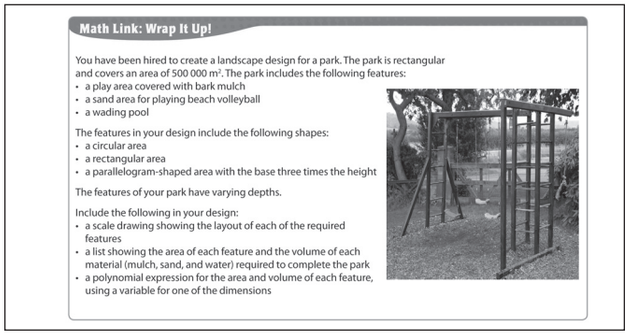
Math Link: Wrap It Up!



Math Link: Wrap It Up!

You have been hired to create a landscape design for a park. The park is rectangular and covers an area of 500 000 m^2. The park includes the following features:

- a play area covered with bark mulch
- a sand area for playing beach volleyball
- a wading pool

The features in your design include the following shapes:

- a circular area
- a rectangular area
- a parallelogram-shaped area with the base three times the height

The features of your park have varying depths.

Include the following in your design:

- a scale drawing showing the layout of each of the required features
- a list showing the area of each feature and the volume of each material (mulch, sand, and water) required to complete the park
- a polynomial expression for the area and volume of each feature, using a variable for one of the dimensions

***MathLinks 9*, page 281**

Suggested Timing
60–75 minutes

Materials
- ruler
- compass
- grid paper

Blackline Masters
Master 1 Project Rubric
Master 6 Square Dot Paper
Master 7 Isometric Dot Paper
Master 8 Centimetre Grid Paper
Master 9 0.5 Centimetre Grid Paper
BLM 7–1 Chapter 7 Math Link Introduction
BLM 7–6 Section 7.1 Math Link
BLM 7–8 Section 7.2 Math Link
BLM 7–10 Section 7.3 Math Link
BLM 7–12 Chapter 7 Math Link: Wrap It Up!

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

Introduce the activity and clarify the assessment criteria. Throughout this chapter, students have been using polynomial multiplication and division within the context of landscape design to solve specific problems. The Wrap It Up! will require students to apply all of these skills in one larger project. Remind students that skills and concepts used in the three chapter Math Links will be used to develop the final design. If possible, a field trip to a local park or recreation centre would enhance students' understanding of the design requirements.

It is important to read through all components and requirements for the Wrap It Up! with students. In particular, decide what the assignment must include. Direct students' attention to the fact that they must develop an expression for the area and volume of each feature and material using a variable for one dimension. Students who complete the Wrap It Up! using only exact values will receive a mark of 3 on the scoring rubric. Emphasize to students that you are looking for their demonstration of polynomials in this Wrap It Up!

Meeting Student Needs

- Encourage students to sketch their scale drawings on scrap paper before they make their final copy.
- You may need to discuss with students the term *bark mulch*.

Gifted and Enrichment

- For the swimming pool, students might be challenged to calculate the volume of water in litres and the mass of water in kilograms.
- Students might be asked to calculate the remaining space in their park after they include their three design features. Consider having them include one of the parking lots that they designed for the section 7.2 Math Link. They would then determine how much space is left after the parking lot is added.
- Have students determine the original 500 000 m^2 in hectares.
- Give students a landscaping budget and challenge them to stay within it. Have them research costs for materials and landscaping work. Direct them to make spreadsheets and submit bids for the landscaping project.

Common Errors

- Some students may plan for unrealistic-sized shapes with too small or too large areas.

R$_x$ Encourage students, if possible, to visit local parks to measure the dimensions of similar features. This could also be accomplished by developing a mock park in the school playground.

Answers

Math Link: Wrap It Up!

Example:

Feature	Area	Volume
Play area • rectangle • depth = 20 cm	$A = lw$ $= 4x(12x)$ $= 48x^2$ $= 48(50)^2$ $= 120\,000$ The area of the play area is 120 000 m^2.	$V = Ad$ $= 4x(12x)(0.2)$ $= 9.6x^2$ $= 9.6(50)^2$ $= 24\,000$ 24 000 m^3 of mulch is required.
Sand area • parallelogram • depth = 50 cm	$A = bh$ $= 3x(8x)$ $= 24x^2$ $= 24(50)^2$ $= 60\,000$ The area of the sand area is 60 000 m^2.	$V = Ad$ $= 3x(8x)(0.5)$ $= 12x^2$ $= 12(50)^2$ $= 30\,000$ 30 000 of sand is required.
Wading pool • circle • depth = 40 cm	$A = \pi r^2$ $= \pi(2x)^2$ $= 4\pi x^2$ $= 4\pi(50)^2$ $\approx 31\,416$ The area of the wading pool is about 31 416 m^2.	$V = Ad$ $= \pi(2x)^2(0.4)$ $= 1.6\pi x^2$ $= 1.6\pi(50)^2$ $\approx 12\,566$ About 12 566 m^3 of water is required.

Assessment	Supporting Learning
Assessment *of* Learning	
Math Link: Wrap It Up! This chapter problem wrap-up gives students an opportunity to demonstrate their understanding of polynomial multiplication and division in a real-world situation. **Master 1 Project Rubric** provides a holistic descriptor that will assist you in assessing student work on this Wrap It Up! Page 383 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 in sections 7.1, 7.2, and 7.3 before they begin. • If students have not completed the Math Links, you may wish to provide them with **BLM 7–1 Chapter 7 Math Link Introduction**, **BLM 7–6 Section 7.1 Math Link**, **BLM 7–8 Section 7.2 Math Link**, and **BLM 7–10 Section 7.3 Math Link**. • Consider allowing students to use the design elements they worked with in the other Math Links as part of their Wrap It Up! design. • Provide students with **Master 6 Square Dot Paper**, **Master 7 Isometric Dot Paper**, **Master 8 Centimetre Grid Paper**, and **Master 9 0.5 Centimetre Grid Paper** for drawing their scale drawings. • You may wish to have students use **BLM 7–12 Chapter 7 Math Link: Wrap It Up!**, which provides scaffolding for the chapter problem wrap-up.

The chart below shows **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 minor error that does not hinder understanding
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 to all parts of the question with a weak justification • provides a complete response to all parts of the question with an error in one of the features or materials • provides a complete and correct response with an error or omitted scale
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: • provides a complete design with correct areas and volumes of the features and material, but either does not use variables or the use of a variable is correct only once • provides a correct partial solution to all parts, with evidence of polynomial multiplication • provides a complete and correct solution that contains answers with no supporting 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: • provides a complete design with correct areas of two features and the volume of one or both materials; no evidence of variables • provides a complete design with areas calculated; an attempt to express the area or volume with a variable has major errors • provides a complete design with all areas calculated without the use of variables
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: • provides a correct start to the landscape drawing: the layout is shown and the required shapes are identified; there may or may not be a scale • provides an initial correct start to any part of the design

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