North Carolina Math 4

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 *North Carolina Math 4 Program* is a complete set of materials developed around the North Carolina Standard Course of Study (NCSCOS) for Mathematics. Topics are built around accessible core curricula, ensuring that the *North Carolina Math 4 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 *North Carolina Math 4 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 eight units of North Carolina Math 4
- 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 *North Carolina Math 4 Program* has been organized to coordinate with the North Carolina Math 4 content map and specifications from the NCSCOS. 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 North Carolina Math 4 content map. These include:

- Building Mathematical Community with Parent Functions and Key Features
- Piecewise Functions, Composition of Functions, and Regression
- Logarithmic Functions
- Trigonometry
- Exploratory Data Analysis
- Probability Distributions
- Statistical Inference
- ACT Prep: Complex Numbers, Matrices, and Vectors

The eight Standards for Mathematical Practice are infused throughout:

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

Structure of the Teacher Resource

The *North Carolina Math 4 Teacher Resource* materials are completely reproducible. The Program Overview is the first section. This section helps you to navigate the materials, offers a comprehensive guide to Instructional Strategies for struggling readers, and shows the correlation between the NCSCOS for Mathematics and the North Carolina Math 4 course description.

The remaining materials focus on content, knowledge, and application of the eight units in the North Carolina Math 4 curriculum: Building Mathematical Community with Parent Functions and Key Features; Piecewise Functions, Composition of Functions, and Regression;

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Logarithmic Functions; Trigonometry; Exploratory Data Analysis; Probability Distributions; Statistical Inference; and ACT Prep: Complex Numbers, Matrices, and Vectors. The units in the *North Carolina Math 4 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.

Each unit includes a mid-unit assessment and an end-of-unit assessment. These enable you to gauge how well students have understood the material as you move from lesson to lesson and to differentiate as appropriate.

Glossary

The Glossary contains vocabulary terms and formulas from throughout the program, organized alphabetically by units. 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; Essential Questions; vocabulary (titled "Words to Know"); a list of recommended websites to be used as additional resources, and one or more conceptual activities.

Each lesson begins with a warm-up, followed by a list of identified prerequisite skills that students need to have mastered in order to be successful with the new material in the upcoming lesson. This is followed by an introduction, key concepts, common errors/misconceptions, guided practice examples, a problem-based task with coaching questions and sample responses, a closure activity, and practice. Each unit includes a Mid-Unit Assessment and an End-of-Unit Assessment to evaluate students' learning.

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

North Carolina Standard Course of Study for the Unit

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

Essential Questions

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

Words to Know

A list of vocabulary terms that appear in the unit are provided as background information for instruction or to review key concepts that are addressed in the lesson. Each term is followed by a numerical reference to the lesson(s) in which the term is defined.

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.

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.

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Warm-Up

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

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 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.

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 lesson. This practice set can be used during instruction time.

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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 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 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 lesson through a journal entry or discussion of one or more of the Essential Questions.

Problem-Based Task Implementation Guide

This instructional overview, found with selected Problem-Based Tasks in each unit, highlights connections between the task and the lesson's key concepts and SMPs. 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 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.

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Answer Key

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

Station Activities

Each unit includes 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.

Mid-Unit and End-of-Unit Assessments

A mid-unit assessment and an end-of-unit assessment offer multiple-choice questions and extended-response questions that incorporate critical thinking and writing components. These can be used to document the extent to which students grasped the concepts and skills of each unit.

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Standards Correlations

Each lesson in this North Carolina Math 4 program was written specifically to address the North Carolina Standard Course of Study (NCSCOS) for Mathematics. Each unit lists the standards covered in all the lessons, and each lesson lists the standards addressed in that particular lesson. In this section, you'll find a comprehensive list mapping the lessons to the NCSCOS.

