G2-1  Lines
Pages 70–71

CURRICULUM REQUIREMENT
AB: required
BC: required
MB: required
ON: required

VOCABULARY
circle
closed
curved
line
open
rectangle
shape
sides
square
straight
triangle

Goals
Students will identify straight and curved lines and sides, and open and closed lines.

PRIOR KNOWLEDGE REQUIRED
Knows the words “line” and “shape”

MATERIALS
large paper square, rectangle, triangle, and circle
attribute blocks made from BLM Attribute Blocks (p M-8–10)
yarn circles
BLM Find Closed Lines (p F-34)
catalogues, magazines, and newspapers

Curved and straight lines. Draw an assortment of straight line segments (see samples below). Tell students that lines that go straight from one point to another are called straight lines. Draw a few curved lines. SAY: A line that is not straight and has no pointed corners is called a curved line. Have volunteers draw two or three more examples of straight and curved lines.

straight lines  
curved lines

Sides of a shape. Show students a large paper square. ASK: What shape is this? If students do not recall the name, SAY: This shape is a square. Run your finger along each of the sides in turn and SAY: These are the sides of the square. ASK: Are the sides of a square straight or curved? (straight) Repeat with a large paper triangle and rectangle. Then show students a large paper circle and ASK: Which type of line makes a circle? Is a circle made with a straight line or a curved line? (curved line)

Show students some shapes with curved and straight sides (from BLM Attribute Blocks, for example). Point to each side of the shape in turn and ASK: Is this side straight or curved? Draw the shapes in the exercises below on the board, one at a time. Ask the questions below for each shape and have students signal the answer with thumbs up for yes and thumbs down for no.

Exercises: Does the shape have at least one straight side? Does the shape have at least one curved side?

a)  
b)  
c)  

Teacher’s Guide for Grade 2
**ACTIVITY 1 (Essential)**

1. **Sorting shapes** (see p F-2). Give students attribute blocks from BLM Attribute Blocks (1). Have them sort the shapes according to whether they have all straight sides or at least one curved side.

**Closed and open lines.** Draw two curved lines, one closed and one open (see examples below). SAY: These are two paths. Draw a person at some point on the closed path and ASK: What will happen as this person keeps walking along the path—where will she end up? (back where she started)

Draw a person at one end of the open path and ASK: Where will this person end up as he walks along the path? Will he end up where he started? (no)

Why not? (because the path has two ends) Tell students that a path that has no ends is called a **closed** path. A path that has two ends is called an **open** path. SAY: We also use the words “closed” and “open” to describe lines. Draw several more curved lines (without vertices), both closed and open, and ASK: Is this line closed or open? PROMPT: Can you get back where you started without turning around?

**Exercises:** Is the line closed or open?

a) ![closed line](image)

b) ![open line](image)

c) ![closed line](image)

d) ![open line](image)

e) ![closed line](image)

**Answers:** a) closed, b) open, c) open, d) open, e) closed, f) closed

**Shapes are closed lines.** Draw three sides of a square on the board. ASK: Is this an open line or a closed line? (open) Then add the fourth side to the square. ASK: Is a square an open or closed line? (closed) Will people walking along the sides of a square end up where they started? (yes)
Explain that sharp turns, such as corners of a square, are not ends of the line. Emphasize that people walking along the sides of a square could keep walking around and around the square. SAY: If you draw a closed line on paper, it creates a shape that you can cut out. An open line does not create a shape that you can cut out. Draw a shape similar to a square but with one curved side and ASK: Is this a closed line? (yes) Why? (because if you walk along it you will end up where you started) How is this shape different from a square? (It has a curved side.) Repeat with a triangle and a circle.

Students can signal the answers for the exercises below using thumbs up and thumbs down.

**Exercises:** Does the line make a shape?

a) ![Diagram](image1)

b) ![Diagram](image2)

c) ![Diagram](image3)

**Answers:** a) no, b) yes, c) yes

**Drawing closed and open lines.** On one side of the board, draw a variety of closed lines, including squares, rectangles, triangles, circles, and other shapes with straight and curved sides. ASK: Are these open or closed lines? (closed) Label the shapes “Closed lines.” Draw a few open lines on the other side of the board. Include a square with a missing side, a triangle with a break in one side, a spiral, and a capital letter “W.” Point to each open line and ASK: How is this line different from the closed lines? (It has a break in it; the ends don’t join up.) Have volunteers draw some lines of both types.

