

Important Concepts . . .

Preview Review



Mathematics Grade 4 *TEACHER KEY*

W3 - Lesson 3: Geometry 1

Important Concepts of Grade 4 Mathematics

W1 - Lesson 1	Number Concepts
W1 - Lesson 2	Addition and Subtraction
W1 - Lesson 3	Patterns
W1 - Lesson 4	Fractions and Decimals
W1 - Lesson 5	Data Management
W1 - Quiz	
W2 - Lesson 1	Multiplication 1
W2 - Lesson 2	Multiplication 2
W2 - Lesson 3	Division 1
W2 - Lesson 4	Division 2
W2 - Lesson 5	Exploring Outcomes
W2 - Quiz	
W3 - Lesson 1	Measurement 1
W3 - Lesson 2	Measurement 2
W3 - Lesson 3	Geometry 1
W3 - Lesson 4	Geometry 2
W3 - Lesson 5	Problem Solving
W3 - Quiz	

Materials Required

Mathematics Grade 4

Version 5

Preview/Review W3 - Lesson 3 TEACHER KEY

Publisher: Alberta Distance Learning Centre

Author: Eric Boerger, Brian Key

Inhouse Teacher: Brian Key

Project Coordinator: Dennis McCarthy

Preview/Review Publishing Coordinating Team: Nina Johnson,

Laura Renkema, and Donna Silgard



The Alberta Distance Learning Centre has an Internet site that you may find useful. The address is as follows: <http://www.adlc.ca>

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

ALL RIGHTS RESERVED

Copyright © 2007, by Alberta Distance Learning Centre, 4601-63 Avenue, Barrhead, Alberta, Canada, T7N 1P4. Additional copies may be obtained from the Alberta Distance Learning Centre.

No part of this courseware may be reproduced or transmitted in any form, electronic or mechanical, including photocopying (unless otherwise indicated), recording, or any information storage and retrieval system, without the written permission of Alberta Distance Learning Centre.

Every effort has been made both to provide proper acknowledgement of the original source and to comply with copyright law. If cases are identified where this effort has been unsuccessful, please notify Alberta Distance Learning Centre so that appropriate corrective action can be taken.

IT IS STRICTLY PROHIBITED TO COPY ANY PART OF THESE MATERIALS UNDER THE TERMS OF A LICENCE FROM A COLLECTIVE OR A LICENSING BODY.

Preview/Review Concepts for Grade Four Mathematics

TEACHER KEY



***W3 - Lesson 3:
Geometry 1***

OBJECTIVES


By the end of this lesson, you should

- explain what is meant by *geometry*
- identify points, horizontal line, line, vertical lines, parallel lines, perpendicular lines, intersecting lines, and ray and vertex
- classify angles as to whether they are right angles, greater than right angles, or less than right angles
- identify and sort polygons (including triangle, circle, square, rectangle, parallelogram, rhombus, and trapezoid)
- verify symmetrical 2-D shapes by drawing lines of symmetry


GLOSSARY


angle - the V-shape created when two lines or two rays meet or intersect at a point

endpoint - the spot where a line segment or ray begins


intersecting lines - lines that
 meet or cross


line of symmetry - a line that divides a shape into two equal and symmetrical parts

parallel lines - lines that are
 always the same distance apart

perpendicular lines - lines
 that form a right angle when they intersect

symmetrical - having identical parts when cut in half by a line

trapezoid - a four sided figure
 with one pair of parallel lines

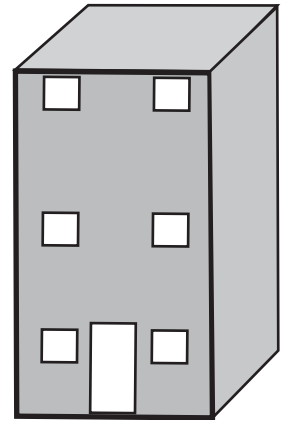
ray - a line with only one
 endpoint

W2 - Lesson 3: Geometry

A. Introduction

Geometry is the study of shapes and the space they take up. Everything has a shape, and everything around us that we can see takes up space. We use geometry to describe the shapes and figures we see.

For example, a building may look like a box or a cube. In geometry, we describe this building as a “geometric solid”. We call it a **rectangular prism**.



When we describe the lines that we see, or the solid shapes that an object contains, or how lines come together to form angles or corners, we are using geometry.

B. Points and Lines

Geometry begins with points. Each **point** is like a tiny dot. If you put a lot of tiny points very close to each other, you make a **line**.

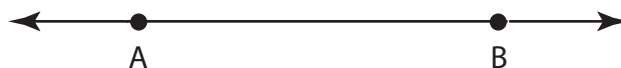
1. Try making a line between the arrows below by making a lot of little points next to each other.



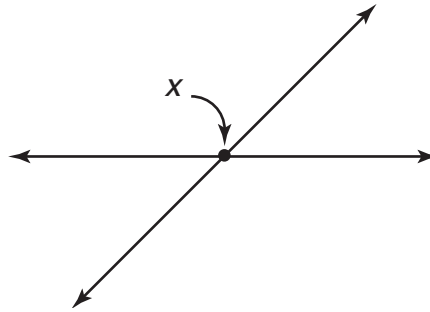
Note: The line drawn by the student should be a series of closely touching dots.

Notice the arrowheads on the ends. These show that the line goes on for a long way in both directions.

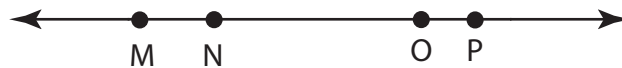
In Geometry, you can label points along a line with letter names. Two points along a line, labelled A and B, are shown like this.



