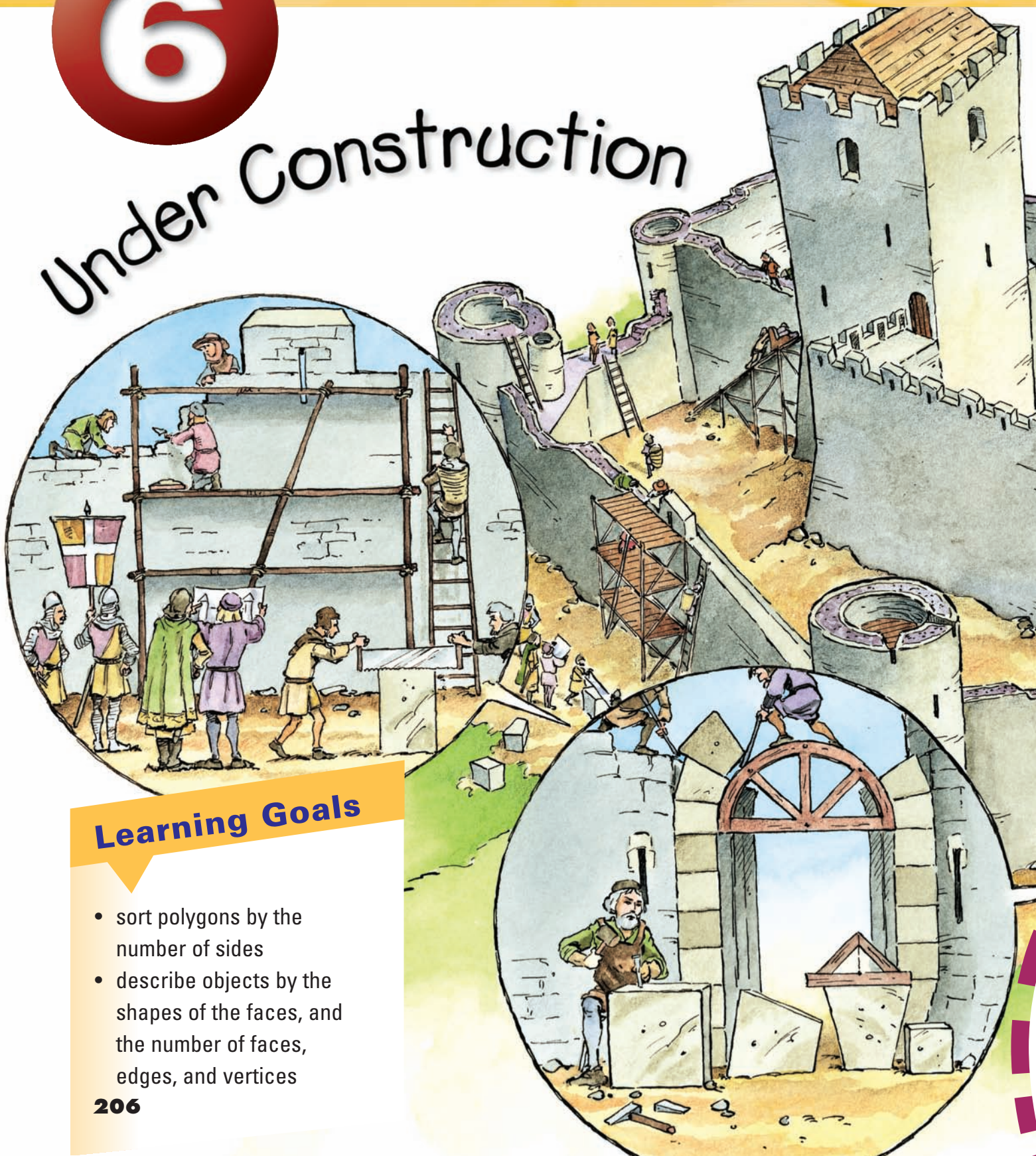
UNIT 6

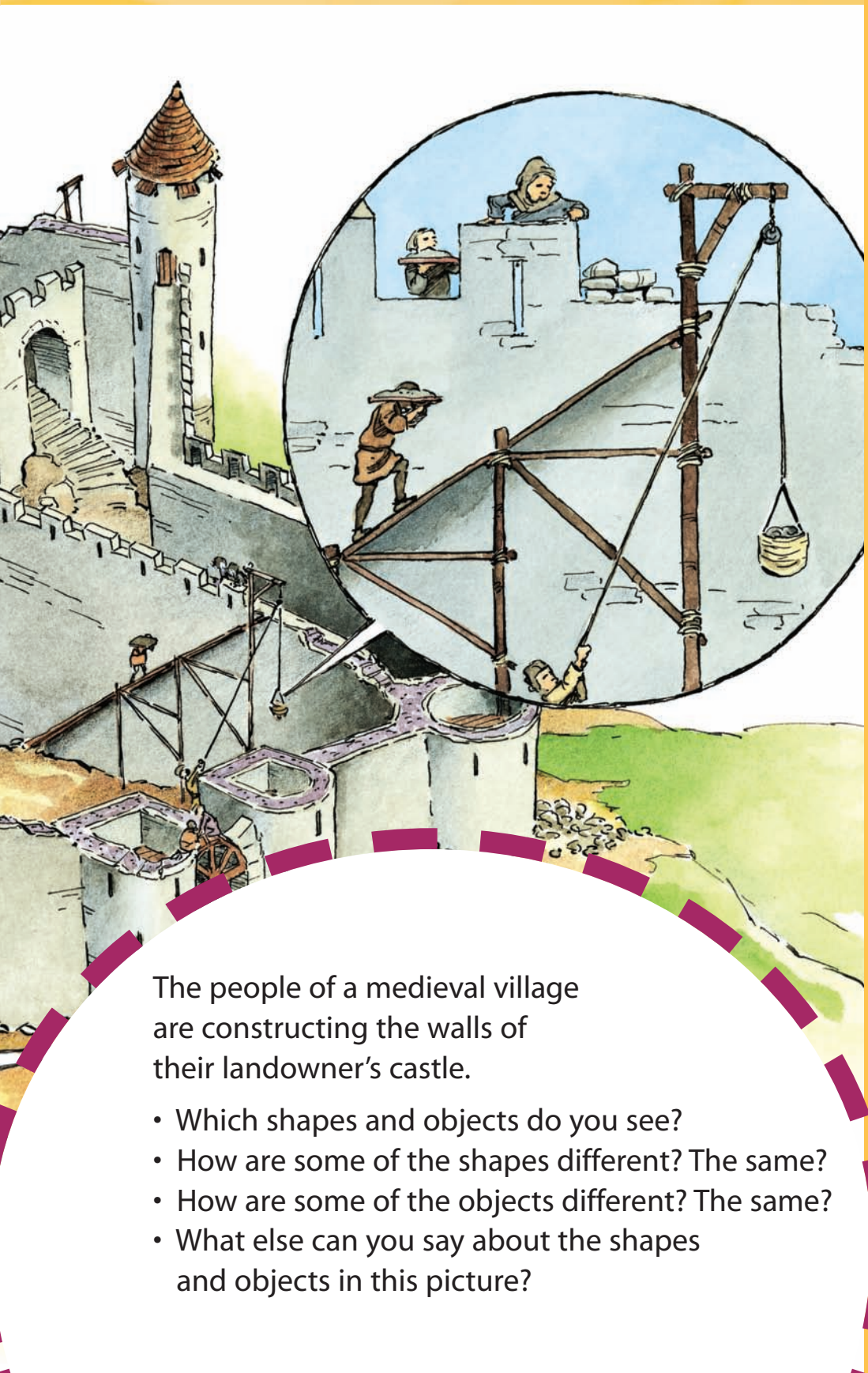
# Geometry

## Under Construction



### Learning Goals

- sort polygons by the number of sides
- describe objects by the shapes of the faces, and the number of faces, edges, and vertices



The people of a medieval village are constructing the walls of their landowner's castle.

- Which shapes and objects do you see?
- How are some of the shapes different? The same?
- How are some of the objects different? The same?
- What else can you say about the shapes and objects in this picture?

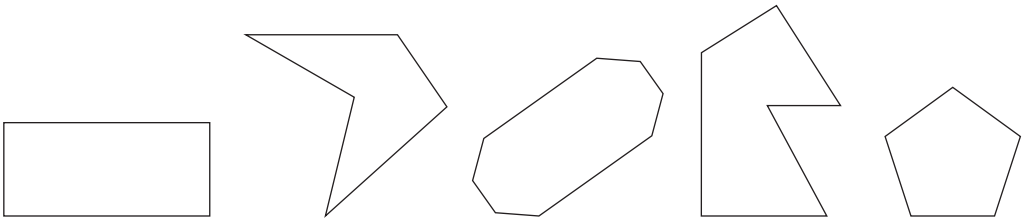
## Key Words

- polygon
- shape
- object
- face
- edge
- vertex, vertices
- base
- skeleton
- prism
- cube
- pyramid
- cone
- sphere
- cylinder
- triangle
- quadrilateral
- pentagon
- hexagon
- octagon

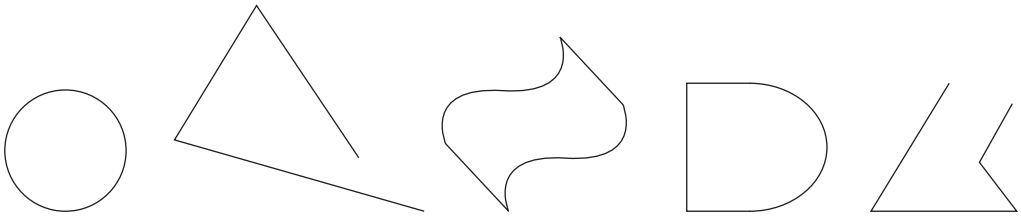
LESSON 1

# Naming Polygons

These are polygons.



These are not polygons.



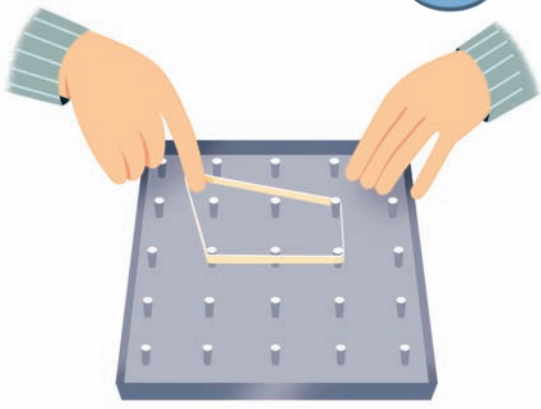
What is a polygon?
Look around your classroom. Find examples of polygons.

