Differentiated Instruction Teaching/Learning Examples

GRADE 9 MATHEMATICS, APPLIED (MFM1P): SOLVING LINEAR EQUATIONS

One 70–75 minute period. This Differentiated Instruction Teaching/Learning Example may also be used for Grade 9 Mathematics, Academic (MPM1D).

1. Individual Pre-Assessment Task
2. Corners, Think-Pair-Share (Cooperative Learning)*
3. Pre-Assessment (Self)(Setting Objectives and Providing Feedback)*
4. Tiered Assignments**
5. Peer Assessment (Setting Objectives and Providing Feedback)*
6. Group Puzzle
7. Self-Assessment (Setting Objectives and Providing Feedback)*

*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 ☑ Preferred method of solving equations

DI

Need to Know
• Each student's level of readiness for solving equations

How to Find Out
• Examine previous work with solving equations algebraically to determine if students can use inverse operations appropriately in multi-step problems, e.g.:
  (1) Do they need teacher guidance to solve a problem?
  (2) Are they able to solve most equations independently but need more practice? Or,
  (3) Are they able to solve any equation accurately?
• Use a pre-assessment problem solving task; see the Minds On segment of the lesson inside this folder

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

CURRICULUM CONNECTIONS

Overall Expectation: Number Sense and Algebra
• Simplify numerical and polynomial expressions in one variable, and solve simple first-degree equations

Specific Expectation:
• Solve first-degree equations with non-fractional coefficients, using a variety of tools

Learning Goals:
• Solve linear equations
• Make connections between graphical and algebraic models

ASSESSMENT AND EVALUATION

Assessment/Success Criteria

Thinking
• Reasoning and Proving≠: Explains a solution to a linear equation and justifies the solution

Communication
• Communicating≠: Uses appropriate mathematical conventions when solving mathematical equations
• Representing≠: Describes the effectiveness of solutions using various representations

≠ Mathematical Process

Assessment Tools:

• Checklists
• Anecdotal Comments

PRIOR LEARNING

Prior to this lesson, students will have:
• Translated statements of mathematical relationship into equations
• Solved and verified linear equations with one variable term using a variety of strategies

MATERIALS AND RESOURCES

Materials:
Four signs labeled "Algebraically," "Graphically," "Guess and Check," and "Another Method" for the Corners activity
Chart paper and markers for Minds On activity
Variety of math tools for Minds On activity (e.g., graphing calculators, algebra tiles, linking cubes, graph paper)
Highlighters for Tiered Assignment A, Activity 1

Appendix A: Class Assessment Checklist—one for teacher reference
Appendix B: Self-Assessment—Solving Linear Equations—one per student
Appendix C1 (pp. 1 & 2): Tier 1: Assignment A (Activities 1, 2 and 3, Activity 1—Guided Discussion Script)—one per student completing Assignment A
Appendix C2: Tier 2: Assignment B (Activities 1, 2 and 3)—one per student completing Assignment B
Appendix C3 (pp. 1 & 2): Tier 3: Assignment C (Activities 1, 2 and 3)—one per student completing Assignment C
Appendix D: Peer Assessment—Solving Linear Equations—one per student
Appendix E: Linear Equations Puzzle—cut and bagged, one set per group of three or four students

Internet Resource:
TIPS4RM (Targeted Implementation and Planning Supports for Revised Mathematics)—Grade 9 Applied:
    www.edu.gov.on.ca/eng/studentsuccess/lms/tips4rm.html#grade9ap

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

Teaching/Learning Sequence: Grade 9 Mathematics, Applied (MFM1P)—Solving Linear Equations

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

Individuals → Pre-Assessment Task
Present the following problem to the class and ask them to solve it individually using any method they choose (e.g., algebraically, graphically, guess and check). Have manipulatives available for the students to use.

Nasir just purchased a custom T-shirt from *T-riffic Prints* with his favourite saying written on the front. T-*riffic Prints* charges $9 for the T-shirt and $0.80 for each letter written on it. If Nasir's custom shirt totaled $30.60 before taxes, how many letters are in his favourite saying?

Circulate while students individually solve the problem to observe students' readiness to solve linear equations.
Observe to determine which students:
(1) Need teacher guidance to solve the problem
(2) Can solve this equation independently but would benefit from more practice
(3) Can solve this equation accurately and with ease
Use Class Assessment Checklist (Appendix A).
Create student groupings for the Tiered Assignment based on student readiness.

ML: Representing. Students represent this problem mathematically in some form to solve it

AfL: Pre-Assessment Task/ Checklist

Small Groups → Corners, Think-Pair-Share
Students:
• Take their solutions to the corner that best represents the method they used to solve the problem
• Review their solution for correctness and form with another student who used the same method
• Note any variations that were used within their chosen method and share with their corner group
• As a corner group, write one complete solution on chart paper, present their solution to the class and describe why this corner was their first choice for solving this particular problem
Observe students' responses using the Class Assessment Checklist (Appendix A) during the Corners activity.

AfL: Mathematical Process— Representing/Corners/Checklist

Individuals → Pre-Assessment (Self)
Students self-assess their current understanding of equation solving by completing the "before" column of the Self-Assessment—Solving Linear Equations Checklist (Appendix B).

AfL (Self): Mathematical Process—Problem Solving/ Corners/ Checklist

ACTION
• Introducing new learning or extending/reinforcing prior learning
• Providing opportunities for practice and application of learning (guided → independent)

Pairs/Small Groups → Tiered Assignments
Students work in groups to complete three tasks solving equations algebraically.
Tiered assignments are differentiated based on student readiness as described below:

Tier 1—Assignment A (see details, Appendix C1, pp. 1 and 2) is for students who still need support to solve equations algebraically. In this highly structured Tiered Assignment, students work through examples that progress from those that provide detailed scaffolding to those that require independent practice.

Tier 2—Assignment B (see details, Appendix C2) is for students who are somewhat comfortable with solving equations algebraically. In this Tier, the assignment is less structured so that students can deepen their understanding.

Tier 3—Assignment C (see details, Appendix C3, pp. 1 and 2) is for students who are skilled at solving equations algebraically. In this Tier, the assignment is more open and complex; students are challenged to think critically and deeply about solving equations.

Observe students as they complete their Tiered Assignment. Provide feedback as required. See the Class Assessment Checklist (Appendix A).

AfL: Tiered Assignments/ Checklist

Pairs → Peer Assessment
Students:
• Pair up with classmates in the same Tier to review each other's work, providing feedback as appropriate using Peer Assessment—Solving Linear Equations (Appendix D)
• Refine their work based on teacher and peer feedback

AfL (Peer): Tiered Assignments/ Checklist

CONSOLIDATION AND CONNECTION
• Helping students demonstrate what they have learned
• Providing opportunities for consolidation and reflection

Heterogeneous Groups of Three to Four → Puzzle
Cut out the cards on the Linear Equations Puzzle (Appendix E) that contain full solutions to four different equations, and place a set of cut-outs in a bag or envelope.
Create new heterogeneous groups of three or four students composed of members from each of the three Tiers and give each group a set of cut-outs.
Group members work together to sort the pieces and construct the four full solutions.

Circulate while students complete the group puzzle to observe their level of understanding of solving linear equations. See the Class Assessment Checklist (Appendix A).

AfL: Linear Equations Puzzle/ Checklist

Individuals → Self-Assessment
Students complete the "After" column of the Self-Assessment (Appendix B).

Use assessment information to determine the starting point for subsequent work on linear equations.

AfL (Self): Solving Linear Equations/ Checklist