Whenever lines **intersect**, or cross each other, they make a point. That point can be labelled with any letter.



2. Use a ruler to draw a straight line in the space below. Add arrowheads. On the line mark four points at different places. Label these points **M**, **N**, **O**, and **P**.



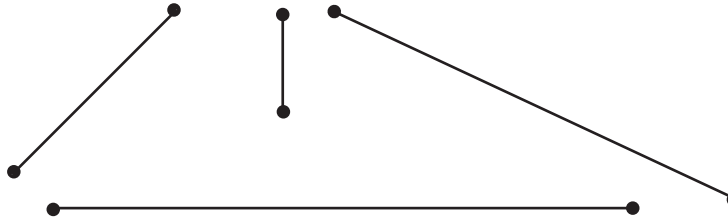
Lines are all around us. Everything has some sort of a line in it. There are many different kinds of lines: straight lines, curved lines, intersecting lines, etc.

3. Look around your classroom. Tell where you can see an example of each of these lines. **Answers will vary. Some examples given.**

- a. a straight line the edge of a table or desk
- b. a curved line the edge of a cup or glass
- c. a short line an answer blank; the edge of a book
- d. a long line the line where the floor meets the wall
- e. lines that meet at a corner the corner of a desk or room
- f. lines that cross each other the lines on a map
- g. lines that run side by side the lines on a loose-leaf paper

Line segments are parts of any line. They have a starting and a stopping point. These points are called **endpoints**.

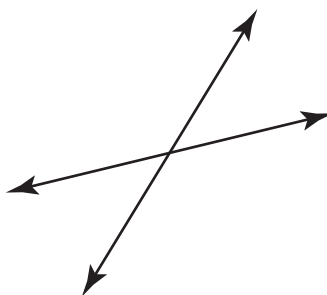
Here are some examples of line segments. Each has a starting point and a stopping point.



4. Use a ruler to draw three line segments. Be sure to show the starting and the stopping points. Do not let any of the lines touch each other.

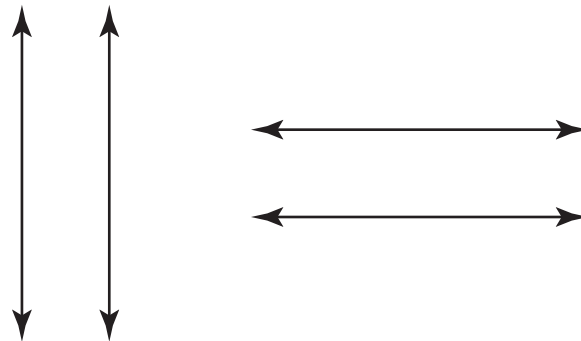
Here are some special lines with special names.

Intersecting lines are lines that meet or cross each other.



The arrowheads indicate that these are lines, not line segments. Lines continue forever in the direction of the arrowhead although the entire line cannot be seen.

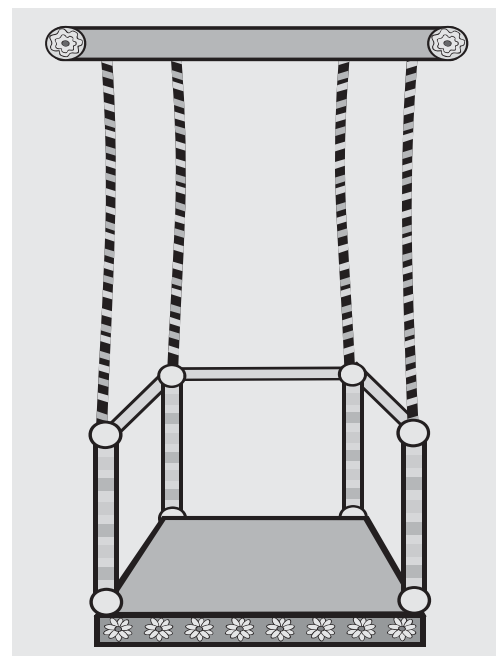
Parallel lines are always the same distance apart. Parallel lines never intersect or cross each other.



A **vertical** line goes up and down.



A **horizontal** line goes from side to side. It follows the horizon.



Can you find the vertical and horizontal lines on this swing?

5. Look around the classroom to find two examples of each of the following:

Answers will vary. Some examples given.

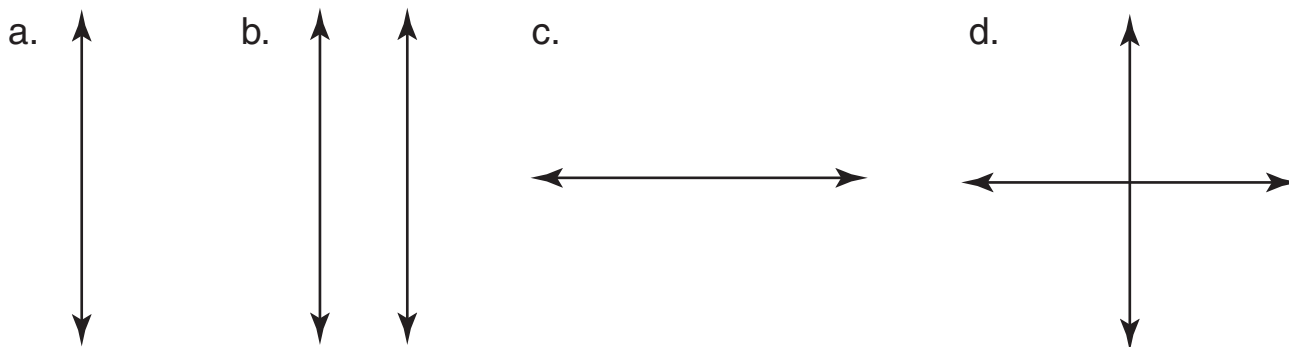
Intersecting lines: 1. *floor or ceiling tiles.* 2. *the corner of a desk.*