**Exercises**

a) Draw a closed line.

b) Draw an open line.

**ACTIVITIES 2–3 (Optional)**

2. **Tic-tac-toe.** Students can complete BLM *Find Closed Lines*. Students can then play an adapted version of Tic-tac-toe (on the board or on scrap paper) where one player draws closed lines and the other draws open lines rather than Xs and Os. Have students switch roles after each game.

3. **Collages and posters** (see p F-2). Invite students to make collages or posters showing the different types of lines they have learned about in this lesson.

**JOURNAL**

Have students draw examples of closed and open lines in their journals, using both straight and curved lines.

**CONNECTION**

Art
Extensions

1. **Length of straight and curved lines.** Create the following picture on the floor using rope. Use masking tape to keep the straight and curved lines in place. Point to each line separately and ask students to describe it as straight or curved.

   ![Start Finish](image)

   Invite two volunteers to walk, heel to toe, along the lines. Volunteers should start from the same dot at the same time and walk at the same pace. Before they begin, invite students to guess who will get from start to finish faster and explain their guesses. ASK: Which line is shorter and why? (the straight line; it does not wander around) Have the volunteers walk along the lines to check the prediction.

2. Copy the shape onto grid paper. Draw the shape without lifting your pencil from the paper. Draw each line only once.

   ![Grid Shapes](image)

3. Have students look at traditional Irish designs, such as Celtic knots. You can find images online by searching for “traditional Irish designs” or “Celtic knots.” Students can pretend that the designs are knots made of lines. Have students determine if the lines are open or closed and how many separate lines are in each design.

**CONNECTION**  
Art, Social Studies
Goals
Students will identify and count sides and vertices of shapes. They will sort shapes by the number of vertices.

Prior Knowledge Required
Knows the word "shape"
Can identify the sides of a shape
Can identify triangles, squares, rectangles, and circles

Materials
attribute blocks made from BLM Attribute Blocks (1) and (2)
(pp M-8–9)
large paper triangle, square, and rectangle
masking tape
yarn circles
BLM Sides and Vertices (p F-35)

Introduce vertices. Give students attribute block triangles made from BLM Attribute Blocks (1) and (2). Show a large paper triangle. ASK: What shape is this? (triangle) Run your finger along a single side of the triangle and SAY: This straight part is a side. Run your finger all the way around the edge of your triangle and have students do the same with their blocks. ASK: Are there places on the edge of the triangle that feel different from the sides? How do these places feel different? (They are sharper, or pointed.) Point to one of the vertices on your paper triangle and SAY: A corner of a shape is called a vertex. Point to the three vertices of the triangle one by one and SAY: When there is more than one vertex, we say vertices. This triangle has three vertices. Trace your triangle on the board, draw a small arrow pointing to each vertex, and write the terms “vertex” and “vertices” as shown in the margin.

Activity 1 (Essential)
1. Counting vertices game. Give each pair of students six attribute blocks that have straight sides only. Player 1 closes their eyes. Player 2 places a block in their partner’s hand. Player 1 counts the number of vertices on the shape by feel, then opens their eyes to check the count. Players swap roles. Students can play this game until they are good at it. Discuss strategies: do not rotate the shape, because you might count some vertices twice; use one hand to hold the shape and the other to count; keep a finger on one corner at all times to know where you started, etc. Point out how the number of vertices of a shape does not change no matter what position the shape is in.
Vertices of open lines. Draw any type of angle on the board. Explain to students that a vertex is created when two sides meet. A vertex is like a sharp turn or a corner. Tell students that the line you just drew has one vertex. ASK: Is this line open or closed? (open) Draw the open lines shown below and ASK: How many vertices do these open lines have? Then draw a circle, a heart, a half moon, and a quarter circle. ASK: Are these lines open or closed? (closed) How many sides and vertices do these shapes have?

![Vertices of open lines diagram]

Counting vertices. Use masking tape to create a polygon (a closed line with straight sides) with seven or eight vertices on the floor, and let students guess how many vertices it has. Then ask volunteers to stand at the vertices and ask another volunteer to count how many students are standing. ASK: Was your guess right? Repeat for more polygons (but do not use this term yet). Then solve the problem a different way: instead of counting volunteers, label the vertices with numbered cards (1, 2, 3, and so on) and have students verify that the answers are the same.

