Core Knowledge® MATHEMATICS

# Two-dimensional Shapes and Perimeter

Student Workbook

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# Two-dimensional Shapes and Perimeter

## Table of Contents


Lesson 1 **What Attributes Do You See?** ..... 1

Lesson 2 **Attributes of Triangles and Quadrilaterals** ..... 4

Lesson 3 **Attributes that Define Shapes** ..... 8

Lesson 4 **Attributes of Rectangles, Rhombuses, and Squares** ..... 12

Lesson 5 **Attributes of Other Quadrilaterals** ..... 17

Lesson 6 **Distance Around Shapes** ..... 24

Lesson 7 **Same Perimeter, Different Shapes** ..... 27

Lesson 8 **Find the Perimeter** ..... 31

Lesson 9 **Perimeter Problems** ..... 35

Lesson 10 **Problem Solving With Perimeter and Area** ..... 40

Lesson 11 **Rectangles with the Same Perimeter** ..... 43

Lesson 12 **Rectangles with the Same Area** ..... 46

Lesson 13 **Shapes and Play** ..... 50

Lesson 14 **Wax Prints** ..... 53

Lesson 15 **Design Your Own Robot** ..... 57

**Cumulative Practice Problems**

Section A: **Reason with Shapes** ..... 60

Section C: **Expanding on Perimeter** ..... 67

Section D: **Design with Perimeter and Area** ..... 70

# Two-dimensional Shapes and Perimeter

## Student Workbook

Core Knowledge Mathematics™

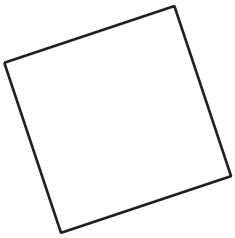
# Lesson 1: What Attributes Do You See?

- Let's sort shapes into groups.

## Warm-up: Which One Doesn't Belong: Who's in the Group?

Which one doesn't belong?

**A**



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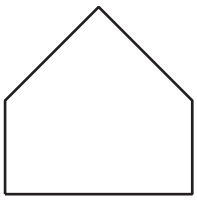

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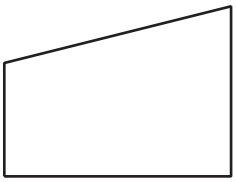

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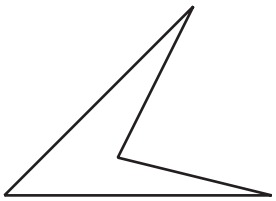
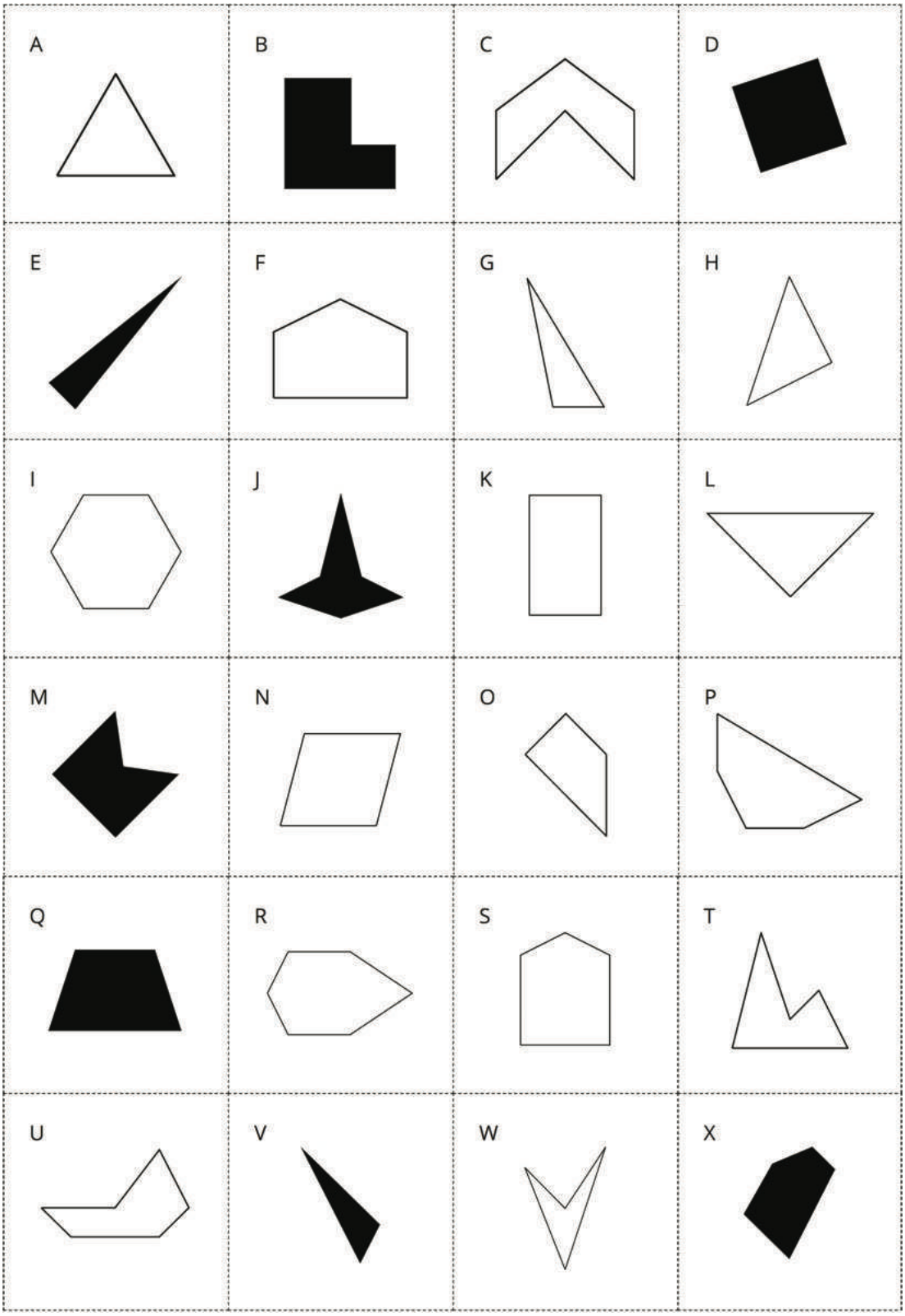


## 1.1: Card Sort: Shapes

Your teacher will give you a set of cards that show shapes.

1. Work with your partner to sort the cards into categories. Be prepared to explain your categories.

2. Take turns sorting the cards into two new categories. Don't tell your partner how you sorted them. Your partner will then guess how you sorted your shapes.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# Lesson 2: Attributes of Triangles and Quadrilaterals

- Let's sort shapes into more specific categories.

## Warm-up: True or False: Multiples of Ten

Decide if each statement is true or false. Be prepared to explain your reasoning.

- $3 \times 60 = 9 \times 10$

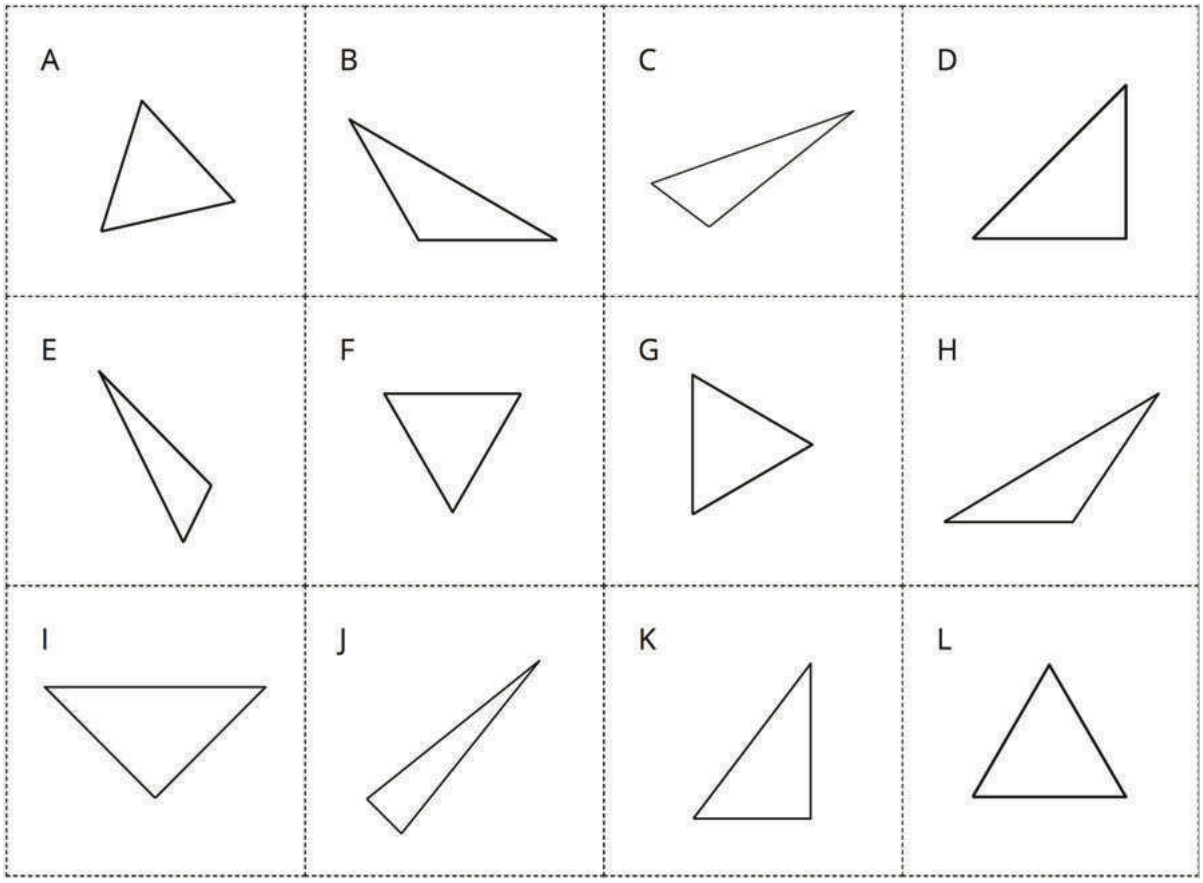
- $180 = 3 \times 60$

- $6 \times 40 = 24 \times 10$

- $24 \times 10 = 240$

## 2.1: Card Sort: Triangles

Sort the triangles into categories. Record your categories and be prepared to explain how you sorted the shapes.



## 2.2: Card Sort: Quadrilaterals

Sort the quadrilaterals into categories. Record your categories and be prepared to explain how you sorted the shapes.

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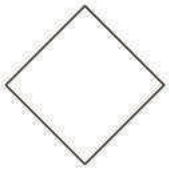
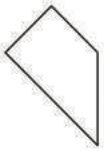
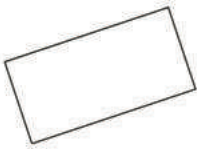
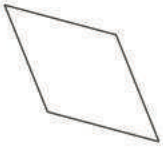
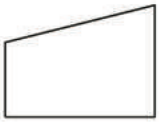
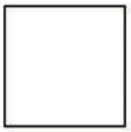
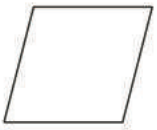
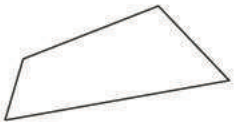
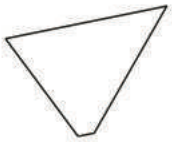
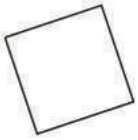
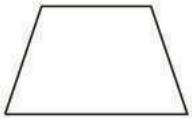
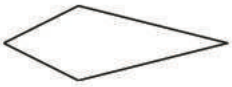
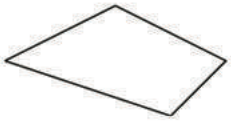
| M  | N | O | P  |
| Q  | R  | S  | T |
| U | V | W | X  |
| Y  | Z  | AA  | BB  |
| CC  | DD | EE  | FF  |

# Lesson 3: Attributes that Define Shapes

- Let’s play Mystery Quadrilateral.

## Warm-up: Number Talk: Multiply Multiples of Ten

Find the value of each expression mentally.

- $4 \times 40$

- $8 \times 40$

- $7 \times 40$

- $9 \times 40$

## 3.1: Learn How to Play Mystery Quadrilateral

Play a round of Mystery Quadrilateral with your teacher.

1. Partner A: Choose a shape from the group of quadrilaterals. Place it in the mystery quadrilateral folder without your partner seeing it.

2. Partner B: Ask up to 5 “yes” or “no” questions to identify the quadrilateral. Then guess which quadrilateral is the mystery quadrilateral.

3. Partner A: Show your partner the mystery quadrilateral.

4. Switch roles and play again.

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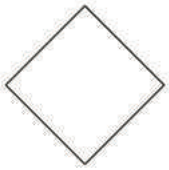
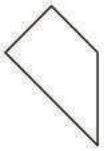
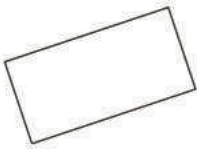
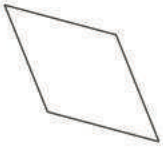
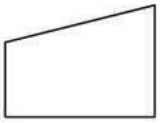
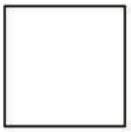
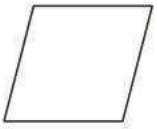
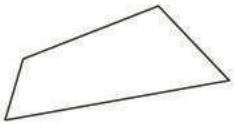
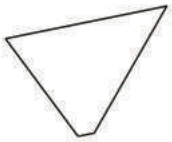
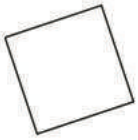
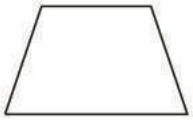
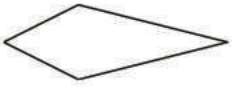
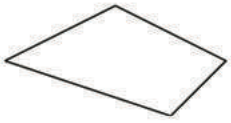
| M  | N | O | P  |
| Q  | R  | S  | T |
| U | V | W | X  |
| Y  | Z  | AA  | BB  |
| CC  | DD | EE  | FF  |

## 3.2: Play Mystery Quadrilateral

1. Partner A: Choose a shape from the group of quadrilaterals. Place it in the mystery quadrilateral folder without your partner seeing it.