Parallel lines: 1. *opposite sides of a door.* 2. *top and bottom of a computer screen.*

Vertical lines: 1. *door frame.* 2. *thermometer.*

Horizontal lines: 1. *bottom of a window frame.* 2. *lines in a scribbler.*

6. Label the following lines with their correct names. Some lines may have more than one label.

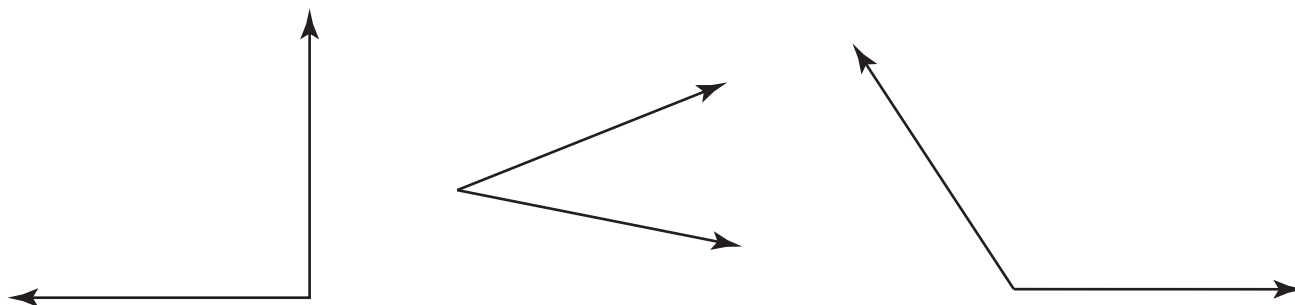


a. *vertical line* b. *parallel lines*

c. *horizontal line* d. *intersecting lines*

C. Angles

Angles are made whenever two lines meet or intersect at a point. When a line changes direction with a very sharp turn, an angle is created.



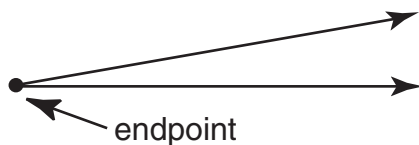
1. Look around the classroom. List four examples of angles that you can see.

Answers will vary.

- a. where two walls meet b. corner of a window
c. corner of a door frame d. where 2 scissor blades meet

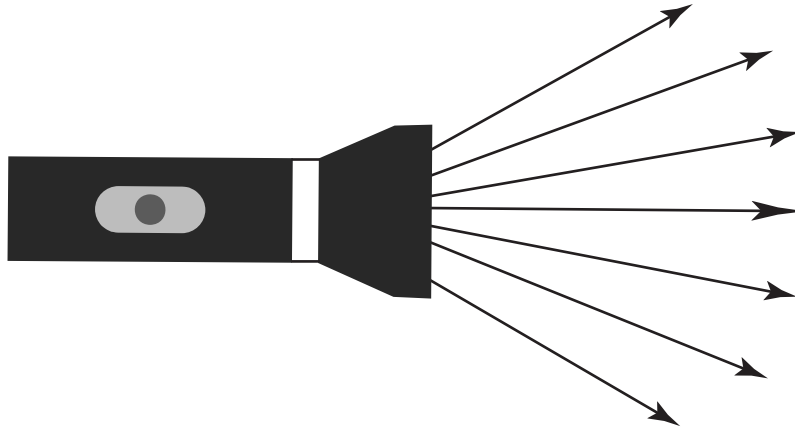
Angles are usually drawn using a special kind of line called a ray.

Rays are lines that have only one endpoint.

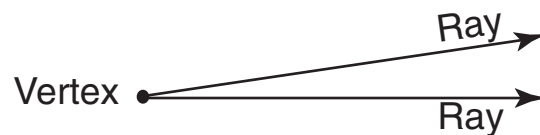


A ray starts at one point and goes on forever in one direction away from the point!

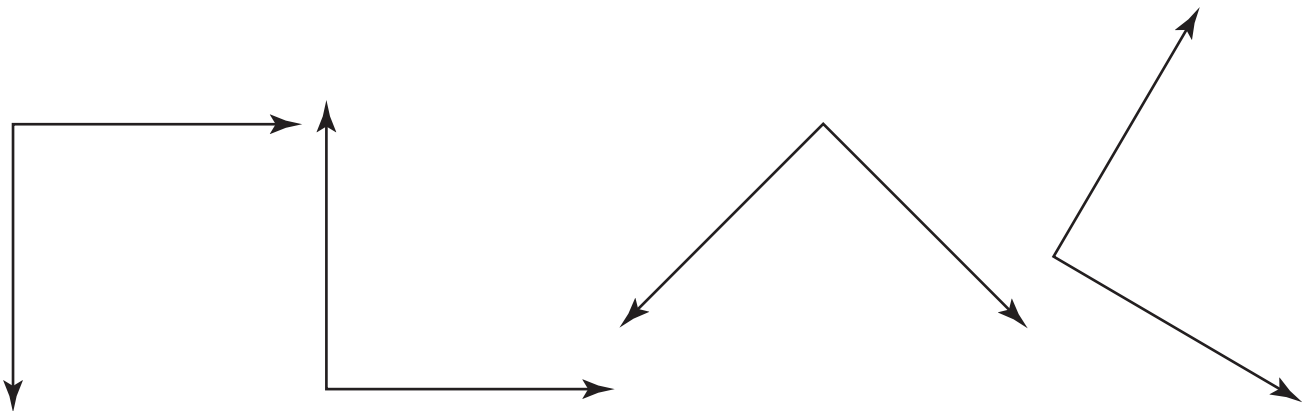
Rays are lines just like the rays of a flashlight. At one end is a flashlight (the point). The rays of light move off into space in straight lines.



