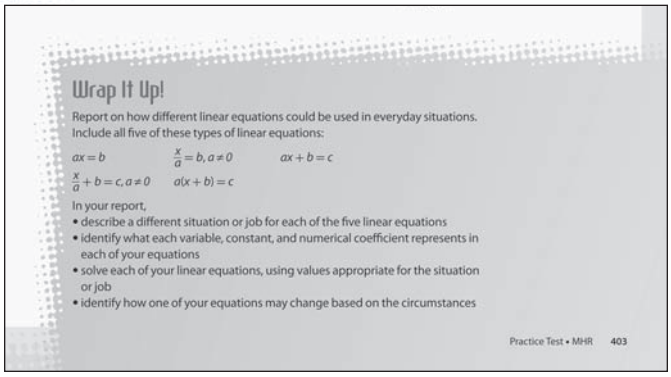
Wrap It Up!



Wrap It Up!

Report on how different linear equations could be used in everyday situations. Include all five of these types of linear equations:

$ax = b$ $\quad \frac{x}{a} = b, a \neq 0$ $\quad ax + b = c$

$\frac{x}{a} + b = c, a \neq 0$ $\quad a(x + b) = c$

In your report,

- describe a different situation or job for each of the five linear equations
- identify what each variable, constant, and numerical coefficient represents in each of your equations
- solve each of your linear equations, using values appropriate for the situation or job
- identify how one of your equations may change based on the circumstances

Practice Test • MHR 403

***MathLinks 8*, page 403**

Suggested Timing

80–100 minutes

Blackline Masters

Master 1 Project Rubric
BLM 10–1 Chapter 10 Math Link Introduction
BLM 10–6 Section 10.1 Math Link
BLM 10–8 Section 10.2 Math Link
BLM 10–10 Section 10.3 Math Link
BLM 10–12 Section 10.4 Math Link
BLM 10–14 Chapter 10 Wrap It Up!

Specific Outcomes

PR2 Model and solve problems using linear equations of the form:

- $ax = b$
- $\frac{x}{a} = b, a \neq 0$
- $ax + b = c$
- $\frac{x}{a} + b = c, a \neq 0$
- $a(x + b) = c$

concretely, pictorially and symbolically, where a, b and c are integers.

Planning Notes

Introduce the problem and clarify the assessment criteria. Have students either research situations and jobs or use their own ideas.

Meeting Student Needs

- Suggest that students look back through the chapter for ideas of situations/jobs that involve linear equations. Brainstorm some jobs and similar situations found in your community.
- Have students work in small groups to match a situation or job to each given equation. Then, have students complete the report as described.
- The project may be in the form of a report, poster, Foldable, PowerPoint presentation, etc. Allow students to choose.

Common Errors

- Some students may identify linear equations that are either too simplistic or too complex.

R_x Make sure that students show you the equations they are using to model the jobs/situations before they continue with the rest of the activity.

- Some students may incorrectly identify the variable and what it models.

R_x Refer students to the poster titled Tips for Writing an Equation that you started at the beginning of the chapter. Have students look back at the examples in the student resource that involve modelling a problem with an equation, such as Example 3 in section 10.1, Examples 2 and 3 in section 10.2, Examples 1 and 2 in section 10.3, and Examples 1 and 2 in section 10.4.

Assessment	Supporting Learning
Assessment *of* Learning	
Wrap It Up! This chapter problem wrap-up gives students an opportunity to identify where linear equations are used in real life. It is important for students to demonstrate their understanding of the structure of the different linear equations and what the variables, numerical coefficients, and constants mean. **Master 1 Project Rubric** provides a holistic descriptor that will assist you in assessing student work on this Wrap It Up! Page 540 in this TR provides notes on how to use this rubric for the Wrap It Up!	• You may wish to have students review the work they have completed in the Math Links before they begin the Wrap It Up! • If students have not completed the Math Links, you may wish to provide them with **BLM 10–1 Chapter 10 Math Link Introduction**, **BLM 10–6 Section 10.1 Math Link**, **BLM 10–8 Section 10.2 Math Link**, **BLM 10–10 Section 10.3 Math Link**, and **BLM 10–12 Section 10.4 Math Link**. • As a class, brainstorm real-life situations and careers that involve equations and list them on the board. Refer students to examples posted in the classroom. • You may wish to have students use **BLM 10–14 Chapter 10 Wrap It Up!**, which provides scaffolding for the chapter problem wrap-up.

The chart below shows the **Master 1 Project Rubric** for tasks such as the Wrap It Up! and provides notes that specify how to identify the level of specific answers for the project.

