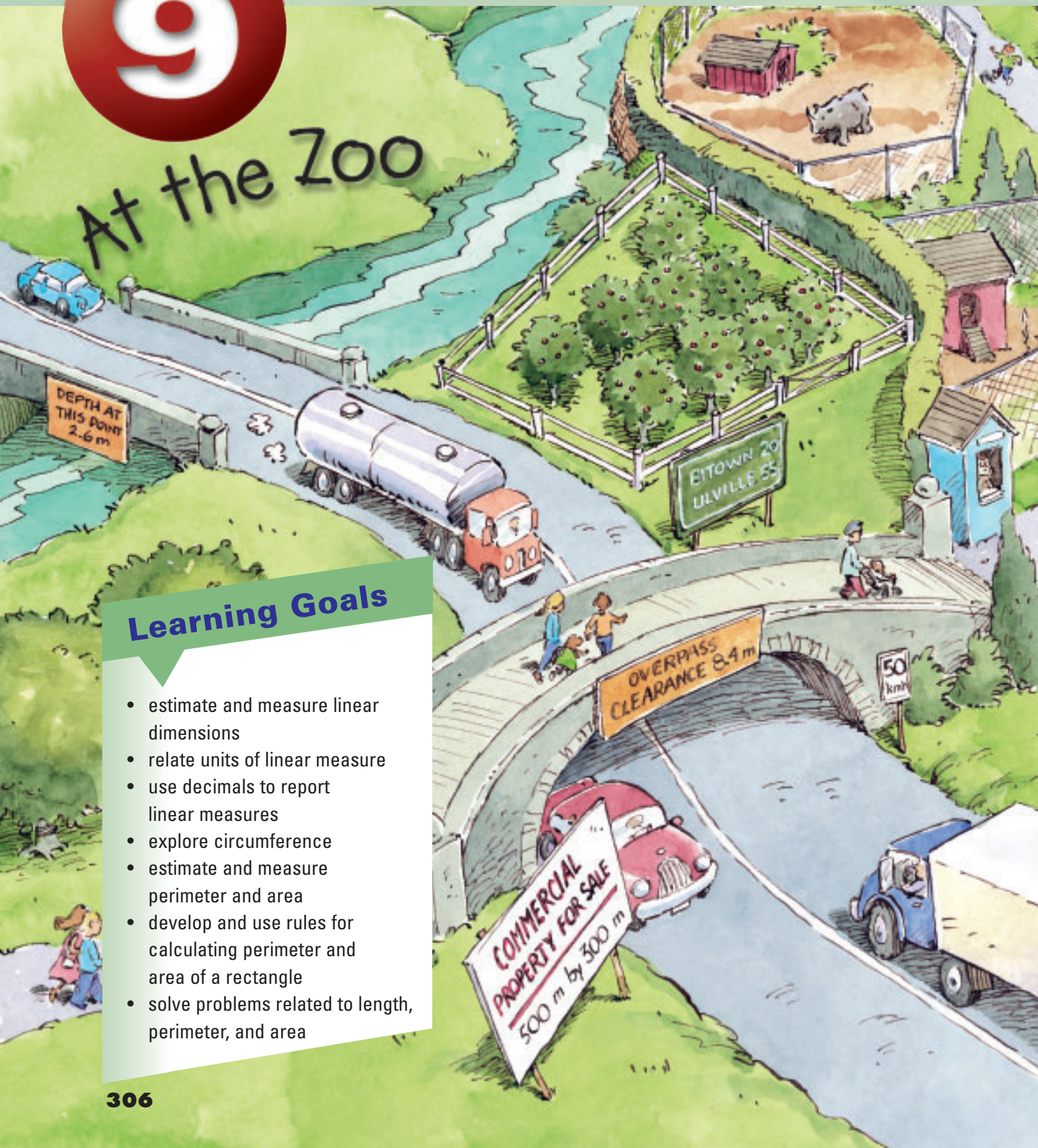
UNIT 9

Length, Perimeter, At the Zoo



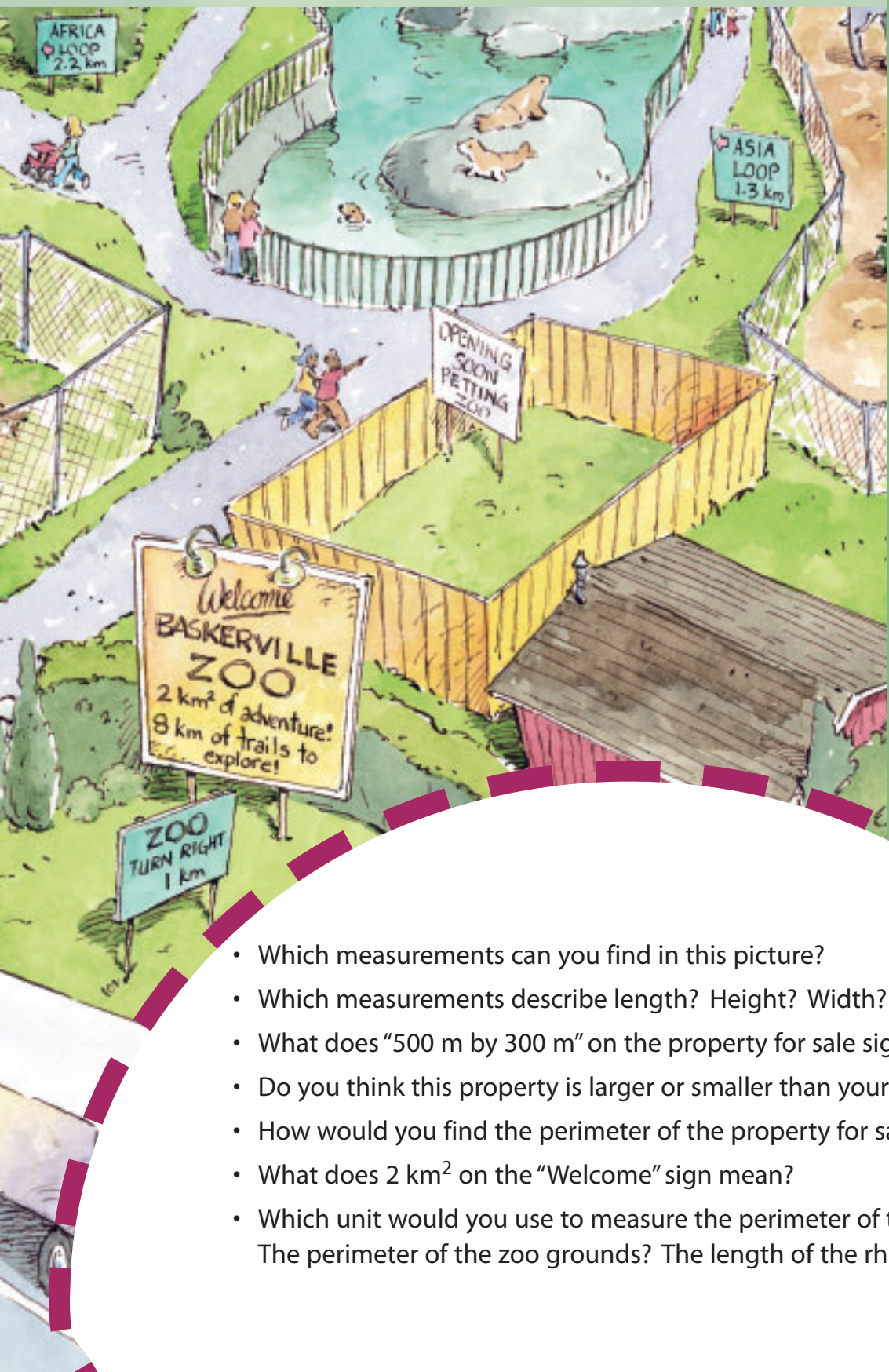
Learning Goals

- estimate and measure linear dimensions
- relate units of linear measure
- use decimals to report linear measures
- explore circumference
- estimate and measure perimeter and area
- develop and use rules for calculating perimeter and area of a rectangle
- solve problems related to length, perimeter, and area

and Area

Key Words

- linear dimensions
- standard units
- non-standard units
- circumference
- scale
- formula



- Which measurements can you find in this picture?
- Which measurements describe length? Height? Width? Area?
- What does "500 m by 300 m" on the property for sale sign mean?
- Do you think this property is larger or smaller than your school's property?
- How would you find the perimeter of the property for sale?
- What does 2 km^2 on the "Welcome" sign mean?
- Which unit would you use to measure the perimeter of the apple orchard? The perimeter of the zoo grounds? The length of the rhinoceros?

LESSON 1

Measuring Linear Dimensions

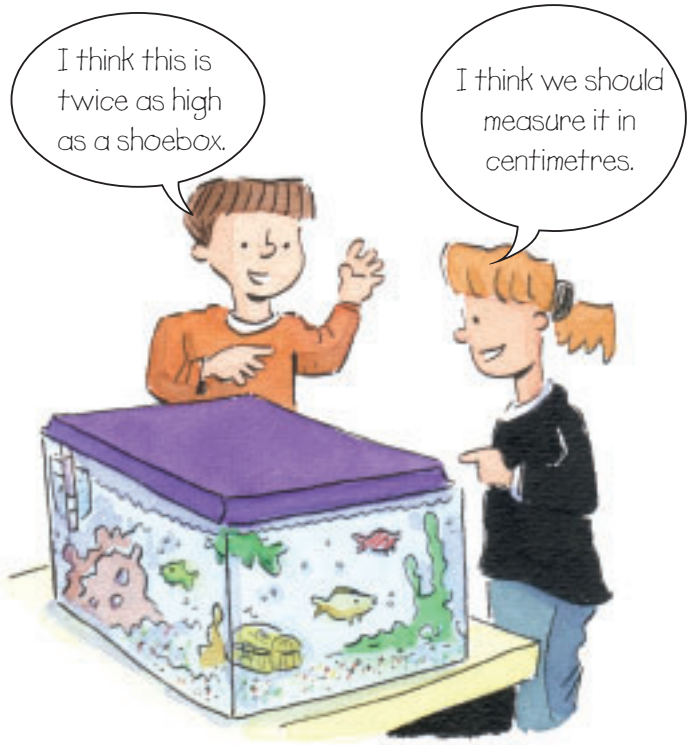
What units could you use to measure the length of this book?

Explore

You will need a ruler and a metre stick or measuring tape.

- Choose an object.
  Find another object that is about twice as high.
  Estimate. Then measure to the nearest unit to check.
- Choose a different object.
  Find another object that is about one-half as wide.
  Estimate. Then measure to check.
- Choose a different object.
  Find another object that is about three times as long.
  Estimate. Then measure to check.