Draw a large triangle on the board and number each vertex. ASK: How many vertices does the triangle have? (3) How do you know? Repeat, this time beginning at a different vertex. ASK: Does it matter which vertex you start counting at? (no) Repeat with a square. Then draw a variety of other polygons and have volunteers count the vertices by numbering them.

Exercises: Copy the shapes onto grid paper. Count the vertices.

a)

![Shape a]

b)

![Shape b]

c)

![Shape c]

Bonus

![Shape e]

Answers: a) 4, b) 3, c) 5, Bonus: 0

To prompt students to see the answer to the Bonus, ASK: Does this line make any sharp turns? (no) Does it have any corners? (no)

Counting sides. Draw on the board:

![Counting sides diagram]
ASK: How many vertices does this shape have? (3) Have a volunteer number the vertices. Point to the middle of the curved side and ASK: Is this a vertex? (no) The line bends here, so why is it not a vertex? (not pointy) Erase the numbers. Remind students that a side is a line between vertices or end points. ASK: How many sides does this shape have? (3) How many are straight? (2) How many are curved? (1) Number the sides, as shown in the margin.

**Exercises:** Look at the shapes you drew on grid paper in the previous exercises. Count the sides in each shape.

**Answers:** a) 4, b) 3, c) 5, Bonus: 1

**Counting sides and vertices.** Have students work in pairs. Each partner draws a shape on grid paper. Students exchange notebooks with partners and count the sides and the vertices of the shape their partner drew.

**ACTIVITY 2 (Optional)**

2. Give each student 8 or 9 attribute blocks from BLM Attribute Blocks (1) and a yarn circle. Have students place all shapes with 3 vertices into the yarn circle. ASK: Where are all the shapes with 3 sides? (in the circle) Repeat with shapes with 4 vertices.

**Review material learned to date.** Remind students that open lines have loose ends, and closed lines do not. Closed lines make shapes. Remind students that sides that do not bend or turn are straight sides, and sides that bend or wiggle are curved sides. Sides meet at vertices, and loose ends are not vertices. One at a time, draw the shapes and lines in the exercises below on the board and ask the questions about each shape or line. Have students signal the answers using thumbs up for yes and thumbs down for no.

**Exercises**

Are there 4 sides? Are there 4 vertices? Is the line closed? Are all sides straight?

a) ![Image](image1)

b) ![Image](image2)

c) ![Image](image3)

d) ![Image](image4)

e) ![Image](image5)

**Bonus:**

**Answers:** a) no, no, yes, yes; b) yes, no, no, yes; c) yes, yes, yes, yes; d) no, yes, no, yes; e) yes, yes, yes, no; Bonus: yes, no, no, no
Extensions

1. The picture shows a fancy way of writing the numbers 1 to 6.

![](image)

a) Count the vertices on the numbers 1, 2, 3, and 5. What do you notice?

b) Draw numbers from 1 to 6 with the same number of sides as the value of the number.

Answer

a) Each number has the same number of vertices as its value (1 has 1 vertex, 2 has 2 vertices, 3 has 3 vertices, and 5 has 5 vertices).

Sample answer

b) ![Sample answer]

NOTE: Answers will vary and do not need to resemble real numbers.

2. Is it possible to draw a closed shape with straight sides and two vertices? If it is, draw an example. If it is not, explain why.

Answer: No, because the straight sides never curve back to close the shape.

3. Is it possible to draw a closed shape with two vertices? If it is, draw an example. If it is not, explain why.

Answer: Yes; example shape: ![Example shape]
Goals
Students will identify squares by their attributes and draw squares.

PRIOR KNOWLEDGE REQUIRED
Knows the word “shape”
Can identify squares visually
Can identify straight and closed lines
Can identify and count sides and vertices of shapes

MATERIALS
large paper shapes (squares and others)
BLM Find the Squares (p F-36)
pattern block squares or squares from BLM Pattern Blocks (p M-11)
BLM Square or Not? (p F-37)
BLM 2 cm Dot Paper (p F-38)

Being a square does not depend on size, colour, or pattern. Show students a large paper square. Ask them to name the shape. Divide the board in two. Trace the paper square on one side of the board so that the bottom side is parallel to the ground. ASK: Is this a square? How do you know? (It is the shape of a square.) Draw a smaller square in the same position (i.e., bottom side parallel to the ground) and ask the same questions. Draw more squares of varying sizes and colours, but again not rotated. Add a pattern (e.g., a dotted pattern) to some squares. ASK: Do the dots change the shape? Is it still a square? Label the shapes you’ve drawn “Squares.”

