7th Grade

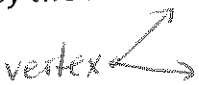
Unit 1 Vocabulary

Two-Dimensional Geometry

Adjacent angles - *In a polygon, adjacent angles are angles that are next to each other. They share a common side*

1 and 2 are adjacent

Angle - *A shape, formed by two lines or rays diverging from a common point (the vertex)*

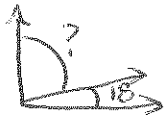


Angle sum - *the sum of the measures of all the inside angles at the vertices of a polygon*

$90° + 90° + 90° + 90° = 360°$

Benchmark angles - *A Benchmark Angle refers to a group of angles that are used as reference angles for other angles. The angles include 45 °, 90 °, 180 °, 450 °, 360 °, and 540 ° among others. A Benchmark Angle is used as a reference for Obtuse and Acute angles.*

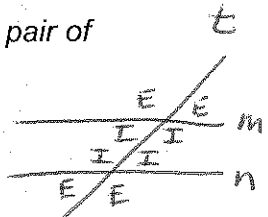
Complimentary angles - *Two angles that add up to 90°*



$72° + 18° = 90°$

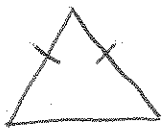
Degree - *Degrees are a unit of angle measure.*

Exterior angle - *Created where a transversal crosses two (usually parallel) lines. Each pair of these angles are outside the parallel lines, and on the same side of the transversal.*



Interior angle - *Created where a transversal crosses two (usually parallel) lines. Each pair of interior angles are inside the parallel lines, and on the same side of the transversal.*

Isosceles - *A triangle which has two of its sides equal in length.*

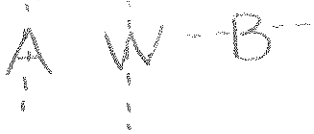


Polygons - *A number of coplanar line segments, each connected end to end to form a closed* figure.

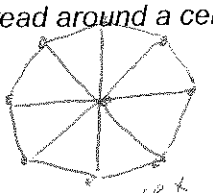
Properties – *a characteristic or attribute a figure has.*

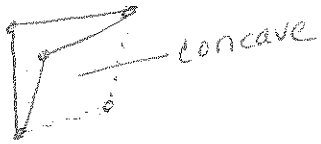
Quadrilateral - *A 4-sided polygon.*

Reflectional symmetry - *A Reflectional Symmetry is a type of symmetry in which one half of the object is the mirror image of the other.*



Regular polygon - The *sides and vertices are evenly spread around a central point, and regular polygons are convex - all the vertices point 'outwards'.*





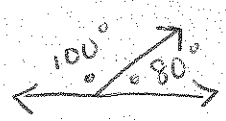
Right angle - *An angle whose measure is exactly 90°*

Rotational symmetry - *If a figure matches itself a number of times while it is being turned about a point, then it is said to have Rotational Symmetry.*

Scalene - *A triangle where all three sides are different in length.*

Side - *a single segment from the union that forms a polygon.*

Supplementary angles - *Two angles that add up to 180°*

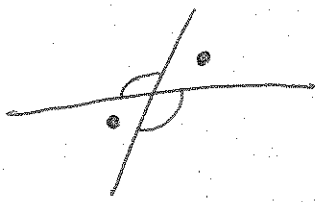


Tiling - *When you fit individual tiles together with no gaps or overlaps to fill a flat space like a ceiling, wall, or floor, you have a tiling. Another word for tiling is tessellation.*

Vertex - *The common endpoint of two or more rays or line segments.*

(Vertices)

Vertical angles - *A pair of non-adjacent angles formed by the intersection of two straight lines*



On the two blank sheets in your IBB, make 3 columns. One should be the term, the other two should be for the example & non-example. For each term on papers 1 & 2 fill in term, example, & non-example.

What is a Polygon?

A closed plane figure made up of several line segments that are joined together. The sides do not cross each other. Exactly two sides meet at every vertex.

Types | Formulas | Parts | Special Polygons | Names

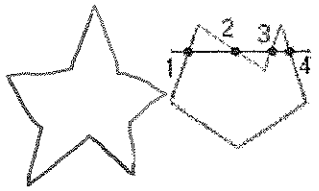
Types of Polygons

Regular - all angles are equal and all sides are the same length. Regular polygons are both equiangular and equilateral.

Equiangular - all angles are equal.

Equilateral - all sides are the same length. ≠ rhombus

Convex - a straight line drawn through a convex polygon**crosses at most two sides.** Every interior angle is less than 180°.



Concave - you can draw at least one straight line through a concave polygon that **crosses more than two sides**. At least one interior angle is more than 180°.

