Overview and Connection to Culminating Project

In the Culminating Project, students will work in teams to design a safe, fun playground that promotes fitness. They will choose playground equipment, price the equipment, and determine the "use zone" (safety zone) needed around the equipment. In designing their playground, students will need to use geometrical reasoning.

Learning Objectives

Students will be able to

- Use precision when selecting, identifying, and converting between units and dimensions of measurement.
- Find the area of rectangles with lengths given in mixed units.
- Use academic language to explain their mathematical design decisions.

Driving Question

• How can we use mathematics to design a playground that is both fun and safe?

Assessment

Check for Understanding • Area of Use Zones

Timeline

- Lesson 1 Look Ahead to the Culminating Project
- Lesson 2 Build Background Knowledge and Spatial Reasoning

Check for Understanding • Area of Use Zones (see Handouts and Assessments)

Language Support Strategies

Highlight the academic vocabulary used in this task. Briefly preview the terms orally and have students repeat them aloud and share what they know (definition or real-life connections).

Academic Vocabulary

- design
- dimension
- floor plan
- one-dimensional (1D)
- ratio
- scale
- system
- three-dimensional (3D)
- two-dimensional (2D)
- unit
- volume

Language of Instruction

- determined
- doubling
- equipment
- feature
- fitness
- ground cover
- hyperlink
- playground
- resilient material
- swings: at rest, frame height, bay, support structure feature
- use zone (safety zone)

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NOTE

Some sites use the term "use zone" and some use the term "safety zone." Make sure your students know that both terms mean the same thing.

Materials, Supplies, and Technology

- <u>http://www.bciburke.com/</u>
- <u>"Playgrounds"</u> digital slide presentation
- <u>Kaboom Playground Construction video</u>
- Kaboom.org
- Examples of playgrounds that use "strange" shapes:
 - http://theverybesttop10.com/unusual-playgrounds/
 - <u>http://www.treehugger.com/sustainable-product-design/ruins-of-electric-train-turned-into-terri</u> <u>bly-cool-amusement-park-in-lima-photos.html</u>
 - http://www.neatorama.com/2012/07/25/the-12-most-unique-playgrounds-in-the-world/
 - <u>https://www.pinterest.com/pin/10977592818873911/</u>
 - <u>http://www.citymuseum.org/</u>
- Copies of Check for Understanding Area of Use Zones (see Handouts and Assessments)

LESSON 1

LOOK AHEAD TO THE CULMINATING PROJECT

WARM-UP

Playground Construction

• Show students the video <u>Kaboom Playground Construction</u>.

PROJECT ACTIVITY

About Playgrounds

• Show the playground requirements in the "Playgrounds" digital slide presentation.

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NOTE

Students may not know that the symbol ' can mean feet and the symbol " can mean inches.

- Assign one <u>playground floor plan</u> to each team.
- Do not discuss dimensions, scale, or other specific information about the floor plans. Instead, tell students to look at the shape of their play area. Explain that the equipment they select must fit within this area, and that the reflecting pool cannot be built on or moved.
- Differentiate instruction by assigning the floor plans in a way that either supports or challenges specific groups or allows student groups to choose their plan. The more right angles there are in the overall shape of the floor plan and in the reflecting pool, the more manageable the design is likely to be for students.
- Tell students to begin researching playground equipment and recording information in the Playground Information Table. They will focus on the area of the "use zone" in the next lesson.

Math Curricular Connection Suggestions

CPM Core Connections Course 1: Lesson 2.2.1, Exploring Area

CPM Core Connections Course 1: Lesson 2.2.2, Square Units and Area of Rectangles

Khan Academy: Intro to area and unit squares

Learnzillion: Identify the difference between a square unit and a cubic unit

LESSON 2

BUILD BACKGROUND KNOWLEDGE AND SPATIAL REASONING

WARM-UP

Units of Measurement Graphic Organizer

- Have students brainstorm ideas for this graphic organizer individually or in pairs.
- Then complete a version together as a class to keep displayed throughout this unit. (You can save the column for cubic units until Learning Task 4.)



STUDENT EDITION

LESSON 2 • BUILD BACKGROUND KNOWLEDGE AND SPATIAL REASONING

PROJECT ACTIVITY

Information about Swings

- Return to the "Playground" digital slide presentation. Show slides 7 and 8 again to talk about use zones (also called safety zones). Why are these necessary for playgrounds?
- Ask students to read the information about swings in their Student Edition.
- Have students finish completing the Playground Information Table, including the "Area of Use Zone" column. Check to make sure that students have recorded the correct areas and units of measurement.

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Here is some special information about swings.

Swing Set Standards

- Frame height can be 5 feet, 8 feet, or 10 feet.
- There should be no more than two swings located within a single swing bay.
- The distance between swings at rest within a single bay should be at least 24 inches.
- The distance between a swing at rest and its support structure should be at least 30 inches.
- The average swing is 18 inches wide.

Safety Zone (Use Zone) Information

- Safety zones with resilient material are necessary around all playground swings.
- The amount of area required for a safety zone is determined by the height of the swing frame.
- Doubling the frame height of your swings will give you the width required for the safety zone in front of the swing and in back of the swing. For example, if a frame height is 10 feet, the safety zone behind the swing frame is 20 feet and the safety zone in front of the swing frame is 20 feet.
- The length of the safety zone is determined by the number of swing bays.

• Fall height is equal to the frame height.

Swing Frame Height	Base Price for One Swing Bay with Two Swings	Price for Each Add-on Swing Bay with Two Swings
10 feet	\$1,115.00	\$432
8 feet	\$1,046.00	\$405
5 feet	\$978.00	\$310

STUDENT EDITION

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LESSON 2 • BUILD BACKGROUND KNOWLEDGE AND SPATIAL REASONING

CHECK FOR UNDERSTANDING

Area of Use Zones

• Distribute the Learning Task 1 assessment: Check for Understanding • Area of Use Zones.

Suppose a group started the following table about their playground. Help finish this group's table. Remember to label all units of measurement. Show or explain how you found the area of the Climbatron 6000.

Name and Model Number	Dimensions for Use Zone	Area of Use Zone
The Eliminator	8' by 12'	96 square feet
Party-Town Funcastle	Length: 36 feet Width: 24 square feet	864 square feet
Climbatron 6000	22'6" × 30'8"	690 square feet

How did you find the area of the Climbatron 6000?

Answers will vary, but students could have multiplied $22\frac{1}{2} \times 30\frac{2}{3}\left(\frac{45}{2} \cdot \frac{92}{3}\right)$, or they could have changed to inches, multiplied, and converted back to square feet by dividing by 144 square inches.

HANDOUTS AND ASSESSMENTS