Being a square does not depend on position. Affix your large paper square to the board in a slightly rotated position (so that the bottom side is not parallel to the ground). Trace and then remove the paper square. ASK: Is this shape a square? How do you know? Point out, if necessary, that the shape is the same square, only turned slightly. Repeat several times, increasing the angle of rotation, until the square is “standing” on a vertex. Emphasize that the shape did not change; you only turned it.

Give each student a copy of BLM Find the Squares and a pattern block square or a square made from BLM Pattern Blocks.

Answer: SQUARE

Exercises: Cross out shapes that are not squares. Use the pattern block to check. What word do the letters on the squares spell?

Squares have 4 sides and 4 vertices. Have a volunteer number and count the sides of one of the squares drawn on the board. ASK: How many sides does the square have? Repeat for vertices. Repeat for a square of a different size, and a square that is rotated. ASK: Do all squares have 4 sides and 4 vertices? (yes) Does the number of sides and vertices change when a square is turned? (no)
Squares have straight sides. Draw a shape like a square but with one side curving inwards. ASK: Is this a square? (no) Why not? (one side is curved) Have a volunteer fix the drawing so that it is a square. ASK: Do all squares have all straight sides? (yes)

A square is a closed line. Draw a square with a small break in one side (see the margin). ASK: is this a closed line or an open line? (open) Is this a square? (no) Why not? (One side has a break in it.) Have a volunteer fix the drawing so that it is a square. ASK: Is a square a closed or an open line? (closed)

Squares have square corners. Draw on the board:

Ask for a volunteer to circle the corner that matches the corners on all the squares. Tell students that squares have a special type of corner that we call a square corner.

Sorting shapes. One by one, show students several large paper shapes, both squares and not squares (e.g., different rectangles, a parallelogram, a circle, a triangle, a trapezoid, a pentagon—but students will describe these shapes simply as “not squares”). Include one or two shapes with curved sides. Decide as a class whether each shape is a square or not and affix it to the appropriate half of the board. Encourage students to look at and count the sides and vertices of the shapes to help them decide. (The fact that the sides of a square are all of equal length is taught in the next lesson; if a student suggests this idea now, tell the class that you will check this later.) Continue with shapes drawn on the board, including one or two open lines; draw the first few examples yourself and invite volunteers to draw others. Prompt students to use different sizes and patterns.

Distribute BLM Square or Not?. Ask students to predict which shapes will become squares when they add a side. Have them mark the guesses on the BLM. (answers will vary) Show students a paper square, holding it like a diamond with the corner pointing downwards. ASK: Is this a square? (yes) Rotate the paper to confirm answers. Then draw a square on the board with a corner pointing downwards. ASK: Can you turn this shape to see if it is a square? (no) Ask students to compare the square on the board to the square on BLM Square or Not?. ASK: Why is it easier to decide that it’s a square when it is on paper than when it is on the board? (you can turn the sheets so that it is easy to see if the shape is a square, but you cannot turn a shape drawn on the board)

Answers: first row: yes, no, no; second row: yes, yes, no

Exercise: Complete BLM Square or Not? by adding the missing side. Check the guess you made before.

As a class, discuss what prevents shapes that are not squares on the BLM from being squares. Students will likely notice that rectangles that are not squares have different side lengths. Confirm the guess and promise to discuss the issue in the next lesson.

Squares have straight sides. Draw a shape like a square but with one side curving inwards. ASK: Is this a square? (no) Why not? (one side is curved) Have a volunteer fix the drawing so that it is a square. ASK: Do all squares have all straight sides? (yes)

A square is a closed line. Draw a square with a small break in one side (see the margin). ASK: is this a closed line or an open line? (open) Is this a square? (no) Why not? (One side has a break in it.) Have a volunteer fix the drawing so that it is a square. ASK: Is a square a closed or an open line? (closed)

Squares have square corners. Draw on the board:

Ask for a volunteer to circle the corner that matches the corners on all the squares. Tell students that squares have a special type of corner that we call a square corner.