2. Partner B: Ask up to 5 “yes” or “no” questions to identify the quadrilateral. Then guess which quadrilateral is the mystery quadrilateral.

3. Partner A: Show your partner the mystery quadrilateral.

4. Switch roles and play again.

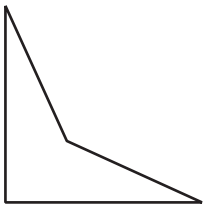
# Lesson 4: Attributes of Rectangles, Rhombuses, and Squares

- Let's find out what makes rectangles, rhombuses, and squares what they are.

## Warm-up: Which One Doesn't Belong: More Attributes

Which one doesn't belong?

**A**



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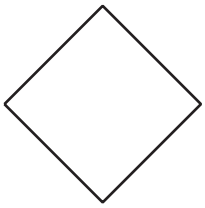

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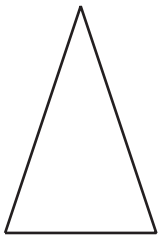

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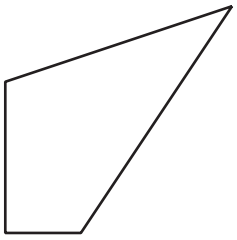
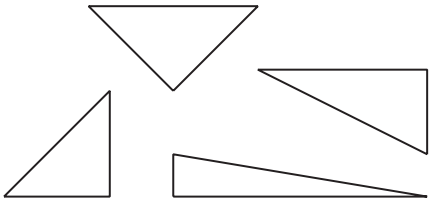
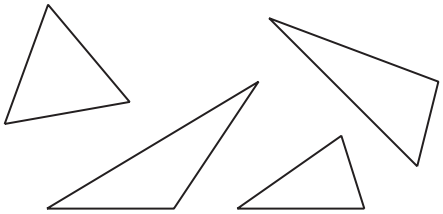


# 4.1: What Makes These Shapes So?

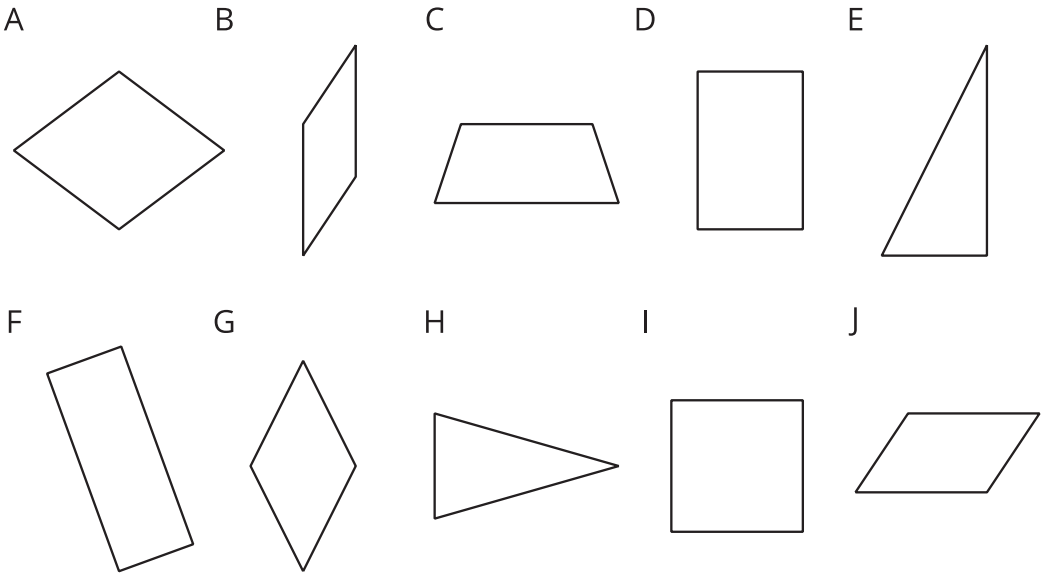
1. These are right triangles.



These are not right triangles.

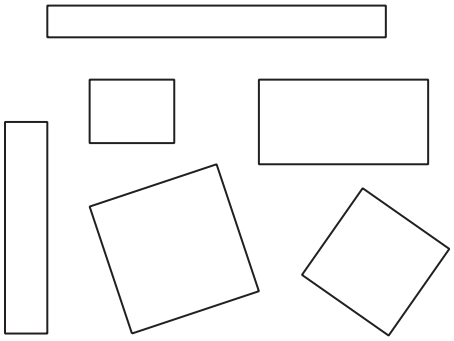


a. Which of the following are right triangles? Circle them.

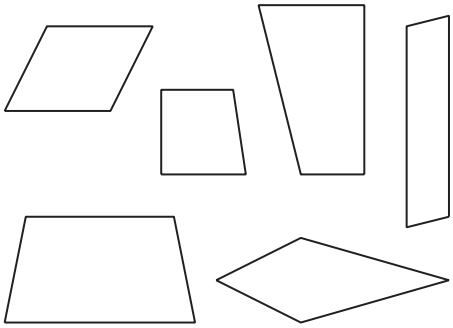



b. What makes a shape a right triangle?

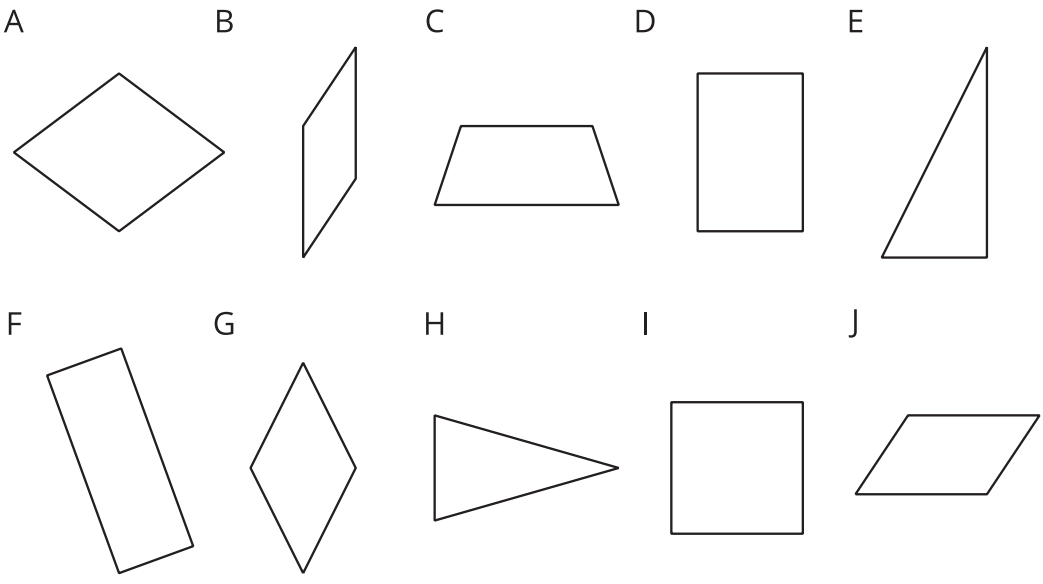
2. These are rectangles.



These are not rectangles.

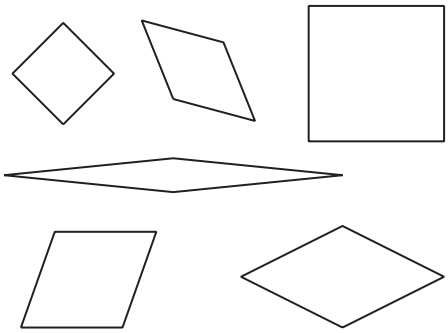


a. Which of the following are rectangles? Circle them.

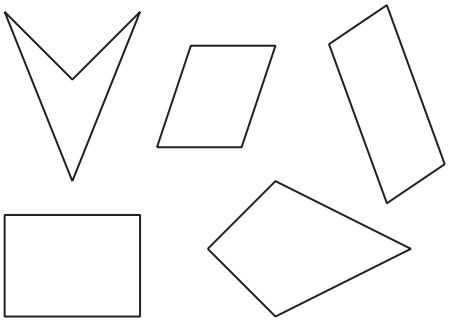



b. What makes a shape a rectangle?

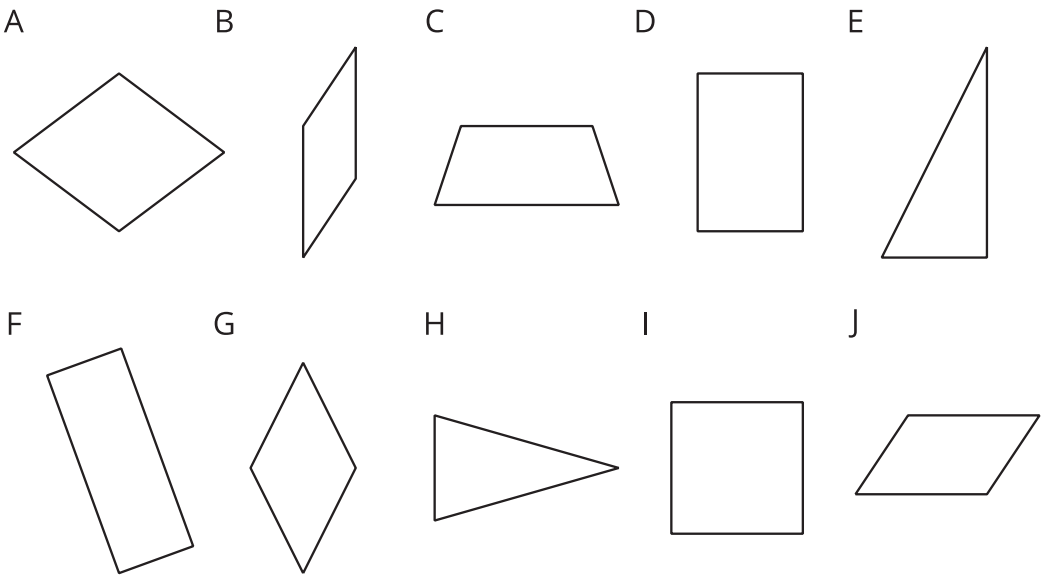
3. These are rhombuses.



These are not rhombuses.

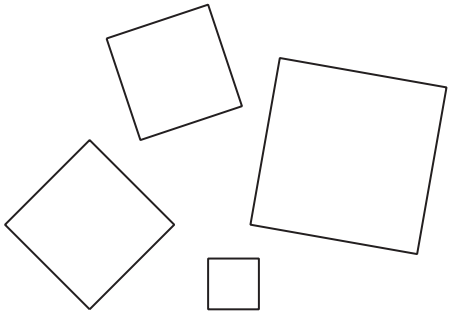


a. Which of the following are rhombuses? Circle them.

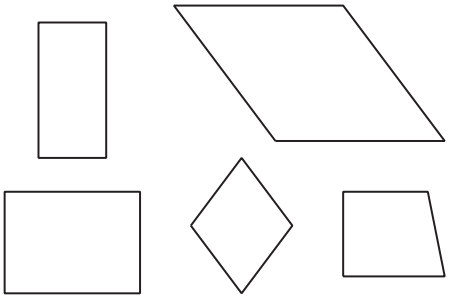



b. What makes a shape a rhombus?

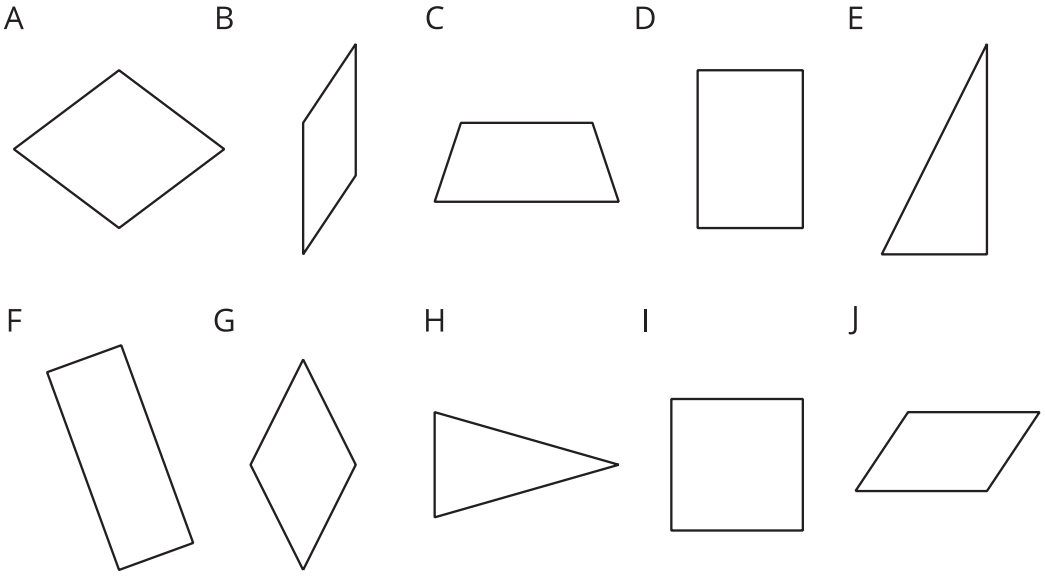
4. These are squares.