## Explore

You will need geoboards, geobands, and geoboard paper.
Take turns.

- Make a polygon on the geoboard. Ask your partner to describe it.
- Copy the polygon on geoboard paper. Write about the polygon.

Repeat until you have made 6 polygons.



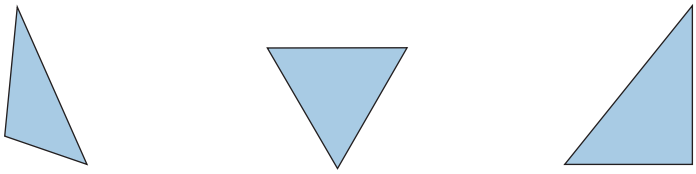
## Show *and* Share

Compare your polygons with those of another pair of classmates.
Name any polygons you know.

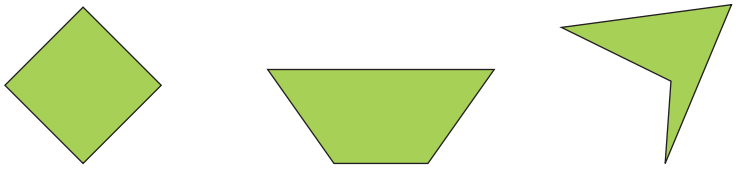
## Connect

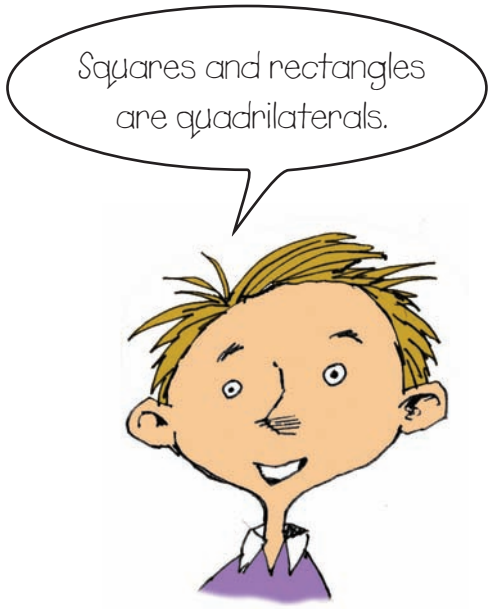
Polygons have straight sides that are joined.

A polygon with 3 sides is a **triangle**.

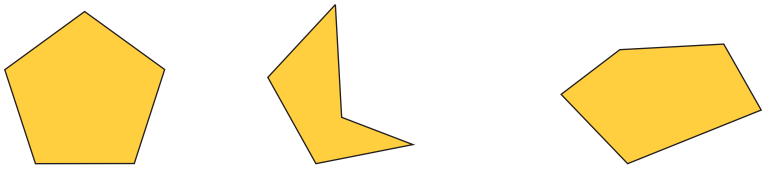


A polygon with 4 sides is a **quadrilateral**.

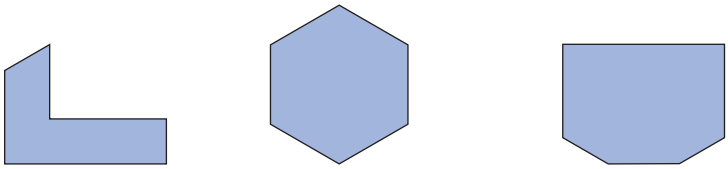




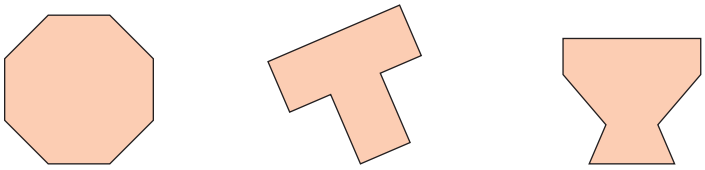

A polygon with 5 sides is a **pentagon**.

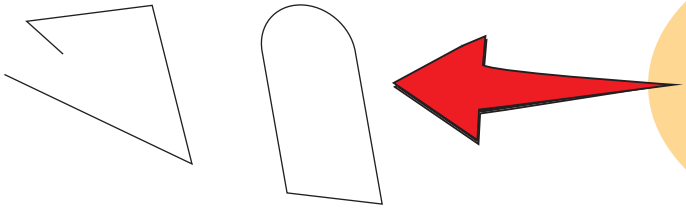


A polygon with 6 sides is a **hexagon**.



A polygon with 8 sides is an **octagon**.





These are not polygons because the sides do not join, or not all the sides are straight.

## Practice

**1.** Use a geoboard and geoboard paper.

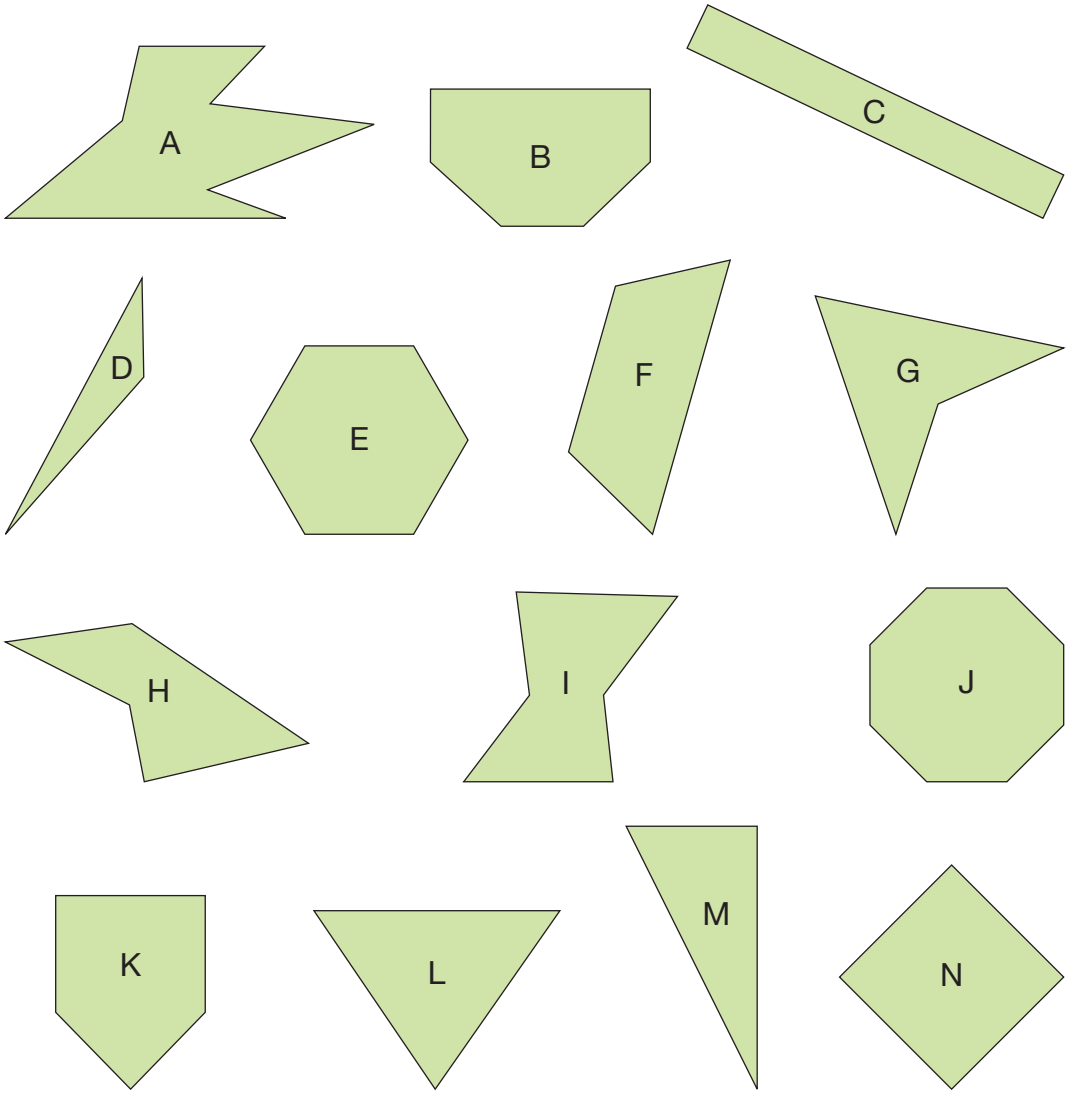
**a)** Make a quadrilateral inside an octagon.

**b)** Make a pentagon and a hexagon that share a side.

**c)** Make a triangle with sides that are different lengths.

Copy your polygons on geoboard paper.

**2.** Use the polygons below.




**a)** Find 2 different quadrilaterals. How are they the same?

**b)** Which polygons are hexagons?
How do you know?

**c)** Stephen says polygon A is an octagon.
Do you agree? Explain.

**3.** Use the polygons from question 2.

**a)** Copy and complete the chart.

**b)** Choose 2 polygons that have the same number of sides. How are they the same? How are they different?

**c)** When you name a polygon, does the length of the sides matter? Use examples to explain.

| Number of Sides | Polygons | Name of Polygons |
|---|---|---|
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 8 | | |

**4.** What is the name of each polygon?

**a)** A polygon with 8 sides

**b)** A polygon with 6 sides

**c)** A polygon with 3 sides that are the same length

**d)** A polygon with 3 sides that are different lengths

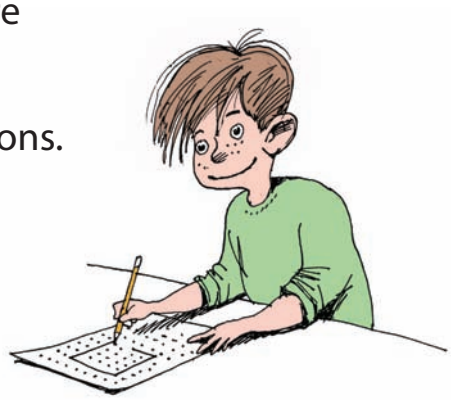
**5.** Use dot paper. Draw these polygons.

**a)** 2 different quadrilaterals

**b)** 2 different hexagons

**c)** 2 different triangles

**d)** 2 different pentagons



**6.** Choose one part from question 5. Describe the 2 polygons you drew. Tell how you know they have the same name.

## At Home

Look around your home for polygons. Name any polygons you see.