Score/Level	Holistic Descriptor	Specific Question Notes
5 **(Standard of Excellence)**	❑ Applies/develops **thorough** strategies and mathematical processes making **significant** comparisons/connections that demonstrate a **comprehensive** understanding of how to develop a complete solution ❑ Procedures are **efficient and effective** and may contain a **minor mathematical error** that does not affect understanding ❑ Uses **significant** mathematical language to explain their understanding and provides **in-depth** support for their conclusion	• provides a complete and correct solution that may contain a communication error or justification error that does not hinder the solution
4 **(Above Acceptable)**	❑ Applies/develops **thorough** strategies and mathematical processes for making **reasonable** comparisons/connections that demonstrate a **clear** understanding ❑ Procedures are **reasonable** and may contain a **minor mathematical error** that may hinder the understanding in one part of a complete solution ❑ Uses **appropriate** mathematical language to explain their understanding and provides **clear** support for their conclusion	• provides a correct response to all bullets but the report lacks organization in presentation *or* • provides a complete solution with well-organized presentation; identifies all variables, numerical coefficients, and constants and how one circumstance may change; either bases the response on only four equations or a repeated equation, or includes errors in solving in bullet 3 (no more than two errors)
3 **(Meets Acceptable)**	❑ Applies/develops **relevant** strategies and mathematical processes making **some** comparisons/connections that demonstrate a **basic** understanding ❑ Procedures are **basic** and may contain a **major error or omission** ❑ Uses **common** language to explain their understanding and provides **minimal** support for their conclusion	• correctly describes situations for the five different equations; attempts to solve the equations but does not identify some parts (variable, numerical coefficient, constant) and includes some errors in the solutions *or* • provides a complete solution to bullets 1, 2, and 4 *or* • provides a complete solution to bullets 1, 3, and 4
2 **(Below Acceptable)**	❑ Applies/develops **some relevant** mathematical processes making **minimal** comparisons/connections that lead to a **partial solution** ❑ Procedures are **basic** and may contain **several major mathematical errors** ❑ Communication is **weak**	• correctly completes the first three bullets for any three of the equations *or* • correctly identifies four or five situations/jobs to match the equations but has only partially started answers to the remaining bullets
1 **(Beginning)**	❑ Applies/develops an **initial start** that may be **partially correct** or could have led to a correct solution ❑ Communication is **weak or absent**	• provides a correct response to one or two equations

Math Games

***MathLinks 8*, pages 404**

Suggested Timing
30–40 minutes

Materials
- algebra tiles
- cups and counters

Blackline Masters
- Master 15 Algebra Tiles

Specific Outcomes
PR2 Model and solve problems using linear equations of the form:
- $ax = b$
- $\frac{x}{a} = b, a \neq 0$
- $ax + b = c$
- $\frac{x}{a} + b = c, a \neq 0$
- $a(x + b) = c$

concretely, pictorially and symbolically, where a, b and c are integers.

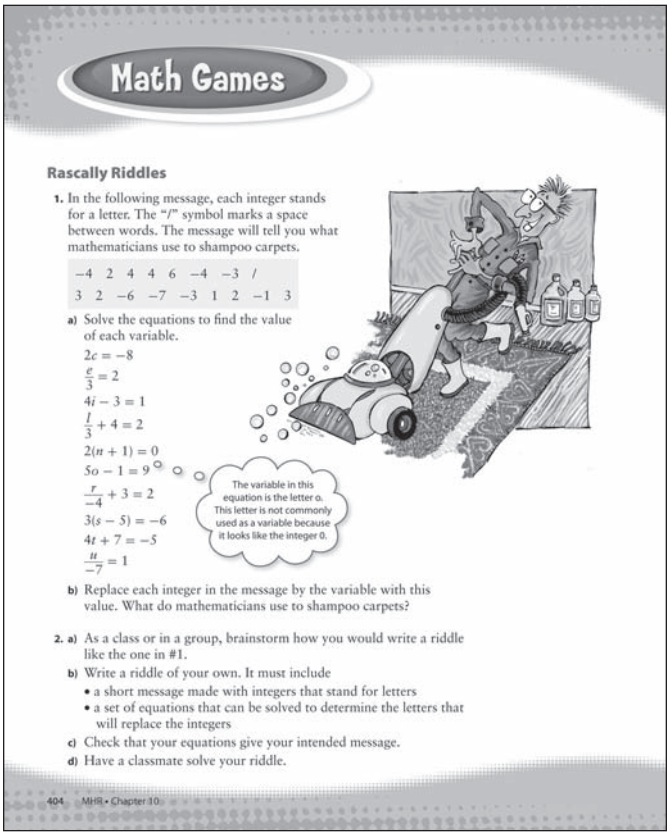
Planning Notes

Before having students play the game, you may wish to read the directions with the class.

