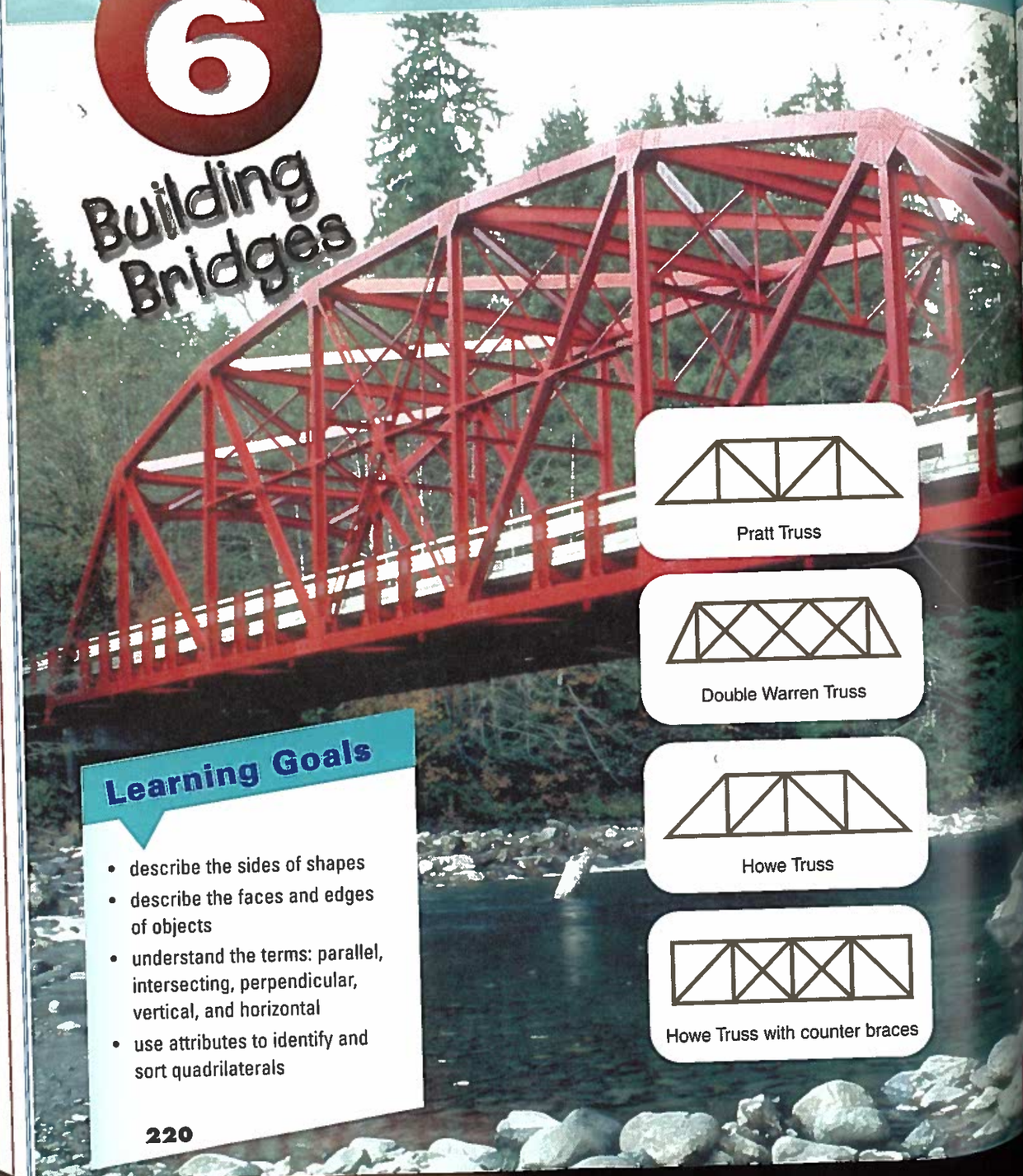
UNIT 6

Geometry

Building Bridges



Pratt Truss

Double Warren Truss

Howe Truss

Howe Truss with counter braces

Learning Goals

- describe the sides of shapes
- describe the faces and edges of objects
- understand the terms: parallel, intersecting, perpendicular, vertical, and horizontal
- use attributes to identify and sort quadrilaterals

These are different types of truss bridges.

They were built during the great age of trains, about a hundred years ago.

A truss is a framework. It is made of wooden beams or metal bars.

The bridges are light, strong, and rigid.

Key Words

- attribute
- parallel
- intersect
- vertex
- horizontal
- vertical
- perpendicular
- right angle
- diagonal
- rhombus
- parallelogram
- trapezoid
- kite

- What is the most common geometric shape you see in the bridges?
- What other geometric shapes do you see? How are they the same? How are they different?
- Where are the lines of symmetry on the bridges?
- How can you check that the bridges are symmetrical?
- Which bridge do you think would support the greatest mass? Why?

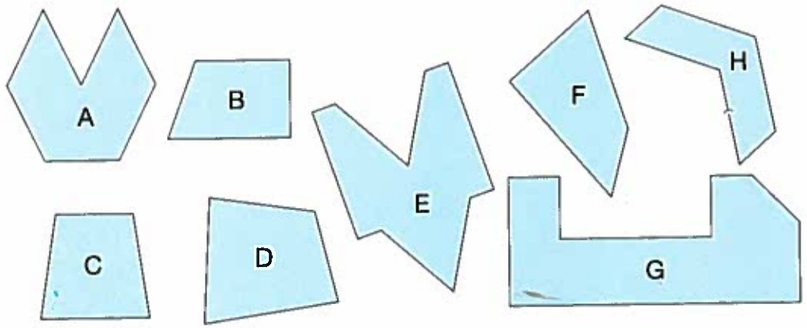
LESSON 1

Describing Shapes

Look around the classroom.
Point out shapes with straight sides.
How else can you describe
the shapes you see?

Explore

Choose one of these shapes.
Keep your choice secret.



- Describe the shape to your partner in as many ways as you can.
  Have your partner guess the shape.
- Trade roles.
- Repeat this activity 4 times.

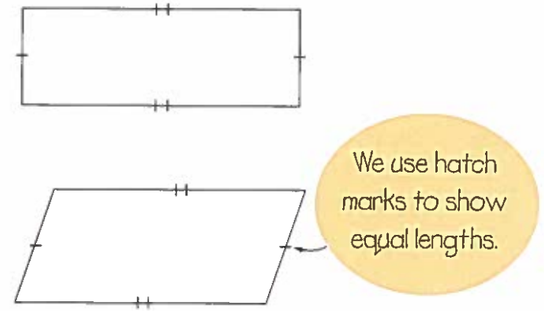
Show *and* Share

Talk with another pair of classmates.
Share some of the ways you described the shapes.
How many sides does each shape have?
Find a way to sort the shapes.

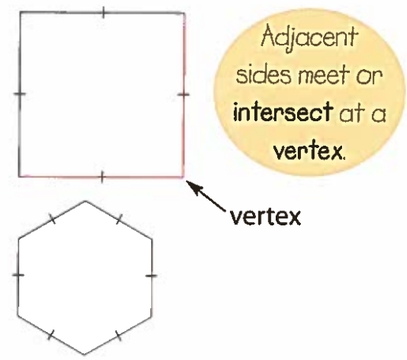
Connect

We can describe a shape by telling about its **attributes**.
Here are some attributes of shapes.