Record your work.



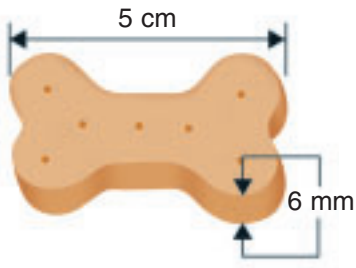
Show *and* Share

Share your work with another pair of students.
Explain how you decided on the units to use to measure.
What strategies did you use to estimate?

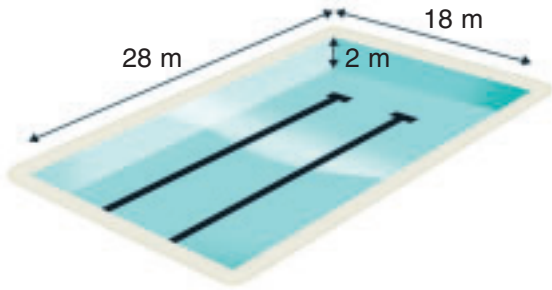
Try to choose objects so you measure:
- in millimetres (mm)
- in centimetres (cm)
- in decimetres (dm)
- in metres (m)

Connect

When you measure the length, width, height, thickness, or depth of an object, you are measuring a **linear dimension**.



This dog biscuit is 5 cm long and 6 mm thick.



This pool is 28 m long and 18 m wide. The depth of the water in the pool is 2 m.

This dog is 4 dm tall.

The Hillsborough River on Prince Edward Island is 45 km long.

Practice

1. Name:

a) an object that is about 2 mm thick
b) an animal that is about 6 m high
c) an object that is about 1 dm long
d) an animal that is about 8 cm long
e) a natural object that is about 7 m high

2. Choose the most appropriate unit for measuring each item. Explain your choice.

a) the length of a driveway
b) the height of a mountain
c) the depth of a footprint in the sand
d) the distance from Calgary to Regina
e) the width of a baby's finger

3. Estimate each linear dimension.
Then measure to the nearest whole unit.
Which tool did you use to measure? Why?

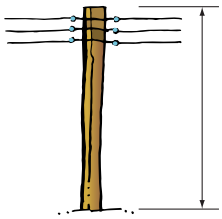
a) the height of your desk
b) the width of the hallway
c) the thickness of a counter
d) the length of a new piece of chalk

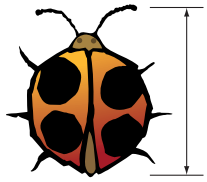
4. Draw a picture of each object. Use grid paper when it helps.

a) a pencil 15 cm long
b) an insect 14 mm long
c) a book 6 cm long and 4 cm wide
d) a flower 1 dm tall

5. Choose the better unit of length for measuring each object.
Why is it better?
Which tool would you use to measure each object?

a) centimetre or metre
b) millimetre or centimetre
c) metre or kilometre





6. Decide if each statement is reasonable.
Explain your thinking.

a) Ellie said that her sun parakeet has a wingspan of 15 dm.
b) Pablo caught a salmon 25 cm long. He said the salmon was big enough to feed his family of 4.
c) Betty says she walks 5 km to school in less than 5 minutes.
d) The length of two shoelaces tied together equals the height of a small child.

Reflect

Choose an object.
Explain how you decide which unit and which tool to use for measuring its linear dimensions.

Numbers Every Day

Number Strategies

Write each number in words, and in expanded form.

21 352

210 001

LESSON 2

Relating Units of Measure

Explore

Each of you will need string, scissors, a ruler, and a metre stick or measuring tape.

➤ Cut off a piece of string you think will fit each description:
- between 1 and 2 m long
- between 50 and 100 cm long
- shorter than 1 dm

➤ Trade strings with your partner.
Measure your partner's strings to the nearest centimetre.
Then record each measurement in metres, decimetres, centimetres, and millimetres.

Show *and* Share

Share your measurements with your partner.
Explain how you changed centimetres to the other units of length.
How did you use decimals to record some of your measures?

Connect

There are relationships among the units you use to measure length.

➤ You can read the height of this troll in several ways.

Lesson Focus | Describe the length of an object in different units.

1 mm = 0.1 cm
1 mm = 0.01 dm

1 cm = 10 mm
1 cm = 0.1 dm
1 cm = 0.01 m

1 dm = 100 mm
1 dm = 10 cm
1 dm = 0.1 m

1 m = 1000 mm
1 m = 100 cm
1 m = 10 dm

1 km = 1000 m

➤ Change 0.28 dm to millimetres.
1 dm = 100 mm
So, 0.28 dm = 0.28 × 100 mm
= 28 mm

➤ Change 3.8 dm to centimetres.
1 dm = 10 cm
So, 3.8 dm = 3.8 × 10 cm
= 38 cm

➤ Change 12 mm to centimetres.
10 mm = 1 cm
So, 12 mm = $\frac{12}{10}$ cm
= 1.2 cm

➤ Change 23 cm to metres.
100 cm = 1 m
So, 23 cm = $\frac{23}{100}$ m
= 0.23 m

Practice

Use a metre stick when it helps.

1. The Komodo dragon is the world's largest lizard.
It can grow to a length of 3 m.
Write this length in decimetres and in centimetres.

2. Copy and complete.
a) 9.6 dm = ☐ cm
b) 15 mm = ☐ cm
c) 5.3 dm = ☐ mm
d) 17 cm = ☐ dm
e) 0.45 m = ☐ cm
f) 45 cm = ☐ m

3. How many centimetre cubes do you need to make a line of each length?
a) 50 mm **b)** 1.2 m **c)** 21.6 dm **d)** 70 mm

4. Record each measure in millimetres, decimetres, and metres.
a) 24 cm **b)** 17 cm **c)** 80 cm **d)** 145 cm

5. Record each measure in millimetres, centimetres, and decimetres.
a) 3 m **b)** 2.5 m **c)** 1.4 m **d)** 0.9 m

6. Draw a feather of each length.
Then write each length in 3 different units.

a) 50 mm **b)** 3 cm
c) 1.1 dm **d)** 0.07 m

7. Copy and complete. Use =, <, or >.
Explain how you know.

a) 5.56 m ☐ 70 dm **b)** 250 cm ☐ 1.46 m
c) 16 mm ☐ 1.6 cm **d)** 3000 mm ☐ 2.8 m
e) 5.3 dm ☐ 53 cm **f)** 2.90 m ☐ 227 cm

8. The great white shark can grow to a length of 4.9 m.
The mako shark can grow to a length of 40 dm.
Which shark can grow to the greater length? Explain.

9. Jackie is 123 cm tall.
Suppose she wants to know her height in metres.
How will the number that represents her height in metres compare to the number that represents her height in centimetres? Explain.

10. Rico is 1.21 m tall, Jeremy is 10.3 dm tall, and Sasha is 131 cm tall.
Order the students from shortest to tallest.
Who is tallest? By how much? Explain.

11. Hannah-Li plans to measure the width of the classroom door in millimetres and decimetres. Which will be greater: the number that represents the width in millimetres or the number that represents the width in decimetres? How do you know?

Math Link

Number Sense

Since $0.1 = \frac{1}{10}$, we can multiply by 0.1 to change millimetres to centimetres, and decimetres to metres.

12 mm = 12×0.1 cm = 1.2 cm

Reflect

Explain how to change a measurement from one unit to another.
Give examples to support your answer.

Numbers Every Day

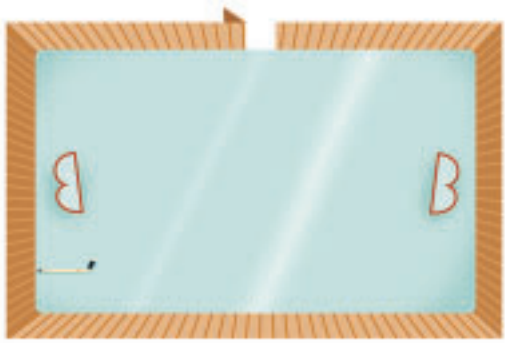
Mental Math

Multiply or divide.

$27.2 \div 10$
3.08×100
$41.2 \div 10$
1.82×10
0.95×100

LESSON 3

Using Non-Standard Units to Estimate Lengths



About how many hockey sticks long is the rink?

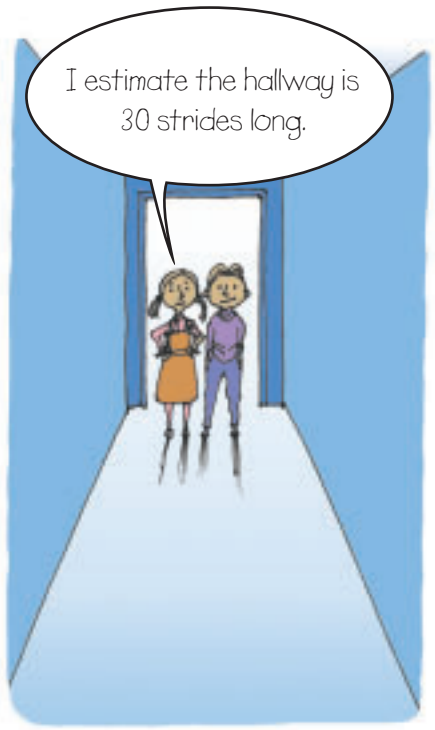
About how many car lengths are there between the blue car and the yellow car?

Explore

Suppose you do not have a ruler, a metre stick, or a measuring tape.

- Choose a long length such as the length of the classroom or the width of the playground.
- Use a stride as a unit.
- Estimate the length you chose, in strides. Then measure with strides to check your estimate.
- Choose a new unit. Estimate the length you chose, in the new unit. Then measure to check your estimate.

Record your work.



Show *and* Share

Show your results to another pair of students.
Share how you chose your unit of length and how you made your estimate.
How do the measures in strides and the other unit compare?

Connect

- Metres and kilometres are **standard units**. You use them to estimate and measure long lengths.
- Units such as floor tiles, car lengths, and strides are **non-standard units**. They can also be used to estimate and measure long lengths.
- A car length is longer than a stride. The measure of a distance in car lengths will be less than the measure of the same distance in strides.

Practice

1. Estimate each distance in strides.
Then measure to check your estimates.
a) the distance from the teacher's desk to the classroom door
b) the distance from your classroom door to the principal's office

2. Compare your measurements from question 1 with those of two other classmates. Why are the results different?

3. Explain how you could use the height of a classmate to measure the length of the playground.

4. Suppose you want to find out how many tables could be lined up in the hallway. How could you do this without moving the tables?
Are you and a classmate likely to get the same result? Explain.

Reflect

Describe a situation when you might want to estimate a long length using a non-standard unit.