Sorting shapes. One by one, show students several large paper shapes, both squares and not squares (e.g., different rectangles, a parallelogram, a circle, a triangle, a trapezoid, a pentagon—but students will describe these shapes simply as “not squares”). Include one or two shapes with curved sides. Decide as a class whether each shape is a square or not and affix it to the appropriate half of the board. Encourage students to look at and count the sides and vertices of the shapes to help them decide. (The fact that the sides of a square are all of equal length is taught in the next lesson; if a student suggests this idea now, tell the class that you will check this later.) Continue with shapes drawn on the board, including one or two open lines; draw the first few examples yourself and invite volunteers to draw others. Prompt students to use different sizes and patterns.

Distribute BLM Square or Not?. Ask students to predict which shapes will become squares when they add a side. Have them mark the guesses on the BLM. (answers will vary) Show students a paper square, holding it like a diamond with the corner pointing downwards. ASK: Is this a square? (yes) Rotate the paper to confirm answers. Then draw a square on the board with a corner pointing downwards. ASK: Can you turn this shape to see if it is a square? (no) Ask students to compare the square on the board to the square on BLM Square or Not?. ASK: Why is it easier to decide that it’s a square when it is on paper than when it is on the board? (you can turn the sheets so that it is easy to see if the shape is a square, but you cannot turn a shape drawn on the board)

Answers: first row: yes, no, no; second row: yes, yes, no

Exercise: Complete BLM Square or Not? by adding the missing side. Check the guess you made before.

As a class, discuss what prevents shapes that are not squares on the BLM from being squares. Students will likely notice that rectangles that are not squares have different side lengths. Confirm the guess and promise to discuss the issue in the next lesson.
Students can use BLM 2 cm Dot Paper to complete the following exercises.

**Exercises:** Use dot paper.

a) Draw 2 different squares.

b) Draw 2 different shapes with 4 sides that are not squares.

**Bonus:** Draw a square that has sides that do not run along the rows or columns of dots.

**Sample answers**

a) , 

b) , Bonus:

**Squares in the environment.** Point to various objects around the room and ask if these shapes look like squares. Then have volunteers identify other objects that include squares. Some examples of objects with square faces include a cubic tissue box, connecting cubes, base ten blocks, and some windows.

**Extensions**

1. Make sure your overhead projector does not distort shapes before you show the shapes to the class. Hold up a patterned square. ASK: What shape is this? (square) SAY: I am going to put the square on the overhead. ASK: What will you see? (a square)

   Put the square on the overhead. Ask students to identify the shadow’s shape. (square) Then discuss the differences between the square and its shadow. (size, pattern, one is a physical object and the other is a shadow) Emphasize that both shapes are squares. Rotate the square on the overhead slightly. ASK: Is the shape still a square? (yes) Is the shadow still a square? (yes) Point out that the block on the overhead is still the same shape—a square—so the block’s shadow is still a square, too, even though it looks slightly different.

2. Use grid paper to create a pattern made up of squares.

   a) Use at least 3 colours.

   b) Use 2 different sizes of squares.

3. Squares are often used in designs. Have students look for squares on clothes, patterns on the floor or carpet, and so on. You can also show different examples of tartans and discuss the significance of tartans to people in Scotland. Students can create their own tartans using grid paper or BLM 2 cm Grid Paper (p M-1).
Goals

Students will identify and model rectangles. They will compare squares and rectangles.

PRIOR KNOWLEDGE REQUIRED

Knows the word "shape"
Can identify rectangles and squares visually
Can identify straight and closed lines
Can identify and count sides and vertices of shapes
Can perform direct and indirect comparisons of length

MATERIALS

large paper rectangle and square
pattern block squares or squares from BLM Pattern Blocks (p M-11)
BLM 2 cm Dot Paper (p F-38)
BLM Rectangles or Squares? (p F-39)
yarn circles
scissors
strips of paper (optional)

Identifying rectangles. Introduce rectangles as you did squares: hold up a large paper rectangle and identify it by name (rectangle); trace the rectangle on one side of the board; draw more rectangles on the board (different sizes, colours, patterns) and label them “Rectangles”; use prompts to elicit that rectangles are closed shapes with 4 straight sides, 4 vertices, and all square corners; turn (rotate) a rectangle several times. Emphasize that a rectangle is still a rectangle regardless of pattern, colour, size, or position.