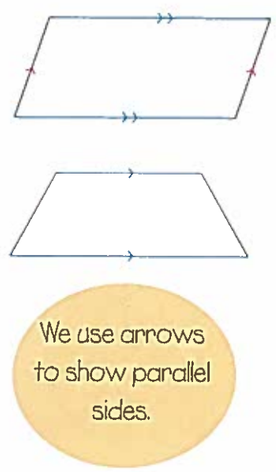
- The lengths of the sides:
  - These shapes have some sides the same length.



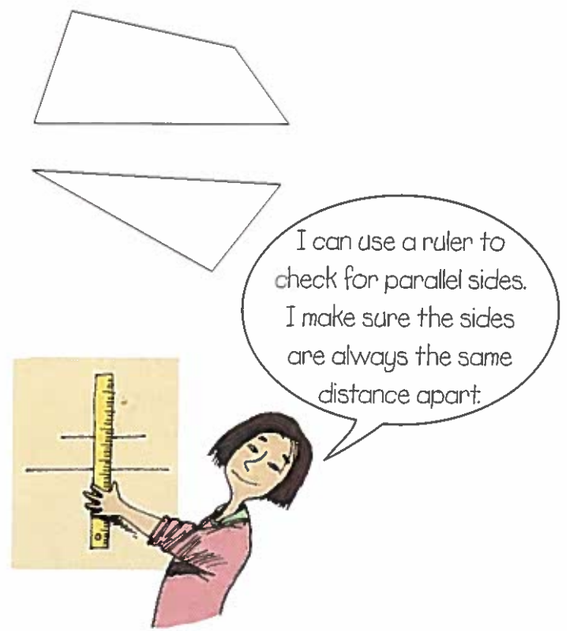
  - These shapes have all sides the same length.



- The direction of the sides:
  - These shapes have at least one pair of **parallel** sides.
    These sides are always the same distance apart and never meet.
    When sides do not meet, we say the sides do not *intersect*.

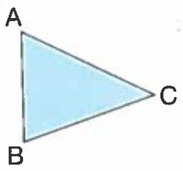


  - These shapes have no parallel sides.



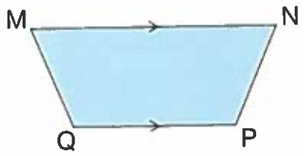
➤ We can label each vertex with a different capital letter.
We then name a shape by its vertices. We write the vertices in order.

This is triangle ABC.



We use the letters to name the sides.
Triangle ABC has 3 sides:
AB, AC, and BC

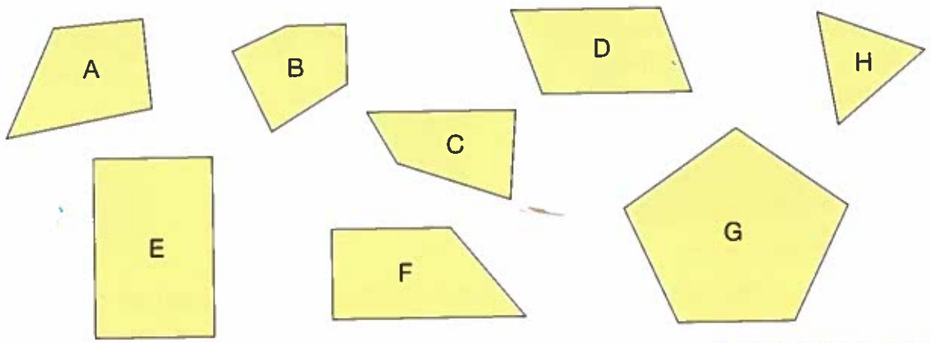
This is quadrilateral MNPQ.



Quadrilateral MNPQ has 4 sides:
MN, NP, PQ, and QM
Sides MN and QP are parallel.
Sides MN and QP do-not intersect.
Sides MN and NP intersect at vertex N.

Practice

Use these shapes for questions 1 and 2. Your teacher will give you copies of them.



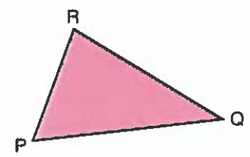
1. Which shapes have:
   a) all sides the same length?
   b) some sides the same length?
   c) parallel sides?

2. Choose 2 shapes above.
   Draw shapes like them on dot paper.
   How are the shapes the same? Different?
   Write about what you see.

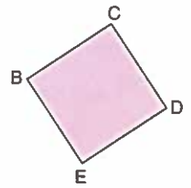
3. Use a geoboard.
   Make as many different shapes as you can with exactly 2 parallel sides.
   Draw your shapes on dot paper.
   Write about the attributes of each shape.

4. Use letters to name each shape.

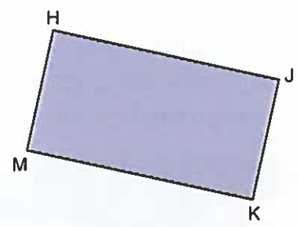
a)



b)



c)



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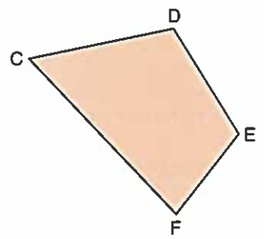
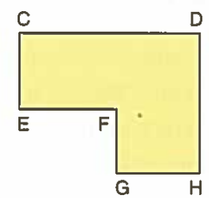


5. Use the shapes in question 4.
   a) For each shape, identify and name two sides that intersect.
   b) Which shapes have parallel sides?
   Identify and name the sides that are parallel.

6. In the classroom:
   a) Find 3 shapes that have parallel sides.
   How do you know the sides are parallel?
   b) Find 3 shapes that have intersecting sides.
   How do you know the sides intersect?

7. **a)** Which sets of letters below name this hexagon?
   Explain your thinking.
   CDEFGH CDHGFE ECDHGF FEGHDC
   b) Describe the sides of the hexagon as many different ways as you can.



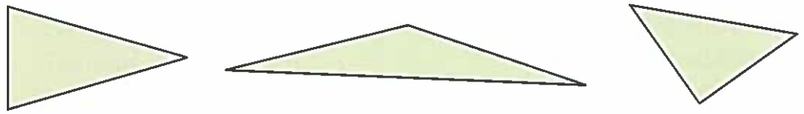
Reflect

How can you tell if a shape has parallel sides?
Use words or pictures to explain.

LESSON 2

Investigating Perpendicular Sides

How are these shapes the same?
How are the shapes different?



Explore

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

Make each shape below on a geoboard.
Then draw the shape on dot paper.
Each shape should have more than 3 sides.

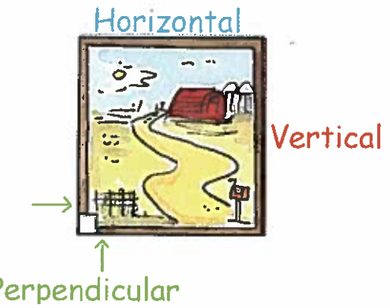
- a shape that has a corner smaller than the corners in a square
- a shape that has a corner larger than the corners in a square
- a shape that has a corner that matches the corners in a square

Show and Share

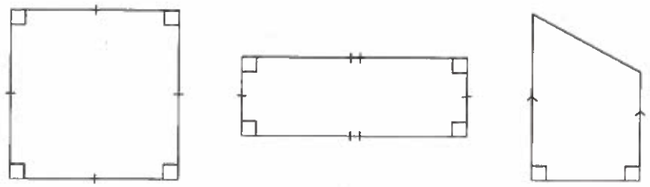
Share your shapes with a classmate.
Which shapes have all the same corners?
Which shapes have more than one type of corner?
Did any shape have three types of corners?
If your answer is yes, describe the shape.