Numbers Every Day

Calculator Skills

Add.

$$\begin{array}{r} 4356 \\ 2722 \\ +\ 5006 \\ \hline \end{array}$$

LESSON 4

Measuring Distance Around a Circular Object

Explore

You will need a collection of circular objects, string, scissors, and a metre stick.

- Predict the order of the objects from the object with the greatest distance around to the object with the least distance around.
- Choose an object from the collection.
  Estimate the distance around the object.
  Use any materials you like to measure the distance.
- Record the estimate and the measurement.
- Repeat the activity with other objects.
- Order the objects from the object with the greatest distance around to the object with the least distance around.

Object	Estimate	Measurement

Show *and* Share

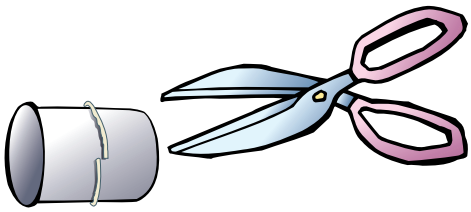
Share your results with another pair of students.
Discuss the strategies you used to measure the distance around an object.
How did you use one measurement to help estimate the next?

Connect

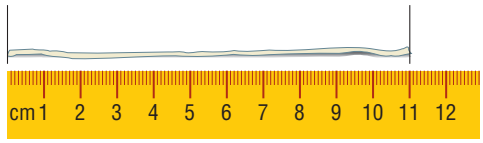
The distance around a circular object or figure is its **circumference**.

Here is one way to find the circumference of a circular object.
Use string and a ruler.

Cut a length of string equal to the circumference of the object.



Measure the string.



The circumference of this film canister is 11 cm.

Practice

1. Which unit and which tool would you use to measure the circumference of each item? Explain your choice.

a) a bicycle wheel
b) a garbage can
c) a diamond ring
d) Earth
e) a circus ring
f) a lollipop stick

2. Estimate first. Then find the circumference of each object in the classroom.

a) the leg of your chair
b) a piece of chalk
c) a globe

3. Work with a partner. Estimate, then measure, the distance around your partner's:

a) wrist **b)** baby finger **c)** ankle

Why might you want to know these measurements?

4. Find an object with each circumference. Measure to check.

a) about 1 m
b) about 5 cm

Numbers Every Day

Number Strategies

Find each pattern rule. Write the next 5 terms in each pattern.

- 190, 179, 168, 157, ...
- 190, 192, 196, 202, ...

5. You can estimate the age of a tree by measuring the circumference of its trunk.
Each 2 cm of circumference represents about one year of growth.

a) An oak tree has a circumference of 81 cm.
About how old is the tree?

b) Manny's elm tree is 13 years old.
What is the approximate circumference of the tree?

6. Karen planted a maple key when she was 4 years old.
Karen is now 39 years old.
Use the data in question 5.
What is the approximate circumference of the maple tree today?

7. A bracelet has a circumference of 15 cm.
Could you wear the bracelet? How do you know?
Show your work.

8. Trace a circular object.
Look at the circle you drew. Estimate its circumference.
How could you check your estimate?

9. Dalton plans to measure the circumference of a circular pool.
Which will be the lesser number: the circumference in metres, or the circumference in centimetres? How do you know?

10. Use the objects from *Explore*.
For each object, estimate about how many times as long as the width the circumference is.
Measure the width of each object.
Use your circumference measurements from *Explore*.
How do you think the width and the circumference are related?

Reflect

Write a letter to a friend to explain how to find the circumference of a telephone pole.

At Home

Measure the circumference of a tree in your neighbourhood.
Use this measure to estimate the age of the tree.

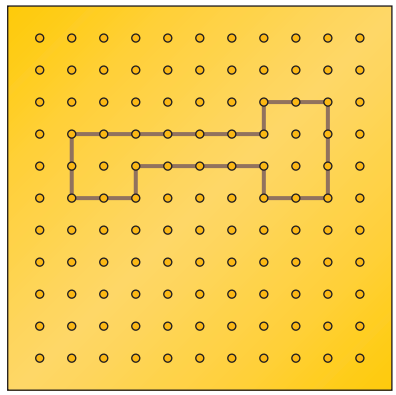
LESSON 5

Using Grids to Find Perimeter and Area

Miss Dahlia likes unusual shapes. How might you find the area of her vegetable garden?

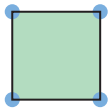
Explore

You will need an 11 by 11 geoboard, geobands, and dot paper.



- Make this figure on the geoboard. Find its perimeter and its area.
- On the geoboard, make a different figure. The figure must have square corners.

You may do this:



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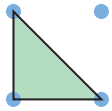


Draw the figure on dot paper. Find the perimeter and the area.

Show *and* Share

Talk with another pair of students about how you used the geoboard or dot paper to measure perimeter and area.

Numbers Every Day

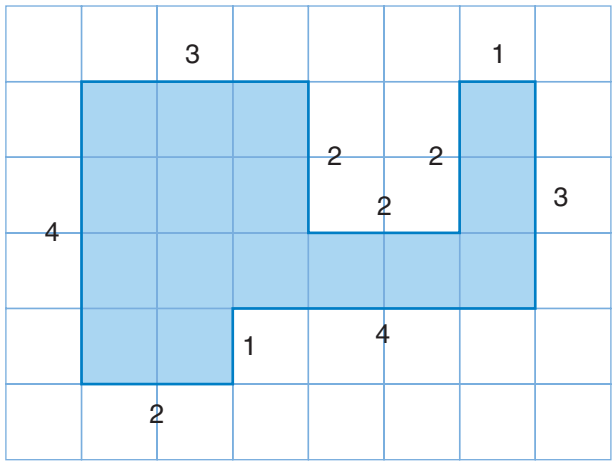
Number Strategies

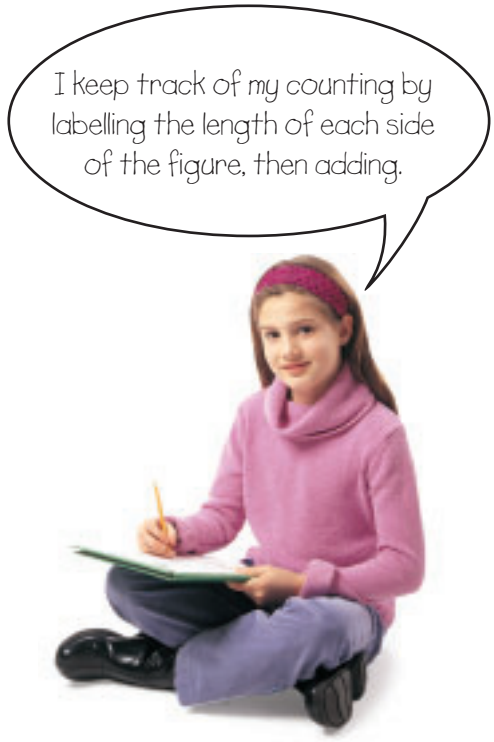
Order these numbers from greatest to least.

125 493, 215 934, 159 234, 251 439

Connect

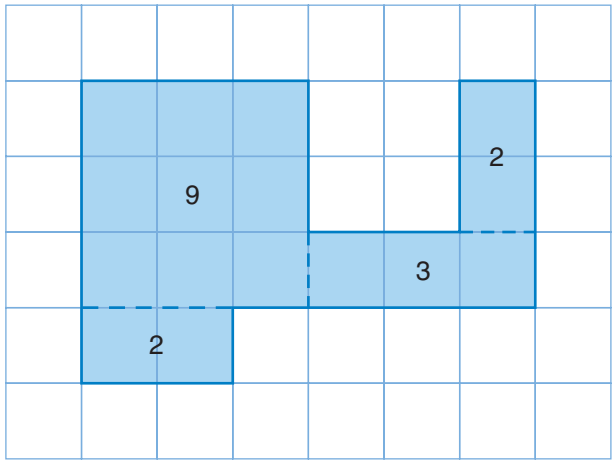
➤ One way to find the *perimeter* of this figure on 1-cm grid paper is to count the units along the outside of the figure.





Each side of every square on this grid is 1 cm long.
3 + 2 + 2 + 2 + 1 + 3 + 4 + 1 + 2 + 4 = 24
The perimeter is 24 cm.

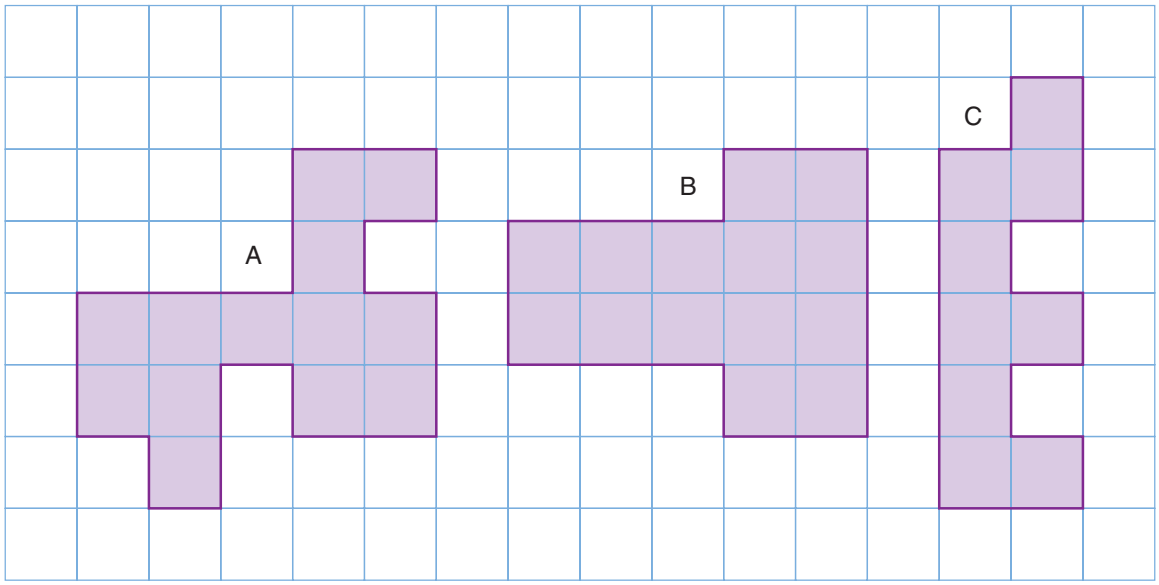
➤ One way to find the *area* of this figure is to count the squares inside the figure.



Each square on the grid has an area of 1 cm^2.
9 + 2 + 3 + 2 = 16
The area of the figure is 16 cm^2.

Practice

1. **a)** Estimate first. Then find the perimeter and area of each figure on this 1-cm grid.