## Reflect

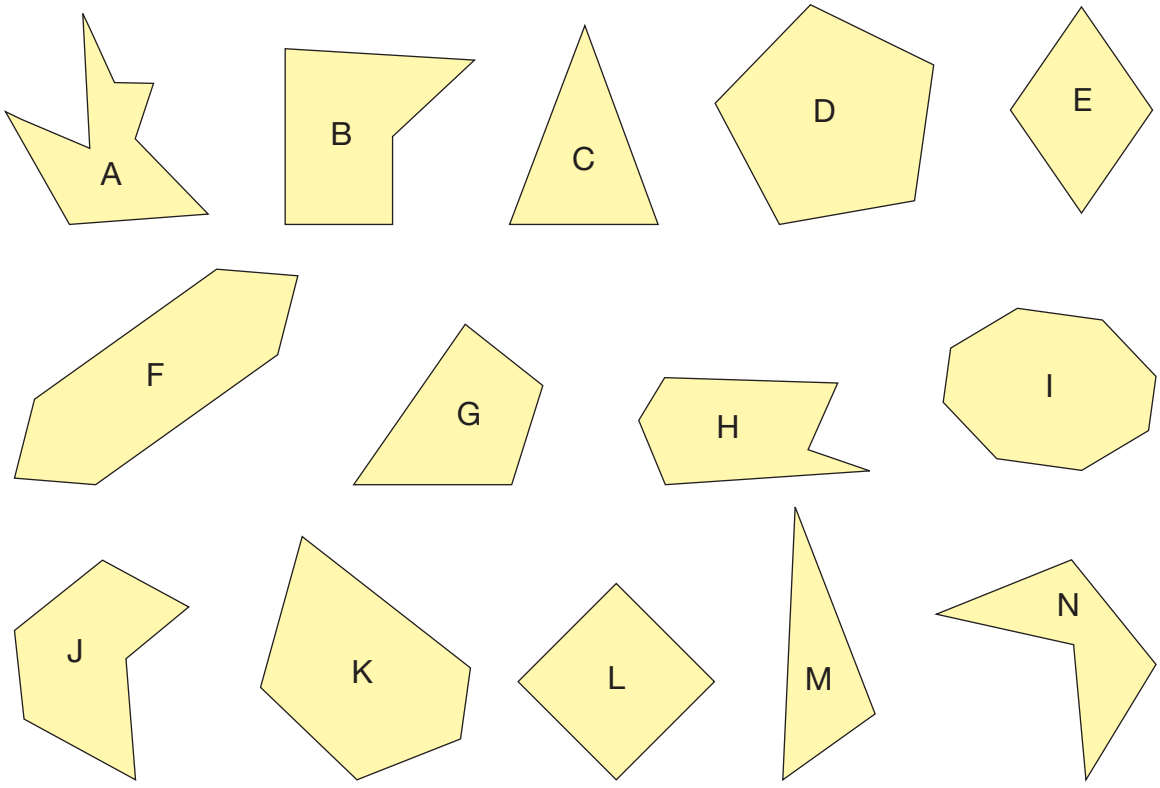
Can a polygon have fewer than 3 sides? Use words, pictures, or numbers to explain.

LESSON 2

# Sorting Polygons

## Explore

You will need large cutouts of these polygons.



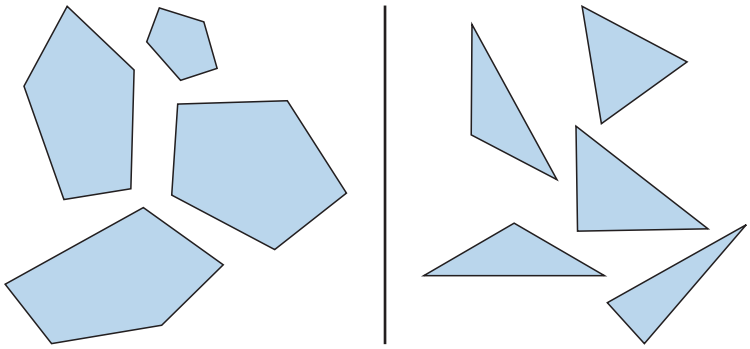

- Sort the polygons into 2 or more sets.
  Use the letters to record your sorting.
  Explain how you sorted.
- Repeat the activity.
  Sort the polygons a different way.

## Show *and* Share

Share your sorting with another group of classmates.
Talk about how you sorted the polygons.

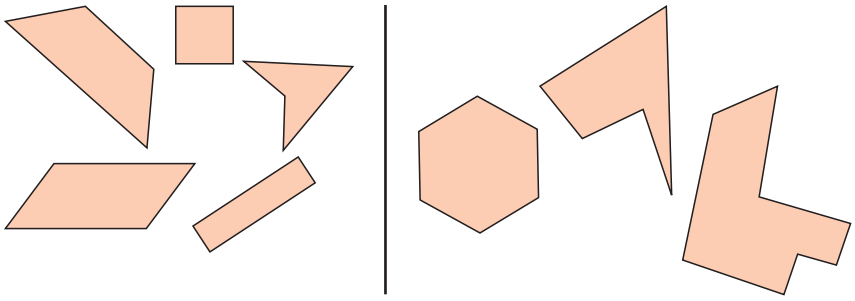
## Connect

You can sort polygons by the number of sides.



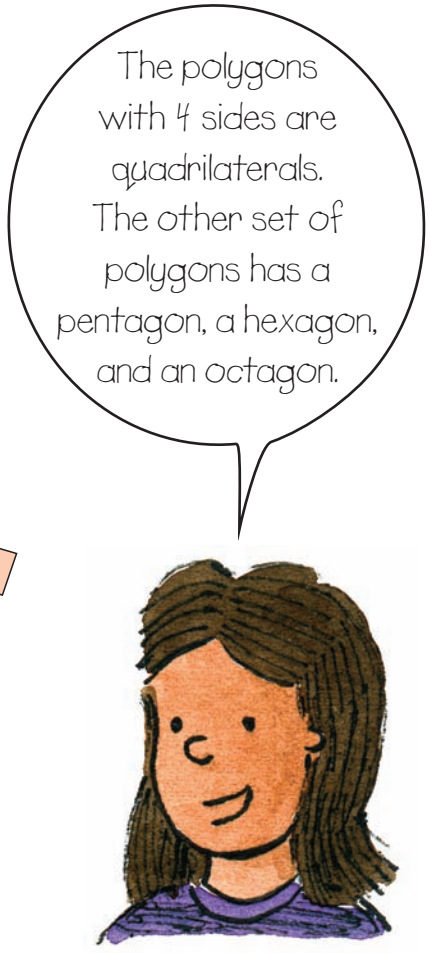
**The sorting rule is:**

Polygons with 5 sides and polygons with 3 sides



**The sorting rule is:**

Polygons with 4 sides and polygons with more than 4 sides




## Practice

For questions 1 and 2, use the polygons from *Explore*.

**1.** Sort the polygons for each sorting rule.
Use the letters to record your sorting.

**a)** Polygons with 3 sides and polygons with 6 sides

**b)** Polygons with fewer than 5 sides and polygons with 8 sides

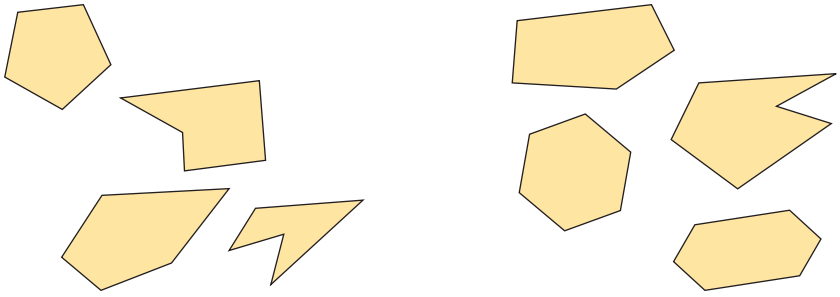
**c)** Quadrilaterals and polygons that are not quadrilaterals

## 2. Secret Sort

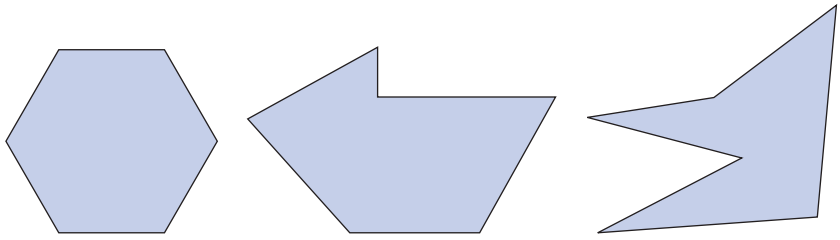
Game

Sort the polygons using a secret sorting rule.
Ask a classmate to say the sorting rule.
If the sorting rule is incorrect, you get 1 point.
If the sorting rule is correct, your classmate gets 1 point.
Repeat the activity. Take turns. See who can reach 5 points first.

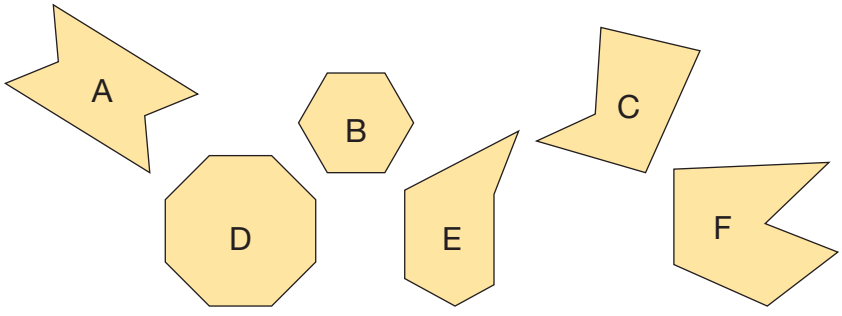
**3.** Jerda sorted polygons into 2 sets by the number of sides.
Did she sort the polygons correctly? How do you know?