Connect

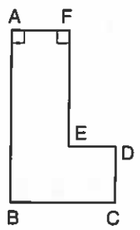
➤ Look at a picture on the wall.
If the picture is positioned correctly,
the top and bottom edges are **horizontal**.
The side edges are **vertical**.
We say that a horizontal edge and a vertical edge are **perpendicular**.
That is, these edges intersect to form a **right angle**.
We draw a square where the edges meet to show they are perpendicular.



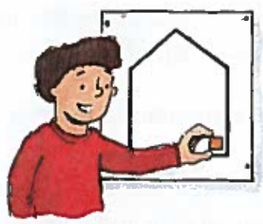
➤ When two sides of any shape intersect to make a right angle,
we say the sides are perpendicular.
These shapes have right angles.



This shape has 6 sides.
It is a hexagon.



In hexagon ABCDEF,
AF is perpendicular to FE.
We write: AF ⊥ FE
Also, AF ⊥ AB

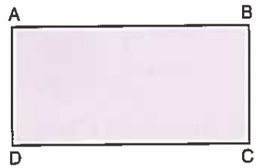


Practice

1. Look at this photograph.
Identify parts of the picture that:
- intersect
- are parallel
- are perpendicular
- appear to be horizontal
- appear to be vertical

2. For each shape below, identify and name perpendicular sides.
Which tool did you use?
If a shape does not have any perpendicular sides, explain how you know.

a)



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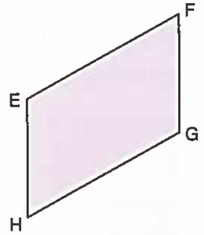

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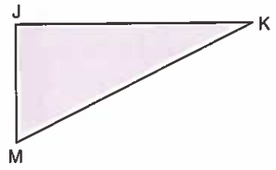

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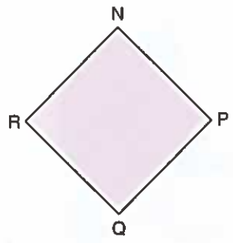
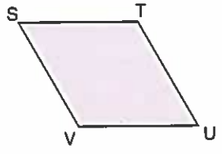
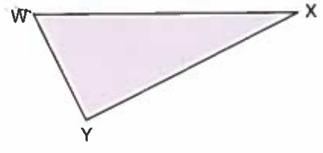


e)



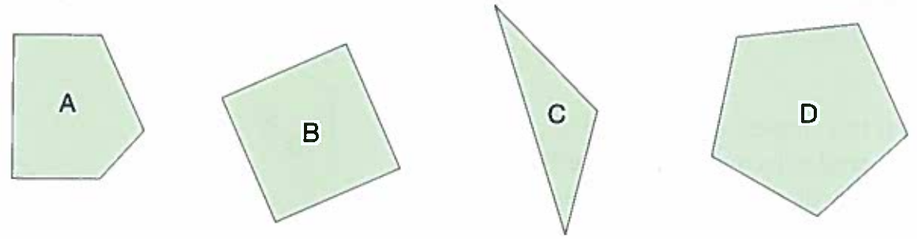
f)



3. Look at the shapes in question 2.
Assume the bottom of the page of this textbook is horizontal.
For each shape above, where possible, identify and name:
a) horizontal sides **b)** vertical sides **c)** intersecting sides

4. Use a geoboard and geobands. You will need square dot paper.
Two edges of the geoboard are vertical, and the other 2 edges are horizontal.
Make, then draw a shape that has:
a) exactly 1 horizontal side and 2 vertical sides
b) exactly 2 horizontal sides and 1 vertical side

5. Look at the shapes below.
Find a shape with:
a) four right angles **b)** two right angles **c)** no right angles



Take 3

6. Use a geoboard and geobands.
Make as many different shapes as you can that have:
a) exactly 1 pair of perpendicular sides
b) exactly 2 pairs of perpendicular sides
c) exactly 3 pairs of perpendicular sides
Draw each shape on dot paper. Label its vertices.
Identify and name any parallel sides.

7. How can you make or draw perpendicular lines without using dot paper?

8. What is the greatest number of right angles a hexagon can have?
Use a geoboard to help you find out.
Show your work.

9. On dot paper, draw as many different shapes as you can.
Include any or all of these attributes of sides each time:
parallel, perpendicular, vertical, horizontal

Reflect

How do you identify shapes with perpendicular sides?
How can you tell if those sides are vertical, or horizontal, or neither?
Use pictures and words to explain.

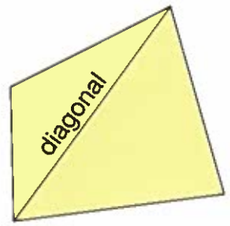
At Home

Look through newspapers and magazines or on the Internet.
Find examples of shapes with sides that are parallel, intersecting, perpendicular, vertical, and horizontal.
Cut out or print the pictures.
Highlight the examples you found.

LESSON 3

Investigating Quadrilaterals

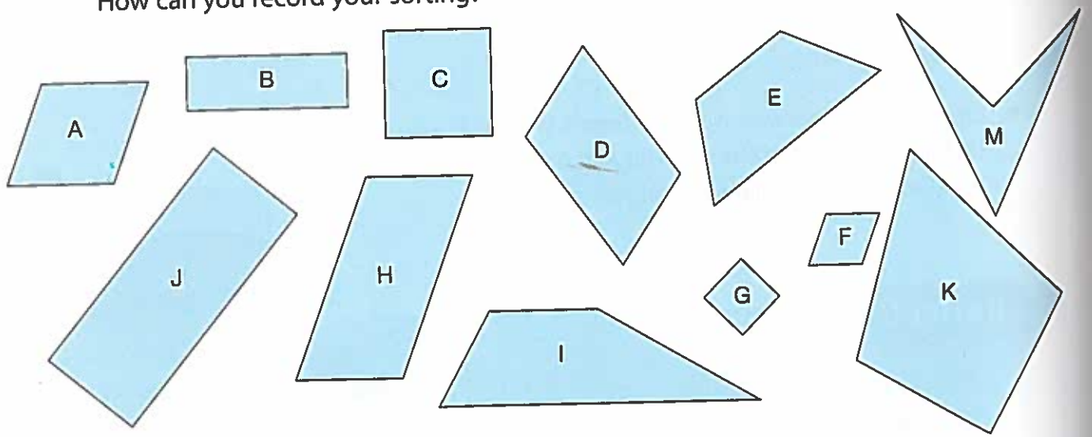
Why is this shape a quadrilateral?
A **diagonal** joins two opposite vertices.
How many diagonals does this quadrilateral have?



Explore

You will need a ruler. Your teacher will give you a copy of the quadrilaterals below.
Share the work.

- How are the quadrilaterals alike? How are they different?
  Name each quadrilateral you can identify.
- Measure the lengths of the sides of each quadrilateral.
  What do you notice?
- Draw the diagonals in each quadrilateral. What do you notice?
- Choose 2 attributes. Sort the quadrilaterals.
  How can you record your sorting?