Students can signal the answers for the exercises below using thumbs up and thumbs down.

Exercises: Is this a rectangle?

a)        b)        c)

 d)        e)        f)

Answers: a) no, b) no, c) yes, d) no, e) no, f) yes

Discuss with students what prevents the shapes in a), b), d), and e) from being rectangles. (a) open line, rectangles are closed; b) 5 sides, 5 vertices,
and not all vertices make square corners, rectangles have 4 sides and 4 vertices and all vertices make square corners; d) curved side, rectangles only have straight sides; e) no square corners, rectangles have square corners at each vertex)

### ACTIVITIES 1–2 (Essential)

1. **Modelling rectangles.** Have students create rectangles using up to 6 pattern block squares or squares made from **BLM Pattern Blocks.** Have them trace their rectangles in their journals and tell how the rectangles are different. (Sample answer: This rectangle is 3 squares wide and 2 squares tall, the other one is wider: it is 6 squares wide, but only 1 square tall.)

2. **Drawing rectangles.** Students can draw a variety of rectangles on **BLM 2 cm Dot Paper.** Also, have students draw some shapes that have 4 sides and 4 vertices but are not rectangles (for example, shapes that have at least one non-square corner or at least one curved side).

### LENGTH OF SIDES IN A SQUARE AND RECTANGLE

**Hold up the large paper rectangle.** Run your finger along one of the shorter sides and ask students how they could check which sides of the rectangle are longer than this side. Point to one of the longer sides. **ASK:** Is it longer? How can we check? Fold the shorter side down towards the longer side to compare. Explain the meaning of the word **equal** in this context: two sides are equal if they have the same length. Now fold a large paper square diagonally to compare the lengths of the adjacent sides. Students will see that the sides of a square are equal in length. Point to one of the shorter sides of the rectangle and **ASK:** How many sides of the rectangle are the same length as this side? Point to one side of the square and **ASK:** How many sides are the same length as this side? Fold shapes as required to check.

**Distinguishing between squares and rectangles by direct comparison of sides.** Ask students if they think their observations (squares have 4 equal sides, rectangles have 2 equal short sides and 2 equal longer sides) will be true for any rectangle and any square. Have students use Activity 3 to check.

### ACTIVITY 3 (Essential)

3. **Sorting.** Give students **BLM Rectangles or Squares?** and have them cut out the shapes. Ask students to sort the shapes (excluding the two mystery shapes) into rectangles and squares and then check, by folding, how many equal sides the squares and rectangles have. Then ask students to check whether the mystery shapes are rectangles or squares. Alternatively, students can use strips of paper to compare side lengths indirectly (as in Lesson ME2-4). Ask students to explain their findings. Encourage the use of correct terminology, such as “sides,” “equal,” “longer,” “shorter,” and so on.
Applying knowledge of squares. Give students scissors and sheets of paper. Ask: What shape is the sheet of paper? (rectangle) How do you know? Show students how to create a square from a sheet of paper by folding. Ask: How do you know that the shape you made is a square?

Squares and rectangles in the environment. Point to various objects around the room (doors, windows, books, and so on) and ask if these shapes look like squares or rectangles. Then have volunteers identify other objects that include squares and rectangles.

NOTE: Extension 1 is required in order to cover the British Columbia curriculum.

Extensions

1. Show students the shapes below. Say: Shapes like these are common in northwest-coast First Nations art. These shapes are called ovoids. Note: Ovoid is the art term, not the standard mathematical term, used for this shape.

Discuss how ovoids and rectangles are similar and how they are different. An ovoid has roughly the same shape as a rectangle, but it has no clear vertices and it has at least one curved side. Add dots to show vertices, as shown below. Say: The ovoid on the left has a straight side and three curved sides. The ovoid on the right has 4 curved sides.

Have students look for ovoids in examples of northwest-coast First Nations art. Individual body parts of animals, such as heads and eyes, are often drawn as ovoids. For example, orcas have white spots near their eyes, which are usually drawn as ovoids. In each example you show, ask students which body parts are drawn as ovoids. Students can also draw an ovoid and incorporate it into a picture. You may wish to invite a local Elder or knowledge keeper to talk about the significance of particular shapes in art.