**4.** **a)** Carl put these polygons together.
What is the sorting rule?



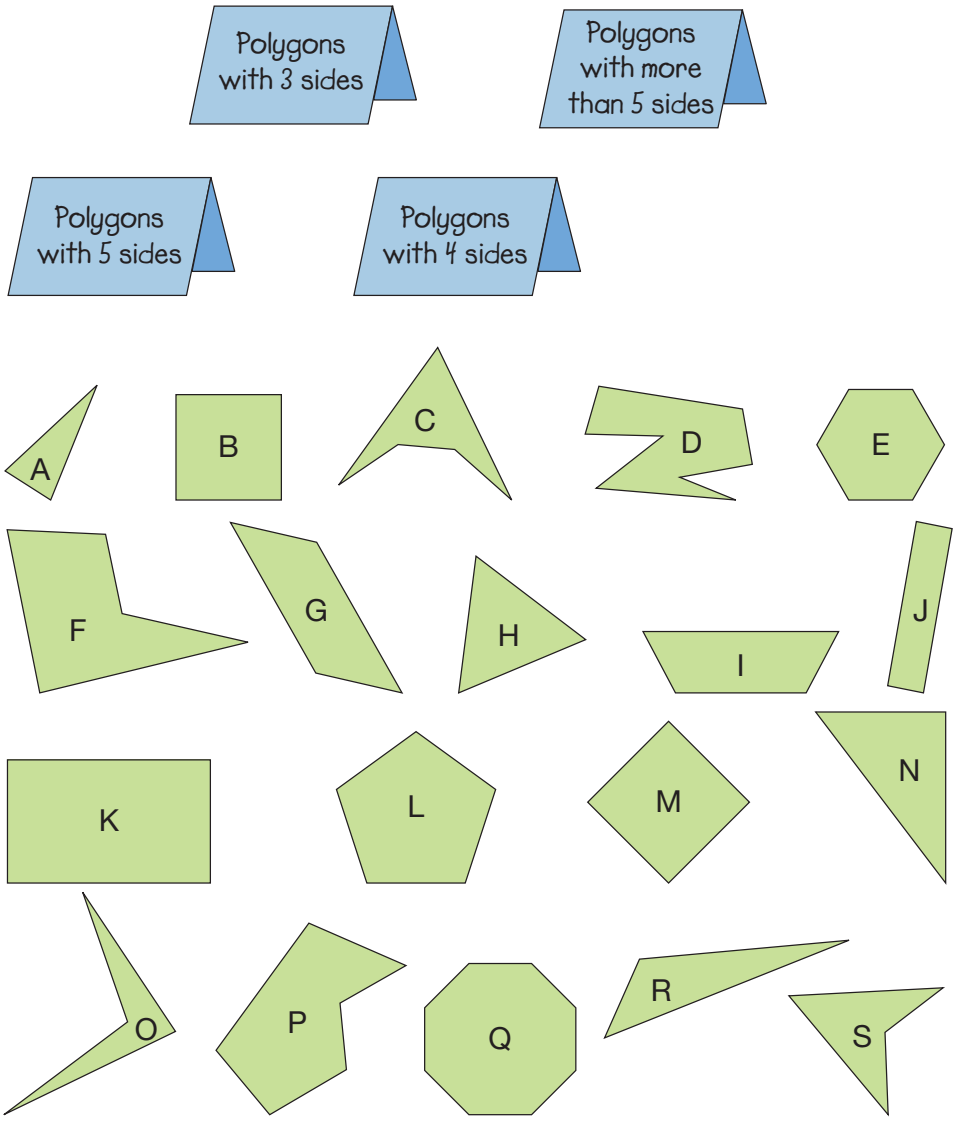
**b)** Which of the polygons below belong in Carl's set?
How do you know?




**c)** Which of the polygons in part b do not belong in Carl's set?
How do you know?

**d)** Sketch a polygon that belongs in Carl's set.
How do you know it belongs?

**5.** Choose 2 labelled cards.




Use the sorting rules on the cards you chose.
Sort as many of the polygons as possible.
Use the letters to record your sorting.
Choose 2 different cards.
Sort the polygons again.

## Reflect

What strategy do you use to keep track of which sides of a polygon you have already counted?
Use pictures, numbers, or words to explain.

LESSON 3

# Strategies Toolkit

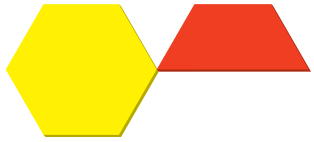
The Quilt of Belonging represents all of Canada's First Peoples.
"Medicine Wheel" is a block from the quilt.
What polygons do you see?

## Explore

Choose any 3 Pattern Blocks.

- Put the blocks next to each other to make a polygon.
- Use the same 3 blocks to make different polygons.
- Sketch your polygons.

You can do this.



You **cannot** do this.

## Show *and* Share

Share your work with another pair of classmates.
Challenge your classmates to make a different polygon with your blocks.

## Connect

Use 1 green, 1 orange, and 1 red Pattern Block.
What different hexagons can you make?


What do you know?

- You must use 1 green, 1 orange, and 1 red Pattern Block.
- You must make hexagons.

### Strategies

- Make a chart.
- Use a model.
- Draw a picture.
- Solve a simpler problem.
- Work backward.
- Guess and test.
- Make an organized list.
- Use a pattern.



Think of a strategy to help you solve the problem.

- You can use **guess and test** to make hexagons.


- Arrange the Pattern Blocks to make a hexagon.
- Count the number of sides.
- If the polygon is a hexagon, sketch it. If the polygon is not a hexagon, try again.


Check your work.
Did you make hexagons? How do you know?

## Practice

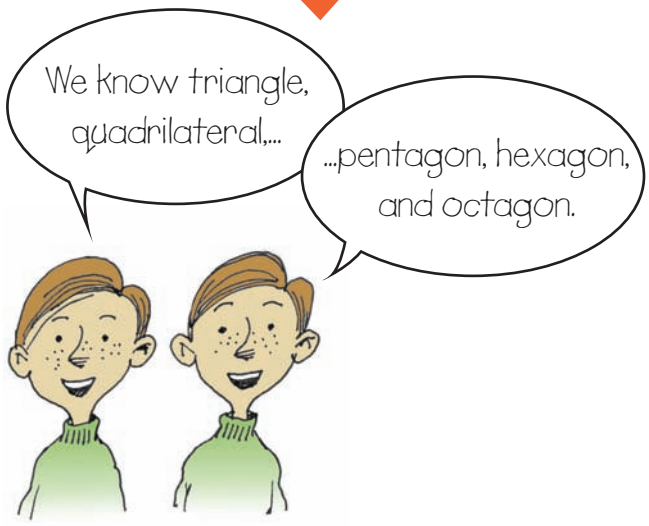
Choose one of the **Strategies**

**1.** Think about the polygons you know. Which ones can you make using any 2 Pattern Blocks?
Show your work.

**2.** Make quadrilaterals with:

- 3 Pattern Blocks,
- 4 Pattern Blocks, and
- 5 Pattern Blocks.

What different quadrilaterals can you make?




## Reflect

Which polygons did you find the easiest to make? The most difficult? Explain.

LESSON 4

# Describing Prisms and Pyramids

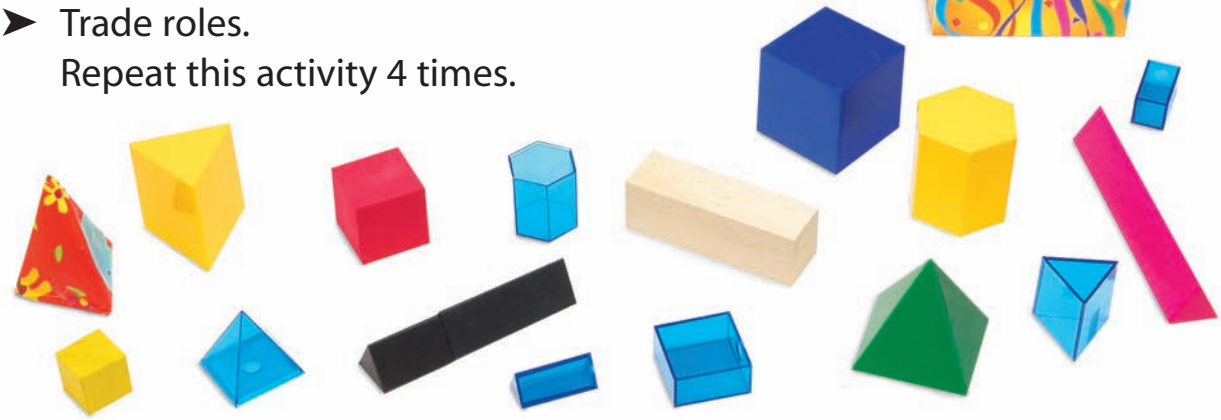
This looks like a **pyramid**.

This looks like a **prism**.

How are the objects the same? How are they different?

## Explore

- Choose an object from the picture.
  Keep your object secret.
  Give your partner 3 clues about the object.
  Ask your partner to guess the object.
- Trade roles.
  Repeat this activity 4 times.



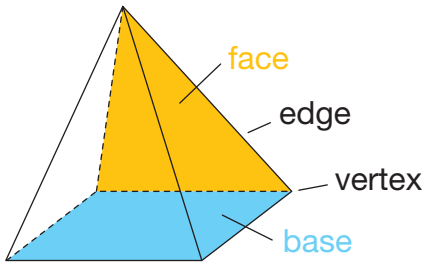
## Show *and* Share

Share with your partner how you guessed each object.
Which clues did you find the most helpful?

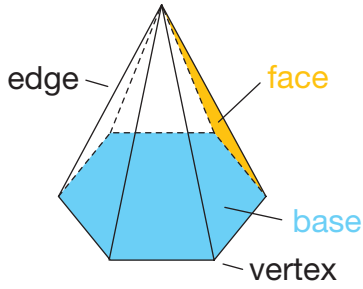
## Connect

➤ A pyramid has 1 **base**. The base is a **face**.
A pyramid has some faces that are triangles.

This pyramid has 5 vertices,
8 edges, and 5 faces:
- 1 square
- 4 triangles

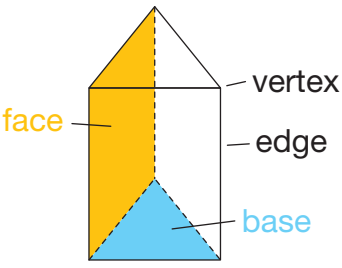



This pyramid has 7 vertices,
12 edges, and 7 faces:
- 1 hexagon
- 6 triangles

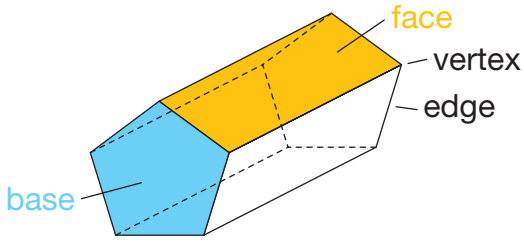


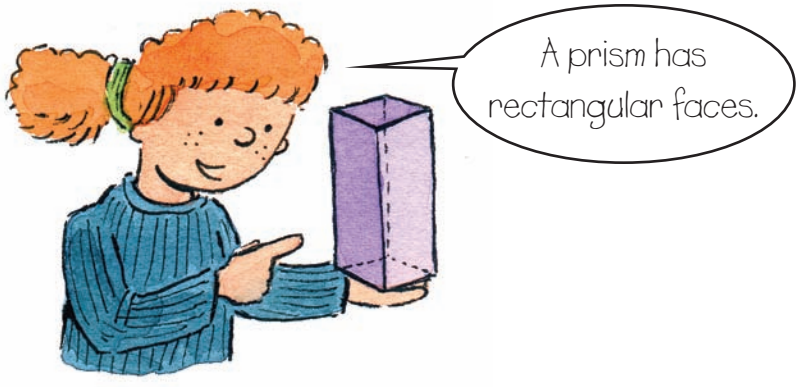

➤ A prism has 2 bases that are the same.
A prism has some faces that are rectangles.