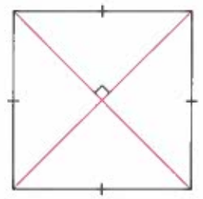


Show and Share

Compare your attributes and sorting with those of another pair of classmates.
Work together to sort the quadrilaterals a different way.

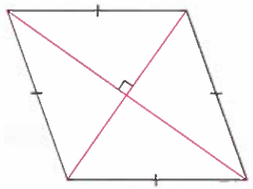
Connect

- Equal sides in quadrilaterals
  - A square has 4 sides equal.



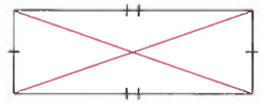
The diagonals of a square are equal.
The diagonals are perpendicular.

  - A **rhombus** has 4 sides equal.



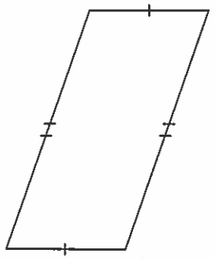
The diagonals of a rhombus are perpendicular.

  - A rectangle has 2 pairs of opposite sides equal.

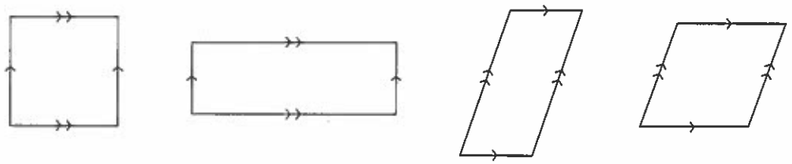


The diagonals of a rectangle are equal.

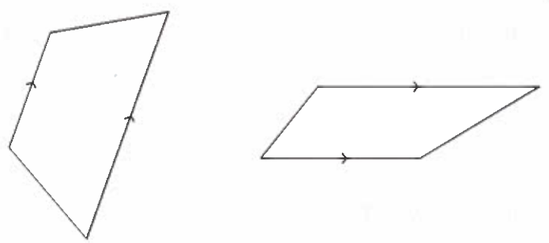
  - A **parallelogram** has 2 pairs of opposite sides equal.



- Parallel sides in quadrilaterals
  - All squares, rectangles, parallelograms, and rhombuses have 2 pairs of parallel sides.

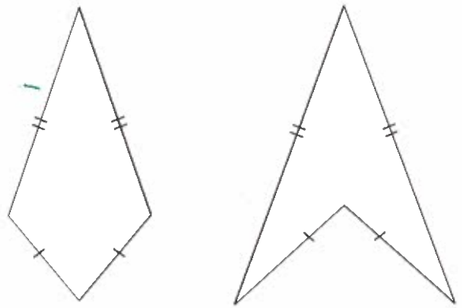


  - A **trapezoid** has exactly 1 pair of parallel sides.



➤ Adjacent sides in quadrilaterals

A **kite** has 2 pairs of equal adjacent sides.

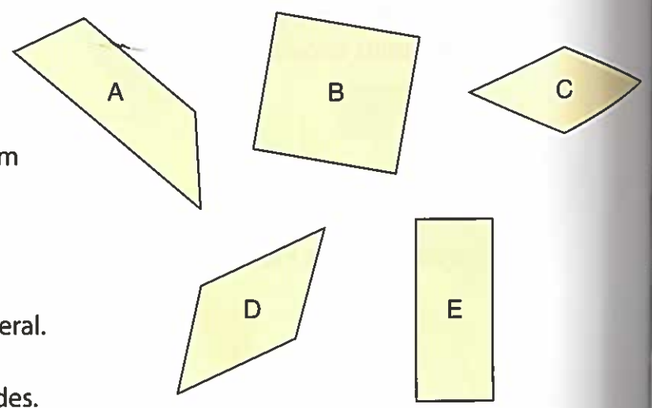


Practice

1. Use a geoboard.
Make 5 different parallelograms.
Draw the parallelograms on dot paper.
Write how each parallelogram is different.

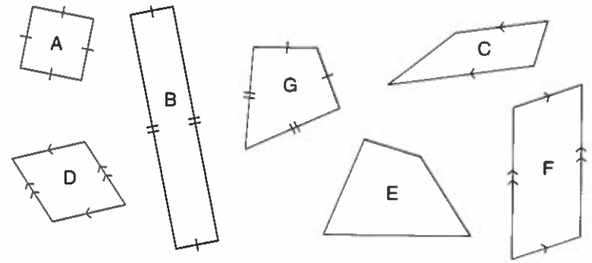
2. Use a geoboard.
How many different quadrilaterals can you make:
a) with 4 equal sides?
b) with 2 pairs of parallel sides?
c) with no equal sides and 2 parallel sides?
Draw each quadrilateral on dot paper.

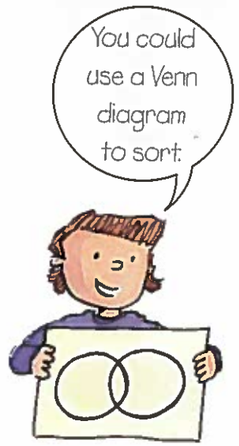
3. Use the shapes at the right.
Find:
a) a rhombus
b) a trapezoid
c) a shape that is a parallelogram and a rectangle
d) a shape that is a square and a parallelogram



4. This riddle describes a quadrilateral.
Solve this riddle:
I have two pairs of parallel sides.
All my sides are equal.
What am I?
How many different quadrilaterals can you name?

5. Sort the quadrilaterals below.
a) Use the attributes: "Has diagonals of different lengths" and "Has 2 pairs of equal sides."



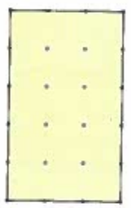


b) Choose two different attributes.
Sort the quadrilaterals a different way.

6. Use dot paper. Draw a parallelogram.
Write something about a parallelogram that is:
a) never true **b)** sometimes true **c)** always true
Explain your work.

7. Use the words "all," "some," or "no."
Complete each sentence to make it true.
a) ☐ rhombuses are parallelograms.
b) ☐ squares are rhombuses.
c) ☐ rhombuses are squares.
d) ☐ parallelograms have diagonals of equal length.

8. Copy this shape on dot paper.
a) Join the dots to divide the shape into 5 congruent rectangles.
b) Can you join the dots to make 4 congruent rectangles?
How do you know?



Remember that congruent shapes match exactly.

Reflect

Can you use the lengths of the sides of a quadrilateral to identify it? Use words and pictures to explain your answer.

LESSON 4

Other Attributes of Quadrilaterals

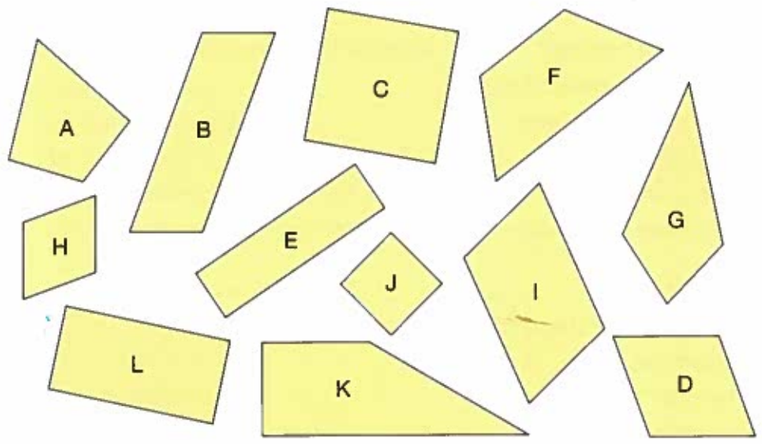
Another attribute of a quadrilateral is the number of lines of symmetry it has.
How can you tell if a quadrilateral is symmetrical?

