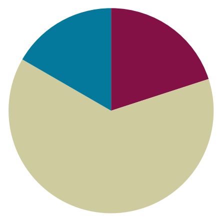
Lesson 24

Objective: Use rectangles to draw a robot with specified perimeter measurements, and reason about the different areas that may be produced.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Concept Development	(38 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Multiply by 6 **3.OA.7** (8 minutes)
- Find the Side Lengths **3.MD.8** (4 minutes)

Multiply by 6 (8 minutes)

Materials: (S) Multiply by 6 (6–10) Pattern Sheet

Note: This activity builds fluency with multiplication facts using units of 6. It works toward students knowing from memory all products of two one-digit numbers. See Lesson 1 for the directions for administration of a Multiply-By Pattern Sheet.

T: (Write 7 × 6 = ____.) Let's skip-count up by sixes. I'll raise a finger for each six. (Raise a finger for each number to track the count.)

S: 6, 12, 18, 24, 30, 36, 42.

T: Let's skip-count up by sixes starting at 30. Why is 30 a good place to start?

S: It is a fact we already know, so we can use it to figure out a fact we do not know.

T: (Track with fingers as students say the numbers.)

S: 30 (5 fingers), 36 (6 fingers), 42 (7 fingers).

T: Let's see how we can skip-count down to find the answer, too. Start at 60 with 10 fingers, 1 for each six. (Count down with fingers as students say the numbers.)

S: 60 (10 fingers), 54 (9 fingers), 48 (8 fingers), 42 (7 fingers).

Continue with the following possible sequence: 9 × 6, 6 × 6, and 8 × 6.

T: (Distribute the Multiply by 6 Pattern Sheet.) Let's practice multiplying by 6. Be sure to work left to right across the page.

Find the Side Lengths (4 minutes)

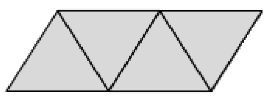
Materials: (S) Personal white board

Note: This activity reviews Lesson 23.

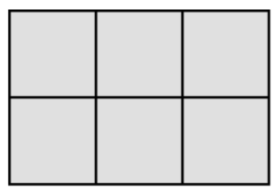
T: (Project the triangle image. Beneath it, write __ cm ÷ __ = __ cm.) Each side of the triangle is the same length. The perimeter of this shape is 24 cm. Find the side lengths of each triangle by filling in the missing numbers.

S: (Write 24 cm ÷ 6 = 4 cm.)

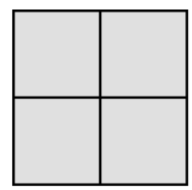
Continue the process for the other images, which are composed of squares.



P = 24 cm



P = 90 in



P = 48 m

> **NOTES ON MULTIPLE MEANS OF REPRESENTATION:**
>
> Students who have difficulty seeing the projected images may construct them from pattern blocks at their desks.

Concept Development (38 minutes)

Materials: (S) Problem Set, personal white board

Note: The whole-class portion of the Concept Development should take about 15 minutes, with the remainder of the time allotted to be used for completing the Problem Set. Save today's Problem Set for use in Lessons 25–26.

T: Today, you will use all you have learned about perimeter and area to start designing a robot and an environment for it. We'll work on this for four days, so today we will just do our planning. Read the directions for completing the chart on the first page of the Problem Set.

S: (Read: Use the given perimeters in the chart below to choose the widths and lengths of your robot's rectangular body parts. Write the widths and lengths in the chart below. Use the blank rows if you want to add extra rectangular body parts to your robot.)

T: We will not be working with fractional units, only whole numbers, throughout the project. Talk to a partner. How can you use the given perimeters to find possible widths and lengths of each robot body part?

> **NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:**
>
> When introducing and giving instructions for designing a robot and its environment, it may be necessary to make certain adjustments for English language learners. Speaking slower, pausing more frequently, giving an example, using visual aids or gestures while checking for understanding, and explaining in students' first languages may prove helpful.

S: I can find half of the perimeter and then find pairs of numbers that add up to half of the perimeter. These pairs of numbers are the possible widths and lengths.

T: Do that now for the perimeter of one of your robot's arms, 14 centimeters. (Allow time for students to work.) How many rectangles can you make for that perimeter with whole number side lengths?