Whenever two rays start at the same endpoint, an angle is created. The starting point is called the **vertex** of the angle.

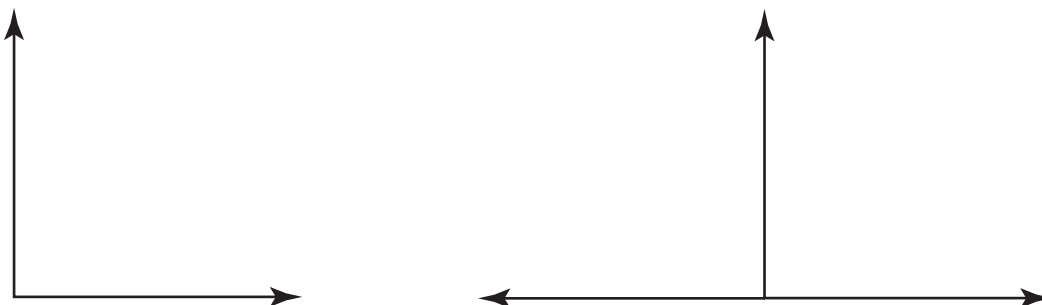


A special kind of angle that forms a "square corner" is called a **right angle**.

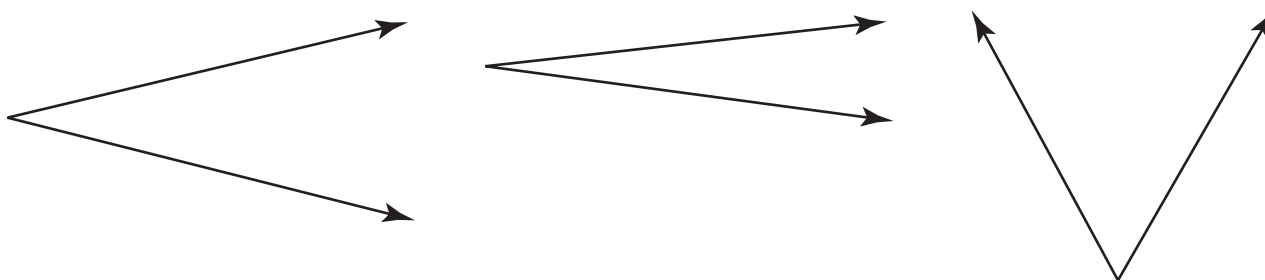


Right angles are very important when building things such as houses and boxes, and when making designs. Carpenters have special tools called carpenter's squares to make right angles.

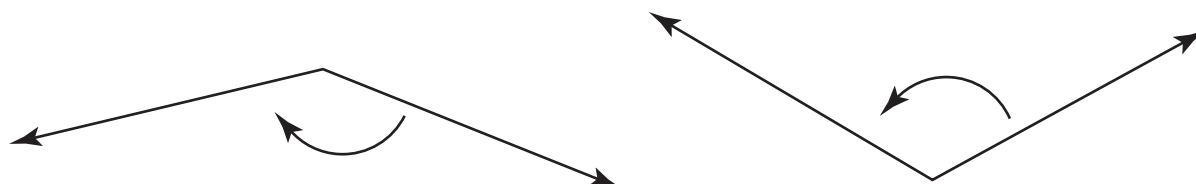
When two rays or two lines intersect and form a right angle, we say they are **perpendicular** to each other. The rays or lines that form right angles are called **perpendicular lines**.



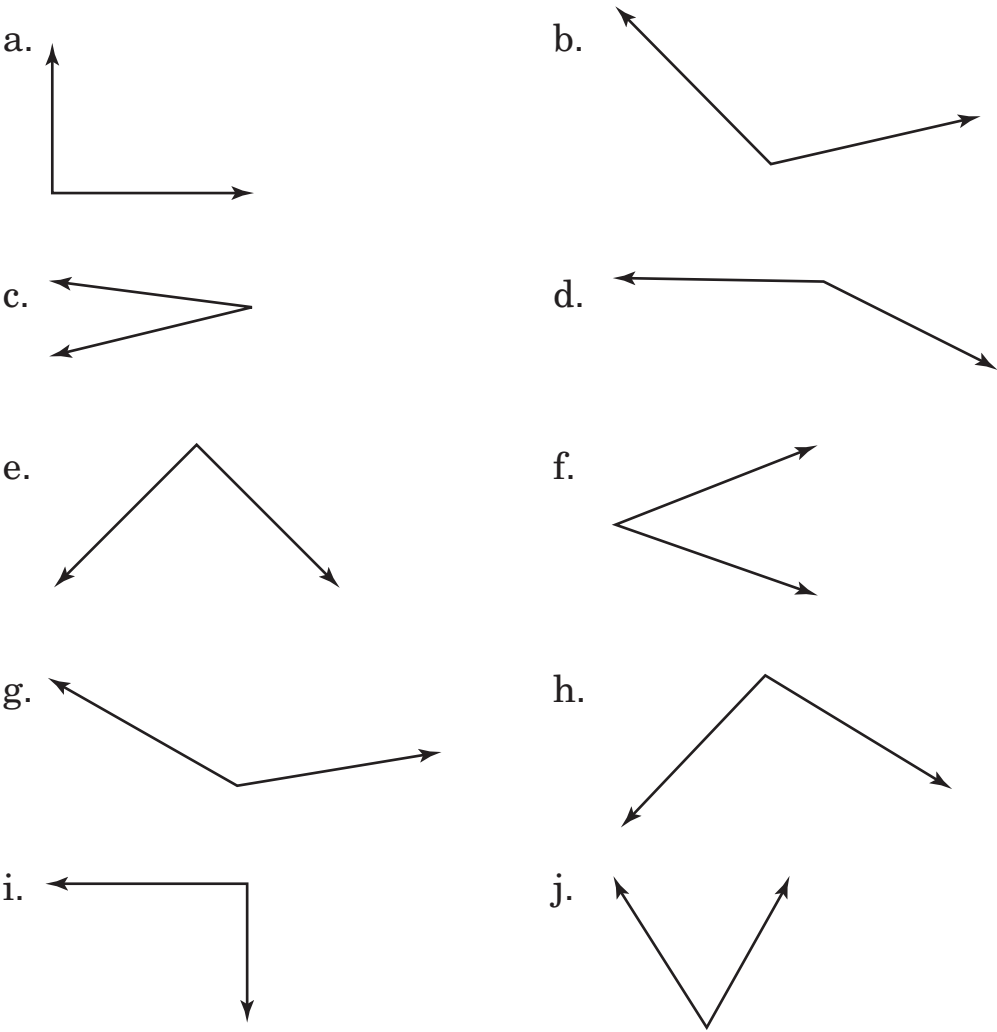
Some angles are smaller than a right angle. The two rays are closer together than they are in a right angle.