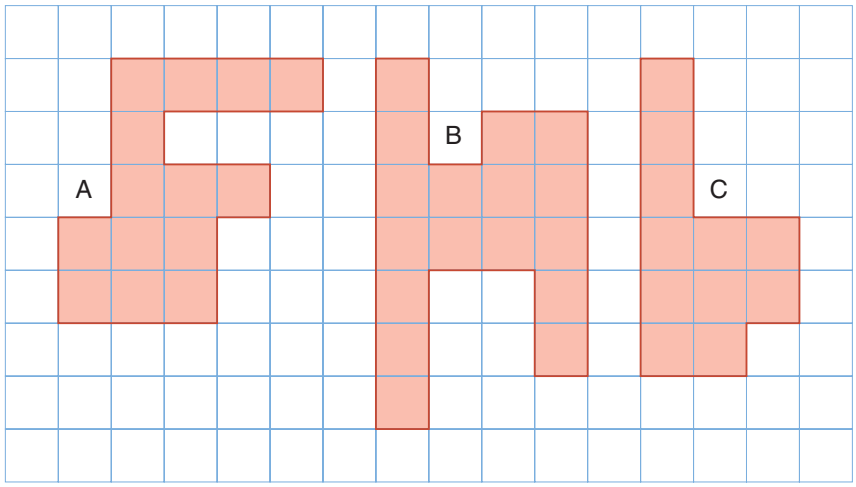
b) Order the figures from least to greatest perimeter.
Then order them from least to greatest area.

2. Use 1-cm grid paper. Draw only on the lines.
Draw 3 figures.
Find and record the perimeter and area of each figure.

3. Use a geoboard. Make a figure with perimeter 16 units.
The figure must have square corners.
Draw your figure on grid paper.
a) Explain how you know the perimeter is 16 units.
b) What is the area of your figure?
c) Make a different figure with perimeter 16 units.
What is the area of this figure?

4. Use a geoboard.
Make a figure to fit each description.
Each figure should have only square corners.
a) a perimeter of 12 units and an area of 5 square units
b) a perimeter of 14 units and an area of 6 square units
c) a perimeter of 10 units and an area of 5 square units
Record your work on grid paper.
Describe each figure you made.

5. These 3 figures have different perimeters.



Copy the figures onto 1-cm grid paper.
Change 2 of the figures so that all 3 figures have equal perimeters.

6. Miss Dahlia wants to make a flower garden with an unusual shape.
She has 28 m of fencing to enclose the garden.

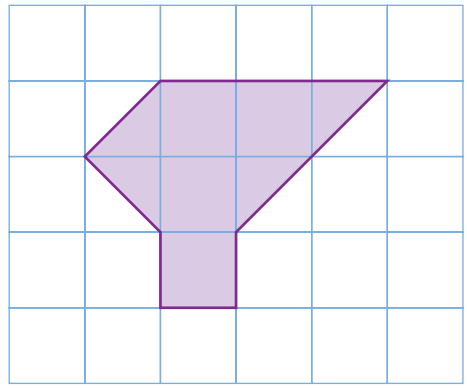
a) Draw 3 different figures on 1-cm grid paper
for Miss Dahlia to choose from.
Let the length of each square on the grid represent 1 m.

b) Which one of your 3 figures will give Miss Dahlia
the greatest amount of space for planting flowers?

Show your work.

7. **a)** Use 1-cm grid paper.
Draw a 1-cm, a 2-cm, a 3-cm, and a 4-cm square.
Use a ruler to draw a diagonal on each square.
Measure and record the length of each diagonal.
Compare the side length of each square to the
length of its diagonal. What do you notice?

b) Danny said the perimeter of this figure is 10 cm.
Do you agree? Explain.



Reflect

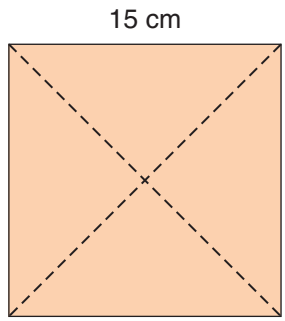
Describe how to find the perimeter and area of a figure drawn on the lines of grid paper. Use pictures and words to explain.

LESSON 6

Measuring to Find Perimeter

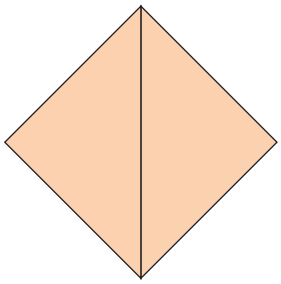
Explore

You will need a 15-cm by 15-cm cardboard square, a ruler, and scissors.

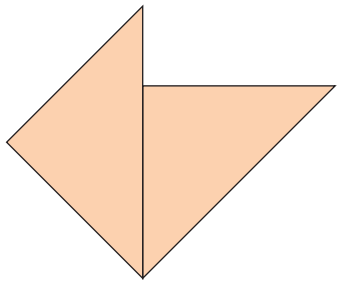


- Draw diagonals on the square. Cut along the diagonals to make 4 congruent triangles.
- Use all 4 triangles to make a polygon. Sides with the same length must align.

You may do this.



You may *not* do this.



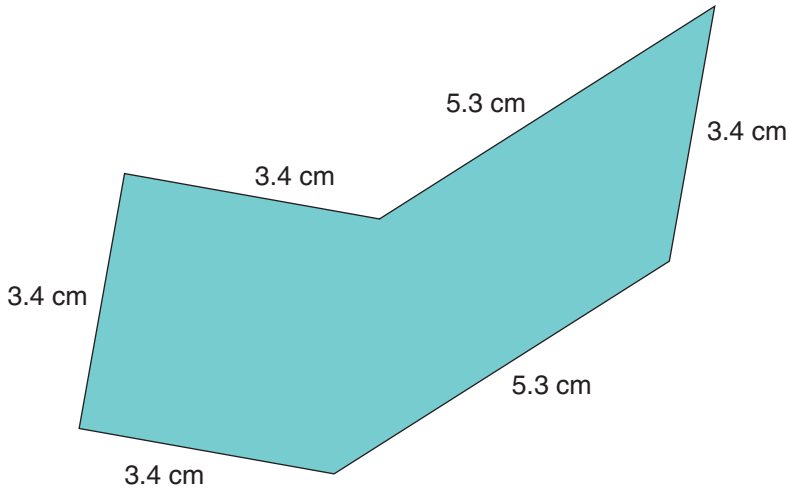
- Measure to find the perimeter of the polygon. Record your work.
- Repeat with other polygons. Try to make one polygon with 3 sides, one with 4 sides, one with 5 sides, and one with 6 sides.

Show *and* Share

Share your work with another pair of students.
Discuss the strategies you used to find the perimeters of the polygons.
Did you find any shortcuts?
What can you say about the area of each polygon you made?

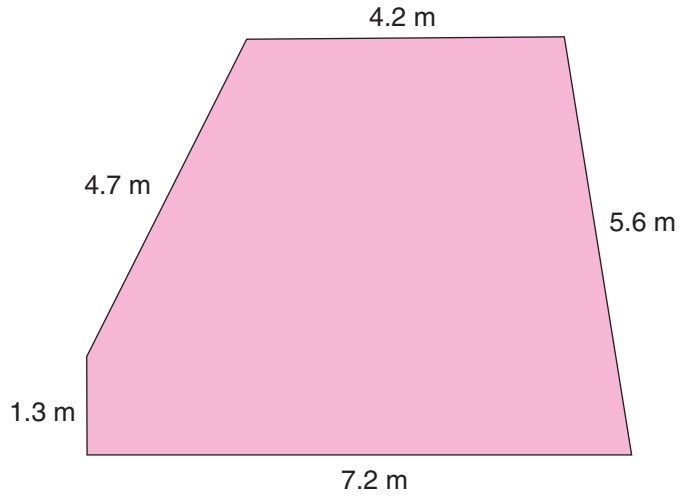
Connect

➤ To find the perimeter of a polygon, measure the lengths of its sides, then add.



Perimeter = 5.3 cm + 3.4 cm + 5.3 cm + 3.4 cm + 3.4 cm + 3.4 cm
Perimeter = 24.2 cm

➤ Some polygons are too large to draw on a page.
A polygon like this is drawn to **scale**.
The drawing is similar to the polygon.
It has the same shape as the polygon, but it is smaller.
The length of each side is given.
To find the perimeter of the polygon, add the lengths of its sides.



Perimeter = 4.2 m + 5.6 m + 7.2 m + 1.3 m + 4.7 m
Perimeter = 23.0 m

Numbers Every Day

Number Strategies

Estimate each sum.

1356 + 2478

5020 + 2891

4522 + 3005

Which strategies did you use?

Practice

1. Choose the most appropriate unit of length. Explain your choice.
Measure to find the perimeter of each object.
Which tool did you use to measure?

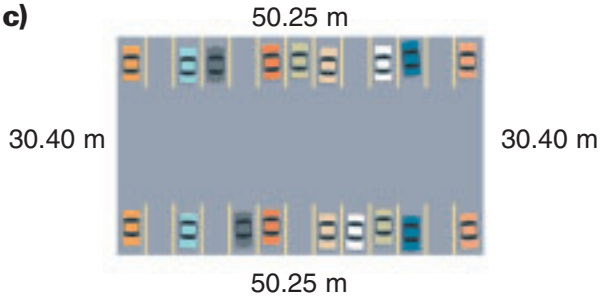
a) a number key on your calculator
b) your math book
c) the classroom
d) a desk or a table

2. Find the perimeter of each object.
Write each perimeter in a different unit.

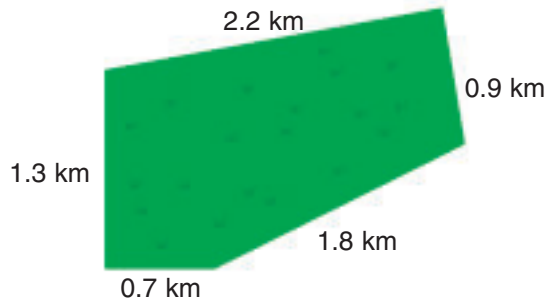
a)

b)

c)

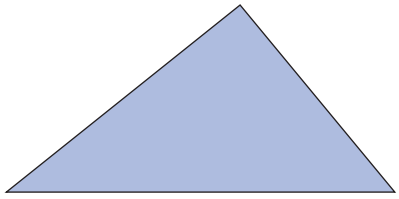


d)

