ADVANCED CURRICULUM FROM THE
CENTER FOR GIFTED EDUCATION AT WILLIAM & MARY

Challenging Australian Curriculum Maths Lessons

ACTIVITIES AND EXTENSIONS FOR GIFTED AND ADVANCED LEARNERS IN

YEAR 6

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INTRODUCTION

The Australian Curriculum: Mathematics is a framework for F–10 curriculum standards that describe the mathematics skills and concepts students need to develop for success in higher education and the 21st-century workplace. The structure of the Australian Curriculum: Mathematics consists of two parts:

- Content strands, which describe what students should be taught and be able to do in their study of mathematics. These content strands are Number and Algebra, Measurement and Geometry, and Statistics and Probability, and are made up of a number of individual sub-strands.
- Proficiency strands, which describe how the content should be explored and developed. These proficiency strands have been integrated into the content strands, and help to ensure that students' mathematical skills become more sophisticated as their learning progresses.

With the adoption of the Australian Curriculum nation-wide, gifted and advanced learners need opportunities to master year-level standards and mathematical practices with greater depth, rigour and understanding. This revised edition of *Challenging Common Core Maths Lessons* is one of a series of books developed in conjunction with the Center for Gifted Education at William & Mary intended to give gifted and advanced learners additional practice and activities to master and engage with the Australian Curriculum: Mathematics. Each book in the series is organised by the content standards in one year level.

The lessons in this book cover Year 6 mathematics content. In Year 6, the content descriptions are addressed in 10 sub-strands:

- Number and Algebra
  - Number and Place Value
  - Fractions and Decimals
  - Money and Financial Mathematics
  - Patterns and Algebra
- Measurement and Geometry
  - Using Units of Measurement
  - Shape
  - Location and Transformation
  - Geometric Reasoning
- Statistics and Probability
  - Chance
  - Data Representation and Interpretation

STANDARDS FOR MATHEMATICAL PRACTICE

To engage learners with the content strands, the Australian Curriculum: Mathematics provides four proficiency strands – ways in which the student can engage with the content descriptions at every year level:

1. Understanding
2. Fluency
3. Problem-Solving
4. Reasoning

Each lesson in this book identifies the proficiency strands by number. Activities and practice problems are structured to develop proficiency in learners. Teachers should be aware of the proficiency strands and look for opportunities to connect these practices to content understanding in every lesson.

PURPOSE

The lessons in this book were written with the assumption that a teacher has already introduced a mathematical content description through a primary curriculum source. Problem solving, practice problems, and activities enrich and extend current year-level mathematics content rather than accelerate students to above-year-level content. Each lesson is specific to a sub-strand, usually only focusing on one or two content descriptions, and provides additional support and enrichment for gifted and advanced learners.

LESSON STRUCTURE

Each lesson follows a predictable structure. It first begins by naming the focal content description(s) – what students should already know or to which they have been introduced. Next, the proficiency strands covered within the activities and problems are listed by number. The lesson includes an estimate for the time it might take to complete the lesson, but this will vary by teacher and classroom. Key terms are listed, and are included based on when the terms are first introduced in the Australian Curriculum or are a prerequisite for understanding the activity or problems in a lesson. Teachers should be sure their students already have a working knowledge of these terms before beginning the lesson.

Every lesson includes a list of materials needed, including handouts. It is assumed that students will have access to commonplace items such as pencils and paper, and the materials noted are those items that teachers will need to obtain/acquire in advance. The lesson objectives highlight what students will learn or be able to do as a result of completing the activities and problems.

All lessons include an opening activity to allow students to explore the concept (e.g. multiple representations, open-ended problems, observing number patterns). Each activity is followed by practice problems that challenge students (e.g. harder or less familiar numbers) and – more importantly – extend students' thinking beyond calculating an answer. The practice problems ask students to grapple with their understanding of the lesson concepts. The lessons conclude with an assessment practice that allows teachers to evaluate student learning. The practice problems were written to engage gifted and advanced learners in higher level thinking and deeper understanding of a mathematical concept. The Australian Curriculum Assessment Practice problems in this book were intentionally written for students to prepare for on-level standardised test questions similar to Australian Curriculum-based year-level assessments, given all students are required to take these types of assessments.

GROUPING OPTIONS

The lessons in this book can be used for whole-group, small-group and individual instruction.

Whole-Group Instruction

Teachers can use this book in one academic year in conjunction with the primary curriculum in a gifted or advanced mathematics class. All students would complete each lesson after being introduced to a particular content description. Teachers can integrate the lessons into the primary curriculum taught to a whole group and address higher-order thinking questions through the lesson activity and practice problems.

Small-Group Instruction

Teachers can use this book to differentiate learning in any mathematics class by creating flexible student groups and giving students who need enrichment an opportunity for deeper understanding and engagement with a concept. Students can complete activities and practise at a self-guided pace with a partner or small group and engage in peer discussion, with or without directed supervision or intervention from the teacher.

Individual Instruction

The practice problems and assessment questions in each lesson are a good way to determine individual understanding of a certain mathematics concept on a deeper level. Nearly every practice problem emphasises making sense of and communicating the process of problem solving and asks students to explain their thinking.