Make sure that students complete #2a) as this will assist students in successfully creating their own riddle. The easiest method is to work backward from the intended message:
- Suppose that one letter in the message is p. Assign any integer value to p, e.g., –2.
- Replace p with –2 in the message.
- Create an equation that includes -2, e.g., $3(-2) + 1 = -5$.
- Since $p = -2$, an equation in the riddle is $3p + 1 = -5$.

Meeting Student Needs

ELL
- You may need to explain or show pictures to students to clarify for them what it means to shampoo carpets. Once they solve the message, you may need to explain the two meanings for the word *solutions*.


Math Games

Rascally Riddles

1. In the following message, each integer stands for a letter. The "/" symbol marks a space between words. The message will tell you what mathematicians use to shampoo carpets.

−4 2 4 4 6 −4 −3 /
3 2 −6 −7 −3 1 2 −1 3

a) Solve the equations to find the value of each variable.

$2c = -8$
$\frac{e}{3} = 2$
$4i - 3 = 1$
$\frac{l}{3} + 4 = 2$
$2(u + 1) = 0$
$5o - 1 = 9$
$\frac{r}{-4} + 3 = 2$
$3(s - 5) = -6$
$4t + 7 = -5$
$\frac{u}{-7} = 1$

The variable in this equation is the letter o. This letter is not commonly used as a variable because it looks like the integer 0.

b) Replace each integer in the message by the variable with this value. What do mathematicians use to shampoo carpets?

2. a) As a class or in a group, brainstorm how you would write a riddle like the one in #1.
b) Write a riddle of your own. It must include
- a short message made with integers that stand for letters
- a set of equations that can be solved to determine the letters that will replace the integers

c) Check that your equations give your intended message.
d) Have a classmate solve your riddle.

404 MHR • Chapter 10

Gifted and Enrichment
- Encourage students to create a more complex riddle, possibly using a computer.
- Have students research applications of secret codes in the real world.

Answers

Rascally Riddles

1. a) $c = -4, e = 6, i = 1, l = -6, n = -1, o = 2, r = 4, s = 3, t = -3, u = -7$

b) correct solutions

2. a) Answers may vary. Example: First, write the riddle and the message. Assign an integer to each letter. Replace the letter in the message with the integer. For each integer, write an equation that has the integer in it. Replace the integer with its corresponding letter.

b) Answers may vary.

Assessment	Supporting Learning
Assessment *for* Learning	
Rascally Riddles Have students play the game independently or with a classmate. Observe students as they solve the equations. Make sure that they keep both sides of each equation balanced.	• Have students solve the equations using a method of their choice, such as algebra tiles, cups and counters, or diagrams. If algebra tiles are not available, distribute **Master 15 Algebra Tiles**. • Have students verify the solutions to the equations.

Challenge in Real Life

***MathLinks 8*, page 405**

Suggested Timing
80–100 minutes

Materials
- grid paper

Blackline Masters
Master 1 Project Rubric
Master 8 Centimetre Grid Paper
Master 9 0.5 Centimetre Grid Paper

Mathematical Processes
- ☑ Communication (C)
- ☑ Connections (CN)
- ☐ Mental Mathematics and Estimation (ME)
- ☑ Problem Solving (PS)
- ☑ Reasoning (R)
- ☐ Technology (T)
- ☐ Visualization (V)

Specific Outcomes
N7 Demonstrate an understanding of multiplication and division of integers, concretely, pictorially and symbolically.
PR1 Graph and analyze two-variable linear relations.
PR2 Model and solve problems using linear equations of the form:
- $ax = b$
- $\frac{x}{a} = b, a \neq 0$
- $ax + b = c$
- $\frac{x}{a} + b = c, a \neq 0$
- $a(x + b) = c$