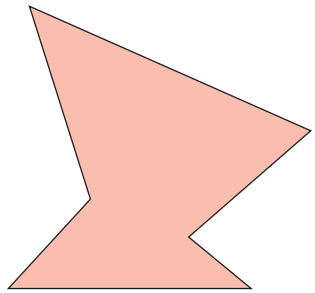


3. Estimate first. Then measure to find each perimeter.
Write each perimeter in centimetres and in millimetres.

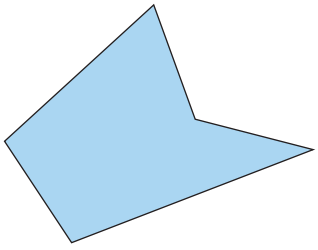
a)



b)



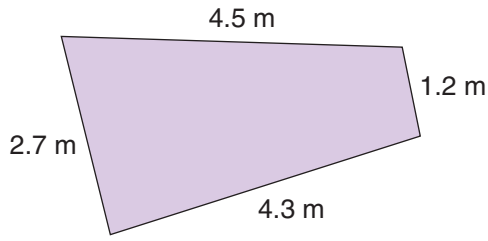
c)



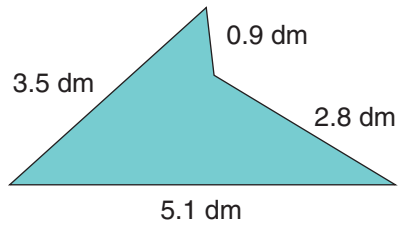
d)

4. Find the perimeter of each region.

a)



b)



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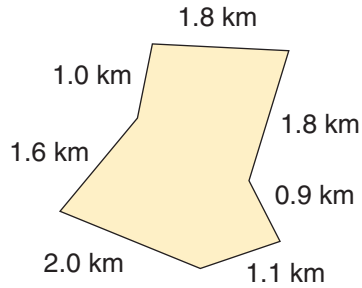

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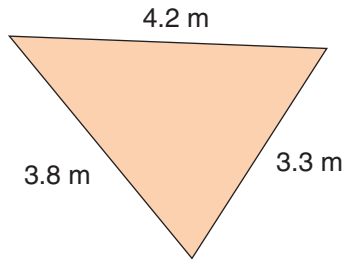


5. Find the perimeter of each figure.

a) a rectangle with sides 1.6 dm and 2.7 dm

b) a triangle with sides 27 mm, 16 mm, and 21 mm

c) a pentagon with sides 1.0 m, 2.3 m, 2.2 m, 1.6 m, and 1.5 m

6. Donald's garden is rectangular. The garden is 14 m long. Its perimeter is 47 m. How wide is the garden?

7. Kim's garden is rectangular. Its perimeter is 55.0 m. Two sides of the garden have lengths between 12.0 m and 12.8 m.

a) What might the dimensions of the garden be? How many answers can you find?

b) How do you know the garden is not square? Show your work.

8. Which unit of length would you use to find each perimeter?

a) a large city **b)** a swimming pool **c)** a placemat

d) a football field **e)** a movie ticket **f)** Saskatchewan

Explain your choice.

Reflect

Draw any polygon. Explain how to find its perimeter.

LESSON 7

Calculating the Perimeter of a Rectangle

Explore

You will need 24 Colour Tiles or congruent paper squares, and 2-cm grid paper.

- Model all the different rectangles you can make using 16 tiles.
  Record each rectangle on grid paper.
  How do you know you have found all the rectangles?
  Record, in a table, the length, the width, and the perimeter of each rectangle in units.

Length	Width	Perimeter

- Repeat the activity with 24 tiles.
- Write a rule for finding the perimeter of a rectangle without counting every unit along the outside of the rectangle.
  Explain your rule.

Show *and* Share

Compare your rule with the rule of another pair of students.
How are the rules the same? Different?
How is the perimeter of a rectangle related to its length and width?
How would you change your rule to find the perimeter of a square?

Numbers Every Day

Number Strategies

Change the units to centimetres.

2.58 dm
258 mm
258 m

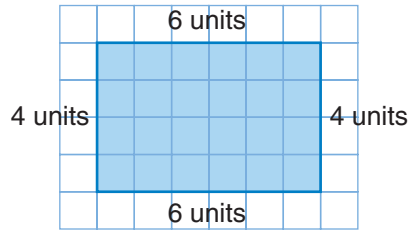
Lesson Focus | Develop rules for calculating the perimeter of a rectangle.

Connect

➤ Here are two different rules for finding the perimeter of a rectangle.
Each rule can be expressed by a **formula**.

A formula is a short way to state a rule.

To find the perimeter of a rectangle:
Multiply the length by 2.
Multiply the width by 2.
Then add.

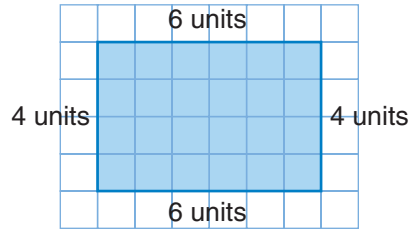


$2 \times 6 = 12$
$2 \times 4 = 8$
$12 + 8 = 20$
Perimeter = 20 units

Formula

Perimeter = 2 × length + 2 × width

To find the perimeter of a rectangle:
Add the length and width.
Then multiply by 2.



$6 + 4 = 10$
$10 \times 2 = 20$
Perimeter = 20 units

Formula

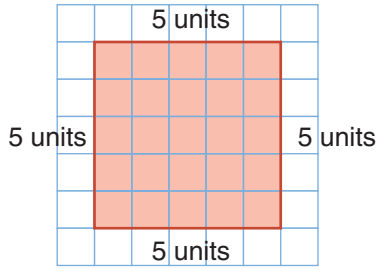
Perimeter = (length + width) × 2

The brackets show that you add the length and width, then multiply the sum by 2.

➤ Here is a shortcut to find the perimeter of a square.

To find the perimeter of a square, I multiply the side length by 4.

$5 \times 4 = 20$
Perimeter = 20 units



Formula

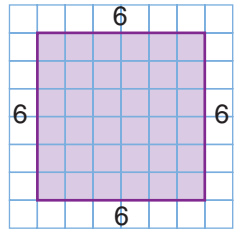
Perimeter = side length × 4

Math Link

Number Sense

To find the perimeter of a square,
use repeated addition or multiplication.
The perimeter is:

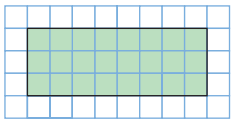
$6 + 6 + 6 + 6 = 4 \times 6$
$= 24$

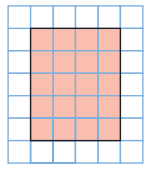


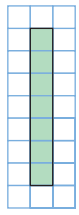
This shows that repeated addition is the same as multiplication.

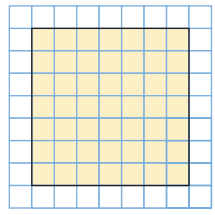
Practice

1. Use Colour Tiles. Make each rectangle.
Find its perimeter in units. Show your work.

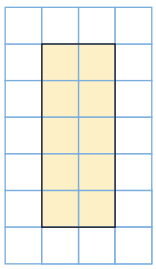
a) 

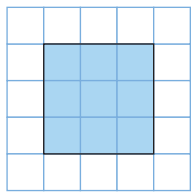
b) 

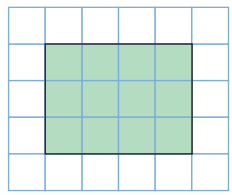
c) 

d) 

2. Draw each rectangle on 1-cm grid paper.
Find the perimeter of each rectangle. Show your work.

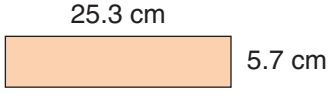
a) 

b) 

c) 

3. Use the dimensions of each rectangle to find its perimeter.
Then write each perimeter in a different unit.

a)



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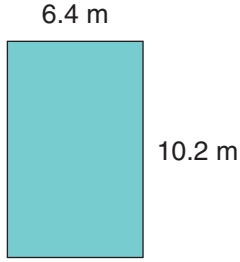

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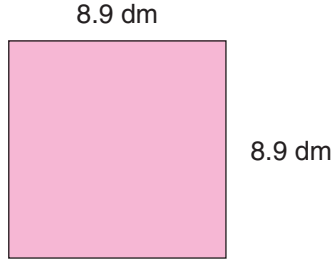
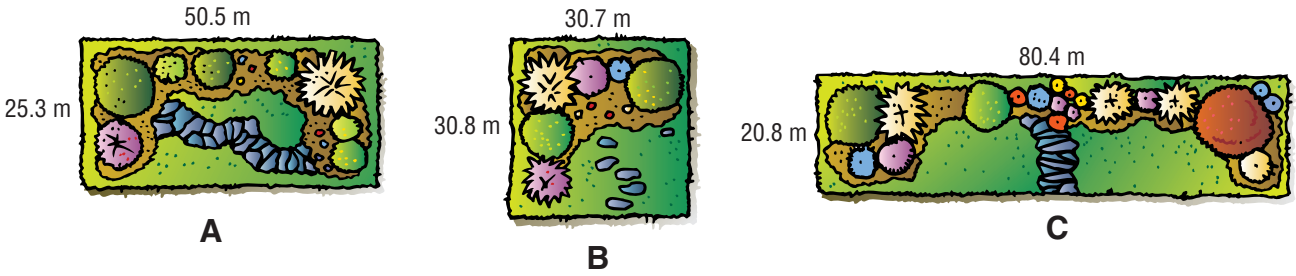


4. Measure the length and width of a rectangular table to the nearest unit. Use these dimensions to find the perimeter of the table. Show your work.

5. Which garden needs the most fencing to enclose it? Explain how you know.



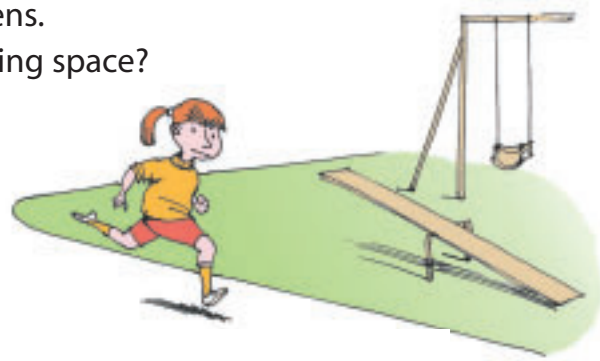
6. The playground at the Community Centre is rectangular. Its length is 60 m. The perimeter is 180 m. What is the width of the playground?

7. The perimeter of Tony's rectangular apple orchard is 1 km. How long might each side be?

8. The perimeter of a square patio is 12.8 m. How long is each side? Explain how you know.

9. The Grade 5 students at Potter Avenue School are planting a rectangular garden. The side lengths will be whole numbers of metres. Twenty-eight metres of fencing will be used for the border. Use grid paper to draw all the possible gardens. Which garden would provide the most growing space? The least growing space? Show your work.