Explore

Your teacher will give you a copy of the quadrilaterals below.
Share the work.

➤ Which quadrilaterals have perpendicular sides? How can you tell?
Name each quadrilateral.

➤ Which quadrilaterals have line symmetry? How do you know?



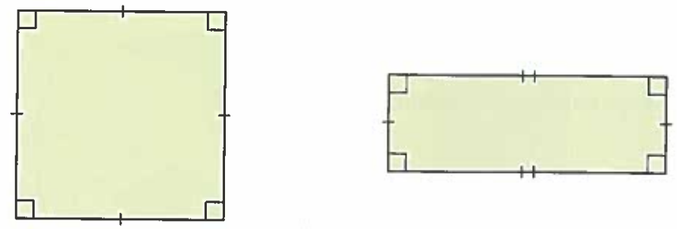
➤ Choose 2 attributes. Sort the quadrilaterals.
How did you know where to place each quadrilateral in your sorting?

Show *and* Share

Trade sortings with another pair of classmates.
Do not tell them your sorting rule.
Identify your classmates' sorting rule.

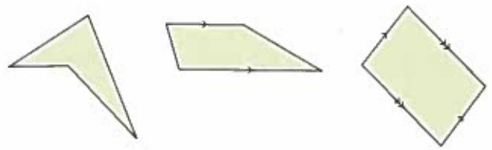
Connect

➤ All squares and rectangles have 4 right angles.
Adjacent sides are perpendicular.

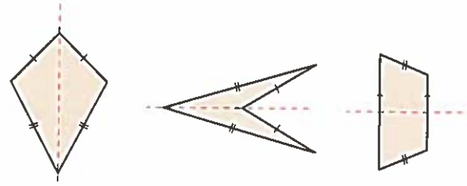


➤ A shape is symmetrical when it can be folded so that one part matches the other part exactly.
The fold line is the line of symmetry.

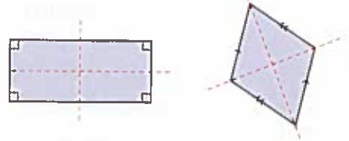
- Some quadrilaterals have no lines of symmetry.



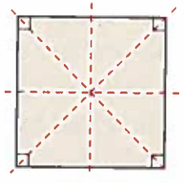
- Some quadrilaterals have 1 line of symmetry.



- Some quadrilaterals have 2 lines of symmetry.



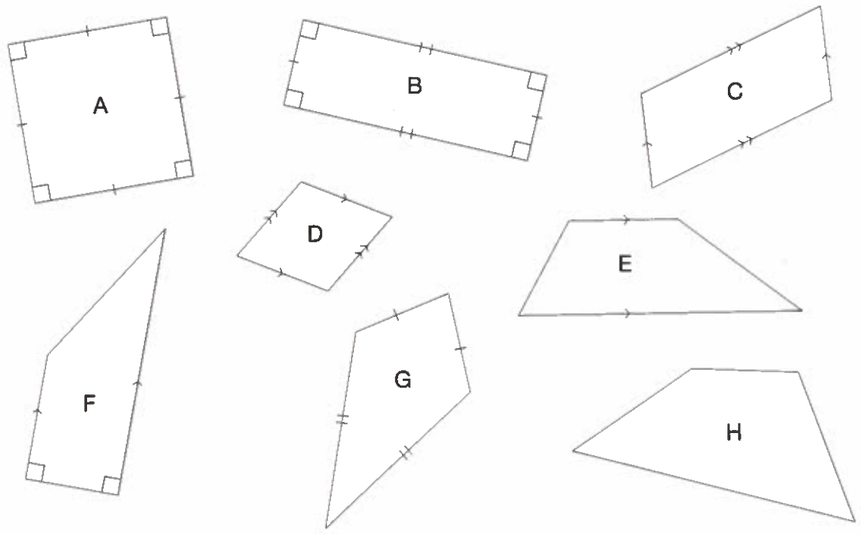
- One quadrilateral has 4 lines of symmetry.



Practice

1. Choose 3 attributes of quadrilaterals.
   Use dot paper.
   Sketch and name as many quadrilaterals as you can that have each attribute.

2. How many different ways can you name each quadrilateral?
   Write the names.

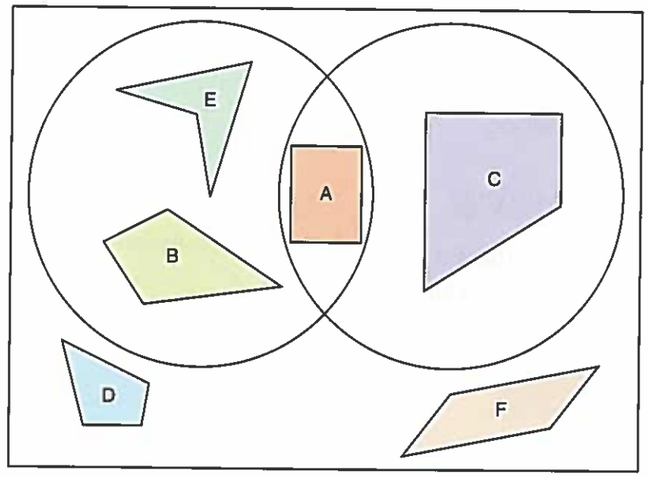


3. Use the quadrilaterals in question 2 and the Carroll diagram below.
   a) Sort the quadrilaterals.
   Use the attributes: "Has parallel sides" and "Has equal sides."
   Record your sorting.
   b) Choose 2 different attributes.
   Sort the quadrilaterals again.
   Record your sorting.

	Has parallel sides	Does not have parallel sides
Has equal sides		
Does not have equal sides		

4. You will need a geoboard and dot paper.
   Try to make a quadrilateral with each attribute.
   a) exactly 1 right angle **b)** exactly 2 right angles **c)** exactly 3 right angles
   Draw each quadrilateral on dot paper.
   Is there any quadrilateral you could not make? Explain.

5. How have these quadrilaterals been sorted?
   Identify the attributes of each quadrilateral.
   Write the sorting rule.

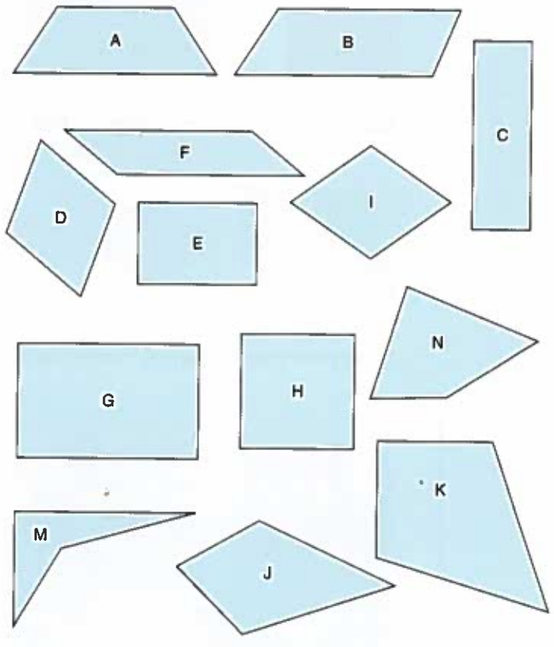


Use the shapes at the right for questions 6 to 8.