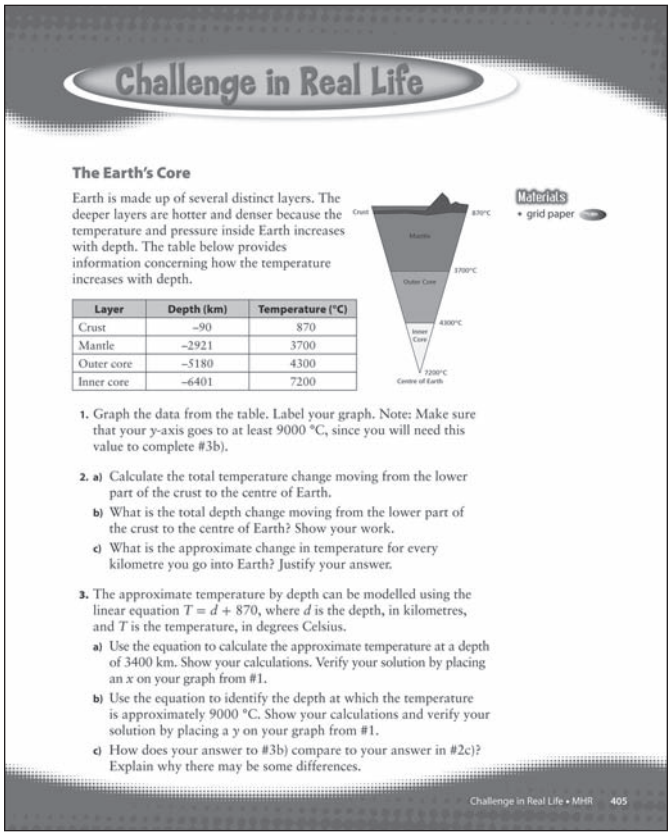
concretely, pictorially and symbolically, where a, b and c are integers.

Planning Notes

This challenge integrates students' knowledge of integers, their skills in graph making, and their ability to solve algebra equations.

You may wish to use the following steps to introduce and complete this challenge:

1. Read through The Earth's Core as a class. Ask students to share what they know about Earth's crust, mantle, and core from what they might have learned in school and on their own.
2. Focus on the diagram. Explain to students that Earth holds many mysteries. Scientists have, however, managed to determine the approximate depths of the various layers of Earth's crust, mantle, and core.



Challenge in Real Life

The Earth's Core

Earth is made up of several distinct layers. The deeper layers are hotter and denser because the temperature and pressure inside Earth increases with depth. The table below provides information concerning how the temperature increases with depth.

Layer	Depth (km)	Temperature (°C)
Crust	−90	870
Mantle	−2921	3700
Outer core	−5180	4300
Inner core	−6401	7200

Materials
• grid paper

1. Graph the data from the table. Label your graph. Note: Make sure that your y-axis goes to at least 9000 °C, since you will need this value to complete #3b).

2. a) Calculate the total temperature change moving from the lower part of the crust to the centre of Earth.
   b) What is the total depth change moving from the lower part of the crust to the centre of Earth? Show your work.
   c) What is the approximate change in temperature for every kilometre you go into Earth? Justify your answer.

3. The approximate temperature by depth can be modelled using the linear equation $T = d + 870$, where d is the depth, in kilometres, and T is the temperature, in degrees Celsius.
   a) Use the equation to calculate the approximate temperature at a depth of 3400 km. Show your calculations. Verify your solution by placing an x on your graph from #1.
   b) Use the equation to identify the depth at which the temperature is approximately 9000 °C. Show your calculations and verify your solution by placing a y on your graph from #1.
   c) How does your answer to #3b) compare to your answer in #2c)? Explain why there may be some differences.

Challenge in Real Life • MHR 405

3. Ask students what level they think 0 km represents. Ensure that they understand that it represents sea level. Explain that the distances included in the chart refer to the *bottom* of each layer.
4. Clarify that the task is to
   - graph the information provided in the table
   - determine the total temperature change, total depth change, and approximate temperature change per kilometre
   - use the provided equation to solve the questions about temperature change in relation to depth
5. Have students work independently or in small groups to complete the challenge. Give them **Master 8 Centimetre Grid Paper** or **Master 9 0.5 Centimetre Grid Paper** to complete the graph.
6. Review the **Master 1 Project Rubric** with students so that they will know what is expected.

Meeting Student Needs

- Some students may need assistance in setting up the graph. Particularly challenging for some students will be labelling the axes of the graph with the large integers. They may need guidance in

determining what increments to use. Ask them to round to the nearest thousand when labelling both axes. For some students, consider providing a graph that already has the increments labelled.
- Some students may be more successful if allowed to create a computer-generated graph. Allow students to use a spreadsheet program to construct the graph.
- Assist students in interpreting their results. For example, to determine the approximate temperature change per kilometre, students can determine the average using the four sets of data in the table. Students should understand that the negative sign indicates a downward direction and that –1 °C/km means that there is a 1 °C drop in temperature for every kilometre travelled downward into Earth's core.

ELL

- Some students will need extra help with some of the terms. Have a large diagram of Earth's layers on a classroom wall for easy reference.