10. Royanna jogs laps around a park playground. The playground is 90 m long and 35 m wide. How many laps will it take her to jog 1 km?



Reflect

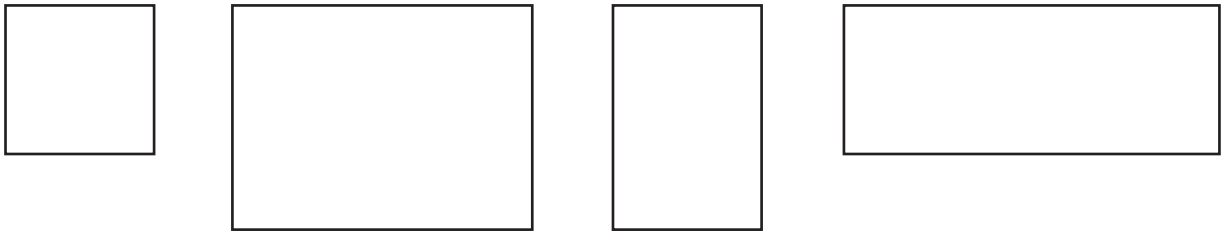
Draw a square on 1-cm grid paper. Label it with its side length. Use two different formulas to find the perimeter of the square. Which formula do you prefer? Explain.

LESSON 8

Calculating the Area of a Rectangle

Explore

You will need paper rectangles, a 1-cm cardboard square, a ruler, and a transparent 1-cm grid.



- Choose a rectangle.
  Use only the 1-cm square and a ruler.
  Find the area of the rectangle.
  Verify the area by using the transparent grid.
- Repeat this activity to find the areas of the other rectangles.
- Write a rule for finding the area of a rectangle without counting every square.

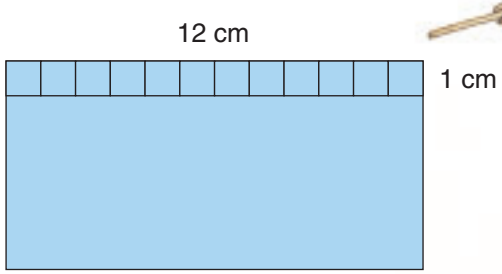
Show *and* Share

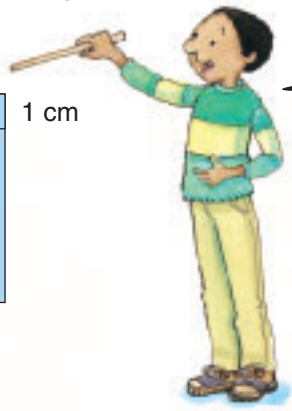
Share your results with another pair of students.
Discuss the strategy you used to find the area of a rectangle without a grid.
Explain the thinking behind your strategy.

Connect

➤ Here is one way to find the area of a rectangle.

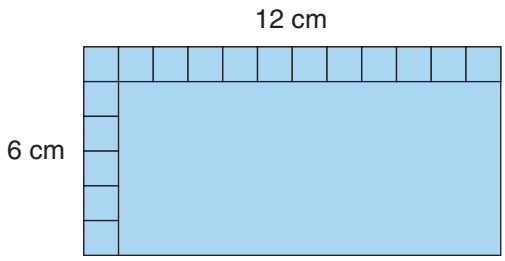
Measure the length of the rectangle.





The length tells how many 1-cm squares fit along it. The length is 12 cm. So, twelve 1-cm squares fit along the length.

Measure the width of the rectangle.



The width tells how many rows of 1-cm squares fit in the rectangle. The width is 6 cm, so there are 6 rows.

Multiply the length by the width.
$12 \times 6 = 72$
So, the area of the rectangle is 72 cm^2.

To find how many 1-cm squares fit in the rectangle, we multiply the length of a row by the number of rows.

We can write this rule:
To find the area of a rectangle, multiply the length by the width.

This rule can be expressed as a formula.

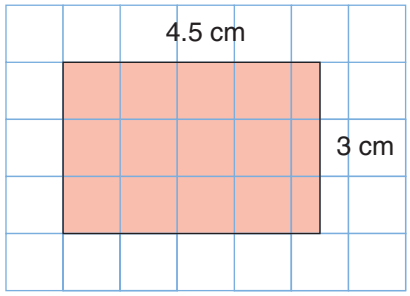
Area = length × width

length

Area = length × width

width

➤ We can use the same method when the dimensions are not whole numbers.

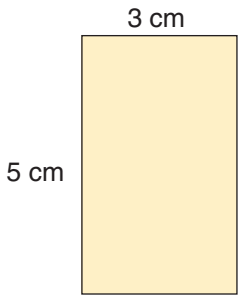


The rectangle is drawn on a 1-cm grid.
4.5 squares fit along the length.
There are 3 rows.
The area is $4.5 \times 3 = 13.5$.
The area is 13.5 cm^2.

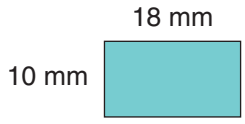
Practice

1. Find the area of each rectangle.

a)



b)



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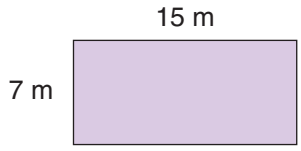

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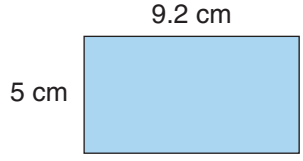
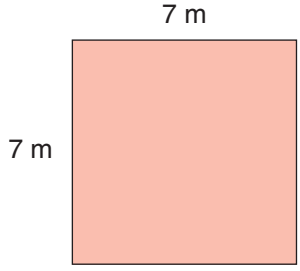
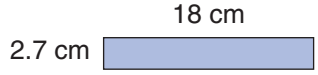


e)

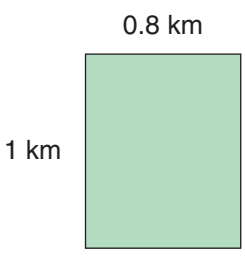


f)

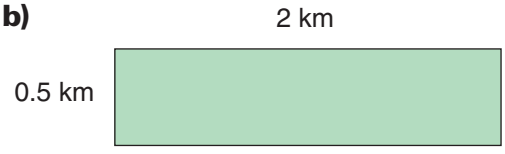


2. Find the area of each rectangle.

a)



b)



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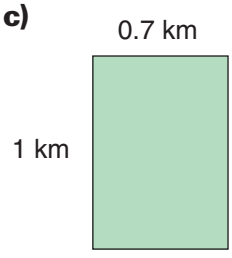


3. Order the areas in question 2 from least to greatest.

4. Measure the length and width of your math book to the nearest unit.
Use these dimensions to find the area of the cover of your math book.
Show your work.

5. The area of Toby's rectangular garden is 56 m^2.
The length of the garden is 8 m.
What is the width of the garden?
Write the number sentence that shows your thinking.

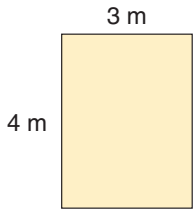
6. Murray's parking pad is rectangular and 4 m long.
It has an area of 10 m^2. How wide is the parking pad?

7. Use 18 Colour Tiles.
Find all the rectangles with an area of 18 square units.
Record each rectangle on grid paper.
Find and record each perimeter.
Which rectangle has the greatest perimeter?
The least perimeter?

8. Betty is building a rectangular hog pen with 40 m of fencing.
What dimensions will give Betty the greatest area for her hogs?

9. A square sandbox has an area of 4 m^2.
How long is each side?

10. Explain what happens to the area of this rectangle when:
a) the length is doubled
b) both the length and the width are doubled
Use grid paper to show your work.



Reflect

How can you find the length of a rectangle when you know its width and area?
Use an example to explain.

Numbers Every Day

Number Strategies

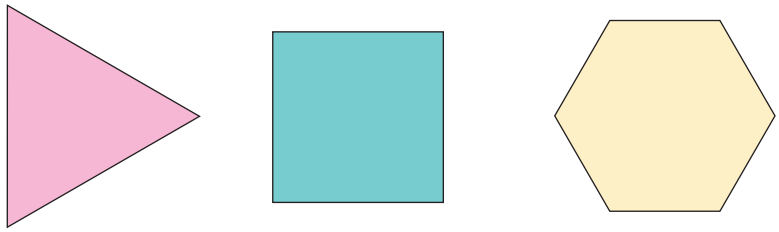
Use a number line.
Order these fractions from least to greatest.

$\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{6}$, $\frac{3}{10}$

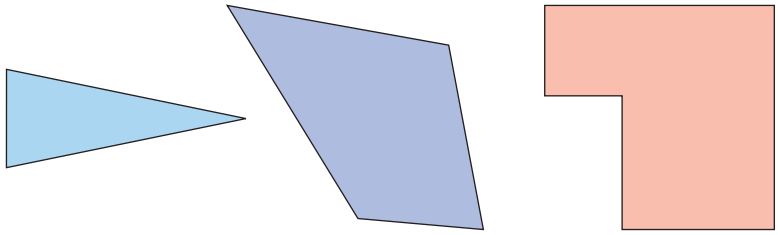
LESSON 9

Finding the Area of an Irregular Polygon

These are regular polygons.
A regular polygon has
equal sides and equal angles.



These are irregular polygons.
An irregular polygon does *not*
have all sides equal and all
angles equal.



Explore

You will need a geoboard, geobands, and square dot paper.

➤ Make 4 figures:
- an isosceles triangle
- a trapezoid
- an irregular pentagon
- an irregular hexagon

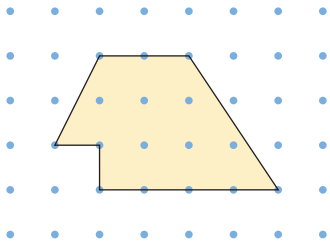
➤ Draw each figure on dot paper. Estimate the area of each figure. Then find and record each area.

Show *and* Share

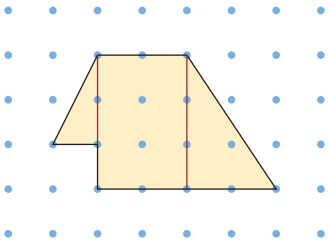
Share your figures with another pair a of classmates.
Explain how you found the areas of the figures.

Connect

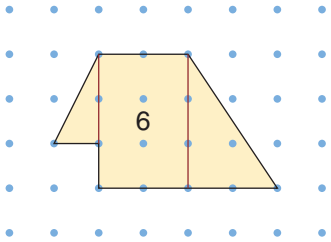
Here is one way to find the area of an irregular hexagon.