This prism has 6 vertices,
9 edges, and 5 faces:
- 2 triangles
- 3 rectangles

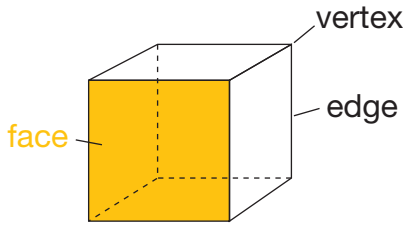



This prism has 10 vertices,
15 edges, and 7 faces:
- 2 pentagons
- 5 rectangles



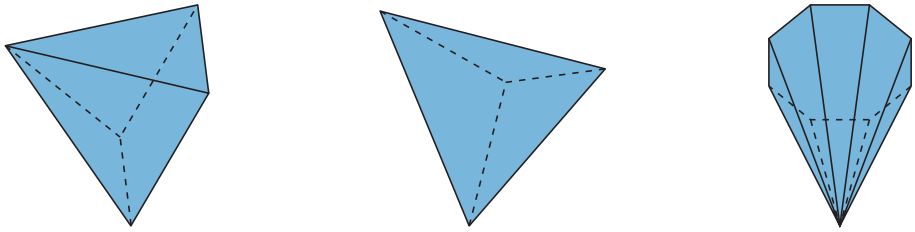



A cube is a prism.
It has 8 vertices, 12 edges, and 6 square faces.

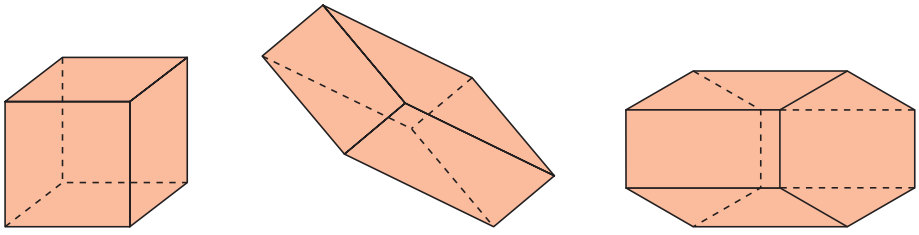



## Practice

**1.** Find objects like the ones in these pictures.
Name the shapes of the faces on each pyramid.
How many faces, edges, and vertices does each pyramid have?



**2.** Find objects like the ones in these pictures.
Name the shapes of the faces on each prism.
How many faces, edges, and vertices does each prism have?

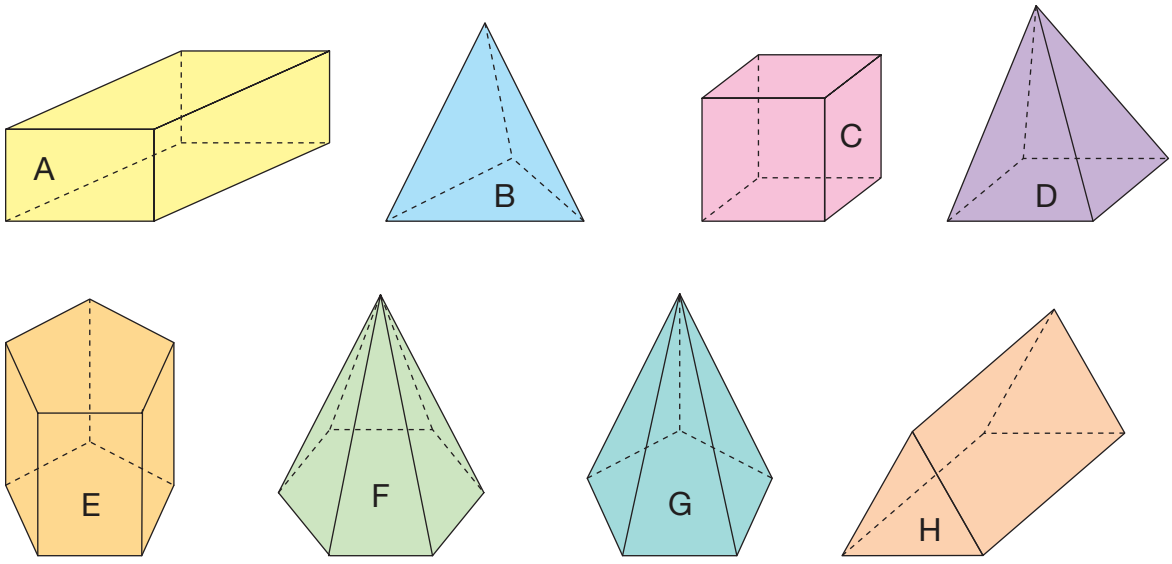


## Math Link

### Social Studies

In the Pacific Northwest, Aboriginal peoples used to make bentwood boxes to store things. Food, clothing, and ceremonial items were kept in boxes of all sizes. Today, the boxes are valued as works of art. The boxes are shaped like prisms.

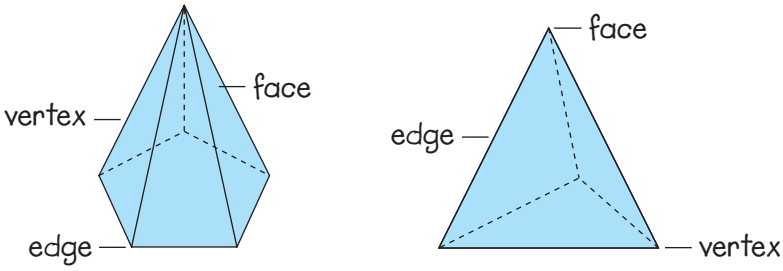
Use models that look like these pictures for questions 3 and 4.




**3.** Which objects are prisms? Tell how you know.
Choose a prism.
How many faces, edges, and vertices does it have?

**4.** Which objects are pyramids? Tell how you know.
Choose a pyramid.
How many faces, edges, and vertices does it have?

**5.** Ronda added labels to each picture.
Did she label the pictures correctly?
If not, what corrections would you make?



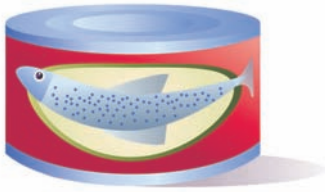

## Reflect

How would you describe prisms to a classmate?
How would you describe pyramids to a classmate?

LESSON 5

# Describing Cylinders, Cones, and Spheres

This looks like a **cylinder**.

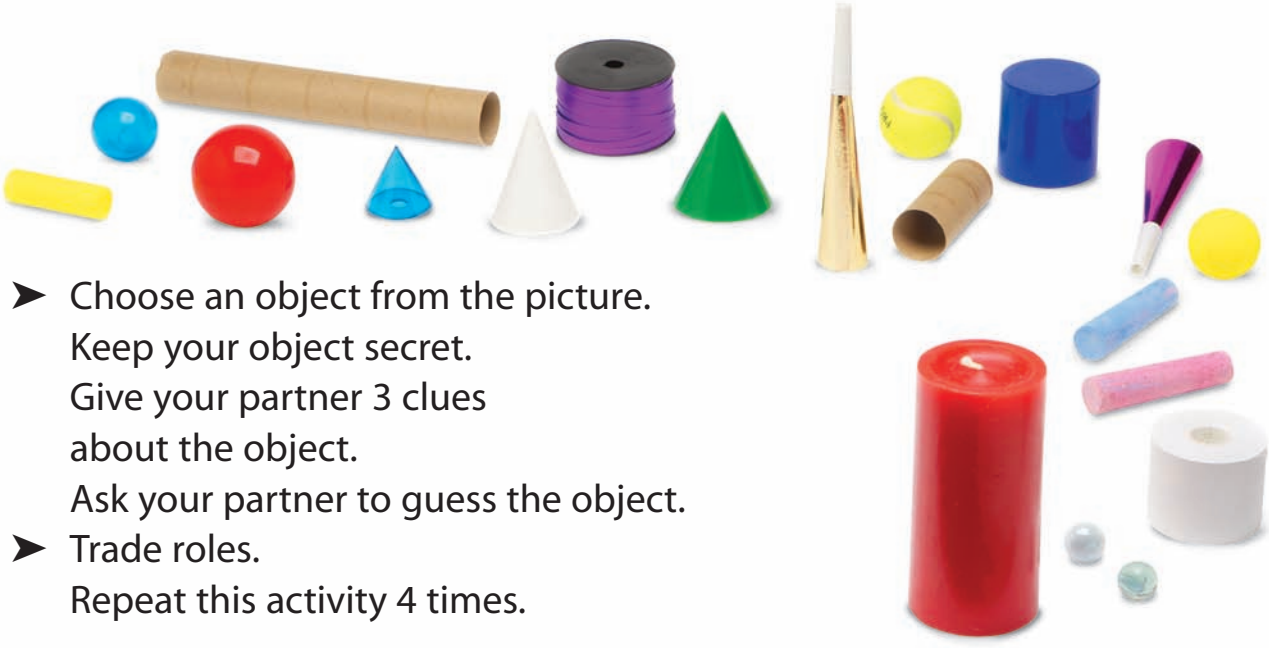


This looks like a **cone**.

This looks like a **sphere**.

How are the objects the same?
How are they different?

## Explore



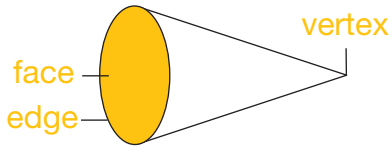
- Choose an object from the picture.
  Keep your object secret.
  Give your partner 3 clues about the object.
  Ask your partner to guess the object.
- Trade roles.
  Repeat this activity 4 times.