2. Have students trace a square from BLM Attribute Blocks (1) and (2) (pp M-8–9) in their notebooks and create a picture that incorporates the square.

Note: Students will need 2 cm dot paper or BLM 2 cm Dot Paper (p F-38) for Extensions 3–6. If students answer “Yes” to Questions 4–6, have them draw an example.
3. Draw a shape with 4 sides that has opposite sides equal and is not a rectangle.

   Sample answer
   \[
   \begin{array}{c}
   \end{array}
   \]

4. Is it possible to draw a shape with 4 equal sides, 4 square corners, and no other vertices that is not a square?

   Answer: no

5. Is it possible to draw a shape with straight sides, 4 square corners, and no other vertices that is not a rectangle or a square?

   Answer: no

6. Is it possible to draw a shape with straight sides and 4 square corners that is not a rectangle or a square?

   Answer: yes; example shape:
Goals
Students will identify and model triangles.

PRIOR KNOWLEDGE REQUIRED
Knows the word “shape”
Can identify triangles visually
Can identify straight and closed lines
Can identify and count sides and vertices of shapes

MATERIALS
large paper equilateral triangle
BLM Triangles and Not Triangles (p F-40)
attribute blocks made from BLM Attribute Blocks (pp M-8–10)
yarn circles
geoboards
drinking straws of three different colours
scissors
 glue and construction paper (optional)
photographs or images from magazines that include triangular shapes

Identifying triangles. Hold up a large paper equilateral triangle and identify it by name (triangle); trace the triangle on one side of the board; draw more equilateral triangles (different sizes, colours, patterns) and label them “Triangles”; use prompts to elicit that triangles are closed shapes with 3 straight sides and 3 vertices; turn (rotate) an equilateral triangle several times. Emphasize that a triangle is still a triangle regardless of pattern, colour, size, or position.

Students can signal the answers for the exercises below using thumbs up and thumbs down.

Exercises: Is this a triangle?

a)  

b)  

c)  

Answers: a) no, b) yes, c) no

Discuss why the shapes from parts a) and c) are not triangles. (a) is not closed, triangles are closed; c) has a curved side, triangles have only straight sides)

Non-equilateral triangles. Draw a large variety of triangles (or photocopy BLM Triangles and Not Triangles on a transparency and display the triangles only, covering the bottom half of the sheet). Explain that all these
shapes are triangles even though they look quite different. ASK: What is the same about all the triangles? (They have 3 straight sides and 3 corners.) How do the triangles change in each row? (They get taller, they lean to the right, and so on.) Students can also show with their hands or whole bodies how the triangles change.

**ACTIVITY 1 (Essential)**

1. **Sorting shapes** (see p F-2). Give students various attribute blocks (squares, rectangles, triangles, and other shapes with only straight sides from BLM Attribute Blocks) and ask them to sort the blocks into “Triangles” and “Not Triangles.” ASK: How many vertices do all the triangles have? Are there triangles that do not have 3 vertices? How many sides do all the triangles have?

Draw a large variety of non-triangles (or show the bottom half of BLM Triangles and Not Triangles). ASK: Why aren’t these shapes triangles? (curved sides, more than 3 sides or vertices) Hold up some attribute blocks, both triangles and not triangles, and ask students where they should be placed on the BLM. Then invite volunteers to draw shapes on the board and decide as a class whether the shapes are triangles or not. Ask students if they can draw a shape that has 3 sides and 3 vertices but is not a triangle (these will need to have at least one curved side).

Students can signal the answers for the exercises below using thumbs up and thumbs down.

**Exercises:** Is this a triangle?

a) ![Image]

d) ![Image]

e) ![Image]

**Answers:** a) no, b) yes, c) yes, d) no, e) yes, Bonus: no

Discuss why some of the shapes in the exercise above are not triangles. Answers will vary for the Bonus; students might consider it a triangle with a missing piece, rather than a shape with 6 sides and 6 vertices. Encourage students to repeat what they know about triangles (3 sides, 3 vertices, closed, straight sides) ASK: Are all sides in this shape straight? (yes) Are there 3 sides? (no) Point out that the moment they say “no” about one of the essential properties of triangles, the shape cannot be a triangle.
ACTIVITIES 2–3 (Optional)

2. **Modelling triangles on geoboards.** Have students create triangles on geoboards. Ask students to move one vertex of the triangle. **ASK:** Is the new shape still a triangle? Encourage students to make more changes to their triangles, so that the resulting shapes have sides of different lengths.

