	2.4.3	Piecewise Functions	F–IF.7b★
Lesson 5	**Analyzing Functions**		
	2.5.1	Analyzing Exponential Functions	F–IF.8b
	2.5.2	Comparing Properties of Functions Given in Different Forms	F–IF.9 F–LE.3★
Lesson 6	**Transforming Functions**		
	2.6.1	Replacing $f(x)$ with $f(x) + k$ and $f(x + k)$	F–BF.3
	2.6.2	Replacing $f(x)$ with $k \bullet f(x)$ and $f(k \bullet x)$	F–BF.3
Lesson 7	**Finding Inverse Functions**		
	2.7.1	Finding Inverse Functions	F–BF.4a

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Unit 3: Expressions and Equations			
Lesson	**Sub-lesson number**	**Title**	**Standard(s)**
Lesson 1	**Interpreting Structure in Expressions**		
	3.1.1	Identifying Terms, Factors, and Coefficients	A–SSE.1a★
	3.1.2	Interpreting Complicated Expressions	A–SSE.1b★
Lesson 2	**Creating and Solving Quadratic Equations in One Variable**		
	3.2.1	Taking the Square Root of Both Sides	A–CED.1★ A–REI.4b
	3.2.2	Factoring Expressions by the Greatest Common Factor	A–SSE.2
	3.2.3	Factoring Expressions with $a = 1$	A–SSE.2
	3.2.4	Factoring Expressions with $a > 1$	A–SSE.2
	3.2.5	Solving Quadratic Equations by Factoring	A–SSE.2 A–CED.1★ A–REI.4b
	3.2.6	Completing the Square	A–SSE.2 A–CED.1★ A–REI.4a A–REI.4b
	3.2.7	Applying the Quadratic Formula	A–CED.1★ A–REI.4a A–REI.4b
	3.2.8	Solving Quadratic Inequalities	A–SSE.2 A–CED.1★ A–REI.4b
Lesson 3	**Creating Quadratic Equations in Two or More Variables**		
	3.3.1	Creating and Graphing Equations Using Standard Form	A–SSE.3a★ A–CED.2★
	3.3.2	Creating and Graphing Equations Using the x-intercepts	A–SSE.3a★ A–CED.2★
	3.3.3	Creating and Graphing Equations Using Vertex Form	A–SSE.3b★ A–CED.2★
	3.3.4	Rearranging Formulas	A–CED.4★

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Lesson	Sub-lesson number	Title	Standard(s)
Lesson 4	**Fundamental Theorem of Algebra**		
	3.4.1	Extending Polynomial Identities to Include Complex Numbers	N–CN.8 (+)
	3.4.2	Solving Quadratic Equations with Complex Solutions	N–CN.7 N–CN.9 (+)
Lesson 5	**Rational Equations**		
	3.5.1	Creating Rational Equations	A–CED.1★
	3.5.2	Graphing Rational Equations	A–CED.2★
	3.5.3	Creating Rational Inequalities	A–CED.1★
Lesson 6	**Writing Exponential Expressions in Equivalent Forms**		
	3.6.1	Writing Exponential Expressions in Equivalent Forms	A–SSE.3c★
Lesson 7	**Solving Systems of Equations**		
	3.7.1	Solving Systems Graphically	A–REI.7
	3.7.2	Solving Systems Algebraically	A–REI.7

Unit 4: Applications of Probability			
Lesson	**Sub-lesson number**	**Title**	**Standard(s)**
Lesson 1	**Events**		
	4.1.1	Describing Events	S–CP.1★
	4.1.2	The Addition Rule	S–CP.7★
	4.1.3	Understanding Independent Events	S–CP.2★
Lesson 2	**Conditional Probability**		
	4.2.1	Introducing Conditional Probability	S–CP.3★ S–CP.5★ S–CP.6★
	4.2.2	Using Two-Way Frequency Tables	S–CP.4★ S–CP.5★ S–CP.6★
	4.2.3	The Multiplication Rule	S–CP.8★ (+)
Lesson 3	**Combinatorics**		
	4.3.1	Combinations and Permutations	S–CP.9★ (+)
	4.3.2	Probability with Combinatorics	S–CP.9★ (+)
Lesson 4	**Making and Analyzing Decisions**		
	4.4.1	Making Decisions	S–MD.6★ (+)
	4.4.2	Analyzing Decisions	S–MD.7★ (+)