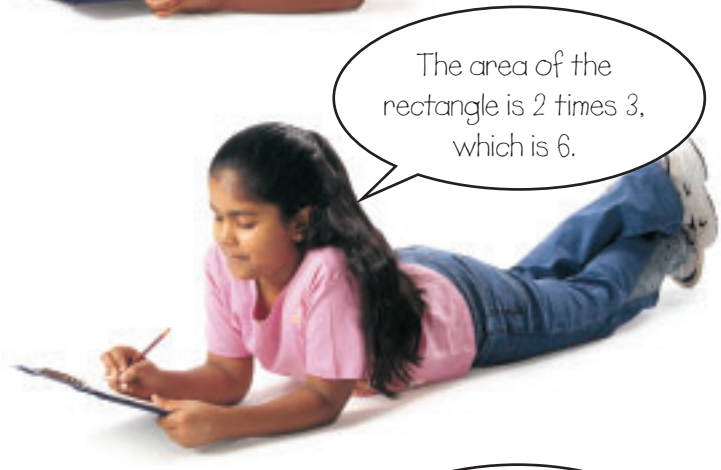


➤ Divide the hexagon into sections.

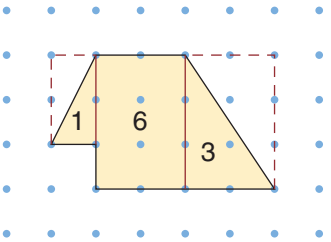


➤ Find the area of the rectangle.





➤ Draw broken lines to make a rectangle for each triangle.
Use the area of the rectangle to figure out the area of the triangle.

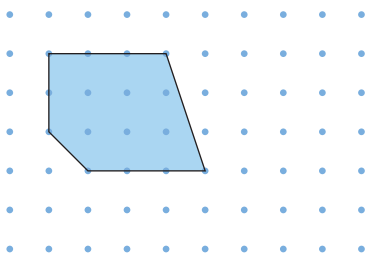


➤ Add the areas of the sections to find the area of the hexagon.
$1 + 6 + 3 = 10$
The area of the hexagon is 10 square units.

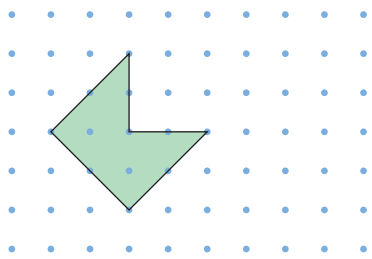
Practice

1. Make each polygon on a geoboard. Estimate first.
Then find the area of each figure in square units.

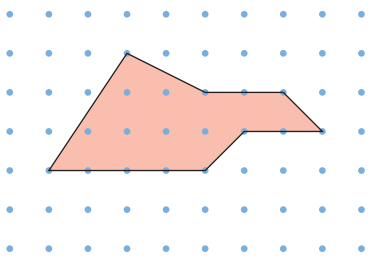
a)



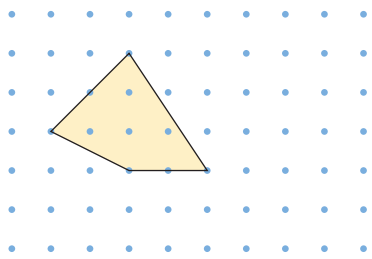
b)



c)



d)



2. Order the polygons in question 1 from least to greatest area.

3. Use a geoboard.
Make an irregular polygon with each area.
Draw the polygon on dot paper.

a) 5 square units
b) 13 square units
c) $3\frac{1}{2}$ square units
d) 12 square units
e) 8.5 square units
f) 20 square units

Numbers Every Day

Number Strategies

Estimate each difference.

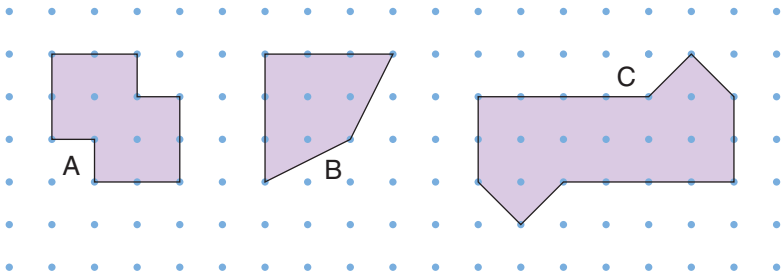
6048 – 3972
5856 – 4724
9147 – 6315

Which strategies did you use?

4. Use dot paper.
Draw 2 different polygons, each with an area of 16 square units.

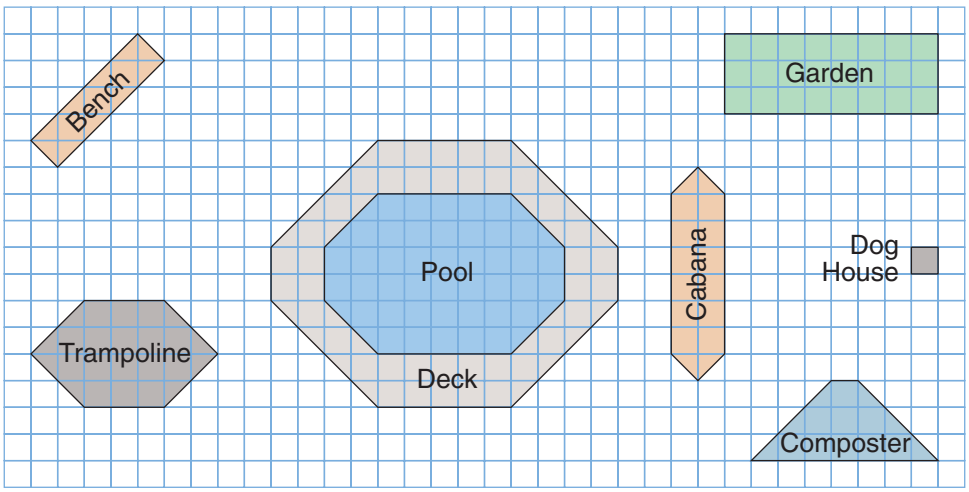
5. Use a geoboard. Make each figure below.

a) Use a geoband to divide each figure into 2 congruent parts.
What is the area of each figure? Each congruent part?
Record your work on dot paper.



b) Find other ways to divide each figure into different numbers of congruent parts.
Find the area of each congruent part.
Record your work on dot paper.

6. Here is a map of Gail's backyard.
Find the area of each section of the yard in square units.
Order the sections from least to greatest area.



Reflect

How does using dot paper or grid paper help you to find the area of an irregular polygon? Use an example to explain.

LESSON 10

Estimating Area

Explore

You will need 1-cm grid paper.

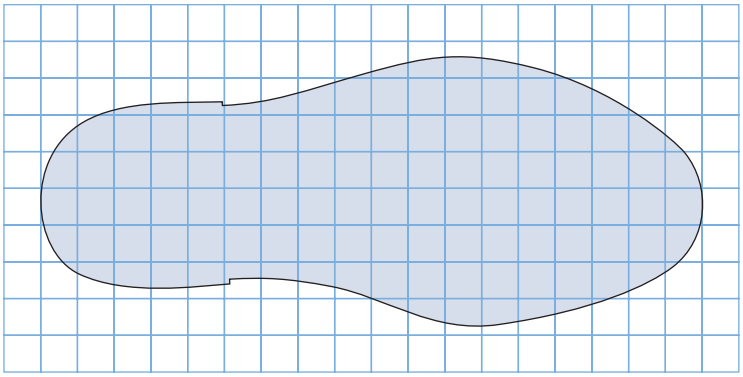
- Place a shoe on the grid paper.
  Estimate how many square centimetres the shoe covers.
- Trace the shoe.
  Find the area of the sole of your shoe.
  Use any strategy you like.
  Record your results.

Show *and* Share

Show your tracing to another pair of students.
Ask them to estimate the area of the tracing.
Discuss the strategies you used to find the area of the sole of the shoe.
Is the area you found exact or an estimate? Explain.

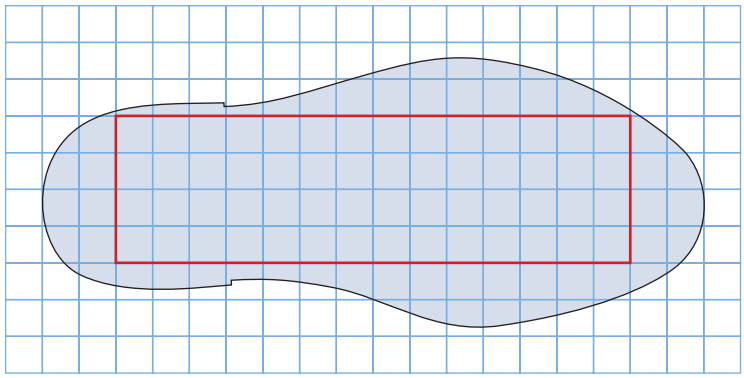
Connect

Here are two ways to estimate the area of this figure:



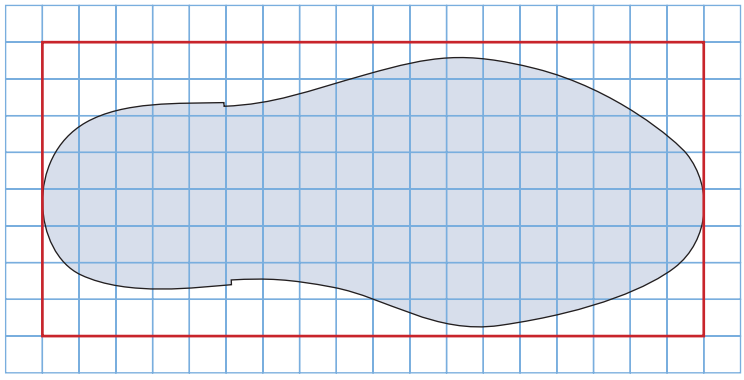
Lesson Focus | Estimate the area of a figure that is not a polygon.

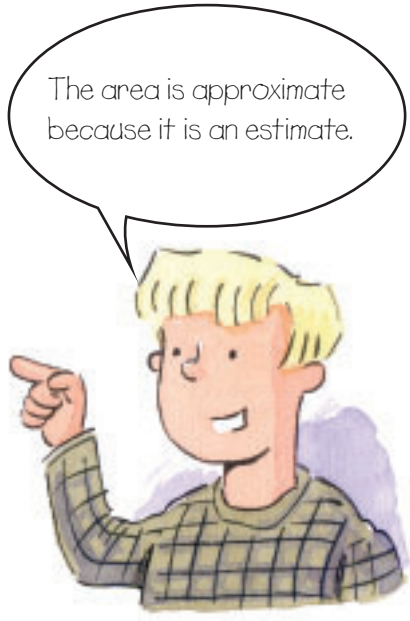
➤ Draw a rectangle along grid lines inside the figure.
Make it as big as you can. Find the area of the rectangle.
Count the whole squares and part squares
outside the rectangle.
Add to find the total area.