6. Sort the shapes into two groups.
   One group has perpendicular sides.
   The other group has no perpendicular sides.
   Record your sorting.

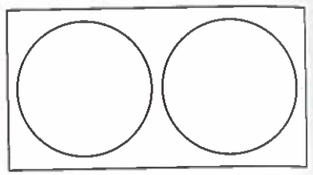
7. Draw a Venn diagram.
   Sort the shapes using these attributes:
   "Has at least one right angle" and
   "Has at least one pair of parallel sides"

8. Draw a Carroll diagram.
   Think about all the attributes of quadrilaterals.
   Choose two attributes, then sort the quadrilaterals.
   Trade your completed Carroll diagram with that of a classmate.
   Identify your classmate's sorting rule.
   Check that your answer matches your classmate's rule.



9. Work with a partner.
You will need a set of quadrilaterals.
Take turns to choose a secret attribute.
Find a set of quadrilaterals with that attribute.
Ask your partner to add a quadrilateral to the set.
Or, have your partner sketch a quadrilateral that belongs.
If the quadrilateral does not belong, tell your partner to try again.
Ask your partner to guess the attribute.

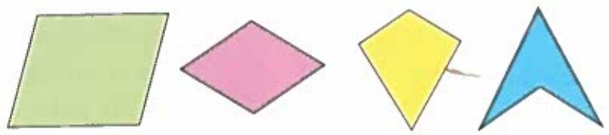
10. Draw a Venn diagram with two separate circles.
Which quadrilaterals could go in each circle?
Sketch the quadrilaterals.
Label each circle.
Explain your work.



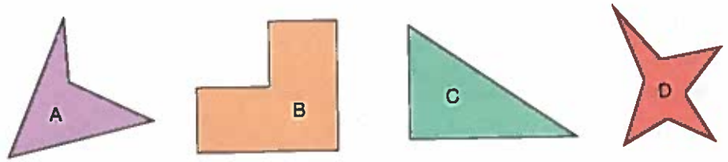
11. Use the clues to help you find the mystery attribute.

- All these quadrilaterals have the attribute.

- None of these quadrilaterals has the attribute.



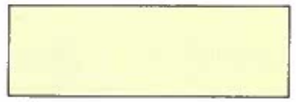
- Which of these shapes have the attribute?



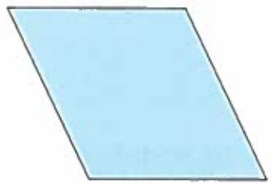
a) What is the attribute?
How do you know?
b) Draw another shape with this attribute.

12. Name each shape.

a) Why is this quadrilateral not a square?



b) Why is this quadrilateral not a rectangle?



c) Why is this quadrilateral not a rhombus?

d) Why is this quadrilateral not a kite?

Show your work.

Reflect

Which attributes are most useful to describe a quadrilateral? Why?
Could someone else think differently?
Check a classmate's response to this question.

Math Link

Your World

You see parallel lines in railroad tracks, rails on a fence, and double yellow lines on a straight road.

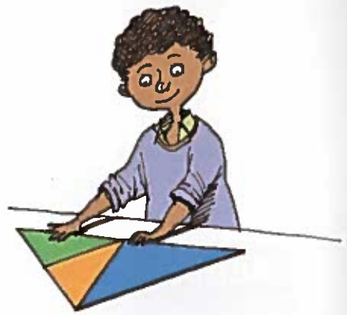
LESSON 5

Strategies Toolkit

A tangram is a square made from 7 shapes or **tans**.
The seven tans are: 2 small triangles,
1 medium triangle, 2 large triangles,
1 parallelogram, and 1 square.

Explore

You will need a tangram and dot paper.
This large triangle is made from the
2 small triangles and the medium triangle.
Which shapes can *you* make with only 3 tans?
Which of these shapes are quadrilaterals?
Record your work.



Show and Share

Tell about the strategy you used to solve the problem.

Connect

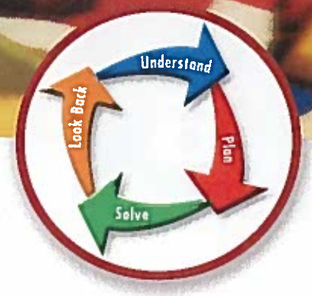
Use the tans.
How many different ways can you make a trapezoid?

What do you know?
- You can use any of the tans.
- You must make a trapezoid.

Think of a strategy to help you solve the problem.
- You can **solve a simpler problem**.
- Start with 2 tans, then try 3 tans, 4 tans, and so on.

Strategies

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



- Choose 2 tans.
  Try to make a trapezoid.
  If you can, sketch it.
  If you cannot, trade 1 tan for a different tan and try again.
  Repeat for different pairs of tans.
- Then choose 3 tans.
  Try to make a trapezoid.
- Repeat for 4, 5, 6, then 7 tans.

How do you know that each shape you made is a trapezoid?

Practice

Choose one of the **Strategies**

1. Think about the shapes you know.
   Which of these shapes can you make using all 7 tans?
   Show your work.

2. Try to make a square with
   2 tans, 3 tans, 4 tans, 5 tans,
   6 tans, and 7 tans.
   What did you find out?

3. Use any of the tans.
   a) How many different shapes can you make with 5 sides? 6 sides?
   b) Which of these shapes have parallel sides? Perpendicular sides?

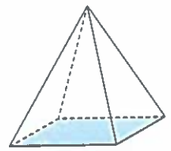
Reflect

Which shapes were easiest to make with tans?
Which shapes were most difficult? Why?
Write about your ideas.

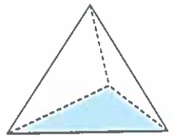
LESSON 6

Exploring Faces and Edges of Objects

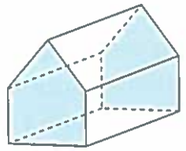
- Why are these objects called pyramids?
- Why are these objects called prisms?



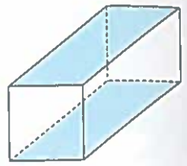
Square pyramid



Triangular pyramid



Pentagonal prism



Rectangular prism

Explore

Describe each object to your partner without saying its name.

Which objects above have:

- parallel faces?
- parallel edges?
- perpendicular faces?
- perpendicular edges?

Create a riddle that tells the attributes of an object but does not name it.

Show and Share

Trade riddles with another pair of classmates.
Identify your classmates' object.
Which words helped you to identify the object?

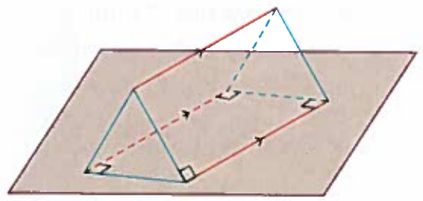
Connect

Look at a wall in your classroom.

➤ Follow the wall down to the floor.
Look at the line that is formed where the wall meets the floor.
The wall and floor *intersect* in this line.
The wall is *vertical*.
The floor is *horizontal*.
We say that the wall is *perpendicular* to the floor.