These are not squares.



a. Which of the following are squares? Circle them.




b. What makes a shape a square?

# Lesson 5: Attributes of Other Quadrilaterals

- Let's describe and draw shapes in specific groups.

## Warm-up: Number Talk: Divide by 7

Find the value of each expression mentally.

- $70 \div 7$

- $77 \div 7$

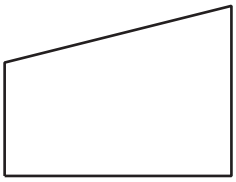
- $63 \div 7$

- $56 \div 7$

## 5.1: All the Ways

Select **all** the ways you could describe each shape. Be prepared to explain your reasoning.

**1**



A. triangle

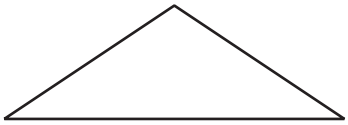
B. quadrilateral

C. square

D. rhombus

E. rectangle

**2**



A. triangle

B. quadrilateral

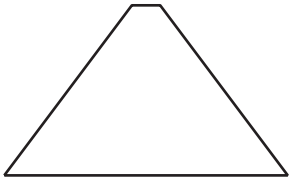
C. hexagon

D. rhombus

E. rectangle

F. square

**3**



A. triangle

B. quadrilateral

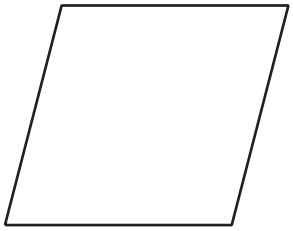
C. pentagon

D. rhombus

E. rectangle

F. square

**4**



A. triangle

B. quadrilateral

C. hexagon

D. rhombus

E. rectangle

F. square

**5**

A. hexagon

B. quadrilateral

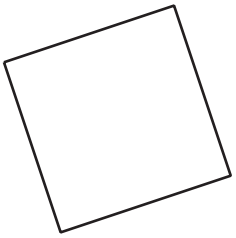
C. triangle

D. square

E. rectangle

F. rhombus

**6**



A. hexagon

B. quadrilateral

C. triangle

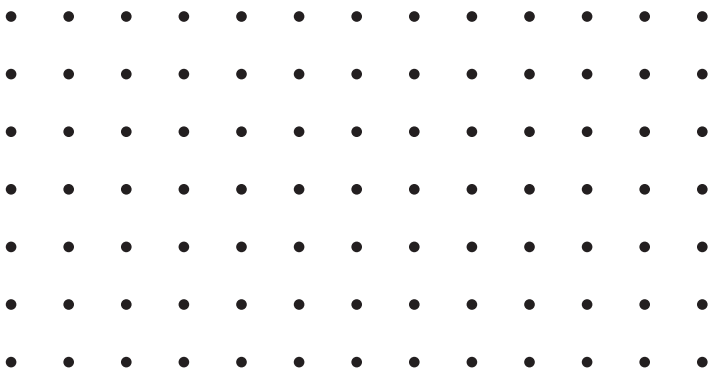
D. rhombus

E. rectangle

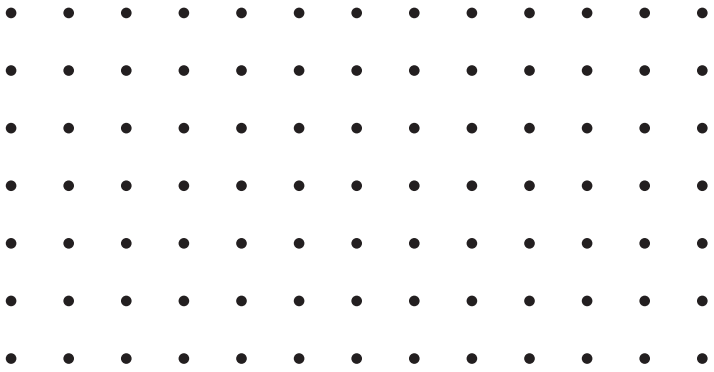
F. square

## 5.2: Draw One That's Not . . .

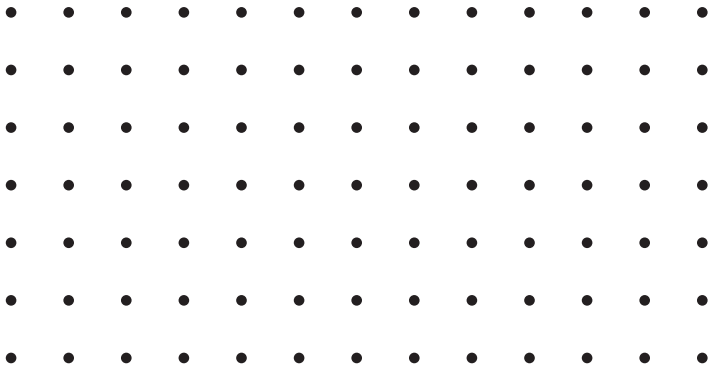
1. Draw a quadrilateral that isn't a square.



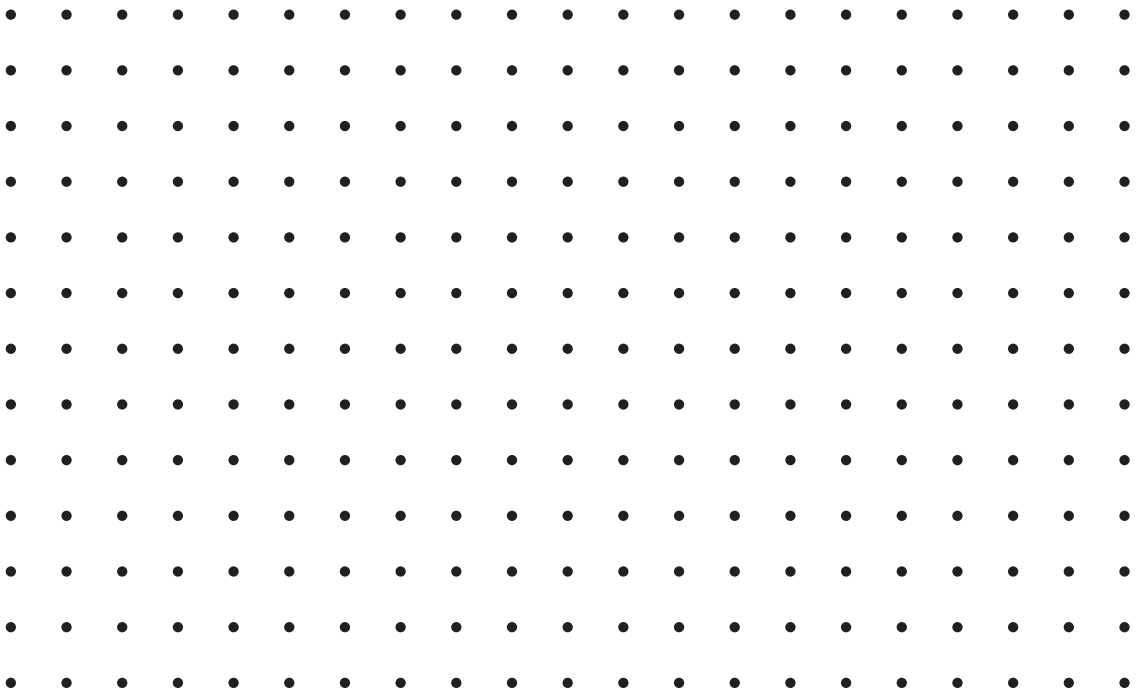
2. Draw a quadrilateral that isn't a rhombus.



3. Draw a quadrilateral that isn't a rectangle.



4. Draw as many quadrilaterals as you can that aren't rhombuses, rectangles, or squares.

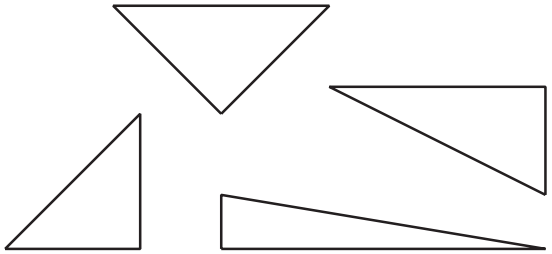


## Section Summary

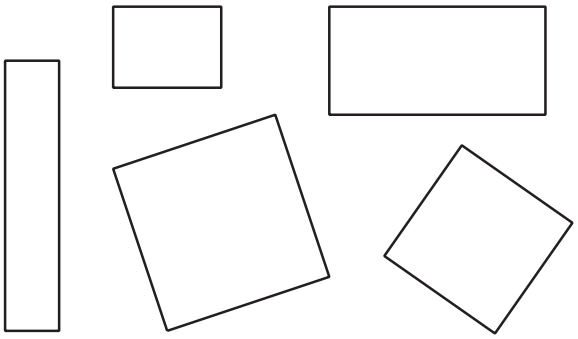
Section Summary
In this section, we learned to sort shapes based on attributes such the number of sides, side lengths, and whether angles were right angles. We also sorted quadrilaterals and triangles into more specific groups.

We learned that a shape can be named based on its attributes. For example:

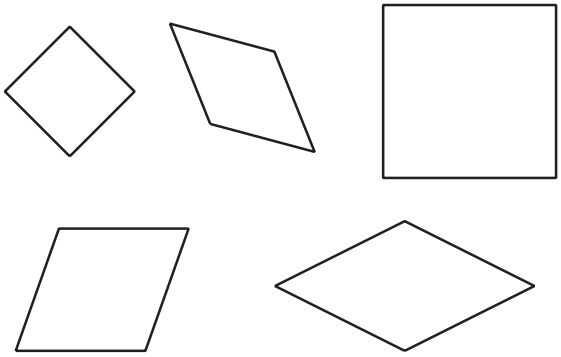
- If a triangle has a right angle, then it is a **right triangle**.



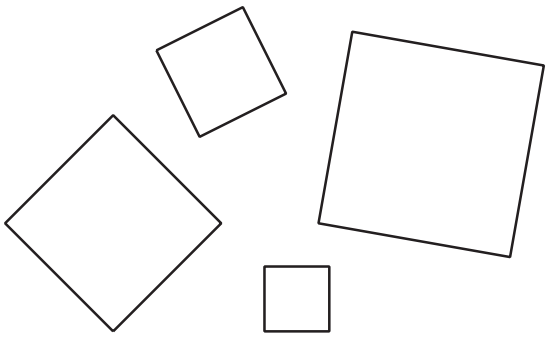
- If a quadrilateral has 2 pairs of sides that are the same length and 4 right angles, then it is a rectangle.



- If a quadrilateral has sides that are all the same length, then it is a rhombus.



- If a quadrilateral has sides that are all the same length and 4 right angles, then it is a square.

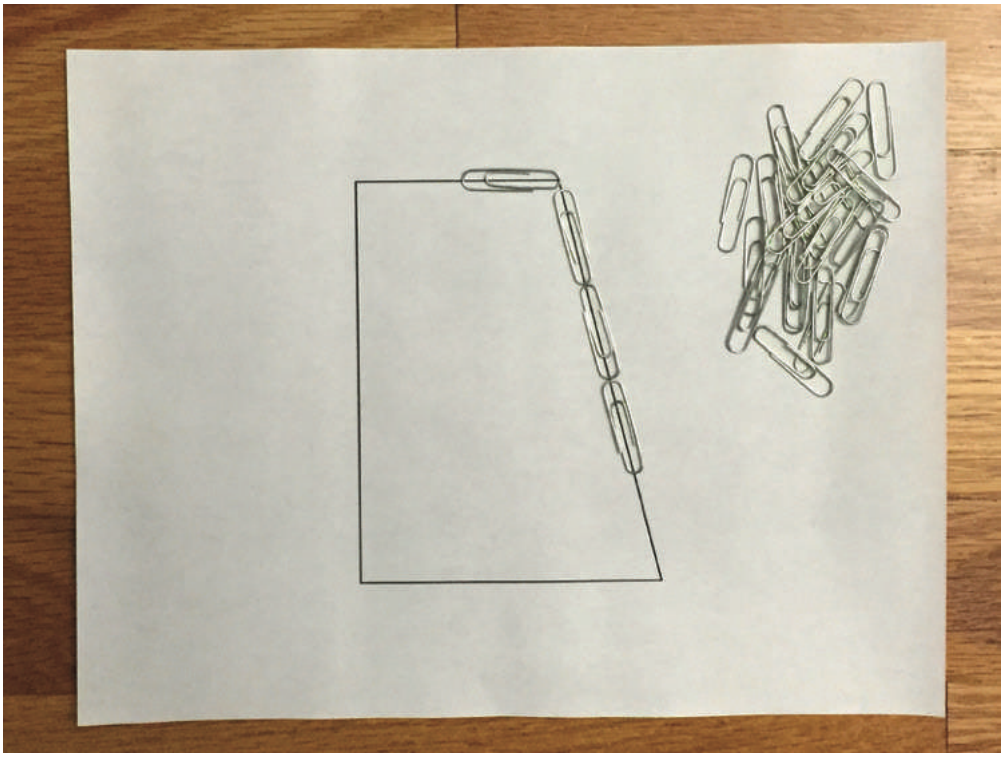


# Lesson 6: Distance Around Shapes

- Let’s find the distance around shapes.

## Warm-up: Notice and Wonder: Paper Clips & Shapes

What do you notice? What do you wonder?



## 6.1: What Does It Take to Build the Shapes?

Your teacher will give you four shapes on paper and some paper clips.

Work with your group to find out which shape takes the most paper clips to build. Explain or show how you know. Record your findings here. Draw sketches if they are helpful.