3. **Modelling straw triangles.** Divide students into groups of three. Give each student in the group a different set of straws of different lengths from the following 3 sets (as shown below): A. 8 cm, 8 cm, 8 cm; B. 8 cm, 6 cm, 6 cm; C. 8 cm, 7 cm, 6 cm. Ask students to use their straws to make a triangle. If possible, give each student in the group a different colour of straw so that they do not mix their straws. Ask students to share their triangles within their groups. How are their triangles different? How are they the same? Then, students can trade straws to make other triangles. You can also give students more straws and scissors and have them cut the straws to lengths of their choosing to make other triangles. Students could glue their triangles to construction paper and create a class display.

![A, B, C](image)

**Exercises:** Use grid paper.

a) Draw 3 triangles of different shapes.

b) Draw a shape that has 3 sides but is not a triangle.

**Sample answers**

a) ![Sample](image)

b) ![Sample](image)

**Triangles in the environment.** Discuss with students where they see triangles in the environment (e.g., half a slice of bread cut diagonally, tile patterns, part of a roof). Ask students to identify triangular shapes around the room and in photographs or images from magazines.

Ask students to trace some attribute block triangles in their journals and create a picture incorporating the shapes.

**NOTE:** Extension 1 is required in order to cover the British Columbia curriculum.
Extensions

1. Introduce the traditional U-shape used in northwest-coast First Nations art. See examples of the shape below:

Discuss the geometric properties. The U-shape has two clear vertices—the sharp tapering corners. All U-shapes have at least one curved side. Some U-shapes also have straight sides. Have students count the sides and the vertices of all the U-shapes. Next, convert one of the U-shapes into a split U-shape by drawing a triangle of a contrasting colour, as shown below:

Point out that split U-shapes have more vertices and more straight sides than regular U-shapes. Discuss where the sides end and where the vertices are located. For example, you can add vertices to the shapes, as shown below:

This split U-shape has 7 vertices (two shown with dots, the others are sharp corners), 2 curved sides, and 5 straight sides.

Have students look for U- and split U-shapes in examples of northwest-coast First Nations art. Discuss how the shapes are used in pictures. Students can also draw pictures using ovoids, U-shapes, and split U-shapes. (See Extension 1 in Lesson G2-4 for an introduction to ovoids.) You may wish to invite a local Elder or knowledge keeper to talk about the significance of particular shapes in art.

2. Have students look for squares and triangles in examples of traditional designs of different cultures. They can try to produce a design in a chosen style on grid paper or BLM 1 cm Grid Paper (p M-7).

3. Introduce students to quilts made of square and triangular pieces of fabric. Show pictures of these types of quilts and ask them what shapes the quilts are made from. Have students create a quilt design on grid paper that uses at least 4 different colours and incorporates both triangles and squares.

Some quilts have a core pattern that is repeated again and again to create a whole quilt. Show students pictures of these types of quilts and ask them to identify and draw the core pattern. Then ask them to create their own core patterns and have them draw three repetitions of their patterns.
Find Closed Lines

☐ Put an \(\times\) on the lines that are **not** closed.
☐ Circle the closed lines.

Who wins: \(\times\), \(\bigcirc\), or nobody? ________________
Sides and Vertices

☐ Count the sides.
☐ Count the vertices.

4 sides
4 vertices

☐ sides
☐ vertices

☐ sides
☐ vertices

☐ sides
☐ vertices

☐ sides
☐ vertices

☐ sides
☐ vertices

☐ sides
☐ vertices

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Find the Squares

☐ Place a pattern block square on each shape.
☐ Turn the square to see if it matches.
☐ Cross out the shapes that are not squares.
☐ Write the letters that are left: ______ ______ ______

Can you make a word with these letters? ____________

S

E

J

Q

U

K

A

N

R

Y

E
2 cm Dot Paper
Rectangles or Squares?

Mystery Shape

Mystery Shape

Mystery Shape
Triangles and Not Triangles

**Triangles**

**Not Triangles**