Area of rectangle: $14 \times 4 = 56$
Area outside rectangle: about 40
$56 + 40 = 96$
The area of the figure is about 96 square units.

➤ Draw a rectangle along grid lines around the figure.
Find the area of the rectangle.
Count the whole squares and part squares
outside the figure, and inside the rectangle.
Subtract this number from the area of the rectangle.





Area of rectangle: $8 \times 18 = 144$
Area outside the figure: about 45
$144 - 45 = 99$
The area of the figure is about 99 square units.

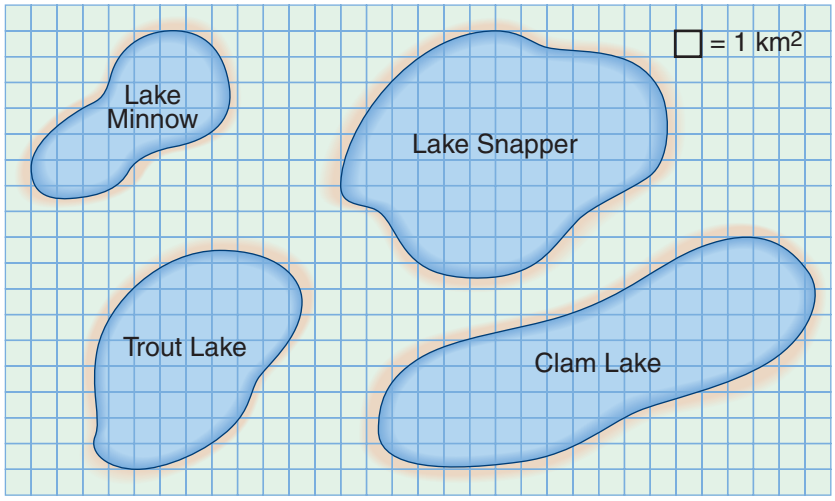
Practice

1. Use 1-cm grid paper.

a) Draw a rectangle that has about the same area as the tracing of the shoe you made in *Explore*.

b) Draw a rectangle that has about one-half the area of the shoe tracing.

2. This is a map of several lakes.
Each square on the map represents 1 km^2.



a) Find the approximate area of each lake.

b) Order the lakes from least to greatest area.

c) Use grid paper. Draw a lake with an area greater than Trout Lake but less than Clam Lake.
Find and record the area of your lake.

3. Trace a circular object on 1-cm grid paper.
Find and record the circumference of the object and the area of its tracing.
Explain how you found the circumference and the area. Show your work.

Reflect

Drip a few drops of water onto a paper towel.
Describe how you could measure the area of the wet spot on the towel.

Numbers Every Day

Number Strategies

Order these decimals from least to greatest.

1.28, 0.37, 1.8, 0.09

LESSON 11

Strategies Toolkit

Explore

Ernesto made a 1-m square garden this year.
He plans to enlarge the garden by
increasing the side lengths by 2 m each year.
What will the perimeter and area of
Ernesto's garden be in 6 years?

Show *and* Share

Describe the strategy you used to solve the problem.

Connect

Helen raises Angora goats.
When Helen got her first pair of goats,
she built a 2-m by 1-m pen for them.
As Helen's goat population grew, she increased
the size of the pen by doubling the length and the width.
What were the perimeter and area of Helen's pen
after she increased its size 5 times?

Strategies

- Make a table.
- Use a model.
- Draw a diagram.
- Solve a simpler problem.
- Work backward.
- Guess and check.
- Make an organized list.
- Use a pattern.
- Draw a graph.

What do you know?

- Helen's first pen measured 2 m by 1 m.
- She increased the size of the pen by doubling the length and width.
- She did this 5 times.

Think of a strategy to help you solve the problem.

- You can **use a pattern**.
- Use Colour Tiles to model each pen.
- List the dimensions, the perimeter, and the area of each pen.

Record your list in a table.

	Length	Width	Perimeter	Area
Original Pen	2 m	1 m	6 m	2 m^2
First Increase	4 m	2 m	12 m	8 m^2
Second Increase				

Look for patterns.
Continue the patterns to find
the perimeter and area after 5 increases.

Check your work.
What pattern rules created the patterns in your table?

Practice

Choose one of the **Strategies**

1. Harold is designing a patio with congruent square concrete tiles. He has 36 tiles.
   Use grid paper to model all the possible rectangular patios Harold could build. Label the dimensions in units.
   Which patio has the greatest perimeter? The least perimeter?

2. Suppose you have a 7-cm by 5-cm rectangle.
   You increase the length by 1 cm and decrease the width by 1 cm.
   You continue to do this.
   What happens to the perimeter of the rectangle? The area?
   Explain why this happens.

Reflect

How does using a pattern help you solve a problem?
Use pictures, words, or numbers to explain.

Unit 9 Show What You Know

LESSON

1 2

1. Measure one dimension of each object below to the nearest unit.
Which tool did you use?
Record each measurement using as many units as you can.
a) a pencil case **b)** a stapler **c)** a computer screen **d)** a table

2

2. Copy each statement. Use =, >, or < to make the statement true.
a) 1.35 m ☐ 14.3 dm **b)** 48 mm ☐ 3.7 cm **c)** 75 cm ☐ 7.5 dm
d) 2 km ☐ 1367 m **e)** 267 cm ☐ 2.67 m **f)** 895 mm ☐ 8.98 m

1 2

3. Draw a line 1.6 dm long.
Write the measurement using as many different units as you can.

2

4. Can you walk 100 000 mm in 2 minutes? Explain.

3

5. Estimate first. Then measure the length of the blackboard using a non-standard unit. Record your estimate and your measurement.

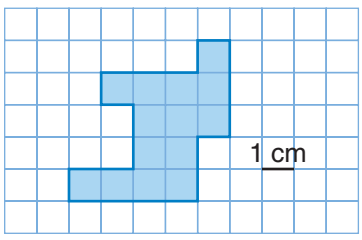
4

6. Find a cylindrical object such as a soup can.
Which do you think is longer—the height of the can or its circumference?
Measure to check your prediction. What did you find?

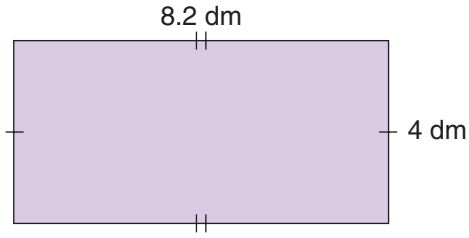
1 5 6 7 9 10

7. Find the perimeter of each figure.
Explain how you found each perimeter.
Write each perimeter in a different unit.

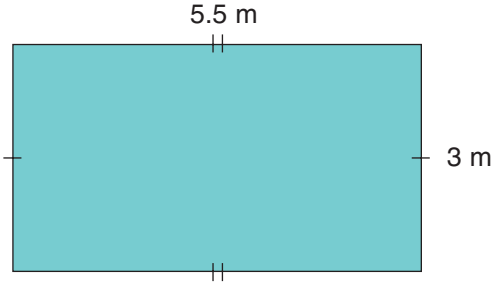
a)



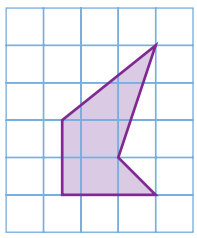
b)



c)



d)



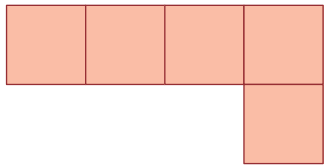
LESSON

1 5 8 9 10

8. Find the area of each figure in question 7.
Explain how you did this.
For which figures is your measure of area an estimate? Explain.

5

9. Use Colour Tiles. Make this pentomino:



a) Add tiles to the pentomino to make a figure with perimeter 18 units.
Draw your figure on grid paper.

b) What are the fewest tiles you can add to the pentomino to make a figure with perimeter 18 units? Draw your figure.

c) What are the most tiles you can add to the pentomino to make a figure with perimeter 18 units? Draw your figure.

d) Find the area of each figure you drew in parts a, b, and c.

1 6 8

10. Choose the most appropriate unit to measure:

a) the length of the school parking lot

b) the perimeter of a province

c) the circumference of a birthday cake

d) the width of a honeybee's leg

e) the area of Lake Superior

7 8

11. Darlene built a rectangular dog pen with area 24.5 m^2. The length of the pen is 5 m.
What is the width of the pen?

12. The building is one storey and rectangular.

What might the dimensions of the floor be?
Give 3 different answers.

UNIT 9 **Learning Goals**

- ✓ estimate and measure linear dimensions
- ✓ relate units of linear measure
- ✓ use decimals to report linear measures
- ✓ explore circumference
- ✓ estimate and measure perimeter and area
- ✓ develop and use rules for calculating perimeter and area of a rectangle
- ✓ solve problems related to length, perimeter, and area

Unit Problem

At the Zoo

Design a Petting Zoo

What do YOU think the NEW Baskerville Petting Zoo should LOOK like?

DRAW A MAP. MAKE IT AS INTERESTING AS YOU CAN.

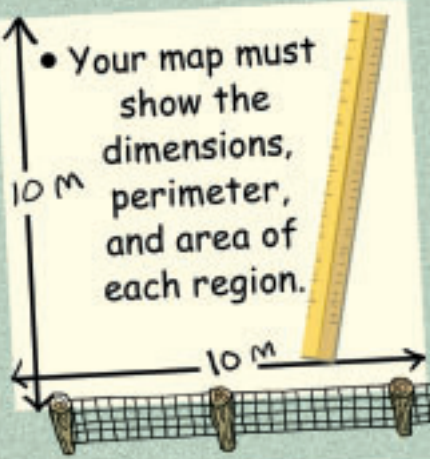
Here are some guidelines to follow:

- The petting zoo is a rectangle 45 m by 36 m.
- It must have separate regions for:
  - RABBITS
  - GOATS
  - SHEEP
  - PIGS
  - PONIES AND DONKEYS

- The regions should have different shapes and sizes.

- You may include other appropriate features on your map.

- Your map must show the dimensions, perimeter, and area of each region.



Check List

Your work should show

- ☑ a map of the petting zoo on grid paper, with each section outlined and labelled
- ☑ the dimensions, perimeter, and area of each section and how you found them
- ☑ a different shape for each region
- ☑ that the size of a region reflects the size of the animal

Reflect on the Unit

How are linear dimensions, perimeter, and area related? Write what you know about them.