## Show *and* Share

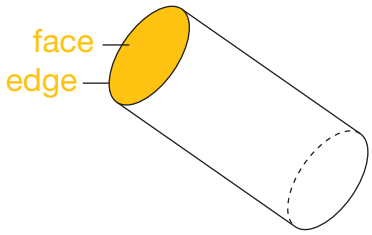
Share with your partner how you guessed each object.
Which clues did you find the most helpful?

## Connect

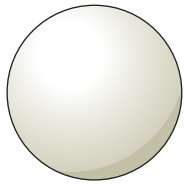
A cone has 1 vertex, 1 edge, and 1 face that is a circle.




A cylinder has 0 vertices, 2 edges, and 2 faces that are circles.

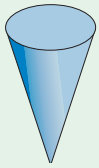
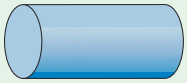



A sphere has 0 vertices, 0 edges, and 0 faces.

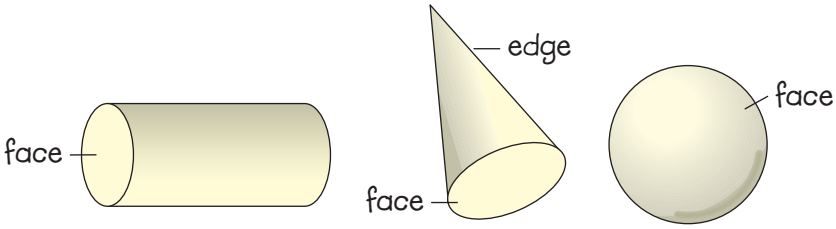


## Practice

**1.** Copy and complete the chart.

| | Name of Object | Number of Faces | Shape of Faces | Number of Edges | Number of Vertices |
|---|---|---|---|---|---|
|  | | | | | |
|  | | | | | |
|  | | | | | |

**2.** Yung added labels to each picture.
Did he label the pictures correctly? If not, what corrections would you make?



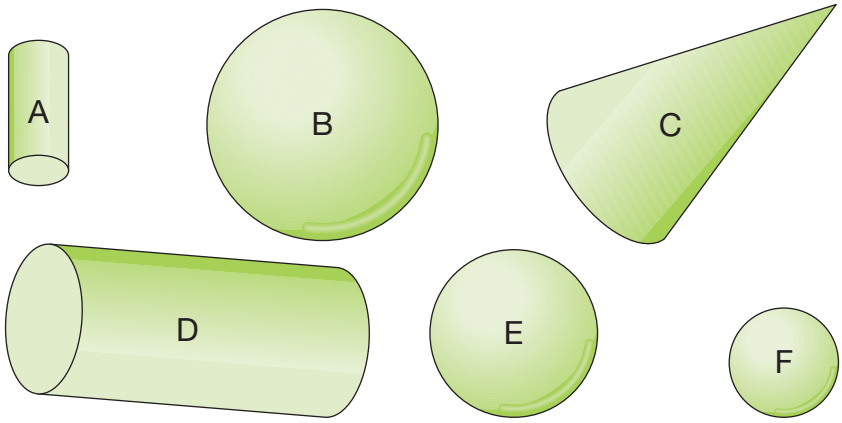

**3.** Is each sentence true or false?
Explain how you know.

**a)** A cone has 0 edges and 1 face.

**b)** A cylinder has 2 faces that are the same.

**c)** A sphere has more vertices than edges.

**4.** Henri chose 3 objects from the picture below.
He counted a total of 4 faces, 4 edges, and 0 vertices.
Which objects did he choose? How do you know?
Use numbers and words to explain.




## Reflect

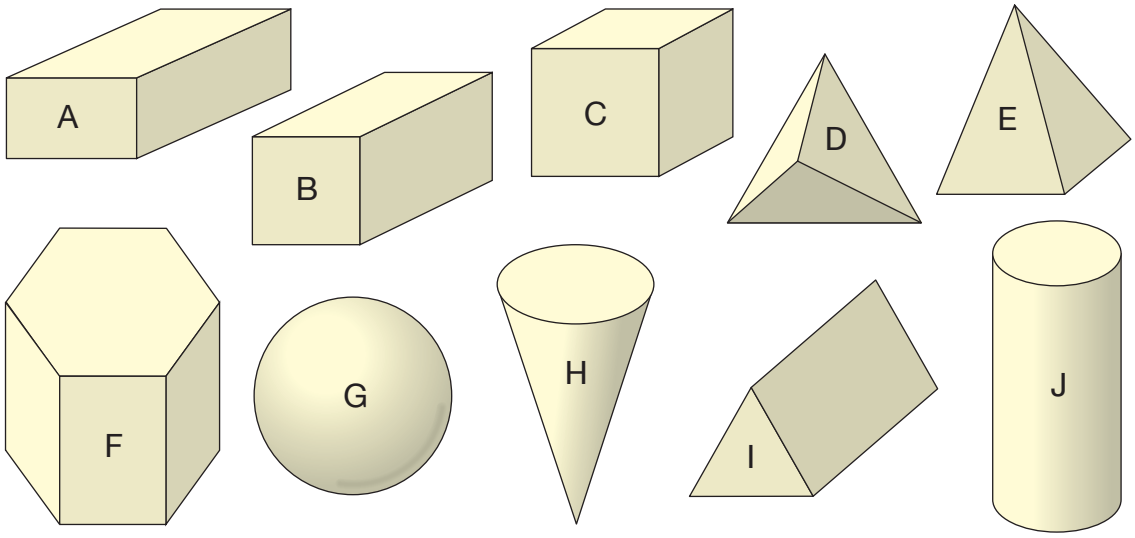
How would you describe cylinders, cones, and spheres to a classmate?
Use numbers and words to describe your thinking.

LESSON 6

# Sorting Objects

## Explore

Use models of these objects.



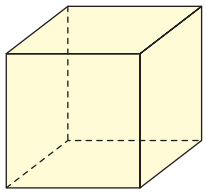

- Take turns sorting the objects.
- Ask your partner to tell the sorting rule you used.
  Record the sorting rule.
- Trade roles.

## Show *and* Share

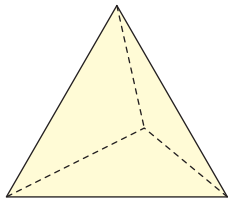
Show another pair of classmates one way you sorted.
Ask them to tell the sorting rule you used.

## Connect

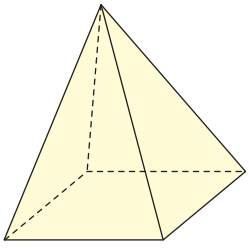
A cube has 6 faces, 8 vertices, and 12 edges.



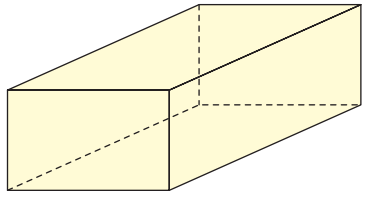
This pyramid has 4 faces, 4 vertices, and 6 edges.



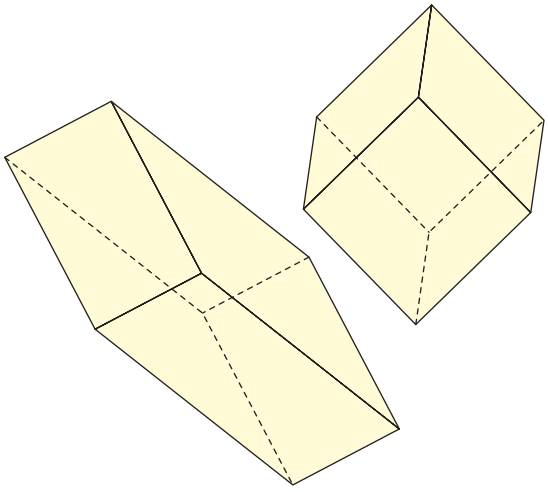
This pyramid has 5 faces, 5 vertices, and 8 edges.



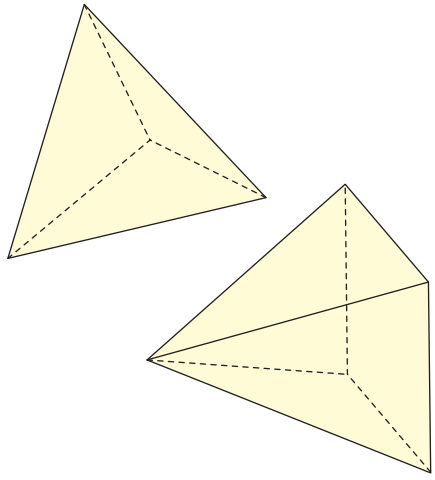
This prism has 6 faces, 8 vertices, and 12 edges.



➤ One way to sort the objects above is shown below.



Objects with 6 faces



Objects with fewer than 6 faces

## Practice

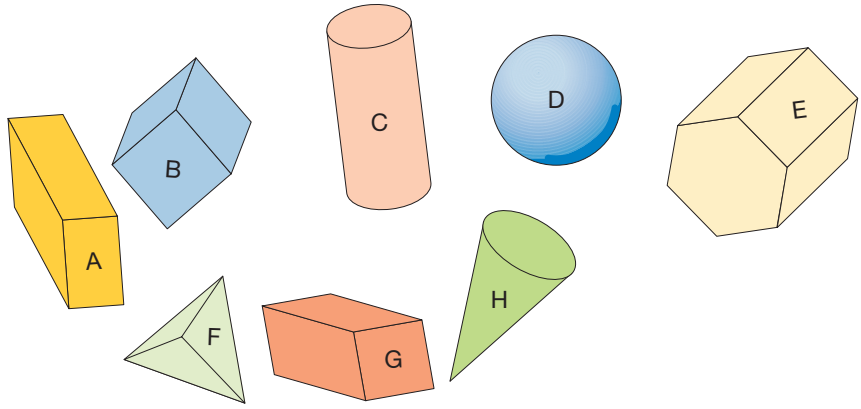
Use models when they help.

**1.** Sort the objects below using each sorting rule.
Use the letters to record your sorting.

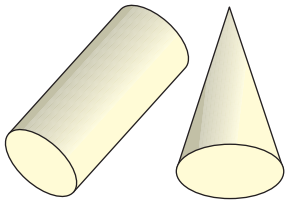
**a)** Objects with 6 faces and objects with 0 vertices

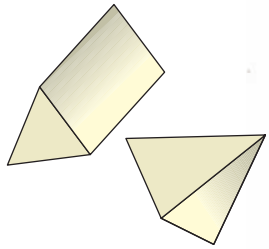
**b)** Objects with 12 edges and objects with fewer than 6 vertices

**c)** Objects with more than 6 edges and objects with fewer than 5 faces




**2.** Norman sorted these objects. Write the sorting rule.
Compare your answer with that of a classmate.





**3.** Use the objects from question 1.

**a)** Sort the objects.
Write the sorting rule.

**b)** Sort the objects again.
Write the new sorting rule.

## Reflect

Choose 5 different objects. Sort the objects.
Use numbers and words to explain how you sorted.