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Unit 5: Similarity, Right Triangle Trigonometry, and Proof			
Lesson	**Sub-lesson number**	**Title**	**Standard(s)**
Lesson 1	**Line Segments**		
	5.1.1	Midpoints and Other Points on Line Segments	G–GPE.6
Lesson 2	**Investigating Properties of Dilations**		
	5.2.1	Investigating Properties of Parallelism and the Center	G–SRT.1a
	5.2.2	Investigating Scale Factors	G–SRT.1b
Lesson 3	**Defining and Applying Similarity**		
	5.3.1	Defining Similarity	G–SRT.2
	5.3.2	Applying Similarity Using the Angle-Angle (AA) Criterion	G–SRT.3
Lesson 4	**Proving Similarity**		
	5.4.1	Proving Triangle Similarity Using Side-Angle-Side (SAS) and Side-Side-Side (SSS) Similarity	G–SRT.4
	5.4.2	Working with Ratio Segments	G–SRT.4
	5.4.3	Proving the Pythagorean Theorem Using Similarity	G–SRT.4
	5.4.4	Solving Problems Using Similarity and Congruence	G–SRT.5
Lesson 5	**Proving Theorems About Lines and Angles**		
	5.5.1	Proving the Vertical Angles Theorem	G–CO.9
	5.5.2	Proving Theorems About Angles in Parallel Lines Cut by a Transversal	G–CO.9
Lesson 6	**Proving Theorems About Triangles**		
	5.6.1	Proving the Interior Angle Sum Theorem	G–CO.10
	5.6.2	Proving Theorems About Isosceles Triangles	G–CO.10
	5.6.3	Proving the Midsegment of a Triangle	G–CO.10
	5.6.4	Proving Centers of Triangles	G–CO.10

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Lesson	Sub-lesson number	Title	Standard(s)
Lesson 7	**Proving Theorems About Parallelograms**		
	5.7.1	Proving Properties of Parallelograms	G–CO.11
	5.7.2	Proving Properties of Special Quadrilaterals	G–CO.11
Lesson 8	**Exploring Trigonometric Ratios**		
	5.8.1	Defining Trigonometric Ratios	G–SRT.6
	5.8.2	Exploring Sine and Cosine As Complements	G–SRT.7
Lesson 9	**Applying Trigonometric Ratios**		
	5.9.1	Calculating Sine, Cosine, and Tangent	G–SRT.8★
	5.9.2	Calculating Cosecant, Secant, and Cotangent	G–SRT.8★
	5.9.3	Problem Solving with the Pythagorean Theorem and Trigonometry	G–SRT.8★
	5.9.4	Proving the Fundamental Pythagorean Identity	F–TF.8

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Unit 6: Circles With and Without Coordinates			
Lesson	**Sub-lesson number**	**Title**	**Standard(s)**
Lesson 1	**Introducing Circles**		
	6.1.1	Similar Circles and Central and Inscribed Angles	G–C.1 G–C.2
	6.1.2	Chord Central Angles Conjecture	G–C.2
	6.1.3	Properties of Tangents of a Circle	G–C.2
Lesson 2	**Inscribed Polygons and Circumscribed Triangles**		
	6.2.1	Constructing Inscribed Circles	G–C.3
	6.2.2	Constructing Circumscribed Circles	G–C.3
	6.2.3	Proving Properties of Inscribed Quadrilaterals	G–C.3
Lesson 3	**Constructing Tangent Lines**		
	6.3.1	Constructing Tangent Lines	G–C.4 (+)
Lesson 4	**Finding Arc Lengths and Areas of Sectors**		
	6.4.1	Defining Radians	G–C.5
	6.4.2	Deriving the Formula for the Area of a Sector	G–C.5
Lesson 5	**Explaining and Applying Area and Volume Formulas**		
	6.5.1	Circumference and Area of a Circle	G–GMD.1
	6.5.2	Volumes of Cylinders, Pyramids, Cones, and Spheres	G–GMD.1 G–GMD.3★
Lesson 6	**Deriving Equations**		
	6.6.1	Deriving the Equation of a Circle	G–GPE.1
	6.6.2	Deriving the Equation of a Parabola	G–GPE.2
Lesson 7	**Using Coordinates to Prove Geometric Theorems About Circles and Parabolas**		
	6.7.1	Using Coordinates to Prove Geometric Theorems About Circles and Parabolas	G–GPE.4

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