Some angles are larger than a right angle. The two rays are farther apart than they are in a right angle.



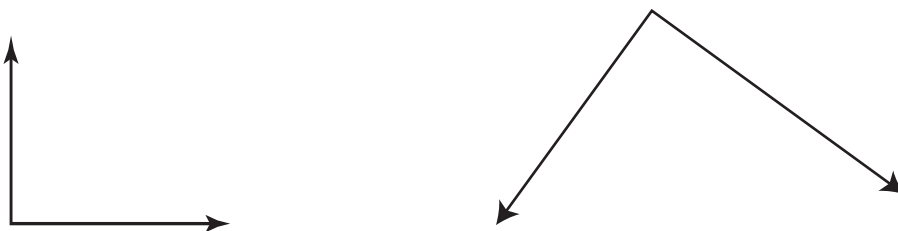
2. Carefully look at each of the angles below. Some of them are right angles. Some of them are smaller than right angles. Some of them are larger than right angles. Put the letter of each angle into the correct part of the chart.



Angles Smaller than a Right Angle	Right Angles	Angles Bigger than a Right Angle
<i>c, f, j</i>	<i>a, e, i</i>	<i>b, d, g, h</i>

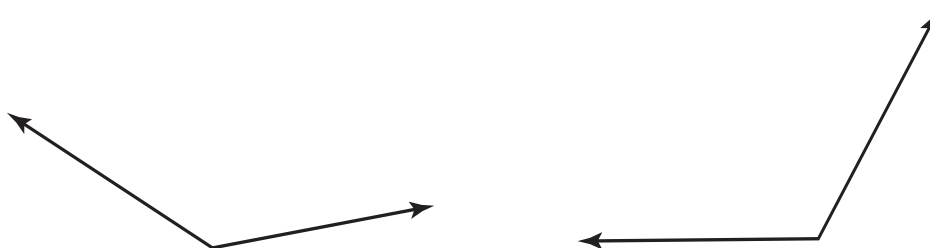
3. In the space below, draw two right angles.

Answers will vary.



Two right angles should be shown.

4. In the space below, draw two angles larger than a right angle.



Two angles greater than 90 degrees should be shown.

5. In the space below, draw two angles smaller than a right angle.



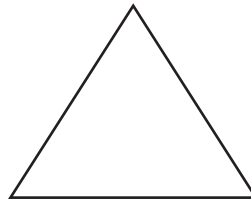
Two angles smaller than 90 degrees should be shown.

By the way, in case you're wondering, there's no such thing as a left angle in the world of geometry!

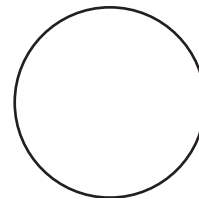
D. Two-Dimensional Figures

Flat shapes are called **two-dimensional** or **2-D figures**. They have only two dimensions: **length** and **width**. Because they are flat, they do not have any thickness or depth.

A **triangle** is any shape with three sides.



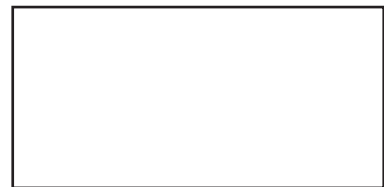
A **circle** is a round shape made with a curved line.



A **square** is a shape with four equal sides and four right angles.



A **rectangle** is a shape with four sides and four right angles. The opposite sides of a rectangle are equal length.



1. List two examples of each of the following shapes that you can see in the classroom around you.

Answers will vary.

Circles: _____

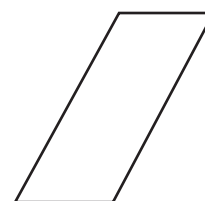
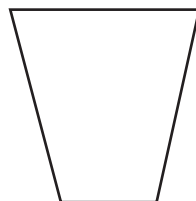
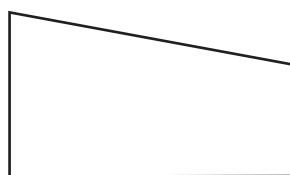
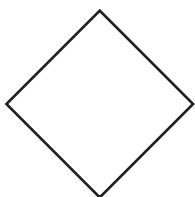
Triangles: _____

Squares: _____

Rectangles: _____

A **polygon** is a two-dimensional figure with three or more straight sides. The prefix “poly” means many. The triangle, the square, and the rectangle are examples of polygons. Here are the names of some new polygons for you to learn.