A

B

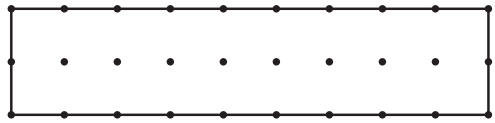
C

D

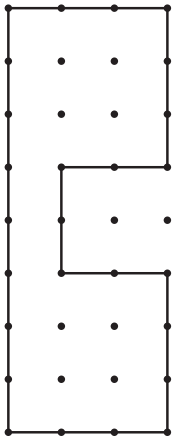
# 6.2: Distance Around

Find the perimeter of each shape.
Explain or show your reasoning.

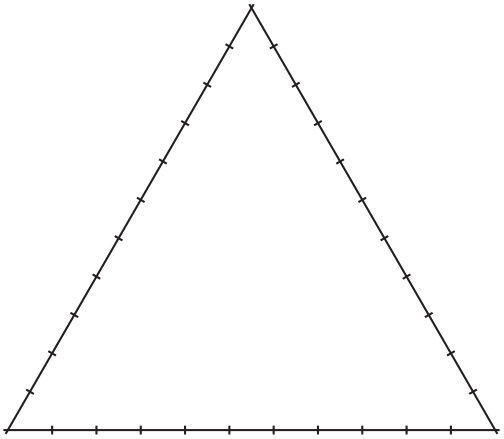
**A**



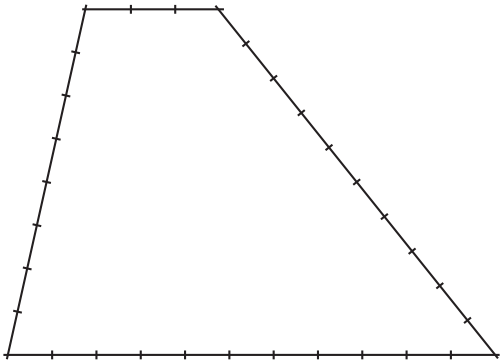
**B**



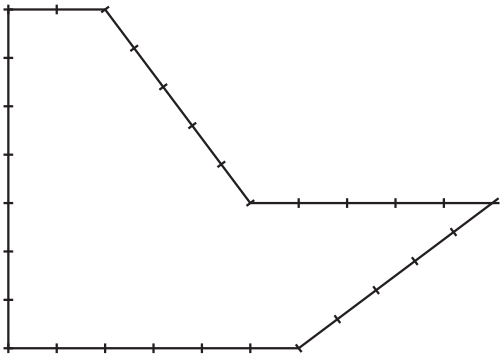
**C**



**D**



**E**



# Lesson 7: Same Perimeter, Different Shapes

- Let's learn about shapes with the same perimeter.

## Warm-up: True or False: Sums of Four Numbers

Decide whether each statement is true or false. Be prepared to explain your reasoning.

- $123 + 75 + 123 + 75 = 100 + 100 + 70 + 70 + 5 + 5 + 3 + 3$

- $123 + 75 + 123 + 75 = (2 \times 123) + (2 \times 75)$

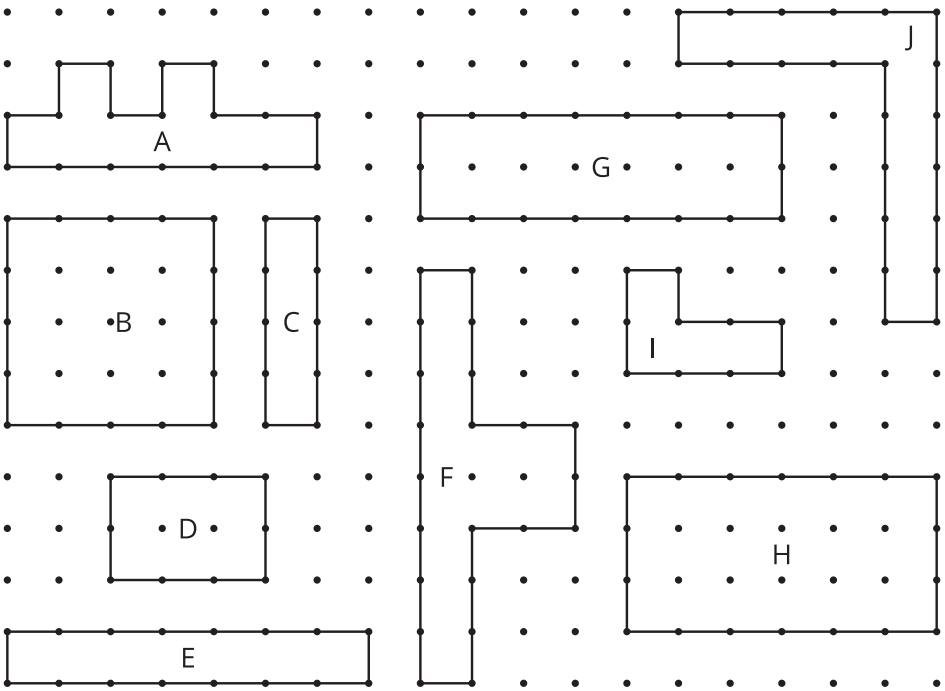
- $123 + 75 + 123 + 75 = 208 + 208$

- $123 + 75 + 123 + 75 = 246 + 150$

## 7.1: All Kinds of Shapes

1. Choose any 3 shapes and find the perimeter of each shape. Explain or show your reasoning.

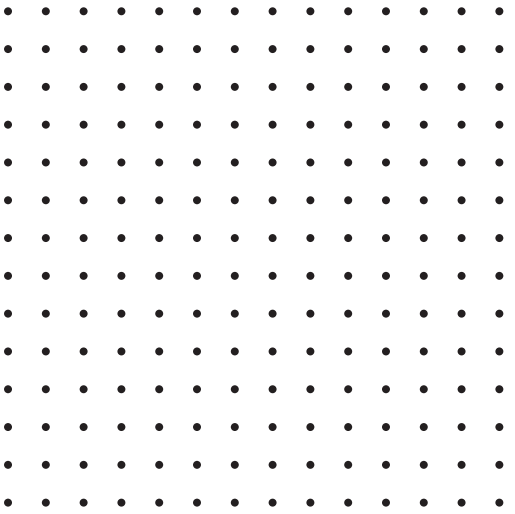
2. Find one shape that has the same perimeter as one of the shapes you chose earlier. Be prepared to explain your reasoning.



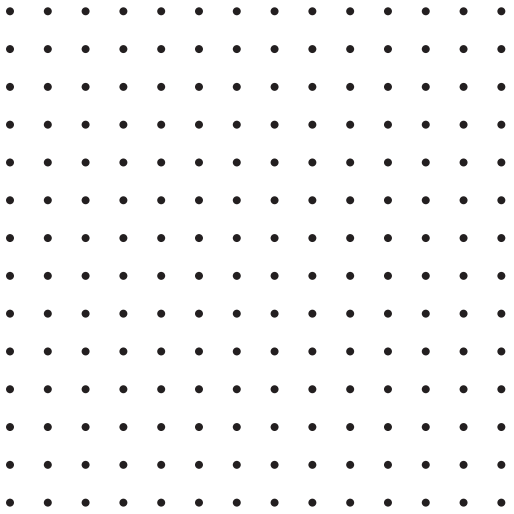
## 7.2: Draw Your Own

1. Draw 2 shapes with each perimeter.

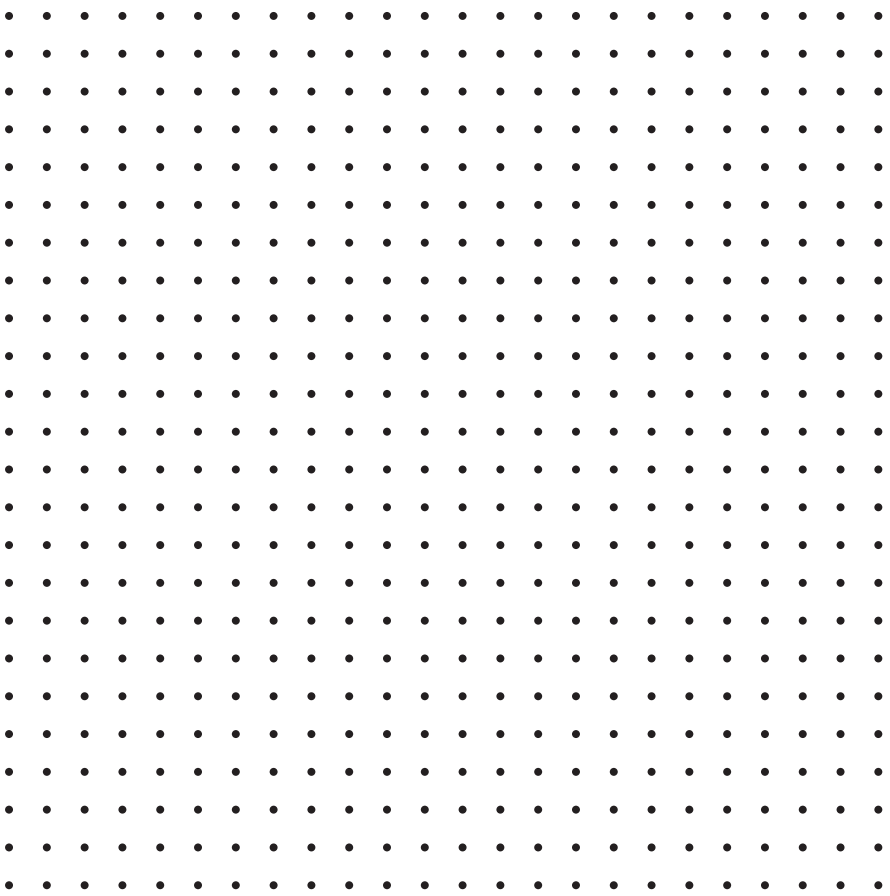
12 units



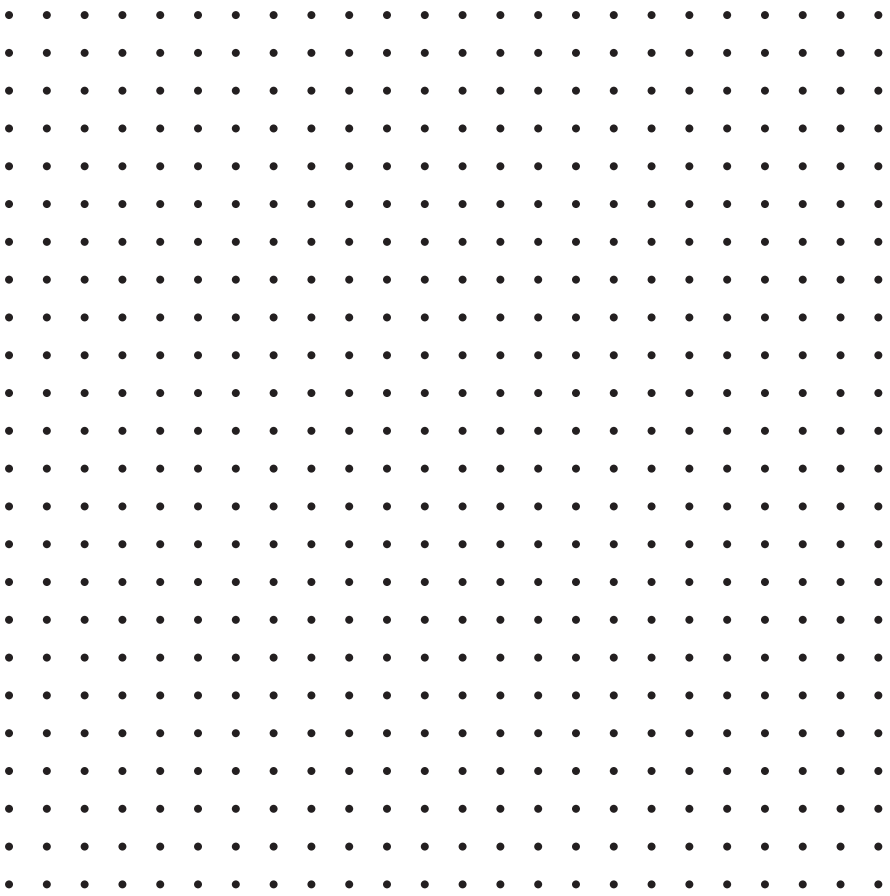
26 units



48 units



2. a. With your partner, choose a length. Then, draw your own shape with that perimeter.



b. Share the shapes you drew and discuss how they are alike and how they are different.

# Lesson 8: Find the Perimeter

- Let’s find the perimeter of more shapes.

## Warm-up: Number Talk: Decreasing Dividend

Find the value of each expression mentally.

- $90 \div 9$

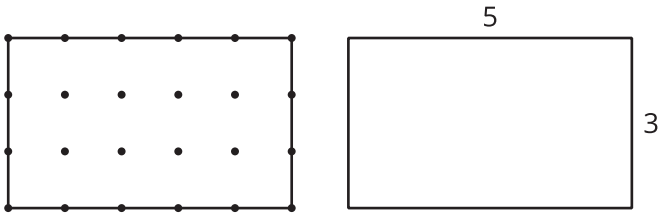
- $81 \div 9$

- $45 \div 9$

- $54 \div 9$

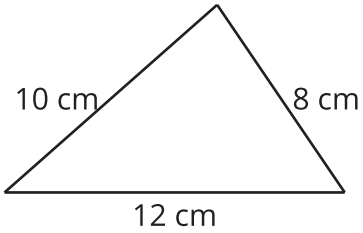
# 8.1: Ways to Find Perimeter

What do you notice? What you wonder?