# Guess My Object


You will need a bag, several small pieces of paper, and a variety of objects: pyramids, prisms, cones, cubes, cylinders, and spheres.

- Display the objects.
- Work together to write the names of the objects on pieces of paper. Fold the pieces of paper and put them in the bag.
- Player A secretly takes a paper from the bag. The object named on the paper is the mystery object.
- Player A gives 2 clues about the mystery object.
- The player who guesses the mystery object correctly gets a point.
- If none of the players guess correctly after 2 guesses, no one gets a point.
- Player A returns the piece of paper to the bag.
- The game continues until everyone has a chance to draw from the bag twice.
- The player with the most points wins.

LESSON 7

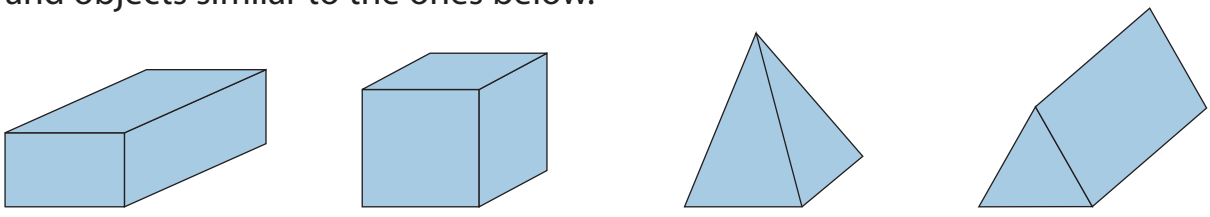
# Constructing Skeletons

When a building is constructed, the first step is to make a frame or **skeleton** of the building.

What can you tell about the skeleton?

## Explore

You will need scissors, straws, modelling clay, and objects similar to the ones below.



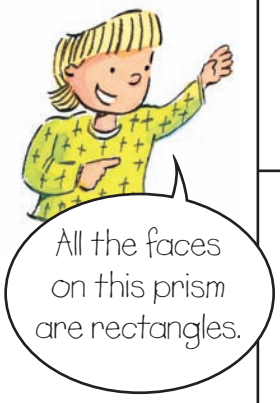
- Choose an object.
- Work together to make a skeleton that matches the object you chose.
- Choose a different object. Make a skeleton of it.
- Take turns describing each skeleton.

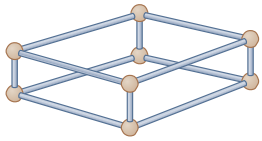
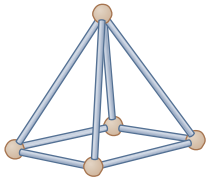
## Show *and* Share

Show your skeletons to another pair of classmates.
Talk about how you made them.

## Connect

A skeleton can be described by how many vertices and edges it has.




| Skeleton | Number of Vertices | Number of Edges |
|---|---|---|
| **Prism**  | 8 | 12 |
| **Pyramid**  | 5 | 8 |

## Practice

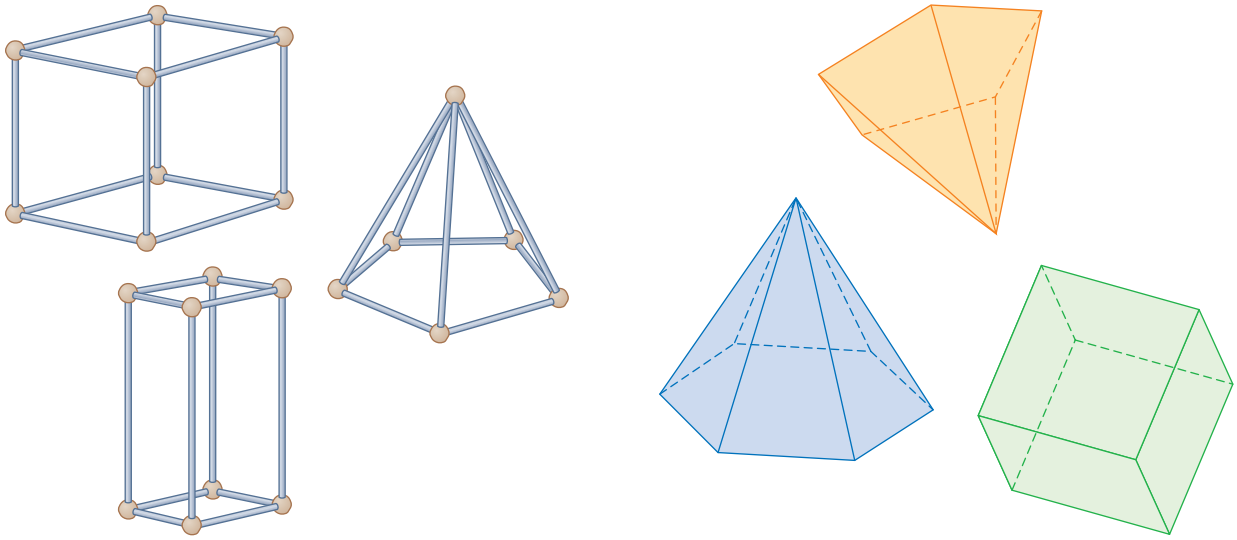
Use models when it helps.

**1.** Jo made skeletons using toothpicks and balls of modelling clay.
She counted edges and vertices.
This chart shows some of Jo's results.
Copy and complete her chart.

| Number of Toothpicks | Number of Balls of Modelling clay | Skeleton |
|---|---|---|
| 6 | | pyramid |
| | 5 | pyramid |
| 9 | | prism |
| | 8 | prism |
| 12 | | cube |

**2.** Construct skeletons that match each description.
Are you able to construct a skeleton each time? Explain.
**a)** 6 vertices **b)** 0 edges **c)** 8 edges

**3.** Match the skeletons to the objects.
Explain how you know when a skeleton and an object match.
Construct a skeleton for any object that does not have a match.



**4.** Get 20 toothpicks and 8 balls of clay.
You can use some or all of these materials, but you cannot break the materials apart.
Construct a skeleton. Describe it.
Construct a different skeleton with a different number of toothpicks and balls of clay.

**5.** Can you make a skeleton of a cone, a cylinder, or a sphere?
Explain why or why not.

## Reflect

Choose an object.
Describe how you would construct a skeleton of it.

# Unit 6 Show What You Know

LESSON

1

**1.** Use dot paper. Draw these polygons.

**a)** An octagon with some sides that are different lengths

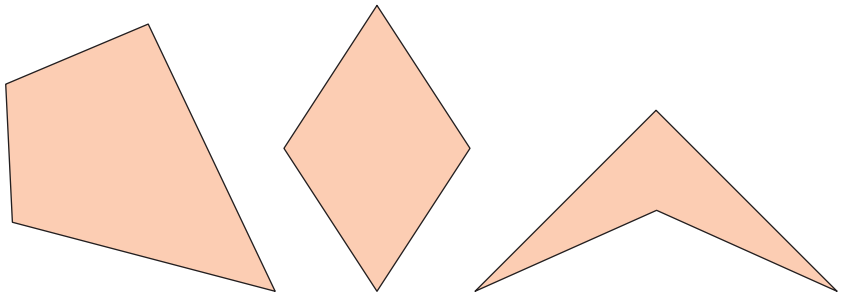
**b)** A pentagon with 3 sides that are the same length

**c)** A triangle and a quadrilateral that share a side

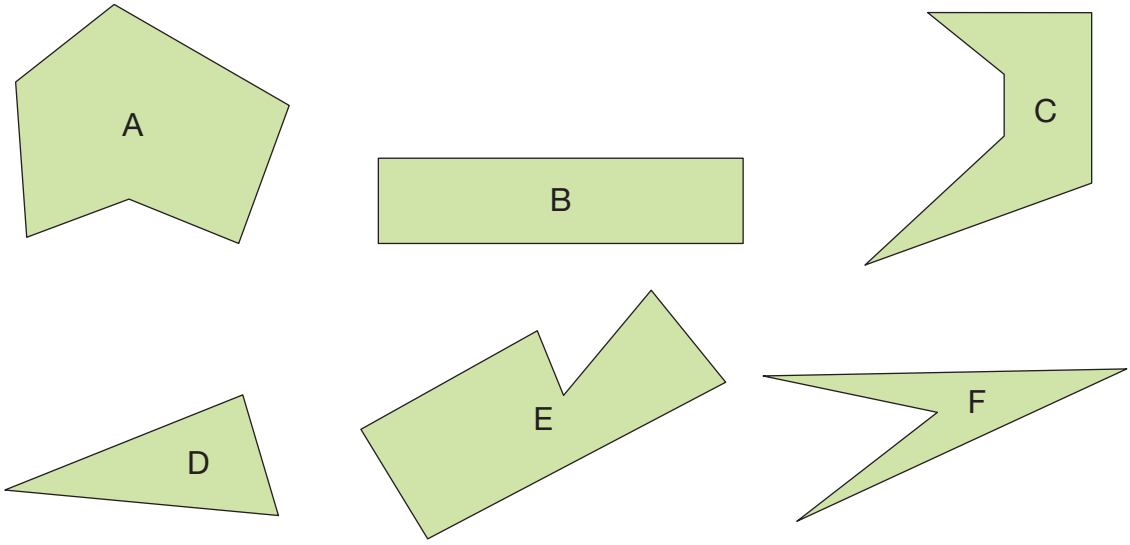
**d)** 2 different hexagons that share a side

2

**2.** **a)** Gerty sorted these polygons.
What is the sorting rule?



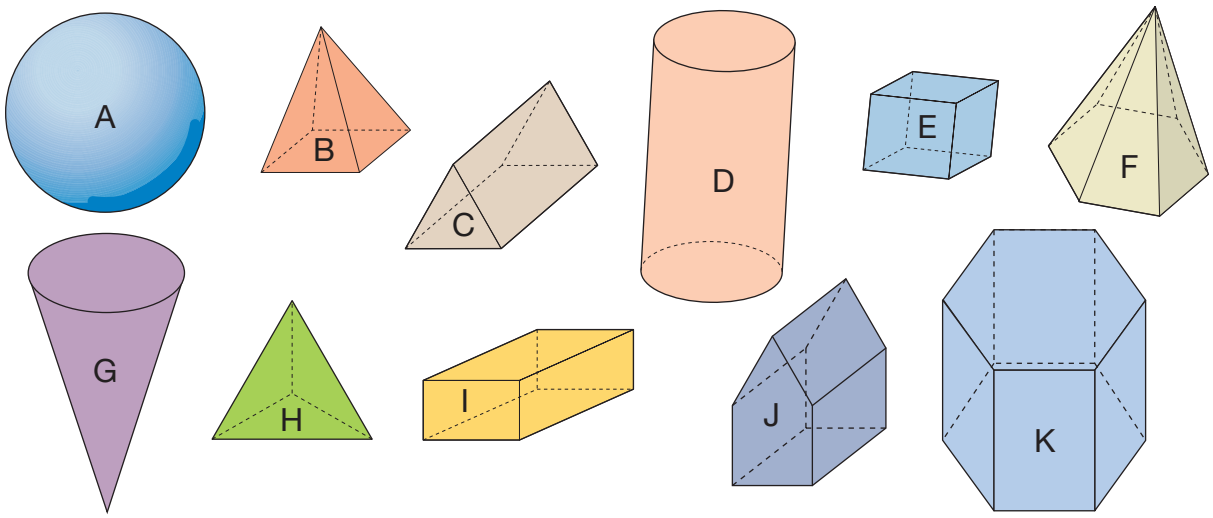
**b)** Which of these polygons belong in Gerty's set?