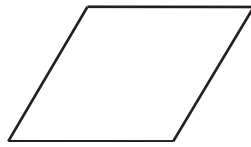
- A **quadrilateral** is any four-sided polygon. The word “quad” means four. Small off-road vehicles are called quads because they have four wheels. Squares and rectangles are all quadrilaterals. Here are some more quadrilaterals.



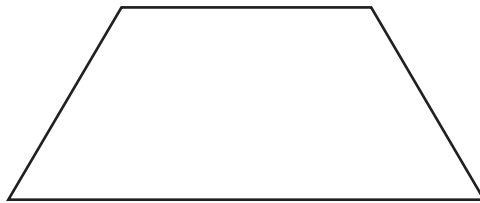
- A **parallelogram** is a four-sided figure in which the opposite sides are parallel and the same length.



- A **rhombus** is a four-sided figure in which the opposite sides are parallel and all the sides are the same length.



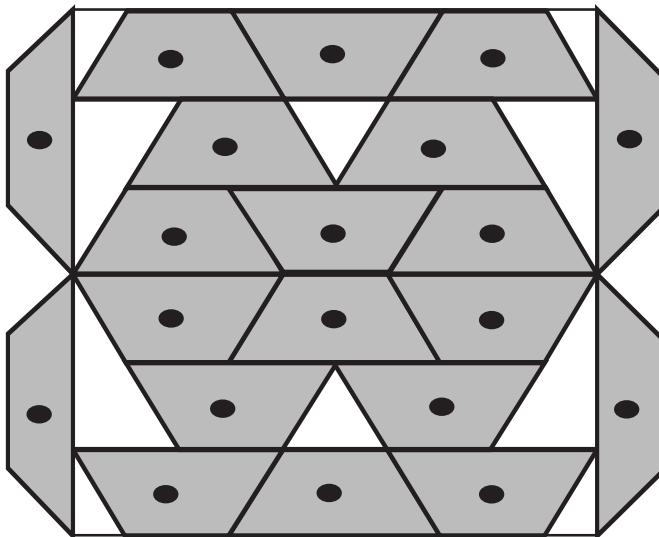
- A **trapezoid** is a four-sided figure with only one pair of parallel lines.



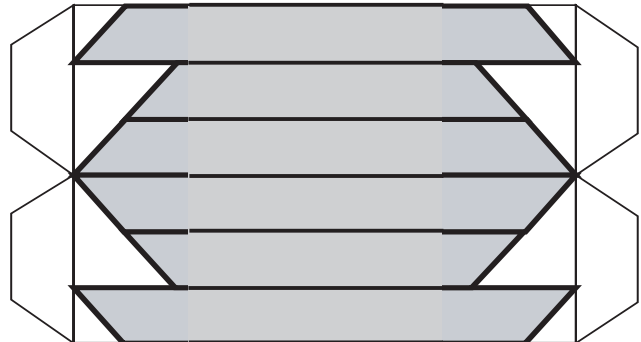
In this trapezoid, the top and bottom sides are parallel.
Notice that the two parallel sides do not have to be the same length.