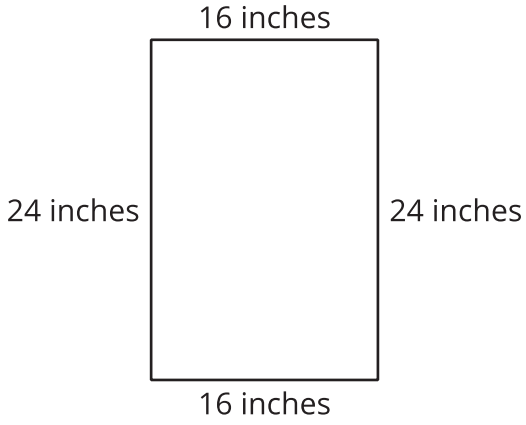



Find the perimeter of each shape. Explain or show your reasoning.

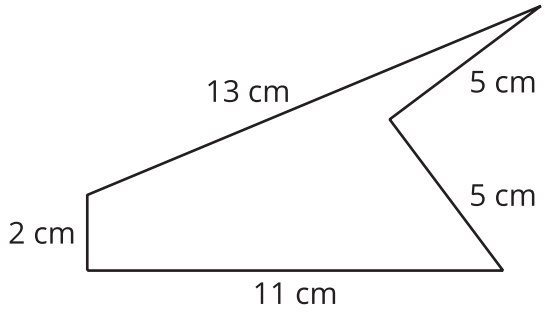
1.



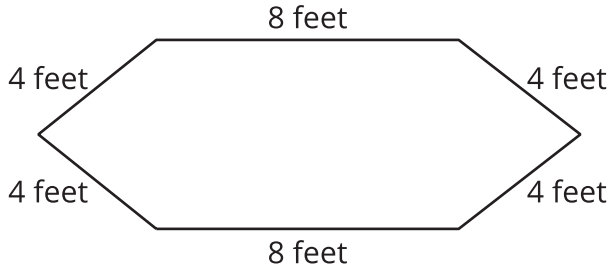

2.



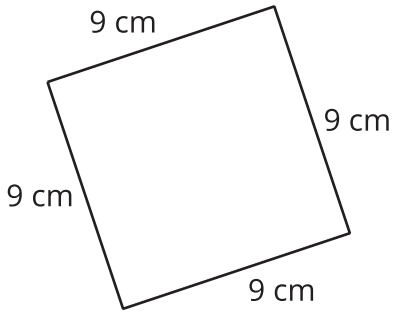
3.


13 cm
5 cm
5 cm
2 cm
11 cm

4.

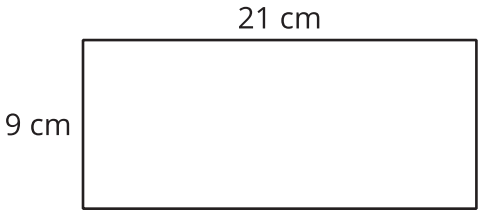

8 feet
4 feet
4 feet
4 feet
4 feet
8 feet

5.

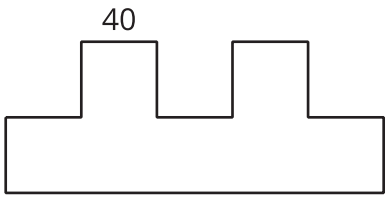

9 cm
9 cm
9 cm
9 cm

## 8.2: Something is Missing

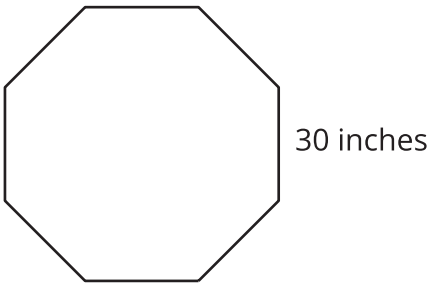
1. Find the perimeter of this rectangle. Explain or show your reasoning.




2. All the short sides of this figure are the same length, and all the angles are right angles. Find the perimeter. Explain or show your reasoning.




3. All the sides of the octagon are the same length. Find the perimeter. Explain or show your reasoning.



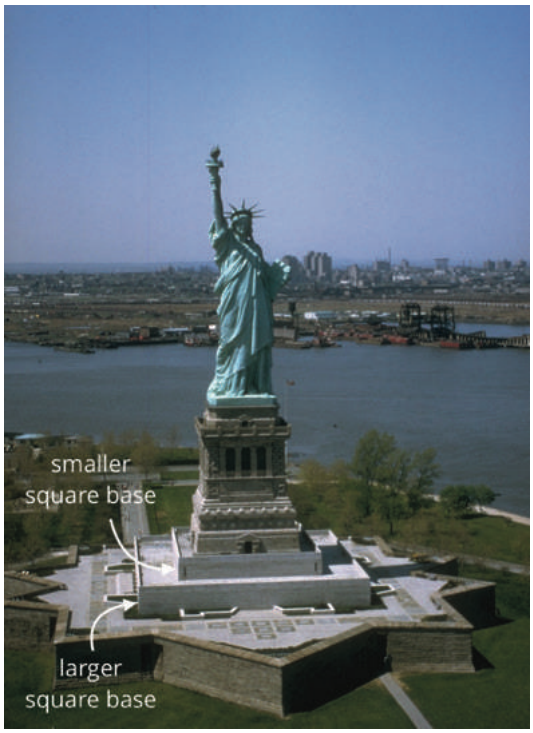
# Lesson 9: Perimeter Problems

- Let's solve problems about perimeter.

## Warm-up: Estimation Exploration: Statue of Liberty

The Statue of Liberty has two square bases—one larger than the other. The larger base has side lengths of 132 feet each.

Estimate the perimeter of the smaller square base.

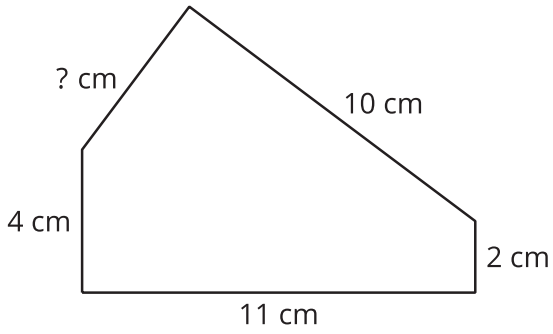



Record an estimate that is:

| too low | about right | too high |
|---|---|---|
| | | |

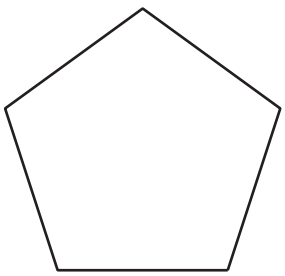
## 9.1: Missing Measurements

1. This pentagon has a perimeter of 32 cm. What is the length of the missing side? Explain or show your work.




2. This rectangle has a perimeter of 56 feet. What are the lengths of the unlabeled sides? Explain or show your work.

3. This pentagon has a perimeter of 65 inches. All the sides are the same length. What is the length of each side? Explain or show your work.



## 9.2: Can I Use Perimeter?

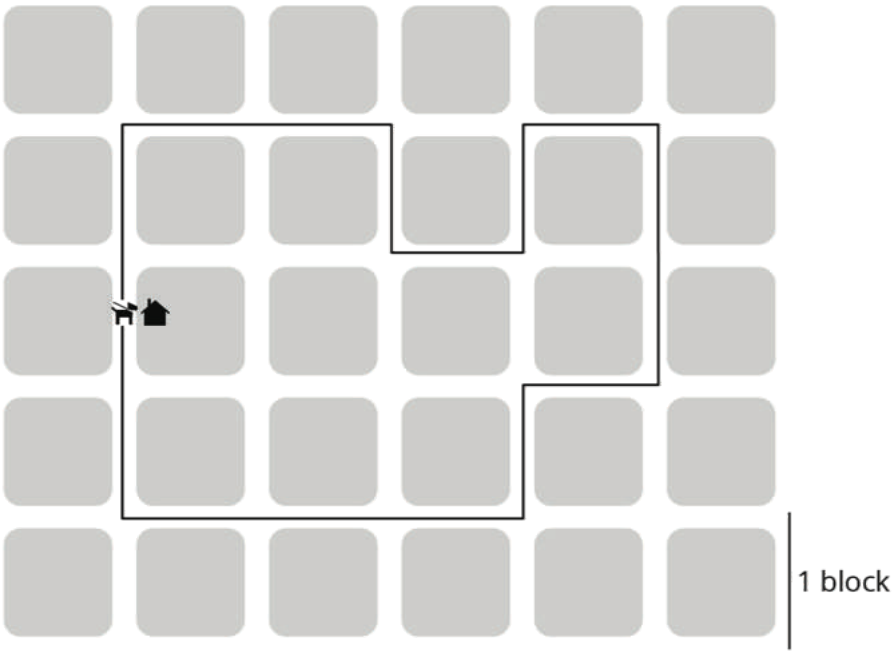
Solve each problem. Explain or show your reasoning.

1. A rectangular park is 70 feet on the shorter side and 120 feet on the longer side. How many feet of fencing is needed to enclose the boundary of the park?

2. Priya drew a picture and is framing it with a ribbon. Her picture is square and one side is 9 inches long. How many inches of ribbon will she need?

3. A rectangular flower bed has a fence that measures 32 feet around. One side of the flower bed measures 12 feet. What are the lengths of the other sides?

4. Kiran took his dog for a walk. Their route is shown. How many blocks did they walk?

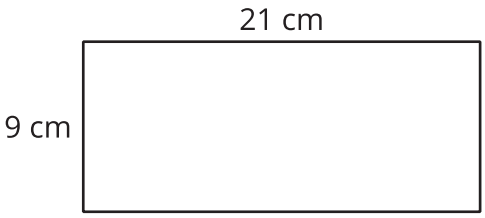



5. A room is 10 feet by 8 feet. How many tiles will be needed to cover the floor if each tile is 1 square foot?

## Section Summary

Section Summary
In this section, we learned that **perimeter** is the boundary of a flat shape.

We can find the length of a perimeter by adding the lengths of all the sides, or by using multiplication when there are sides with the same length.

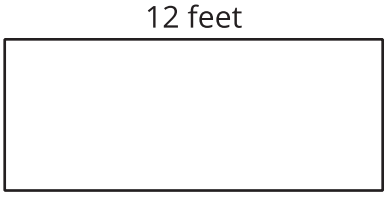



$$9 + 9 + 21 + 21$$

$$(2 \times 9) + (2 \times 21)$$

We used our knowledge of shapes to find the perimeter even when some side lengths were missing, and to use the perimeter to find missing side lengths.

For example, if we know the perimeter of this rectangle is 32 feet, we can find the lengths of the three unlabeled sides.



# Lesson 10: Problem Solving With Perimeter and Area

- Let's solve problems involving perimeter and area.

## Warm-up: True or False: Divide in Parts

Decide if each statement is true or false. Be prepared to explain your reasoning.

- $60 \div 6 = 10$

- $72 \div 6 = (60 \div 6) + (12 \div 6)$

- $78 \div 6 = (60 \div 10) + (18 \div 6)$

- $96 \div 8 = (80 \div 8) - (16 \div 8)$

## 10.1: Rope Off the Garden

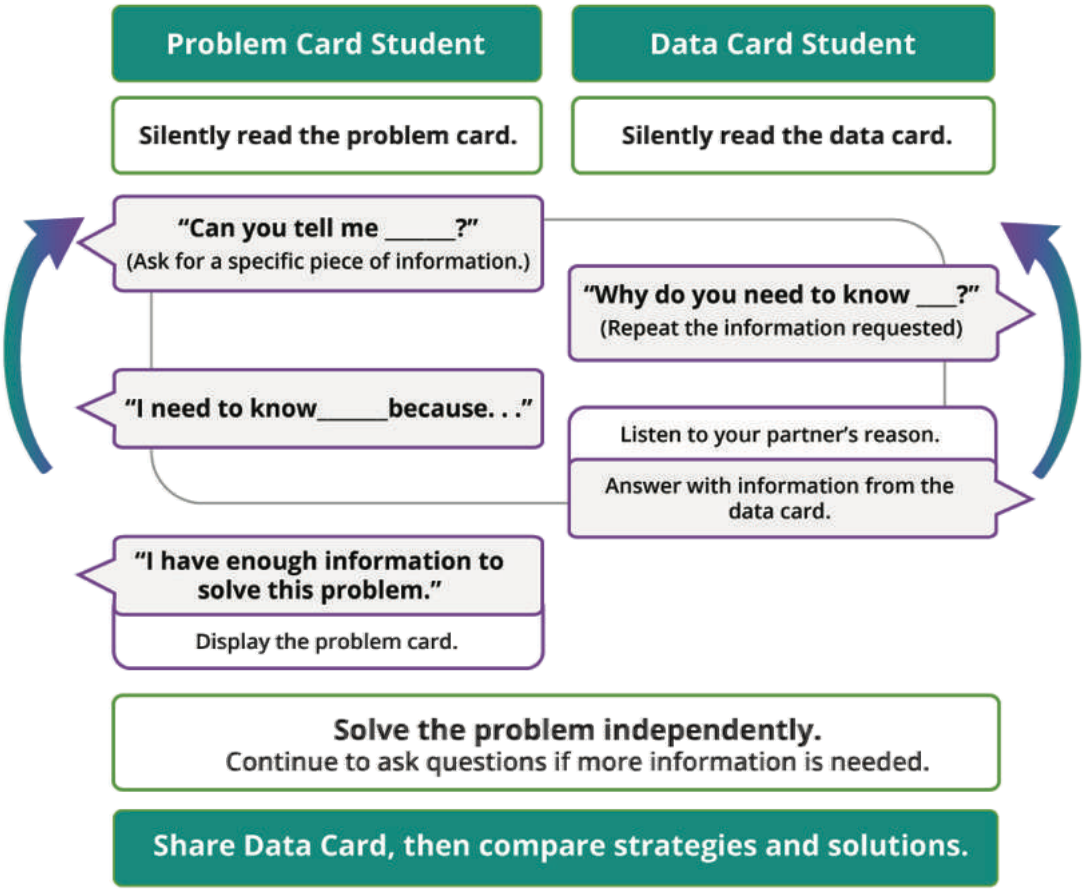
Andre wants to know how much rope is needed to enclose the new rectangular school garden. The length of the garden is 30 feet. The width of the garden is 8 feet.

