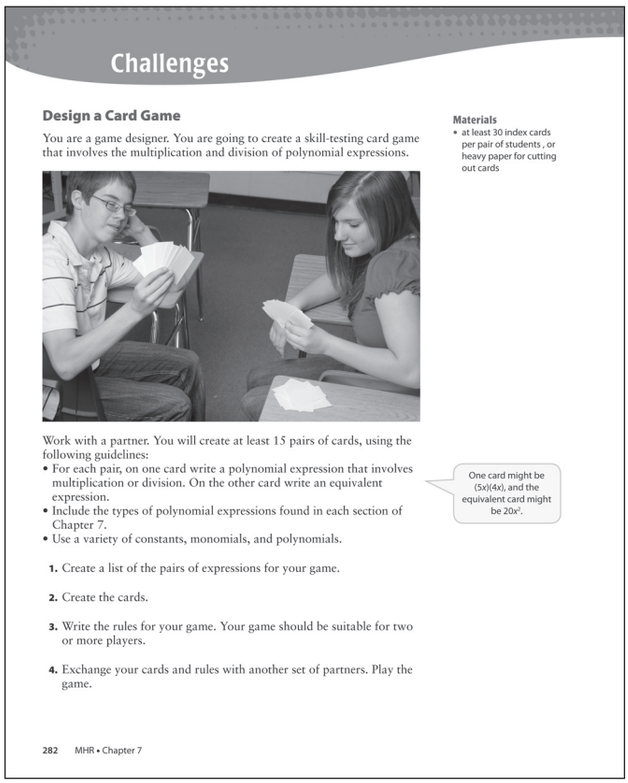
Challenges



Challenges

Design a Card Game

You are a game designer. You are going to create a skill-testing card game that involves the multiplication and division of polynomial expressions.

Materials
- at least 30 index cards per pair of students , or heavy paper for cutting out cards

Work with a partner. You will create at least 15 pairs of cards, using the following guidelines:
- For each pair, on one card write a polynomial expression that involves multiplication or division. On the other card write an equivalent expression.
- Include the types of polynomial expressions found in each section of Chapter 7.
- Use a variety of constants, monomials, and polynomials.

One card might be $(5x)(4x)$, and the equivalent card might be $20x^2$.

1. Create a list of the pairs of expressions for your game.
2. Create the cards.
3. Write the rules for your game. Your game should be suitable for two or more players.
4. Exchange your cards and rules with another set of partners. Play the game.

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Suggested Timing
80–100 minutes

Materials
- at least 30 index cards or heavy paper for cutting out cards per pair of students

Blackline Masters
Master 1 Project Rubric

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

Specific Outcomes
PR7 Model, record and explain the operations of multiplication and division of polynomial expressions (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially and symbolically.

Planning Notes: Design a Card Game

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

1. With the class, discuss different game formats students could develop to help them reinforce what they have learned about polynomials. Brainstorm the different types of card games students enjoy playing (e.g., Memory, Go Fish, War). Alternatively, you may wish to have students review any games in the pages of this student resource and other math resources and consider how they could alter them to use with polynomials. Depending on student interests and abilities, encourage students to consider a number of formats, including possible computer applications. Also, discuss the purpose of a polynomial game and how it might be set up.
2. Ask the class how they might develop cards with matching polynomials. Have each student develop two or more equivalent polynomials for such a game. Consider having partners work together, each develop a set of cards, and then explain to each other how the cards are equivalent.
3. Clarify that the task is to
   - choose a game format for a polynomial game
   - make up a game in this format
   - develop a list of equivalent pairs of polynomial expressions for the game
   - create cards for the game
   - develop rules for the game
   - play the game developed by someone else
4. Review the **Master 1 Project Rubric** with students so that they will know what is expected.
5. After the activity has been completed, ask students how the game has helped them with polynomials.

Meeting Student Needs

- Limit the types of expressions students use, such as by asking them to use:
  – only monomials and binomials
  – only positive integer coefficients
- Challenge students to develop a cooperative game in which players help each other.
- Students may need additional time, either in class or outside of class, to create their game if it includes a game board or is more complex in other ways.

Gifted and Enrichment

- Challenge students to work with a wide variety of equivalent expressions, such as $\frac{12y^3 + 6y}{3y}$ and $\frac{8y + 4}{2}$.

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

Assessment	Supporting Learning
Assessment *for* Learning	
Match the Polynomials Discuss the Challenge as a class. Have students complete the activity in pairs.	• Remind students to include the types of polynomial expressions found in each section of Chapter 7 and to use a variety of constants, monomials, and polynomials. • Remind students that they will be required to demonstrate both multiplication and division.
Assessment *of* Learning	
Match the Polynomials Introduce the Challenge to the class. Have students complete the activity in pairs.	• **Master 1 Project Rubric** provides a holistic descriptor that will assist you in assessing student work on this Challenge. Page 386 provides notes on how to use this rubric for the Challenge. • To view student exemplars, go to www.mathlinks9.ca, access the Teacher Centre on the Online Learning Centre, go to Assessment, and then follow the links.

The chart below shows the **Master 1 Project Rubric** for tasks such as this Challenge, Match the Polynomials, and provides notes that specify how to identify the level of specific answers for this 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	Demonstrates one of the following: • provides a complete and correct 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	Demonstrates one of the following: • provides a complete response with minor communication errors or lack of clarity in the rules • provides a correct and complete solution that contains a maximum of two repetitions
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	Demonstrates one of the following: • correctly completes a list of equivalent expressions and outlines the rules which may lack clarity; there may be errors in the pairs (maximum of two) • correctly completes a minimum of 15 pairs that contain repetitions; rules of the game are clear • correctly complete a minimum of 15 pairs with no further work.
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**	Demonstrates one of the following: • correctly completes only 10 to 14 equivalent expressions • completes equivalent expressions but there are errors or repetitions in the constants, monomials, or polynomials or all include the same operation; may have attempted to start the rules
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**	Demonstrates one of the following: • begins list of pairs but it is incomplete or contains numerous errors; one pair is correct. • outlines the rules but a link to any specific pairs or requirements for the game is not present

For student exemplars, go to www.mathlinks9.ca and follow the links.