Guide to North Carolina Standard Course of Study Annotation

As you use this program, you will come across a star symbol (★) included with the standards for some of the lessons and activities. This symbol is 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

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Unit 1: Building Mathematical Community with Parent Functions and Key Features		
Lesson	**Title**	**Standard(s)**
1.1	Reading and Identifying Key Features of Real-World Situation Graphs	NC.M3.F–IF.4★
1.2	Transformations of Parent Graphs	NC.M3.F–BF.3
1.3	Recognizing Odd and Even Functions	NC.M3.F–BF.3

Unit 2: Piecewise Functions, Composition of Functions, and Regression		
Lesson	**Title**	**Standard(s)**
2.1	Piecewise, Step, and Absolute Value Functions	NC.M4.AF.4.1, NC.M4.AF.4.2
2.2	Composition of Functions	NC.M4.AF.1.1
2.3	Evaluating Composite Functions in Various Forms	NC.M4.AF.1.2
2.4	Linear, Exponential, and Quadratic Regression	NC.M4.AF.5.1
2.5	Analyzing Residual Plots	NC.M4.AF.5.2

Unit 3: Logarithmic Functions		
Lesson	**Title**	**Standard(s)**
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3.3	Natural Logarithms	NC.M4.AF.3.1, NC.M4.AF.3.2
3.4	Interpreting Logarithmic Models	NC.M4.AF.3.1, NC.M4.AF.3.2, NC.M4.AF.3.3
3.5	Logarithmic Regression	NC.M4.AF.5.1

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Unit 4: Trigonometry		
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4.2	Proving the Law of Sines	NC.M4.AF.2.2
4.3	Proving the Law of Cosines	NC.M4.AF.2.2
4.4	Applying the Laws of Sines and Cosines	NC.M4.AF.2.2
4.5	Key Features of Trigonometric Functions	NC.M4.AF.2.3
4.6	Sinusoidal Regression	NC.M4.AF.5.1

Unit 5: Exploratory Data Analysis		
Lesson	**Title**	**Standard(s)**
5.1	Simple Random Sampling	NC.M4.SP.1.1, NC.M4.SP.1.2
5.2	Sampling Methods and Sources of Bias	NC.M4.SP.1.1, NC.M4.SP.1.2, NC.M4.SP.1.3, NC.M4.SP.1.4
5.3	Observational Studies, Surveys, and Experiments	NC.M4.SP.1.1, NC.M4.SP.1.3, NC.M4.SP.1.4
5.4	Experimental Design	NC.M4.SP.1.1, NC.M4.SP.1.2, NC.M4.SP.1.3, NC.M4.SP.1.4
5.5	Analyzing Data Visualizations	NC.M4.SP.1.4

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Unit 6: Probability Distributions		
Lesson	**Title**	**Standard(s)**
6.1	Creating Graphs of Probability Distributions	NC.M4.SP.3.1, NC.M4.SP.3.3
6.2	Expected Value	NC.M4.SP.3.1
6.3	Normal Distributions and the 68–95–99.7 Rule	NC.M4.SP.3.3, NC.M4.SP.3.4
6.4	Standard Normal Calculations	NC.M4.SP.3.3, NC.M4.SP.3.4
6.5	Assessing Normality	NC.M4.SP.3.3, NC.M4.SP.3.4
6.6	Developing Probability Distributions	NC.M4.SP.3.1, NC.M4.SP.3.3
6.7	Using Probability Distributions to Evaluate Outcomes	NC.M4.SP.3.1
6.8	The Binomial Distribution	NC.M4.SP.3.2

Unit 7: Statistical Inference		
Lesson	**Title**	**Standard(s)**
7.1	Confidence in Sample Statistics	NC.M4.SP.2.2, NC.M4.SP.2.3
7.2	Estimating with Confidence	NC.M4.SP.2.2, NC.M4.SP.2.3
7.3	Using Simulations	NC.M4.SP.2.1

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Unit 8: ACT Prep: Complex Numbers, Matrices, and Vectors		
Lesson	**Title**	**Standard(s)**
8.1	Defining Complex Numbers, i, and i^2	NC.M4.N.1.1
8.2	Adding and Subtracting Complex Numbers	NC.M4.N.1.1
8.3	Multiplying Complex Numbers	NC.M4.N.1.2
8.4	Finding the Complex Conjugate	NC.M4.N.1.2
8.5	Operations with Matrices	NC.M4.N.2.1
8.6	Using Operations on Matrices	NC.M4.N.2.1
8.7	Zero, Identity, Inverse, and Transformation Matrices	NC.M4.N.2.1
8.8	Representing and Modeling with Vector Quantities	NC.M4.N.2.2
8.9	Performing Operations on Vectors	NC.M4.N.2.2

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