- Clare says she can use multiplication to find the length of rope Andre needs.
- Diego says he can use addition to find the length of rope Andre needs.

Who do you agree with? Explain or show your reasoning.

## 10.2: Info Gap: A Garden and a Playground

Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.




Pause here so your teacher can review your work.

Ask your teacher for a new set of cards and repeat the activity, trading roles with your partner.

# Lesson 11: Rectangles with the Same Perimeter

- Let's explore rectangles with the same perimeter.

## Warm-up: Number Talk: Multiply to Divide

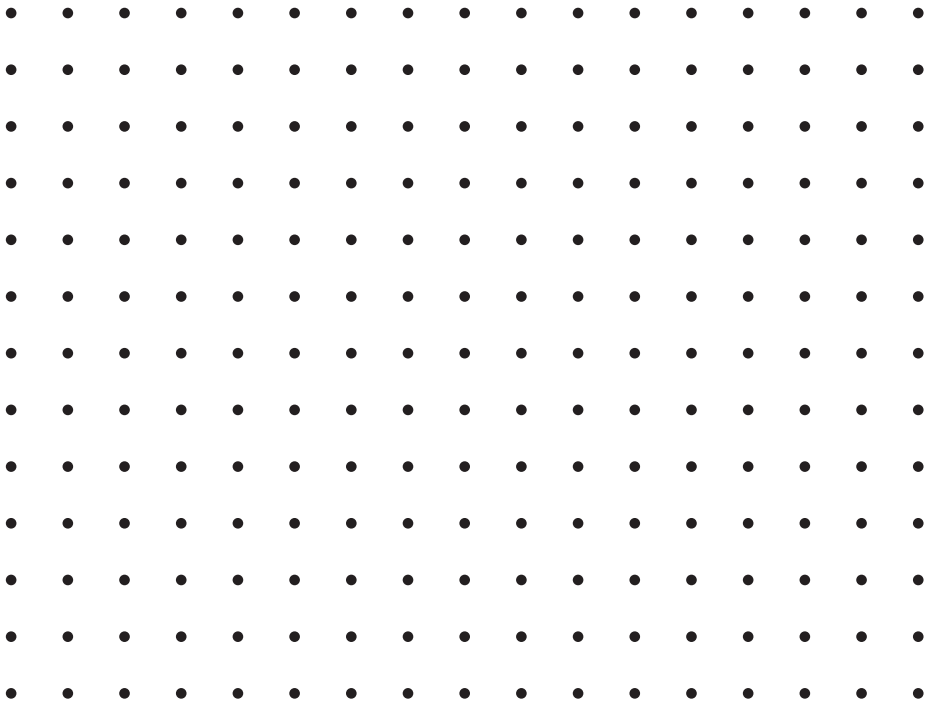
Find the value of each expression mentally.

- $5 \times 5$
- $10 \times 5$
- $2 \times 5$
- $85 \div 5$

## 11.1: Perimeter of 16 Units

1. Draw as many different rectangles with a perimeter of 16 units as you can.

2. Calculate the area of each rectangle you draw. Explain or show your reasoning.



## 11.2: Same Perimeter, Different Area

Your teacher will give you some dot paper for drawing rectangles.

1. For each of the following perimeters, draw 2 rectangles with that perimeter but different areas.

    a. 12 units

    b. 20 units

    c. 26 units

    d. 34 units

    e. Choose your own perimeter.

2. Cut out 1 or 2 rectangles you want to share and put them on the appropriate poster. Try to look for rectangles that are different from what other groups have already placed.

3. Gallery Walk: As you visit the posters with your partner, discuss something you notice and something you wonder.

# Lesson 12: Rectangles with the Same Area

- Let's explore rectangles with the same area.

## Warm-up: Number Talk: Divide in Parts

Find the value of each expression mentally.

- $40 \div 4$

- $60 \div 4$

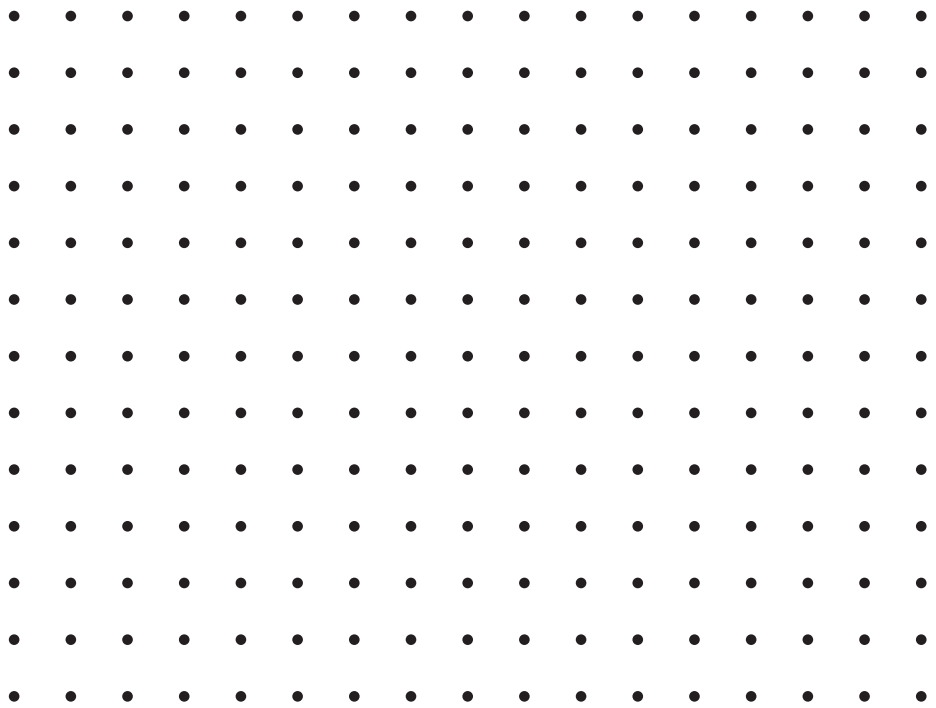
- $80 \div 4$

- $96 \div 4$

## 12.1: Area of 24

1. Draw as many different rectangles as you can with an area of 24 square units.

2. Find the perimeter of each rectangle you draw. Explain or show your reasoning.



## 12.2: Same Area, Different Perimeter

Your teacher will give you some paper for drawing rectangles.

1. For each of the following areas, draw 2 rectangles with that area but different perimeters.

    a. 12 square units
    b. 20 square units
    c. 42 square units
    d. 48 square units
    e. Choose your own area.

2. Cut out the rectangles you want to share and place them on the appropriate poster. Try to look for rectangles that are different from what other groups have already placed.

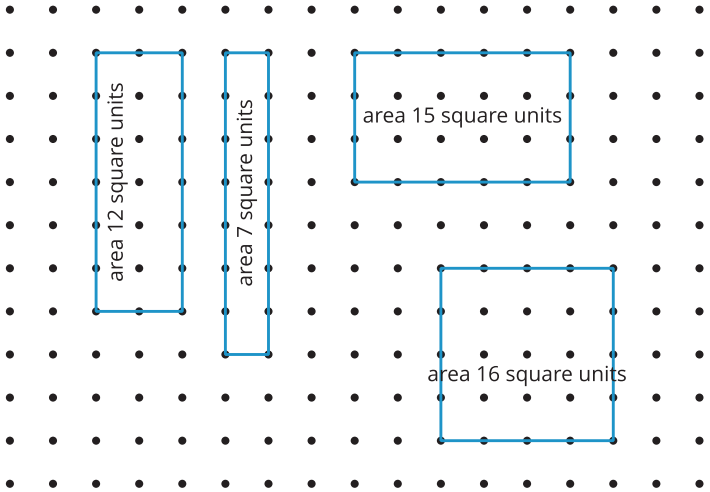
3. Gallery Walk: As you visit the posters, discuss something you notice and something you wonder.

## Section Summary

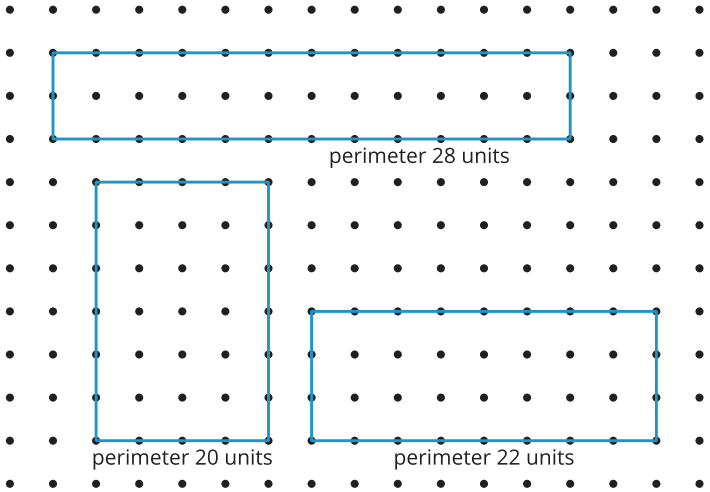
Section Summary

In this section, we drew rectangles with the same perimeter and different areas. We also drew rectangles with the same area and different perimeters.

rectangles with a perimeter of 16 units




rectangles with an area of 24 square units

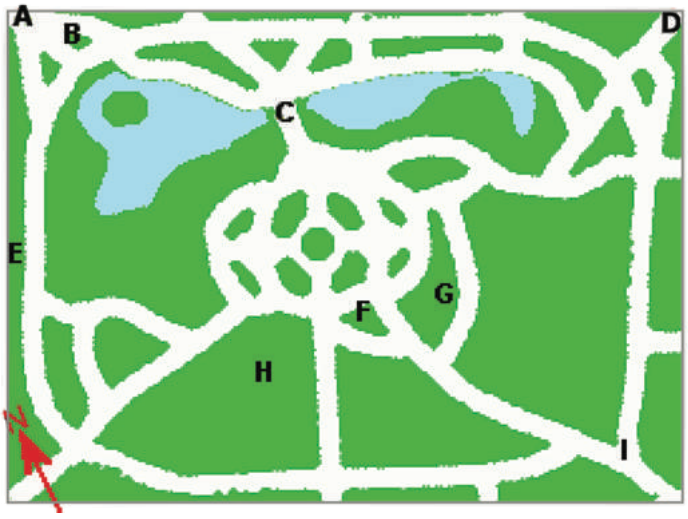


# Lesson 13: Shapes and Play

- Let's design a park.

## Warm-up: Notice and Wonder: A Park

What do you notice? What do you wonder?



## 13.1: Design a Park

Your teacher will give you some dot paper for drawing.

1. The distance from 1 dot to another horizontally or vertically represents 1 yard. Connect dots on the grid horizontally or vertically to design a small park that has 5 of these features:

    a. basketball court

    b. soccer goal

    c. swings

    d. a slide

    e. an open area

    f. picnic table

    g. water play area

    h. skate park

    i. a feature of your choice

2. Describe the area and the perimeter of 3 features in the park.

## 13.2: Park Problems

Solve each problem. Explain or show your reasoning.

1. A rectangular playground is 6 yards by 14 yards.
    a. How much fencing is needed to fence in the playground?

    b. What is the area of the playground?

    c. Give another pair of side lengths that would have the same perimeter, but a different area.

2. A rectangular open area in a park is going to have an area of 48 square yards. Give 2 possible perimeters for the rectangular area.

# Lesson 14: Wax Prints

- Let's analyze and make wax prints.

## Warm-up: Notice and Wonder: Textiles

What do you notice? What do you wonder?

## 14.1: Create a Wax Print Pattern

Your teacher will give you some dot paper for drawing.