LESSON

4 5

**3.** Use models of the objects in the picture.
Choose 2 objects. Name the shapes of the faces on each object.
How many faces, edges, and vertices does each object have?




**4.** Is each sentence true or false?
Use numbers or words to explain your answers.

**a)** All pyramids have 3 faces.

**b)** Spheres have no vertices.

**c)** Some cones have 2 edges.

**d)** A prism has more edges and vertices than a cylinder.

6

**5.** **a)** Sort the objects in question 3.
Write the sorting rule.

**b)** Sort the objects again.
Write the new sorting rule.

7

**6.** Find objects like those in question 3.
Choose an object for which a skeleton can be made.
Construct a skeleton of it.
Explain to a classmate how you made the skeleton.

UNIT 6 **Learning Goals**

- ☑ sort polygons by the number of sides
- ☑ describe objects by the shapes of the faces, and the number of faces, edges, and vertices

# Unit Problem

# Under Construction

**Part 1**

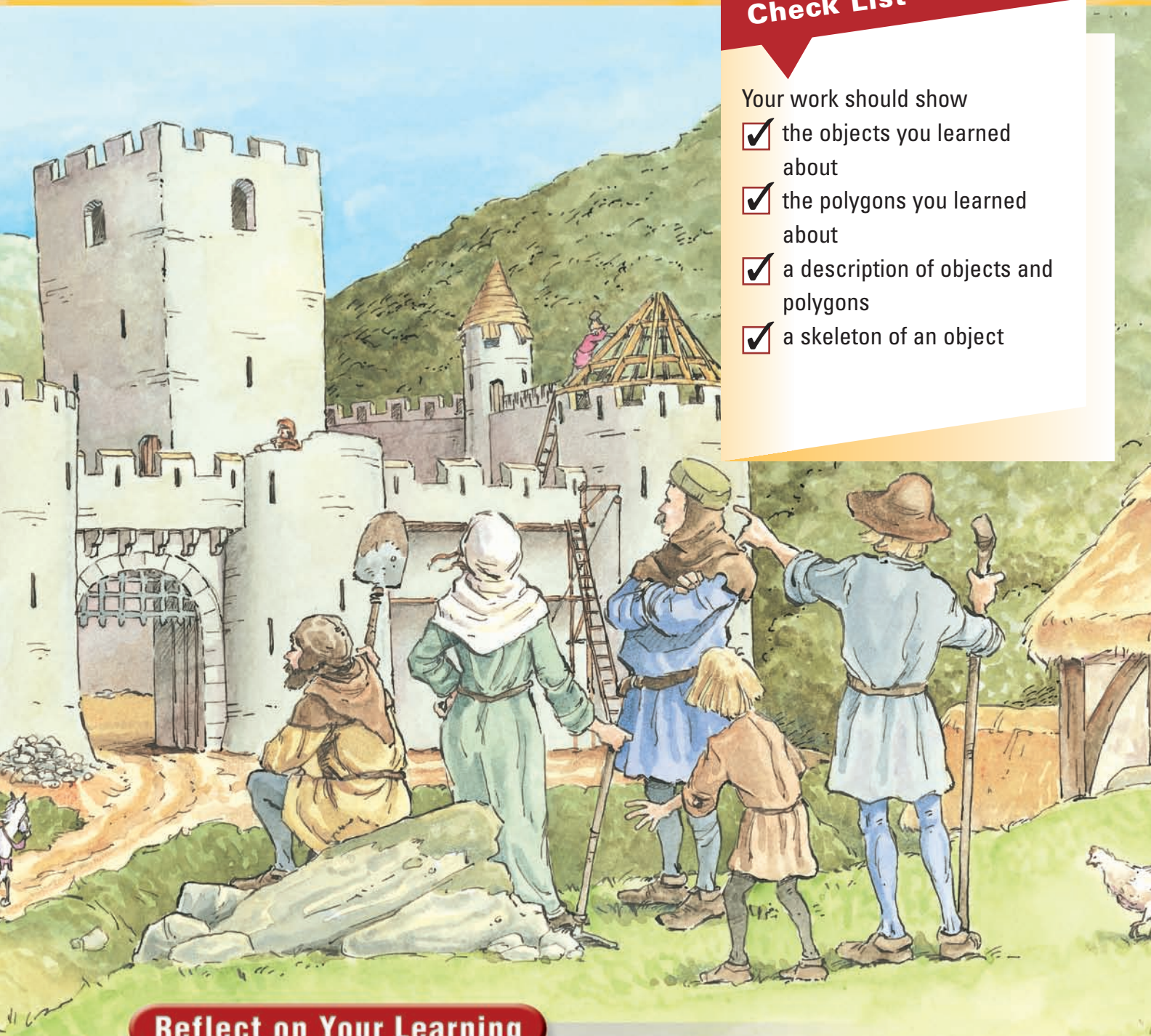
- Use objects, such as geometric models, cereal boxes, wooden blocks, straws, or cardboard tubes, to build a model of a castle.
- Explain how you made your castle.
- Choose 2 objects in your castle. Write what you know about each.

**Part 2**

- Use polygons and Pattern Blocks to add details, such as windows and doors.
- Choose any 2 of these polygons: triangle, quadrilateral, pentagon, hexagon, and octagon. Write about them.

**Part 3**

- Choose 1 object in your castle for which a skeleton can be made.
- Make the skeleton. Compare the skeleton and the object.



## Check List

Your work should show

- ☑ the objects you learned about
- ☑ the polygons you learned about
- ☑ a description of objects and polygons
- ☑ a skeleton of an object

## Reflect on Your Learning

Write what you know about polygons and objects. Use pictures, numbers, and words to explain your thinking.

# Units 1-6 Cumulative Review

UNIT

1

**1.** What are the next 3 numbers in each pattern?

**a)** 67, 72, 77, 82, . . .

**b)** 99, 97, 95, 93, . . .

**c)** 12, 15, 18, 21, 24, 27, . . .

**d)** 64, 60, 56, 52, 48, 44, . . .

**2.** **a)** How are these patterns the same? How are they different?

25, 30, 35, 40, 45, 50, . . .

25, 35, 45, 55, . . .

**b)** Make another pattern that is different from both patterns in part a. Write your pattern rule.

2

**3.** Use Base Ten Blocks, or make a picture.
Show each number 3 different ways.

**a)** 327 **b)** 210 **c)** 583

**4.** Choose one number from question 3.

**a)** Show the number on a place-value chart.

**b)** Write the number in words.

**5.** Copy each pattern. Fill in the missing numbers.

**a)** 325, ____, 375, 400, 425, ____, 475

**b)** ____, 734, 730, 726, 722, ____, 714

3

**6.** Look at these numbers: 26, 85, 41, 73, 95, 24
Estimate. Which 2 numbers have a sum closest to 100?
Use pictures, words, or numbers to show your thinking.

**7.** Find two 3-digit numbers that have a difference of 234.
Write a story problem for the numbers you chose.

4

**8.** Choose the better time estimate for each activity.

**a)** A visit to the library: 4 min or 30 min?

**b)** A school holiday: 2 weeks or 5 months?

**9.** Use a ruler, metre stick, or measuring tape. Find an object that is

**a)** about 10 cm long

**b)** about 1 m high

**c)** about 30 cm wide

Measure each object. Record your work.

**10.** Use square tiles and grid paper.
Find 3 shapes that have a perimeter of 20 units.
Draw the shapes on grid paper.

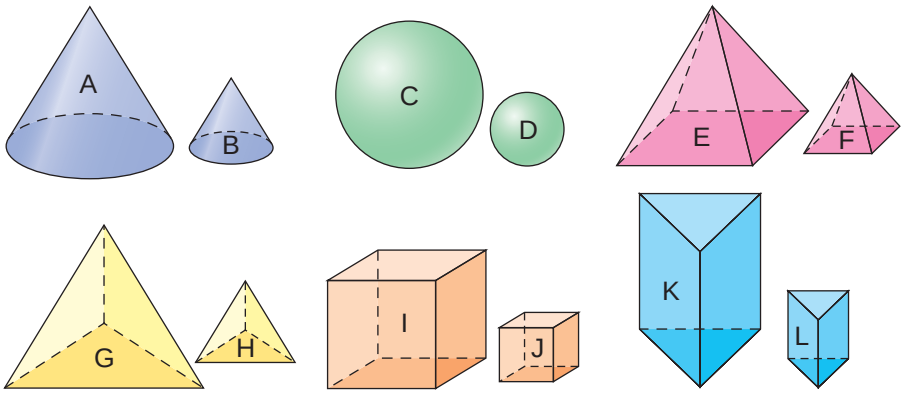
5

**11.** Make pictures to show a shape divided into fourths.
Find 3 different ways.

**12.** Fold a paper strip to show fifths. Colour $\frac{3}{5}$ of the strip.
What fraction of the strip is not coloured?

6

**13.** Name each object. Sort the objects. Write your sorting rule.




**14.** Solve each riddle.

**a)** I am a polygon with 5 sides. What is my name?

**b)** I am an object with 2 bases and 6 faces. What am I?

**c)** I am an object with 1 face only. What am I?