Differentiated Instruction Teaching/Learning Examples

GRADE 10 MATHEMATICS, APPLIED (MFM2P): TRIGONOMETRY
One 70–75 minute period

1. Triangle Challenge (Cooperative Learning)*
2. RAFT (Role, Audience, Format, Topic)**
3. Write-Pair-Share (Cooperative Learning)*
4. Reflection Exit Card (Questions, Cues and Advance Organizers)*

*Marzano's Categories of Instructional Strategies (See Resources, below)
**Differentiated Instruction Structure

DIFFERENTIATED INSTRUCTION DETAILS

Knowledge of Students
Differentiation based on student:
☐ Readiness   ☑ Interests   ☐ Preferences:
                    ☐ Styles   ☐ Intelligences   ☐ Other (e.g., environment, gender, culture)

Need to Know
• Occupational interests of students in the class

How to Find Out
• Provide career/occupational contexts for mathematics work on an ongoing basis. Observe "math talk" and discussions
• Ask students about their occupations of interest on an Exit Card prior to this lesson

Differentiated Instruction Response
☑ Learning materials (content)   ☑ Ways of learning (process)   ☐ Ways of demonstrating learning (product)   ☐ Learning environment

CURRICULUM CONNECTIONS

Overall Expectation: Measurement and Trigonometry
• Solve problems involving right triangles using the primary trigonometric ratios and the Pythagorean theorem

Specific Expectations:
• Solve problems involving the measures of sides and angles in real-life applications using the primary trigonometric ratios and the Pythagorean theorem
• Describe, through participation in an activity, the application of trigonometry in an occupation

Learning Goal:
• Use the primary trigonometric ratios to solve problems for occupational applications

ASSESSMENT AND EVALUATION

Assessment/Success Criteria

Thinking
• Reflecting≠: Judges the reasonableness of his or her results

Communication
• Communicating≠: Explains and justifies solutions orally, visually and/or in writing

Application
• Connecting≠: Describes examples of problem solving using trigonometry in an occupation
• Selecting Tools and Computational Strategies≠: Selects appropriate computational strategies to solve for unknown sides and angles in right triangles

Assessment Tools:

• Checklist
• Anecdotal Comments

≠ Mathematical Process

PRIOR LEARNING

Prior to this lesson, students will have:
• An understanding that the primary trigonometric ratios represent a ratio of two sides in a right triangle. (See Activity 2.4.1, What's My Triangle, TIPS4RM in Internet Resource section, below.)
• Some experience solving for unknown sides and angles in right triangles using the primary trigonometric ratios
• An understanding of scale drawings—in particular, an ability to create a scale drawing given measurements

MATERIALS AND RESOURCES

Materials:
Pipe cleaners, Popsicle sticks, glue, or other materials to construct the sides of triangles for Triangle Challenge
Geoboards, scissors, rulers, dot paper, graph paper, blank paper, lined paper
Dynamic Geometry® software (e.g., Geometer's Sketchpad® (GSP), TI-Nspire™, etc.) and/or rulers and protractors

Appendix A: Trigonometry RAFT: Choose Your Own Adventure!—one per student
Appendix B: Class Assessment Checklist—one for teacher reference
Appendix C: Reflection Exit Card—one per student

Internet Resource:
TIPS4RM (Targeted Implementation and Planning Supports for Revised Mathematics)—Grade 10 Applied (MFM 2P)
        www.edu.gov.on.ca/eng/studentsuccess/lms/tips4rm.html#grade10ap

Resource:
Ministry of Education (2005). *The Ontario Curriculum, Grades 9 and 10: Mathematics.*

Teaching/Learning Sequence: Grade 10 Mathematics, Applied (MFM2P)—Trigonometry

MINDS ON • Establishing a positive learning environment • Connecting to prior learning and/or experiences • Setting the context for learning	CONNECTIONS L: Literacy ML: Mathematical Literacy AfL, AoL: Assessment for/of Learning
NOTE: This Differentiated Instruction Teaching/Learning Example may be used on Day 5 of Unit 2 of TIPS4RM, Grade 10 Applied. It can be used to help prepare students for the *Who Uses Trigonometry?* assignment introduced on Day 3, or to help support the specific expectations from *Who Uses Trigonometry?* **Heterogeneous Small Groups → Triangle Challenge** The Triangle Challenge differentiates content by providing students with a choice of learning materials. Students, in groups of four or five: • Select from a variety of materials (e.g., pipe cleaners, Geoboards, blank paper, graph paper) to create/draw as many right triangles as possible with at least one side that is 9 cm long • Identify the lengths of at least one other side and one other angle in the triangle(s) they create • For each triangle, check that their measurements are correct and/or calculations seem reasonable by using Dynamic Geometry® software (Geometer's Sketchpad®, TI-Nspire™, Cabri™) or by using a ruler and protractor Each student in the group completes at least one triangle correctly. Group members assist each other so that all understand and are able to complete the task. Circulate, facilitating discussion and assisting as required.	ML: Problem Solving
Whole Class → Discussion Facilitate a discussion about the types of strategies they used to solve the problem. Consider the following guiding questions: • How many students used the sine ratio? • What information was given if you had to use the sine ratio? • How many different triangles did each group create? • How many possible solutions are there to this problem?	AfL: Triangle Challenge/ Anecdotal Comments

ACTION • Introducing new learning or extending/reinforcing prior learning • Providing opportunities for practice and application of learning (guided → independent)	
Whole Class → Brainstorm Students, as a class, brainstorm some examples of how trigonometry might be used in some occupations. Share with the whole class. Clarify, refine and conclude that trigonometry is useful in a variety of occupations.	ML: Connecting
Individuals → RAFT Distribute the Trigonometry RAFT (Appendix A). Individually, students select one of the RAFT tasks to complete. The RAFT choices differentiate the way students learn (process) based on student occupational interests. Note: Although the occupations are different, students are investigating similar problems. Problems can be added or removed from the Trigonometry RAFT template provided, based on the number of choices desired.	ML: Selecting Tools and Computational Strategies
Circulate while students complete the task. Provide feedback and guidance to students who are having difficulty selecting appropriate computational strategies to solve the given problems. See the Class Assessment Checklist (Appendix B). Note: Students who are having difficulty making connections to previous learning may refer to their work from TIPS4RM Activity 2.4.1—*What's My Triangle* to try to find a similar problem to solve.	AfL: RAFT/Class Assessment Checklist

CONSOLIDATION AND CONNECTION • Helping students demonstrate what they have learned • Providing opportunities for consolidation and reflection	
Pairs → Write-Pair-Share—RAFT Solutions and Strategies Pair students together so that each set of partners has two different solved problems. Students share their solutions and ask questions to clarify each other's work within small groups or with the class. **Individuals → Reflection Exit Card** Students complete the Reflection Exit Card (Appendix C). Collect reflections, provide feedback the following day, and adjust instruction in response to Exit Card information and observation of RAFT task completion.	AfL: Exit Card/Anecdotal Comments