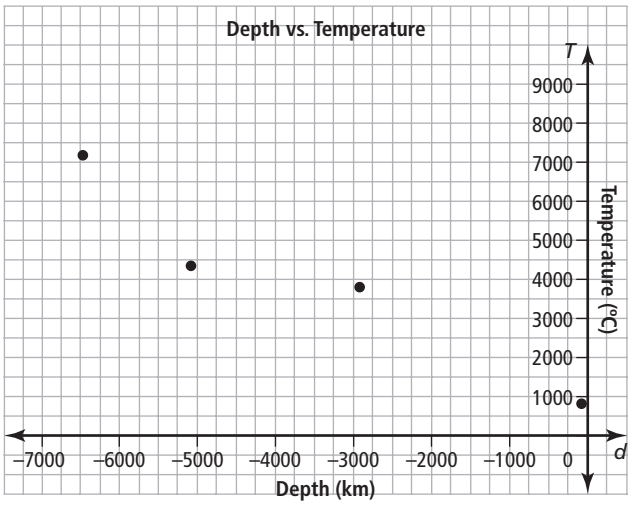
Gifted and Enrichment

- Have students investigate how scientists determine the depth and composition of the various layers.
- Students might be asked to create a third column in the table that asks them to determine the temperature change per kilometre for each layer. They will find that, although the approximate temperature change is 1 °C/km, as you move through the layers, the temperature change in each layer is quite different, ranging from 0.3 °C/km to 2.4 °C/km.

Answers

The Earth's Core

1. Answers may vary. Example:



2. a) 6330 °C **b)** 6311 km **c)** approximately 1 °C/km

3. a) 4270 °C. Students should mark (3400, 4270) with an *x* on the graph from #1.

b) 8130 km. Students should mark (8130, 9000) with a *y* on the graph from #1.

c) Answers may vary. Example: The answer to #3b) is a little higher than expected due to rounding of decimals in #2c). The graph may be an approximation, so points could lie above or below it.

This challenge can be used for either Assessment *for* Learning or Assessment *of* Learning.

Assessment	Supporting Learning
Assessment *for* Learning	
The Earth's Core Discuss the challenge as a class. Have students work in small groups or independently.	• Students may determine different answers for the approximate temperature change per kilometre, depending on how they make their calculation. Most important is that they are able to justify their answer. • Allow students to present #3c) of their report either in written form or orally. • For a second challenge, complete with teaching notes and student exemplars, go to www.mathlinks8.ca, access the online Teacher Centre, go to Assessment, and then follow the links.
Assessment *of* Learning	
The Earth's Core Introduce the challenge to the class. Have students work in small groups or independently.	• **Master 1 Project Rubric** provides a holistic descriptor that will assist you in assessing student work on this challenge. Page 544 provides notes on how to use this rubric for the challenge. • To view student exemplars, go to www.mathlinks8.ca, access the online Teacher Centre, go to Assessment, and then follow the links.

The chart below shows the **Master 1 Project Rubric** for tasks such as the Challenge in Real Life and provides notes that specify how to identify the level of specific answers for this project.

Score/Level	Holistic Descriptor	Specific Question Notes
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4 **(Above Acceptable)**	❑ Applies/develops **thorough** strategies and mathematical processes for making **reasonable** comparisons/connections that demonstrate a **clear** understanding ❑ Procedures are **reasonable** and may contain a **minor mathematical error** that may hinder the understanding in one part of a complete solution ❑ Uses **appropriate** mathematical language to explain their understanding and provides **clear** support for their conclusion	• provides a complete response with weak communication or an incorrect #3c) *or* • provides a complete response with no justification in #2b) and c) *or* • provides a complete solution with an incorrect #1 or with labels missing on the graph
3 **(Meets Acceptable)**	❑ Applies/develops **relevant** strategies and mathematical processes making **some** comparisons/connections that demonstrate a **basic** understanding ❑ Procedures are **basic** and may contain a **major error or omission** ❑ Uses **common** language to explain their understanding and provides **minimal** support for their conclusion	• correctly completes #1, #2 and #3a) *or* • correctly completes #1, #2 and #3b)
2 **(Below Acceptable)**	❑ Applies/develops **some relevant** mathematical processes making **minimal** comparisons/connections that lead to a **partial solution** ❑ Procedures are **basic** and may contain **several major mathematical errors** ❑ Communication is **weak**	• correctly completes #1 and #2 *or* • correctly completes #1 and #3a) and b)
1 **(Beginning)**	❑ Applies/develops an **initial start** that may be **partially correct** or could have led to a correct solution ❑ Communication is **weak or absent**	• makes a correct initial start to any one part of the problem *or* • correctly completes #1

For student exemplars, go to www.mathlinks8.ca and follow the links.