2. Just for Fun!

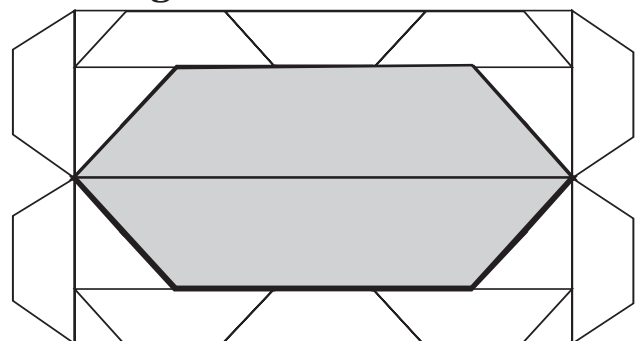
Small



Medium



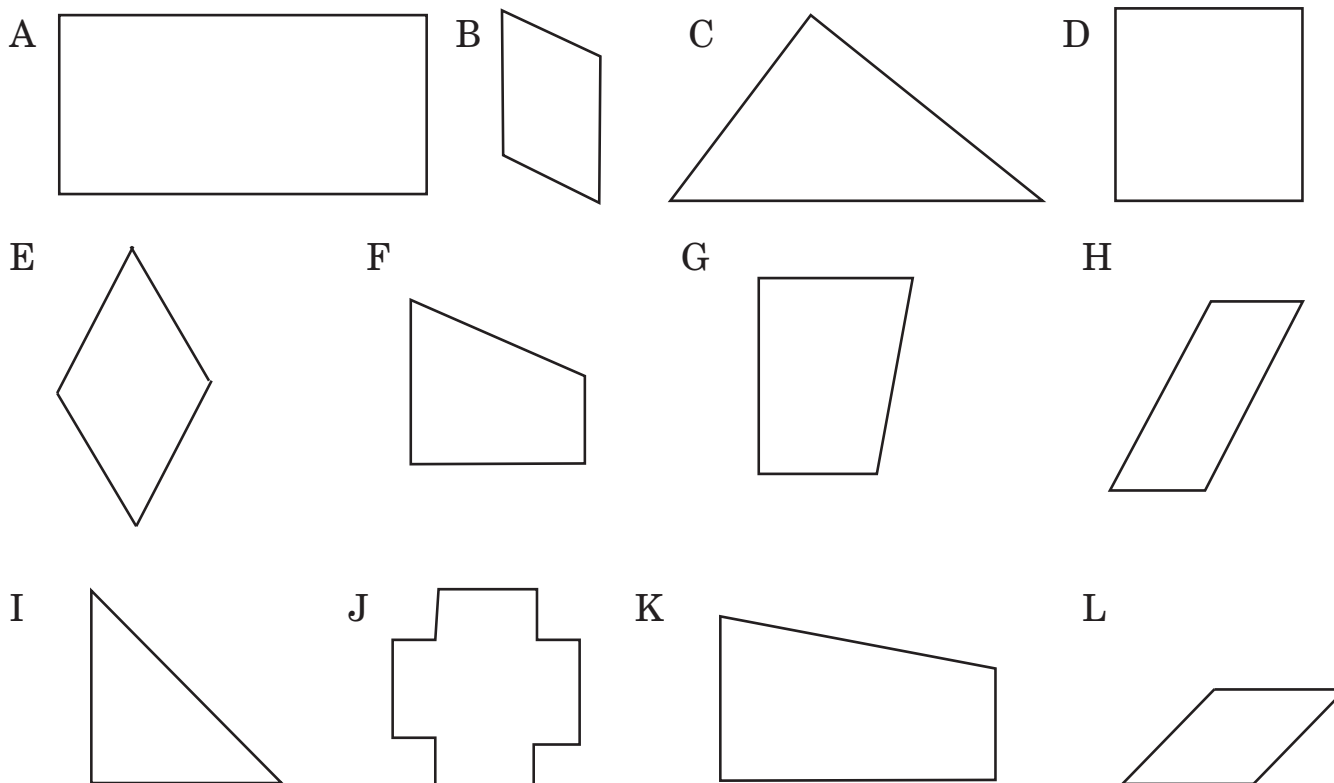
Large



How many trapezoids can you find in this design?

Answer: 28 trapezoids (20 small, 6 medium and 2 large)

3. In the pictures below, locate all the triangles and quadrilaterals. Sort them into the correct categories on the chart. Write the letter from each shape under the correct heading for that shape. Most of the shapes can be placed in more than one category. **Try to place each shape into as many categories as you can.** Shape A has been done for you.

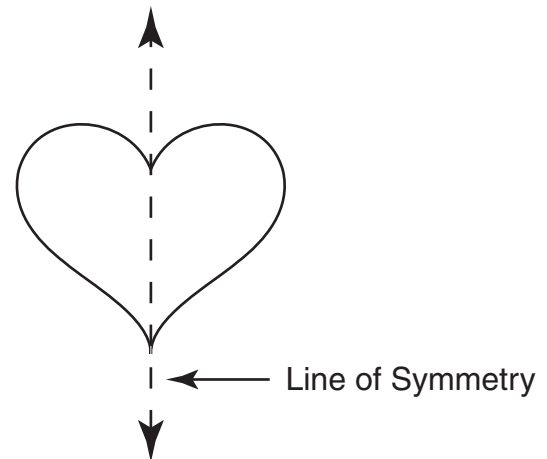


Triangle	Right Triangle	Quadrilateral	Rectangle
<i>C, I</i>	<i>I</i>	<i>A, B, D, E, F, G, H, L</i>	<i>C, I</i>
Trapezoid	Rhombus	Parallelogram	Polygon
<i>F, G, K</i>	<i>E, L</i>	<i>A, B, D, E, H, L</i>	<i>A, B, C, D, E, F, G, H, I, J, K, L</i>

E. Symmetry

Some shapes can be divided into two equal parts. The two parts have exactly the same size and shape.

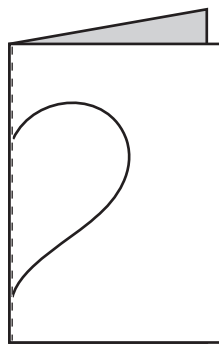
This heart shape can be divided into two equal parts that are exactly the same shape and size.



The line that divides the heart down the middle is called a **line of symmetry**. It divides the heart in two equal parts that are the same shape and size. We say the two halves are **symmetrical**.

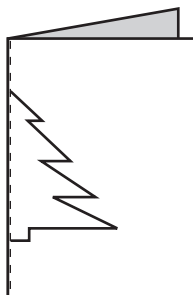
Whenever you fold a piece of paper in half to make a shape by drawing only half a figure, you are making use of a line of symmetry. Try the following activity.

- Fold a piece of paper in half. On one side, starting from the fold in the paper, draw half a heart shape. Then cut out the shape along the line that you drew. Unfold the shape.



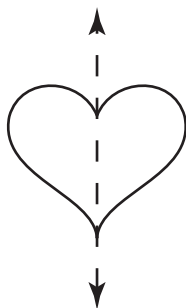
The fold in the paper is the line of symmetry of the heart shape.

- Using the same procedure you used for the heart, cut out three more symmetrical shapes. You can use curved lines as well as straight lines. Use your imagination to make the shapes different and interesting. Here's an example:

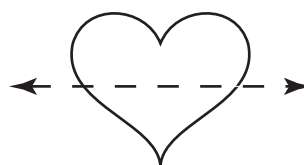


Find the heart shape that you made first. The first fold you made was a vertical fold. Now try folding it in half horizontally.

Vertical Fold



Horizontal Fold



When you fold the heart in half horizontally, the two halves do not match. There is no line of symmetry because the two folded halves are not the same size or shape. The two halves are **not** symmetrical.

- Find one of the other shapes that you cut out. Make a fold perpendicular to the first fold.