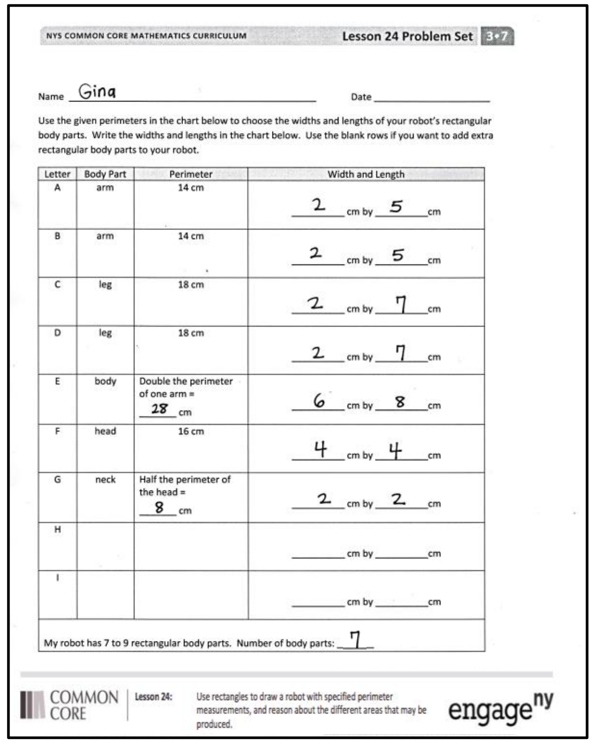
S: Three rectangles!

T: Sketch the rectangles, and then compare them to decide which one to use for your robot's arm. Record the width and length of your choice in the chart.

S: (Sketch the rectangles and record choices in the chart.)

T: Look at the chart on page 2 of your Problem Set. Why are some of the width and length spaces shaded in?

S: They are circles, so they do not have length and width. → We do not know how to use the perimeter of a circle to find its width and length. → Circles do not even have a width and length.



NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 24 Problem Set 3•7

Name Gina Date

Use the given perimeters in the chart below to choose the widths and lengths of your robot's rectangular body parts. Write the widths and lengths in the chart below. Use the blank rows if you want to add extra rectangular body parts to your robot.

Letter	Body Part	Perimeter	Width and Length
A	arm	14 cm	2 cm by 5 cm
B	arm	14 cm	2 cm by 5 cm
C	leg	18 cm	2 cm by 7 cm
D	leg	18 cm	2 cm by 7 cm
E	body	Double the perimeter of one arm = 28 cm	6 cm by 8 cm
F	head	16 cm	4 cm by 4 cm
G	neck	Half the perimeter of the head = 8 cm	2 cm by 2 cm
H			cm by cm
I			cm by cm

My robot has 7 to 9 rectangular body parts. Number of body parts: 7

COMMON CORE Lesson 24: Use rectangles to draw a robot with specified perimeter measurements, and reason about the different areas that may be produced. engage^ny

T: So, do you have to write anything in your chart for the widths and lengths of the circular items?

S: No!

T: What is the given perimeter of the robot's house?

S: 82 centimeters.

T: What is half of 82?

S: 41.

MP.5

T: Think about finding the pairs of numbers that add to 41 (or writing all the doubles to 82, depending on which strategy you taught in Lesson 20).

S: That is a lot of pairs of numbers! → It will take a long time, and it seems easy to miss one.

T: Talk to a partner: If you want a tall, skinny house for your robot, will the difference between the width and length be big or small? How do you know?

S: It will be big. A big difference between the width and length makes a tall and skinny rectangle. → That is true. When the difference is small, the rectangle starts to look like a square.

T: Keep that in mind when you plan for the robot's house. Instead of listing all the pairs of numbers that add to 41 and then deciding, think about the pairs of numbers that have a sum of 41 that will make the type of house you want.

Release students to work on their plans for their robots and their robots' environments. Circulate as students work, checking for understanding and clearing up any misconceptions.

Problem Set (23 minutes)

Students should do their personal best to complete the Problem Set within the allotted 23 minutes. Students who do not finish planning during this time can finish for homework, possibly instead of the Homework provided. Students who finish early may begin constructing their robots.

Student Debrief (10 minutes)

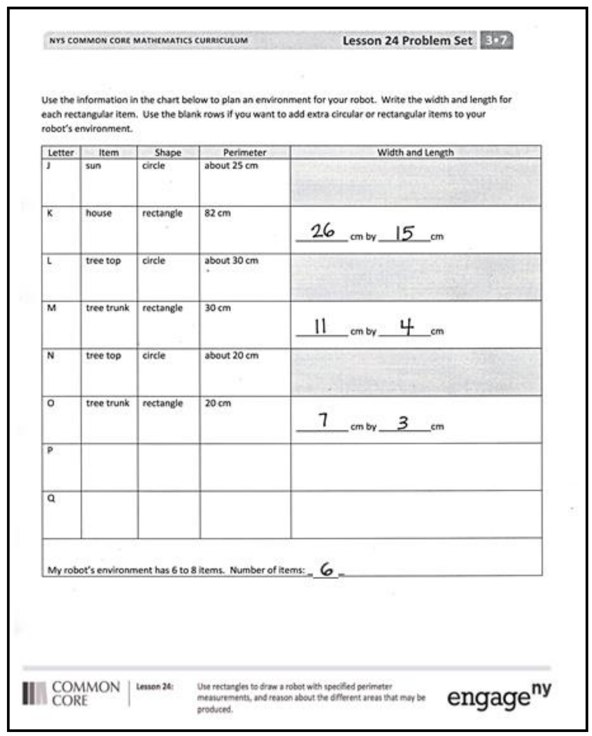
Lesson Objective: Use rectangles to draw a robot with specified perimeter measurements, and reason about the different areas that may be produced.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- Which body part has the greatest perimeter? Why? The smallest perimeter? Why?
- The perimeter of the body is double the perimeter of an arm. Are the width and length of your robot's body double the width and length of its arm? Why or why not?
- The perimeter of the neck is half the perimeter of the head. Are the width and length of your robot's neck half the width and length of its head? Why or why not?
- Explain to a partner how you found the width and length of your robot's house. What shape house will your robot have? How do you know?
- What extra body parts or items for the environment did you plan? What shapes are your extra body parts or items?


NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 24 Problem Set 3•7

Use the information in the chart below to plan an environment for your robot. Write the width and length for each rectangular item. Use the blank rows if you want to add extra circular or rectangular items to your robot's environment.

Letter	Item	Shape	Perimeter	Width and Length
J	sun	circle	about 25 cm	
K	house	rectangle	82 cm	26 cm by 15 cm
L	tree top	circle	about 30 cm	
M	tree trunk	rectangle	30 cm	11 cm by 4 cm
N	tree top	circle	about 20 cm	
O	tree trunk	rectangle	20 cm	7 cm by 3 cm
P				
Q				

My robot's environment has 6 to 8 items. Number of items: 6

COMMON CORE Lesson 24: Use rectangles to draw a robot with specified perimeter measurements, and reason about the different areas that may be produced. engage^ny

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Multiply.

6 x 1 = ________	6 x 2 = ________	6 x 3 = ________	6 x 4 = ________
6 x 5 = ________	6 x 6 = ________	6 x 7 = ________	6 x 8 = ________
6 x 9 = ________	6 x 10 = ________	6 x 5 = ________	6 x 6 = ________
6 x 5 = ________	6 x 7 = ________	6 x 5 = ________	6 x 8 = ________
6 x 5 = ________	6 x 9 = ________	6 x 5 = ________	6 x 10 = ________
6 x 6 = ________	6 x 5 = ________	6 x 6 = ________	6 x 7 = ________
6 x 6 = ________	6 x 8 = ________	6 x 6 = ________	6 x 9 = ________
6 x 6 = ________	6 x 7 = ________	6 x 6 = ________	6 x 7 = ________
6 x 8 = ________	6 x 7 = ________	6 x 9 = ________	6 x 7 = ________
6 x 8 = ________	6 x 6 = ________	6 x 8 = ________	6 x 7 = ________
6 x 8 = ________	6 x 9 = ________	6 x 9 = ________	6 x 6 = ________
6 x 9 = ________	6 x 7 = ________	6 x 9 = ________	6 x 8 = ________
6 x 9 = ________	6 x 8 = ________	6 x 6 = ________	6 x 9 = ________
6 x 7 = ________	6 x 9 = ________	6 x 6 = ________	6 x 8 = ________
6 x 9 = ________	6 x 7 = ________	6 x 6 = ________	6 x 8 = ________

multiply by 6 (6–10)

Name ____ Date ______________________

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H			__________ cm by __________cm
I			__________ cm by __________cm
My robot has 7 to 9 rectangular body parts. Number of body parts: _______			

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N	tree top	circle	about 20 cm	
O	tree trunk	rectangle	20 cm	__________ cm by __________cm
P				
Q				
My robot's environment has 6 to 8 items. Number of items: _______				

Name ____ Date ______________________

Estimate to draw three different rectangles with a perimeter of 16 centimeters. Label the width and length of each rectangle.

Name ____ Date ______________________

1. Brian draws a square with a perimeter of 24 inches. What is the width and length of the square?

2. A rectangle has a perimeter of 18 centimeters.

   a. Estimate to draw as many different rectangles as you can that have a perimeter of 18 centimeters. Label the width and length of each rectangle.

   b. How many different rectangles did you find?

   c. Explain the strategy you used to find the rectangles.

3. The chart below shows the perimeters of three rectangles.

   a. Write possible widths and lengths for each given perimeter.

Rectangle	Perimeter	Width and Length
A	6 cm	________ cm by ________ cm
B	10 cm	________ cm by ________ cm
C	14 cm	________ cm by ________ cm

   b. Double the perimeters of the rectangles in part (a). Then, find possible widths and lengths.

Rectangle	Perimeter	Width and Length
A	12 cm	________ cm by ________ cm
B		________ cm by ________ cm
C		________ cm by ________ cm