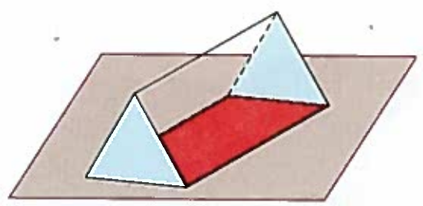
➤ Look at the vertical line where two walls intersect and the horizontal line where one of these walls meets the floor.
These lines are perpendicular.

Here is a triangular prism.



If the prism sits as shown on a table,
the red edges are horizontal.
They are also parallel.
Each blue edge is perpendicular to the red edge where the edges intersect.

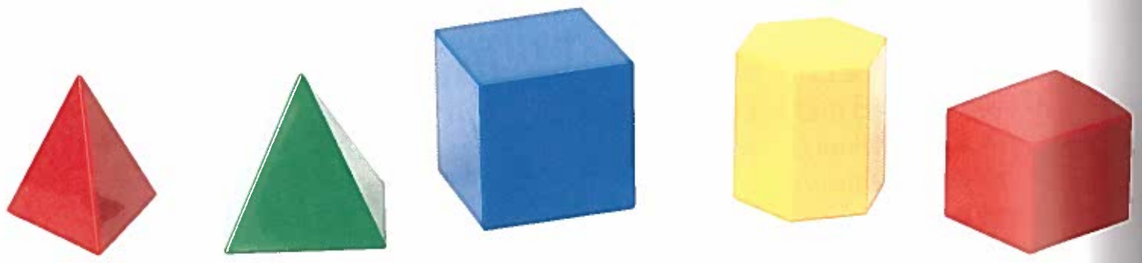
Here is the same prism with some faces shaded.
The red rectangular face is horizontal.
Each blue triangular face is vertical.
So, each triangular face is perpendicular to the red rectangular face.
Since both triangular faces are vertical, these faces are parallel.



Practice

1. In your classroom, identify:
   - **a)** two parallel walls
   - **b)** two intersecting walls
   - **c)** two perpendicular walls
   - **d)** a horizontal edge
   - **e)** a vertical edge
   - **f)** two intersecting edges
   - **g)** two parallel edges
   - **h)** two perpendicular edges

2. Find each geometric object below in your classroom.



On each object, identify, where possible:
- **a)** parallel edges
- **b)** parallel faces
- **c)** perpendicular faces
- **d)** perpendicular edges
- **e)** horizontal edges
- **f)** horizontal faces
- **g)** vertical faces
- **h)** vertical edges
- **i)** intersecting faces

3. Use the pictures and data from question 2.
   Create "What Am I?" riddles.
   Trade riddles with a classmate.
   Identify each object from your classmate's riddle.

Grade 2 3

4. Compare two prisms with different bases.
   Use the words you have learned in this lesson to answer the questions below.
   - **a)** How are the prisms the same?
   - **b)** How are they different?

Reflect

Choose two objects in the classroom, different from those in the questions above. Describe each object using these words: parallel, perpendicular, vertical, horizontal

Face-Off!

The goal of this game is to show all the faces of a geometric object.

Game Rules

Your teacher will give you 36 cards.
Each card shows the face of a geometric object.

- The dealer deals 3 cards to each player.
  The deck of remaining cards is placed face down.
- The dealer places one of her cards face up.
  This is one face of an object.
- Each time a player places a card face up,
  the player takes a new card from the deck.
- The second player selects a card from his hand
  that shows another face of the object started by the dealer.
  If a player does not have a card that can be used,
  he takes a new card from the deck. The player loses his turn.

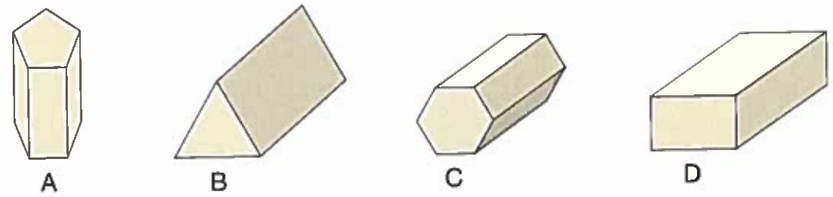
- The third player selects a card from her hand
  that is another face of the object.
- Play continues until all faces of the object are shown.
- The player who places the last card to complete all faces
  of the object, names the object, and gets a point.
- All the cards are shuffled and a new round begins.
- Play continues for 4 more rounds.
  The player with the most points wins.

In each round, players must complete a new object with their face cards.

LESSON 7

Drawing Objects

Identify each object. Describe as many attributes as you can.



Explore

You will need both triangular and square dot paper, and models of the objects above.

➤ Match each object above with its front face below.
Explain how you know.

➤ Choose one front face and matching object.
Use dot paper.
Sketch the object.

➤ Trade sketches with your partner.
Identify your partner's object.

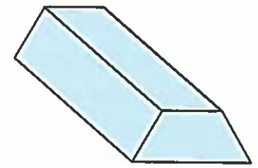
Show and Share

How did the dot paper help you draw the object?
What clues did you use to identify your partner's object?

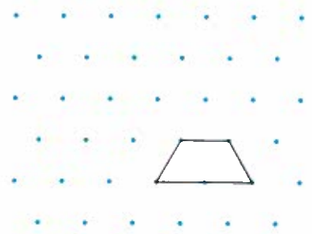
Connect

Here are 2 ways to sketch an object.

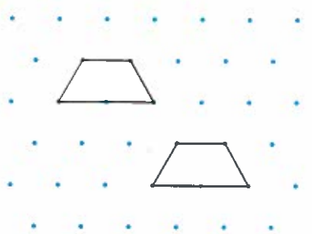
➤ To draw this prism on triangular dot paper:



Step 1: Use a trapezoid as the front face.
Join dots to draw a trapezoid.

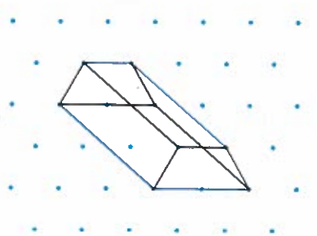


Step 2: Draw a congruent trapezoid that is up and to the left of the first trapezoid.



These faces are parallel.

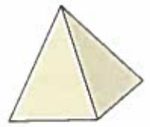
Step 3: Join corresponding vertices for the edges of the prism. These edges are parallel.



The blue edges that intersect are perpendicular.

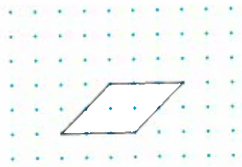
On triangular dot paper, each dot is the same distance from the 6 closest dots around it.

➤ To draw a square pyramid on square dot paper:

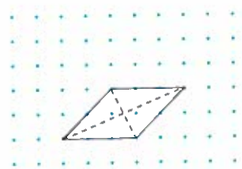


The base is horizontal.

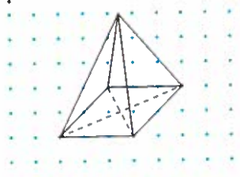
Step 1: The base is a square, but we draw a parallelogram for the base.



Step 2: Draw the diagonals of the base with broken lines.
The diagonals intersect at the midpoint of the parallelogram.



Step 3: Mark a point directly above the midpoint.
This new point is the top vertex of the pyramid.
Join this vertex to each vertex of the parallelogram.