1. Use the dot paper to design your own wax print pattern. Your pattern should:

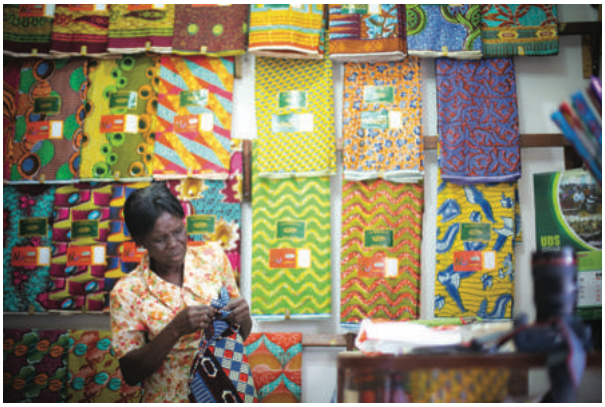
    a. use a rhombus, rectangle, or square

    b. use a quadrilateral that is not a rhombus, rectangle, or square

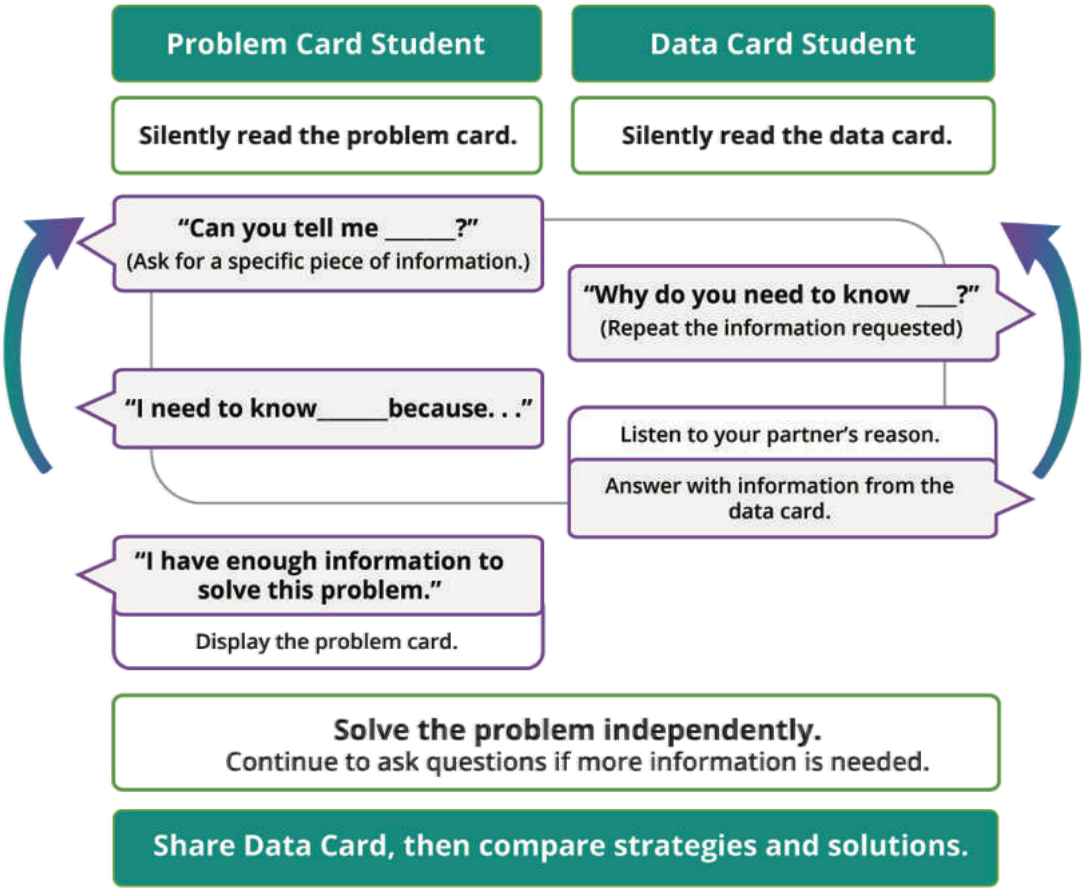
    c. have each shape repeat at least 5 times

2. Color the pattern in a way that highlights the shapes you chose or choices you made.

## 14.2: Info Gap: The Bundle



Your teacher will give you either a problem card or a data card. Do not show or read your card to your partner.




Pause here so your teacher can review your work. Ask your teacher for a new set of cards and repeat the activity, trading roles with your partner.

# Lesson 15: Design Your Own Robot

- Let's use perimeter and area to design robots.

## Warm-up: What Do You Know About Area and Perimeter?

What do you know about area and perimeter?

## 15.1: Create Your Own Robot

1. Create your own robot with these specifications. Explain or show your work so it is clear your robot meets the required specifications.

    a. Each body part must be a rectangle.

    b. Head: perimeter of 36 units

    c. Neck: perimeter of 8 units

    d. Body: perimeter of 64 units

    e. Each arm: perimeter of 24 units

    f. Each leg: perimeter of 32 units

    g. Include one more rectangular feature of your choice on your robot.

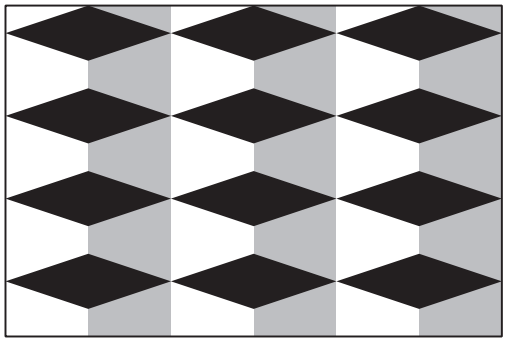
2. Find the area of each of your robot's body parts.

3. Find the total area of your robot.

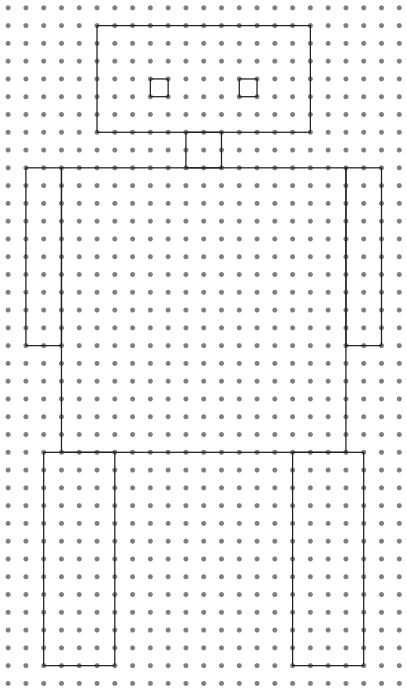
4. Gallery Walk: As you visit the robots with your partner, discuss the different areas that can be created with rectangles that have the same perimeter.

## Section Summary

Section Summary
In this section we reasoned about shapes to design wax prints, a park, and a robot.



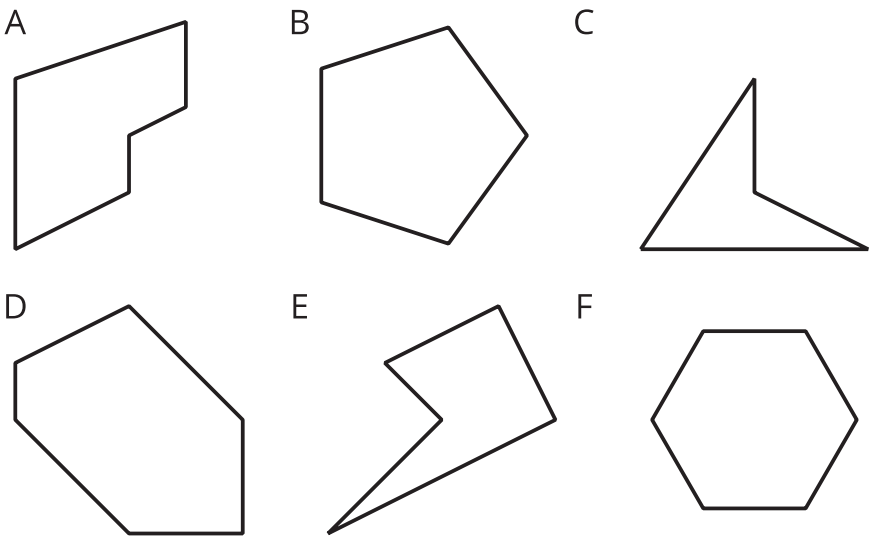
Also, we solved problems involving area and perimeter.



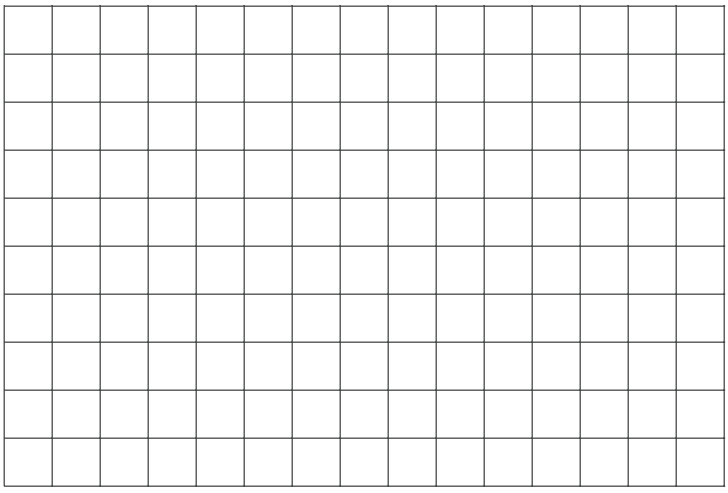
## Section A: Practice Problems

1. **Pre-unit**

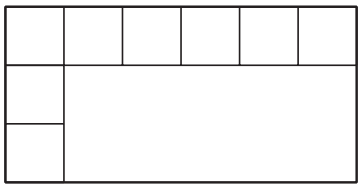
a. Which shapes are hexagons? _____




b. Draw a quadrilateral and label it Q. Draw a pentagon and label it P.



2. **Pre-unit**



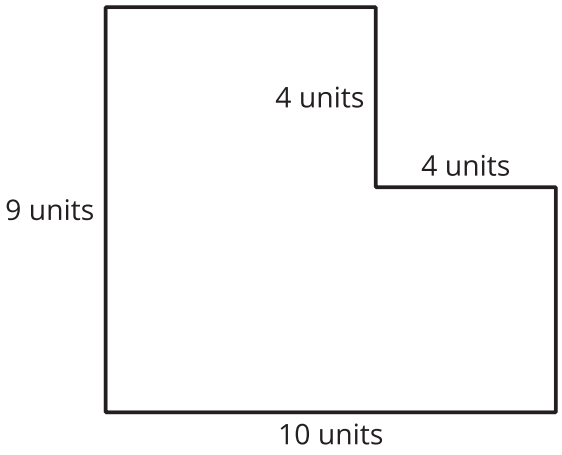
a. Finish covering the rectangle with equal-sized squares.

b. Write an addition equation showing how many small squares there are in the rectangle.

c. Write a multiplication equation showing how many small squares there are in the rectangle.

3. **Pre-unit**

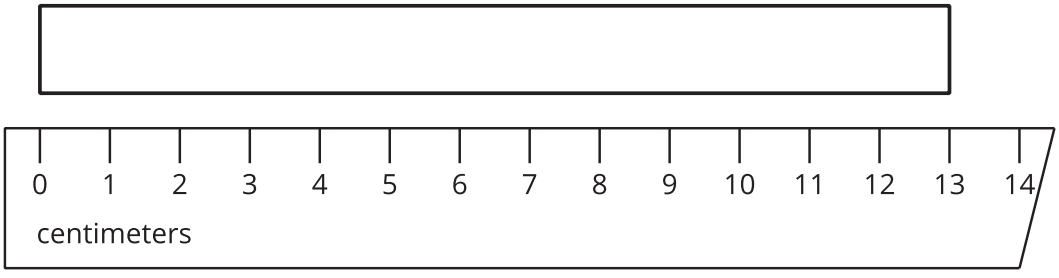
What is the area of the figure?



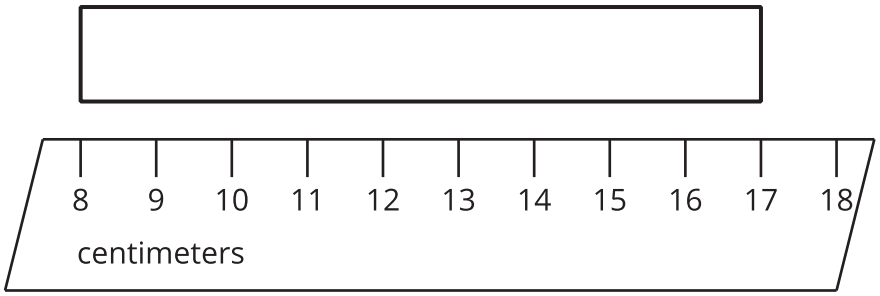

4. **Pre-unit**

Find the length of each rectangle.

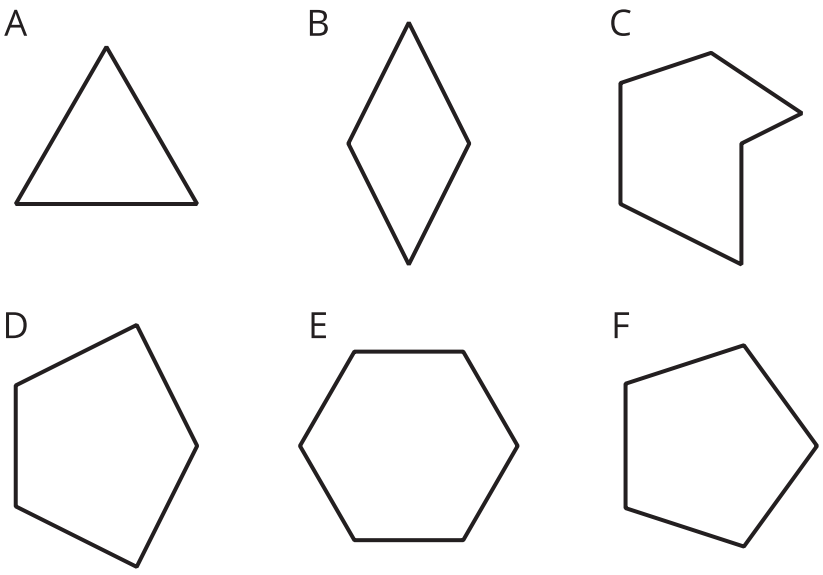
a.



b.




5.