Is the new fold also a line of symmetry? **Answer is likely No.**

Why or why not? **A shape drawn freehand will not likely have a horizontal axis of symmetry. Lead students to see that the halves must be mirror images to be symmetrical.**

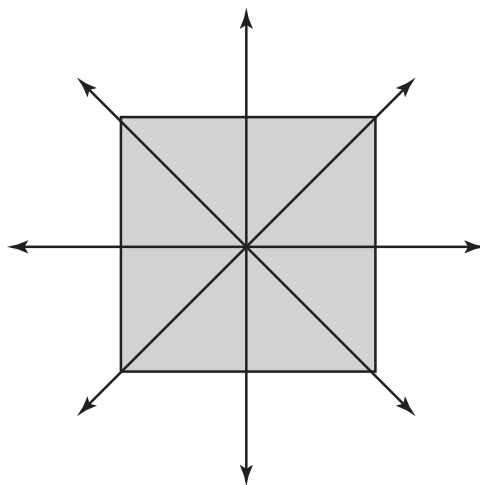
2. Make new folds in all the shapes you cut out. Are any of the new folds lines of symmetry? Why or why not?

Help students to understand that symmetrical figures are like books opening up. Both halves must be mirror images to be symmetrical.

Remember: When a shape is folded along its line of symmetry, the two sides will match exactly in size and in shape. The two sides are symmetrical.

The shapes that you folded probably had only one line of symmetry. However, many shapes do have more than one line of symmetry.

Look at the shape of the square below. It can be folded four different ways so that each half has exactly the same shape and size.

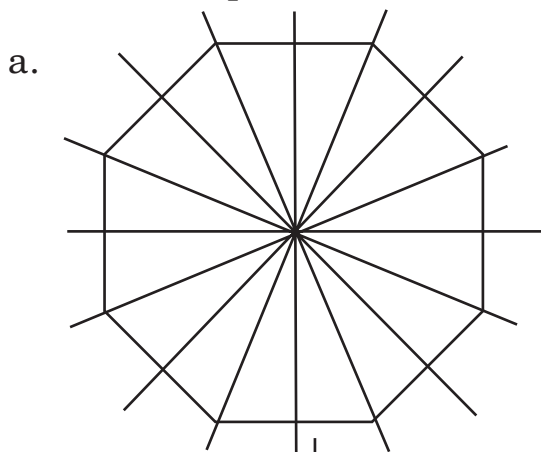


3. Use a **square** piece of paper. Carefully make the four folds shown in the drawing above. Each side of the fold should be exactly the same shape and size.

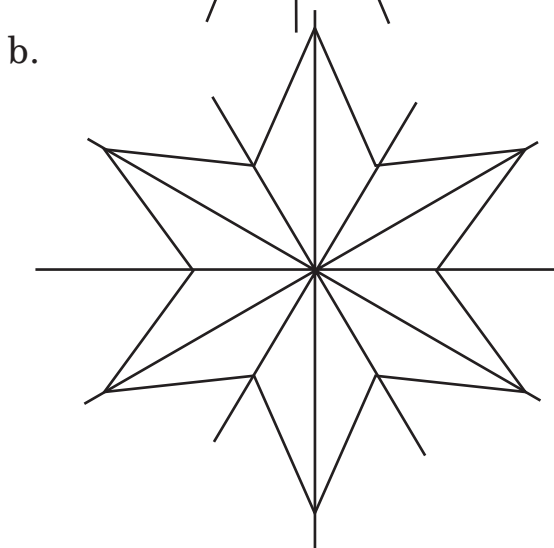
4 lines of

How many lines of symmetry does a square have? ***symmetry***

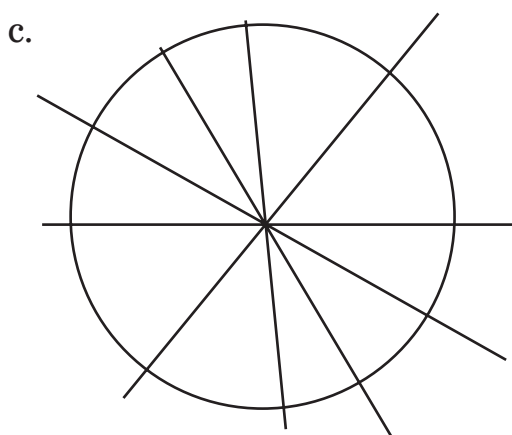
4. Each of the shapes below has more than one line of symmetry. Use a ruler to draw as many lines of symmetry as you can find. Remember that the dividing line must create two parts that are exactly the same size and shape.



***The octagon has
8 lines of symmetry.***



***The six-point star has
6 lines of symmetry.***



***Help students to see that the
circle has an infinite number
of lines of symmetry.***

Note: Some students will benefit from using cut-outs of these shapes so they can make folds along the lines of symmetry and “see” that the two parts are mirror images

Homework

1. The capital letters of the alphabet are printed below. Study then carefully and then answer the questions below.

A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z

- a. Which capital letters have only **one** line of symmetry?

A, B, C, D, E, M, T, U, V, W, Y

- b. Which capital letters have **two** lines of symmetry?

H, I, O, X

- c. Which capital letters have **more than two** lines of symmetry?

O (unlimited)

Note: Students may view the letter O as an oval rather than a circle. If so, the O has two lines of symmetry.

- d. Which capital letters have **no** lines of symmetry?

F, G, J, K, L, N, P, Q, R, S, Z

2. Carefully study the lowercase or small letters below

a b c d e f g h i j k l m
n o p q r s t u v w x y z

a. Which lowercase letters have only **one** line of symmetry?

c, l, v, w

b. Which lowercase letters have **two** lines of symmetry?

o, x (if “o” is viewed as an oval)

c. Which lowercase letters have **more than two** lines of symmetry?

o (if “o” is viewed as a circle)

d. Which lowercase letters have **no** lines of symmetry?

a, b, d, e, f, g, h, i, j, k, m, n, p, q, r, s, t, u, y, z