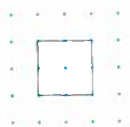
The sloping edges intersect at the top vertex.

Practice

1. Follow the steps in *Connect* to draw:
   a) the prism **b)** the square pyramid

Use square dot paper or triangular dot paper.

2. Each picture below is the front face of a prism.
   Draw each prism.
   a) a cube **b)** a pentagonal prism



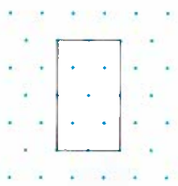
3. Each picture below is the base of a pyramid.
   Draw each pyramid.
   a) a rectangular pyramid **b)** a hexagonal pyramid

4. Name 3 objects outside the classroom that have:
   a) the shape of a prism
   b) the shape of a pyramid
   Describe each object in as much detail as possible.

5. Work with a partner.
   Use dot paper.
   Draw an object. Do not show your partner.
   Describe your object to your partner.
   Have her guess your object.
   Use any of these words to describe your object:
   perpendicular, parallel, horizontal, vertical, faces, and edges

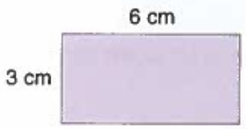
6. Draw as many prisms and pyramids as possible that have a triangle as a front face.
   Write about each object you draw.

7. A triangular prism with a horizontal base has this front face:



Draw this prism.

8. Here is the front face of a rectangular prism.
   Draw a prism with this face.



Reflect

How would you explain to someone how to draw a triangular pyramid?
Write the steps.
Include a drawing.

At Home

Look through newspapers and magazines or on the Internet.
Find examples of objects with edges and faces that are parallel, intersecting, perpendicular, vertical, and horizontal.
Cut out or print the pictures.
Highlight the examples you found.

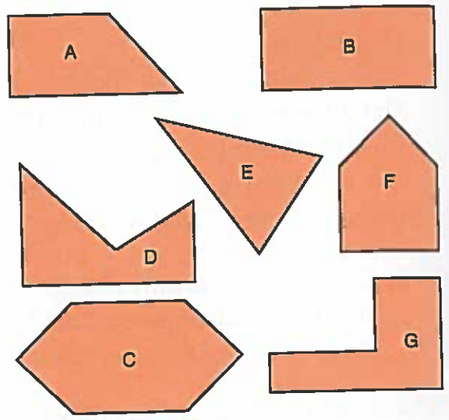
ASSESSMENT FOCUS | Question 6

Unit 6 Show What You Know

LESSON

1

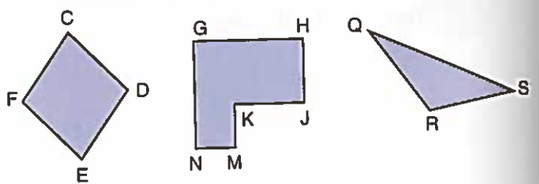
1. **a)** Describe each shape at the right.
b) Which shapes have at least 2 equal sides?



1
2

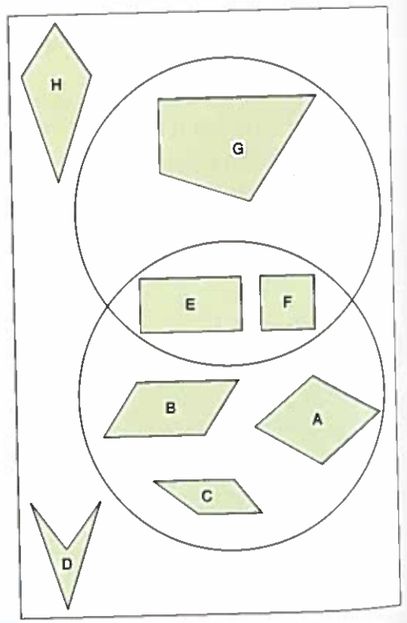
2. Use the shapes in question 1.
Which shapes have:
a) perpendicular sides?
b) parallel sides?
c) no perpendicular sides?
d) no parallel sides?

3. **a)** Use letters to name each shape at the right.
b) For each shape, identify and name 2 sides that intersect.
c) Which shapes have parallel sides? Identify and name the sides that are parallel.



3
4

4. Look at the Venn diagram at the right.
a) Name each quadrilateral.
Write some attributes it has.
b) How have the quadrilaterals been sorted?
Write the sorting rule.



5. Look at the shapes in question 4.
a) Use these attributes:
"Has 2 sides equal" and
"Has no parallel sides"
Re-sort the shapes.
Use a Venn diagram if it helps.
b) Choose 2 different attributes.
Sort the shapes.
Trade sortings with a classmate.
Find your classmate's sorting rule.

LESSON

3
4

6. Use square or triangular dot paper.
a) Draw each shape:
rectangle, square, trapezoid, rhombus, parallelogram, kite
b) Draw another quadrilateral that is different from the shapes in part a.
c) Assume the bottom of each dot paper page is horizontal.
Which quadrilaterals in parts a and b have:
- horizontal sides?
- vertical sides?

d) Choose 2 attributes. Sort the quadrilaterals in parts a and b.
What is the sorting rule?

6

7. For each object below:

a) How many parallel faces?
b) How many perpendicular faces?
c) How many horizontal faces?
d) How many vertical faces?

7

8. Look at the geometric objects in your classroom.
Identify an object with the attributes shown below.
Use square or triangular dot paper.
Draw the object.
a) an object with 2 pairs of parallel edges and no vertical edges
b) an object with 2 horizontal faces and 4 vertical faces

UNIT 6 Learning Goals

- ☑ describe the sides of shapes
- ☑ describe the faces and edges of objects
- ☑ understand the terms: parallel, intersecting, perpendicular, vertical, and horizontal
- ☑ use attributes to identify and sort quadrilaterals

Unit Problem

Building Bridges

You will need:
- Bristol board
- a hole punch or a compass
- paper fasteners
- a centimetre ruler
- centimetre cubes or standard masses
- scissors

Part 1

Choose one type of bridge truss to build.
Your bridge must:
- span a 35-cm gap
- support a load
- stand up by itself

Your teacher will give you a copy of the truss pieces.
Use the truss pieces to cut strips of Bristol board.
How many of each size of strip do you need?
Cut a strip of Bristol board 14 cm wide for the roadway.
How long does the road need to be?
Draw a line 2 cm in from each long edge.
Fold along the lines.

Build the bridge.
How will you brace the top?

Pratt Truss

Double Warren Truss

Part 2

Look at your bridge.
Identify as many of these attributes as you can:
- equal sides
- parallel sides
- perpendicular sides
- horizontal sides
- vertical sides
- lines of symmetry

Name the different quadrilaterals you see.

Part 3

Use two desks or some textbooks to make a 35-cm gap.
Place your bridge across the gap.
Find the load your bridge can support.

Compare your bridge with those of other groups.
Which type of bridge can support the greatest mass?

Write about the bridges and the attributes that make them strong.

Howe Truss

Howe Truss with counter braces

Check List

Your work should show
- ☑ a clear explanation of what you did and why
- ☑ as many attributes as possible
- ☑ how you used what you know about geometry
- ☑ how you found the greatest mass your bridge could support

Reflect on Your Learning

What have you learned about shapes and objects?
When you see a quadrilateral, which attributes do you use to identify it?
Use words and pictures to explain.