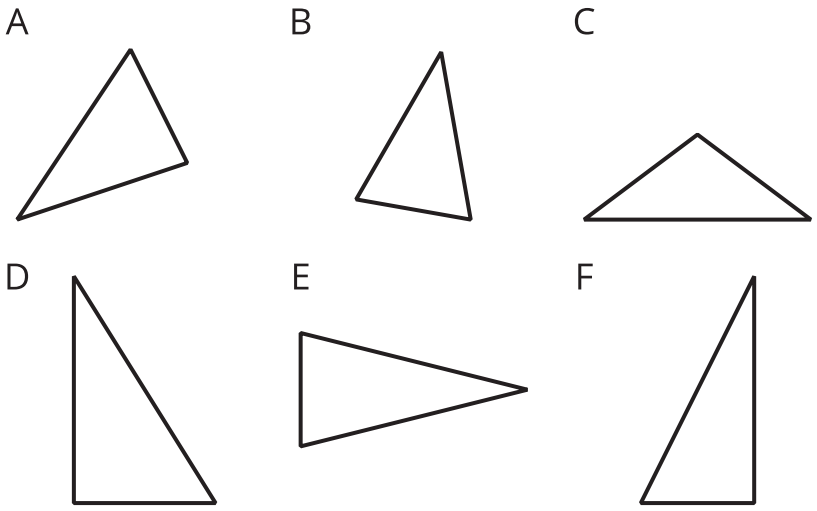



a. Which shapes have 5 angles? _____

b. Which shapes have all side lengths the same size? _____

(From Unit 7, Lesson 1.)

6.

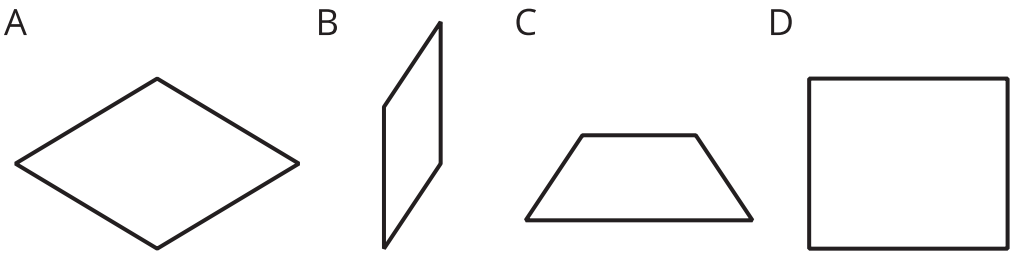



a. Which triangles have one right angle? _____

b. Which triangles have two sides that are the same length? _____

(From Unit 7, Lesson 2.)

7. One of these quadrilaterals is Diego's mystery quadrilateral.




List some questions you would ask to figure out Diego's mystery quadrilateral. How would the answers help you figure out which quadrilateral it is?

_____

_____

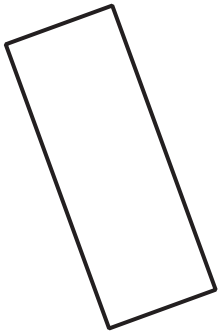
_____

_____

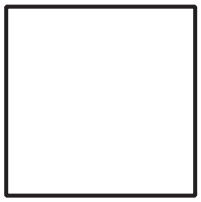
(From Unit 7, Lesson 3.)

8. Select **all** of the quadrilaterals that are rectangles.

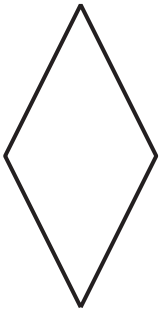
A.



B.



C.

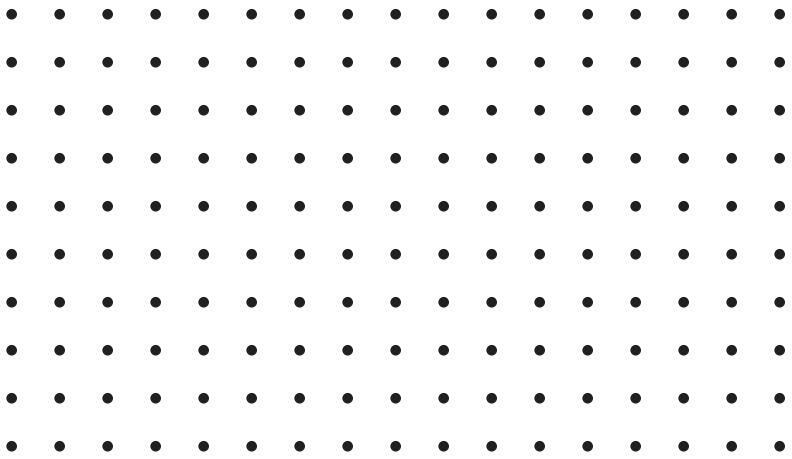


D.

E.

(From Unit 7, Lesson 4.)

9.



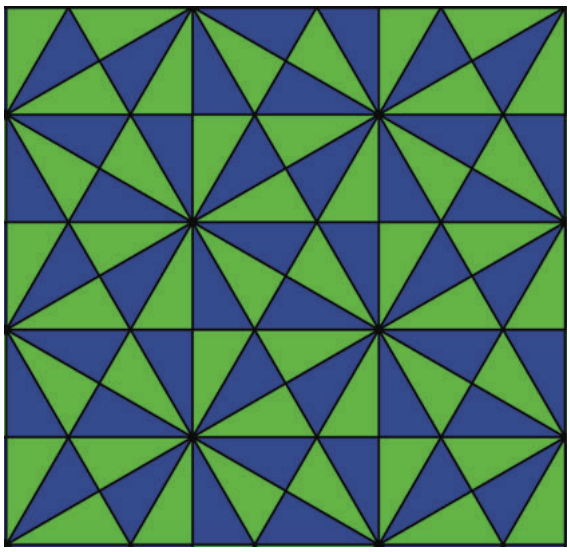
a. Draw a quadrilateral that is *not* a rhombus and label it A. Explain why your shape is not a rhombus.

b. Draw a quadrilateral that is *not* a rectangle and label it B. Explain why your shape is not a rectangle.

(From Unit 7, Lesson 5.)

10. **Exploration**

Find one of each of the following shapes in the image.



a. A triangle with a right angle

b. A triangle with 3 equal sides

c. A rhombus

d. A rectangle

e. A square

11. **Exploration**

Do any of the triangles have:

a. a right angle?

b. two equal sides?

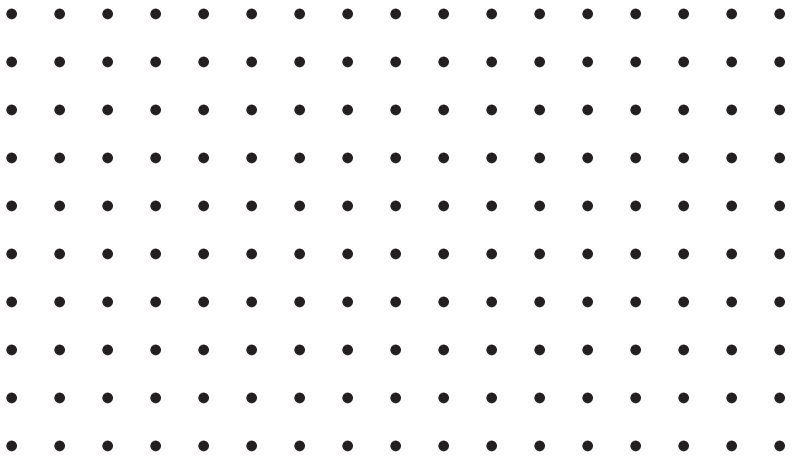
c. three equal sides?

## Section C: Practice Problems

1. A rectangular card has an area of 60 square centimeters. It is 4 centimeters longer than it is wide. What is the perimeter of the card? Explain or show your reasoning.

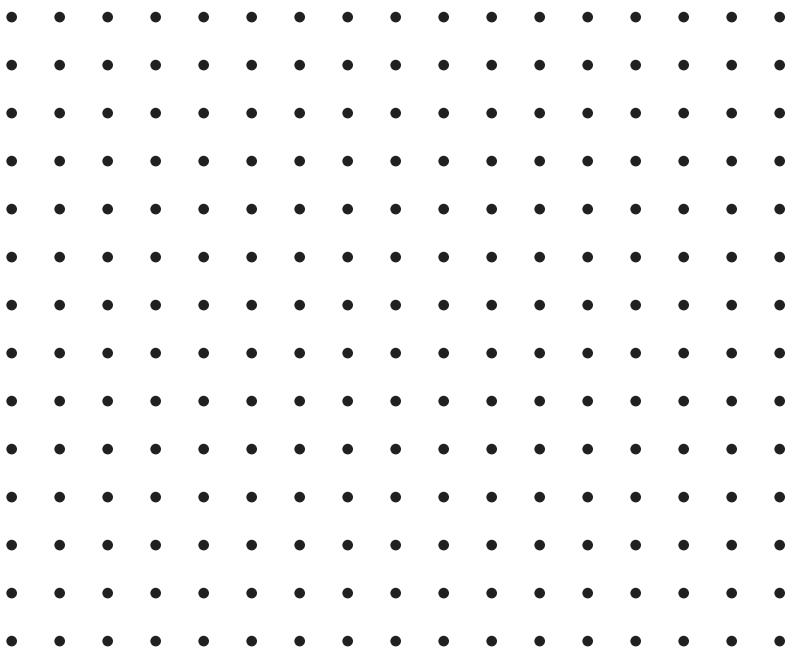
(From Unit 7, Lesson 10.)

2. Draw two rectangles with perimeter 20 units on the grid whose areas are different. What are the areas of the rectangles?



(From Unit 7, Lesson 11.)

3. Draw two rectangles on the grid with area 30 square units whose perimeters are different. What are the perimeters of your rectangles?



(From Unit 7, Lesson 12.)

4. **Exploration**

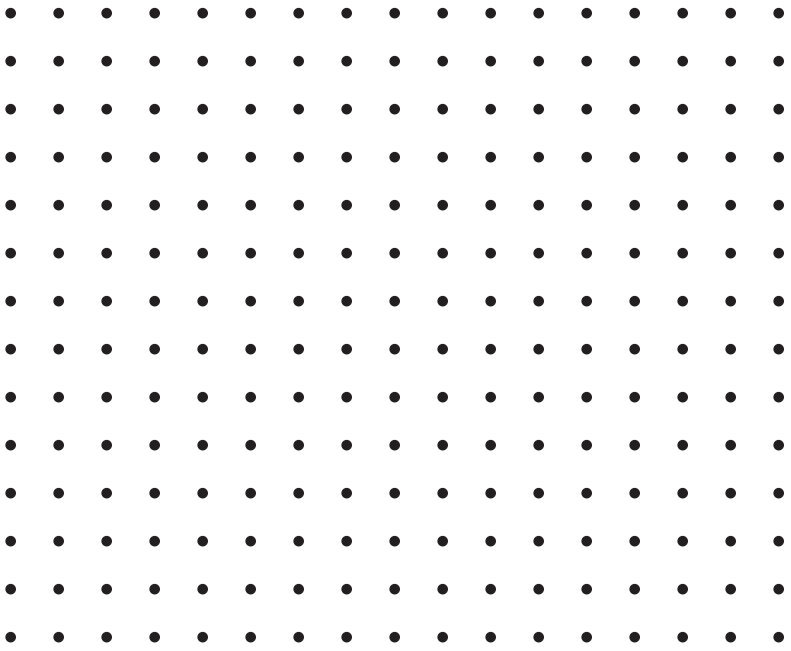
   Clare draws a rectangle.

   a. She tells you that the perimeter is 36. What rectangle could Clare have drawn?

   b. Then she tells you that her rectangle has the biggest area possible. What rectangle could Clare have drawn?

5. **Exploration**

Draw a rectangle on the grid but don't share with your partner. Give your partner clues to help them guess the perimeter and area of your rectangle. Try not to just tell them the side lengths of your rectangle.

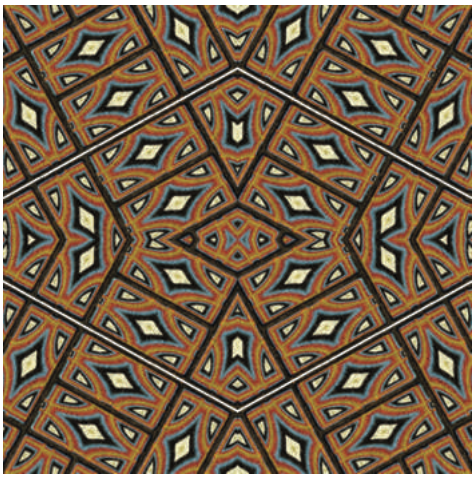


## Section D: Practice Problems

1. The perimeter of a rectangular park is 444 meters. The park is 175 meters long. How wide is the park? Explain or show your reasoning.

(From Unit 7, Lesson 13.)

2. a. Where do you see rhombuses in the design?



b. Where do you see rectangles in the design?

c. Are there any triangles in the design?

(From Unit 7, Lesson 14.)

3. a. The body of your robot has a perimeter of 64 units. What were some different lengths and widths you could choose that fit on the grid?

   b. The head has a perimeter of 36 units. What were some different lengths and widths you could choose for the head that fit on the grid?

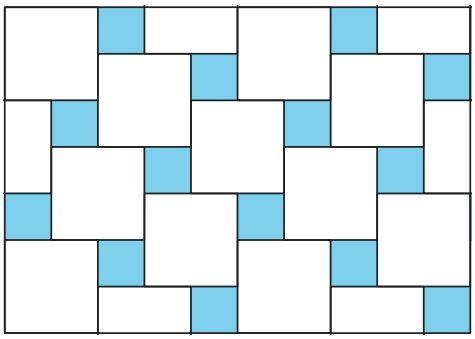
(From Unit 7, Lesson 15.)

4. **Exploration**

   Han is making a rectangular garden in his backyard. He has 42 feet of fencing and the garden needs to be at least 3 feet wide. What are the possible lengths and widths of the garden Han could make? Explain or show your reasoning.

5. **Exploration**

   The small square is 6 inches long. What is the perimeter of the design? Explain or show your reasoning.



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