Modelling Whole-Number Multiplication and Division

Australian Curriculum: Mathematics Content Description

- Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers (ACMNA123)

Mathematical Practices

- 1, 2, 3 and 4

Estimated Time

- 60 minutes

Key Terms

- Multiplication
- Division
- Rectangular arrays
- Area models

Materials

- Lesson 1.1 Activity: Shopping for a Vehicle
- Lesson 1.1 Window Tags (one for each pair of students)
- Lesson 1.1 Practice: Modelling Whole-Number Multiplication and Division
- Lesson 1.1 Australian Curriculum Assessment Practice

Objectives

In this lesson, students will
- multiply multi-digit numbers
- divide whole numbers based on strategies
- problem solve using multiplication and division.

Lesson 1.1 Activity: Shopping for a Vehicle

Tell students that they will work in pairs to help a friend make a smart purchase of a new vehicle. The friend went to the car dealership and chose two vehicles that are her final two options. It is important that the car be reliable, but also cost the least amount of money in the long run. The friend returned home with the window stickers from the cars that include all of the details that students will use to make the smartest and most economic purchase. Each pair of students needs to receive both window tags. Students need to know that the friend wants to purchase the vehicle that would be the most cost effective after four years of ownership.

Modelling Decimals Through Operations

Australian Curriculum: Mathematics Content Descriptions

- Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers (ACMNA128)
- Multiply decimals by whole numbers and perform divisions by non-zero whole numbers where the results are terminating decimals, with and without digital technologies (ACMNA129)

Mathematical Practices

- 1, 3 and 4

Estimated Time

- 60 minutes

Key Terms

- Sum
- Difference
- Product
- Quotient
- Simple machines

Materials

- Lesson 2.2 Activity: Can Your Machine Handle It?
- Lesson 2.2 Practice: Modelling Decimals Through Operations
- Lesson 2.2 Australian Curriculum Assessment Practice
- Lego kits

Objectives

In this lesson, students will
- add, subtract, multiply and divide decimals
- represent values with concrete models or drawings based on place value.

Lesson 2.2 Activity: Can Your Machine Handle It?

Students will relate their scientific knowledge of simple machines to mathematics. Inform students that a new hotel is being built near their suburb. The hotel will be 20 storeys high, and will contain windows all the way to the top. The contractor for the hotel is not pleased with the current company, who has supplied a machine to lift the glass windows high enough to be installed, because the glass keeps falling and breaking. Students will use Lego to build a model of a simple machine they feel would be best for the job. Students will then answer the marketing questions about their design. This activity can be completed independently or within small groups.

Analysing Patterns and Relationships

Australian Curriculum: Mathematics Content Description

- Continue and create sequences involving whole numbers, fractions and decimals. Describe the rule used to create the sequence (ACMNA133)

Mathematical Practices

- 1, 2 and 3

Estimated Time

- 60 minutes

Key Terms

- Patterns
- Relationships
- Ordered pairs
- Coordinate plane

Materials

- Lesson 3.1 Activity: Soccer Tournament
- Lesson 3.1 Tournament Scores
- Lesson 3.1 Practice: Patterns and Relationships
- Lesson 3.1 Australian Curriculum Assessment Practice

Objectives

In this lesson, students will
- generate patterns based on rules
- determine relationships between numbers
- graph ordered pairs on coordinate grids.

Lesson 3.1 Activity: Soccer Tournament

Set up the activity scenario for students by telling them that they will be viewing scores from a recent soccer tournament. Each team played five games during the tournament, and their scores have been given to students. The students will analyse the clues to determine which data set belongs to which team as well as which teams played against each other during the tournament. The data will be organised into tables on the activity sheet. Students will then graph the scores for each of the three games on three different coordinate grids.

LESSON 4.3

Conversion Practice

Australian Curriculum: Mathematics Content Description

- Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137)

Mathematical Practices

- 1, 2, 3 and 4

Estimated Time

- 90–120 minutes

Key Terms

- Metric system
- Customary system

Materials

- Lesson 4.3 Activity: Patio Problem
- Lesson 4.3 Practice: Conversion Practice
- Lesson 4.3 Australian Curriculum Assessment Practice
- Computer with internet access
- Large container over a litre in capacity for practice extension (optional)

Objectives

In this lesson, students will

- develop a plan to resurface an area based on set requirements
- justify their design plan to determine the profit made by the company
- apply knowledge of unit conversions to solve various problems.

Lesson 4.3 Activity: Patio Problem

In this activity, students will work as contractors to design and build a patio for a home. The student-contractor must adhere to several requirements stated by the contractor to design a floor plan to complete the project and determine the amount of profit they made from the project.

LESSON 5.1

The Coordinate Plane

Australian Curriculum: Mathematics Content Description

- Introduce the Cartesian coordinate system using all four quadrants (ACMMG143)

Mathematical Practices

- 1, 2, 3 and 4

Estimated Time

- 60–90 minutes

Key Terms

- Y-axis and x-axis
- Cartesian coordinate plane
- Cartesian coordinates
- Origin
- Ordered pair

Materials

- Lesson 5.1 Activity: Mapping a Novel
- Lesson 5.1 Coordinate Grid Setting Map
- Lesson 5.1 Setting Map
- Lesson 5.1 Practice: Coordinate Grids
- Lesson 5.1 Australian Curriculum Assessment Practice
- *Hatchet* by Gary Paulsen (optional)
- Ruler
- Grid paper

Objectives

In this lesson, students will
- understand how ordered pairs indicate locations in quadrants of a coordinate plane
- find and position integers on a coordinate plane
- solve real-world problems by graphing points on a coordinate plane and using absolute value to find the distance between two points.