Polygon Formulas

(N = # of sides and S = length from center to a corner)

Area of a regular polygon = (1/2) N sin(360°/N) S^2

Sum of the interior angles of a polygon = (N - 2) x 180°

Add inside ← number of sides

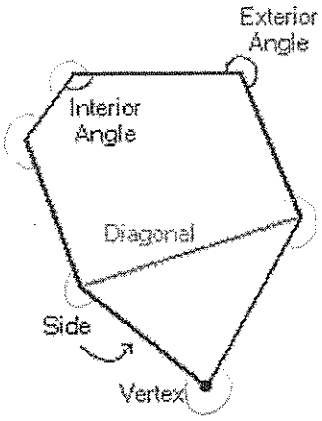
$(4-2) \times 180^\circ$

$2 \times 180 = 360^\circ$

The **number of diagonals** in a polygon = 1/2 N(N-3)

The **number of triangles** (when you draw all the diagonals from one vertex) in a polygon = (N - 2)

Polygon Parts



Side - one of the line segments that make up the polygon.

Vertex - point where two sides meet. Two or more of these points are called vertices.

Diagonal - a line connecting two vertices that isn't a side.

Interior Angle - Angle formed by two adjacent sides inside the polygon.

Exterior Angle - Angle formed by two adjacent sides outside the polygon.

Special Polygons

Special Quadrilaterals - square, rhombus, parallelogram, rectangle, and the trapezoid. all have 4 sides

Special Triangles - right, equilateral, isosceles, scalene, acute, obtuse. 2 sides equal / equal sides

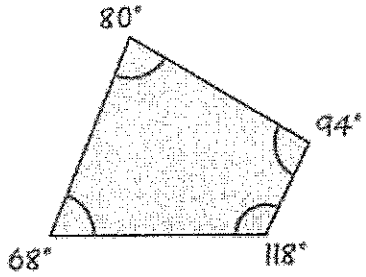
Polygon Names

Generally accepted names

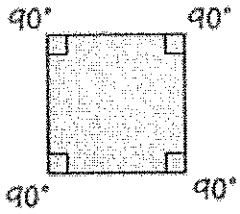
Sides	Name
n	N-gon — I don't know how many sides ...
3	Triangle 3-gon
4	Quadrilateral 4-gon
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
10	Decagon
12	Dodecagon

Properties of Quadrilaterals

- Four sides (edges)
- Four vertices (corners)
- The interior angles add up to **360 degrees**:



$68° + 118° + 94° + 80° = 360°$

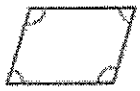


$4 \times 90° = 360°$

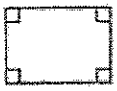
Try drawing a quadrilateral, and measure the angles. They should add to **360°**

Types of Quadrilaterals

There are special types of quadrilateral:

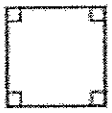


Parallelogram



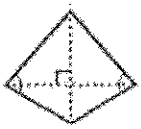
Rectangle

Rhombus



Square

Trapezoid (US)
~~*Trapezium (UK)*~~

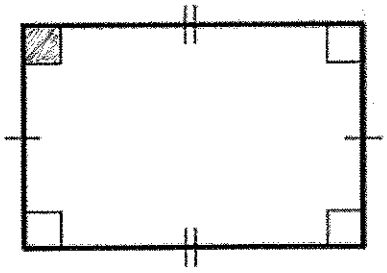


Kite

Some types are also included in the definition of other types! For example a **square**, **rhombus** and **rectangle**are also ***parallelograms***. See below for more details.

Let us look at each type in turn:

The Rectangle



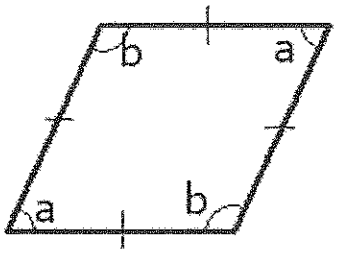
□ *means "right angle"*

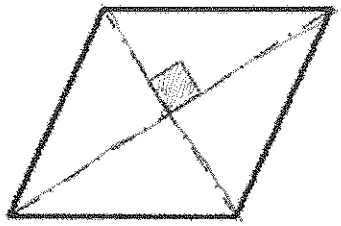
| and || *show equal sides*

A rectangle is a four-sided shape where every angle is a right angle (90°).

Also **opposite sides** are parallel and of equal length.

The Rhombus



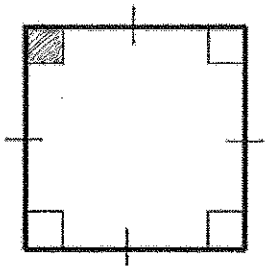


A rhombus is a four-sided shape where all sides have equal length.

Also opposite sides are parallel *and* opposite angles are equal.

Another interesting thing is that the diagonals (dashed lines in second figure) meet in the middle at a right angle. In other words they "bisect" (cut in half) each other at right angles.

The Square



means "right angle"

show equal sides

A square has equal sides and every angle is a right angle (90°)

Also opposite sides are parallel.

A square also fits the definition of a **rectangle** (all angles are 90°), and a **rhombus** (all sides are equal length).

The Parallelogram

start

Quadrilaterals

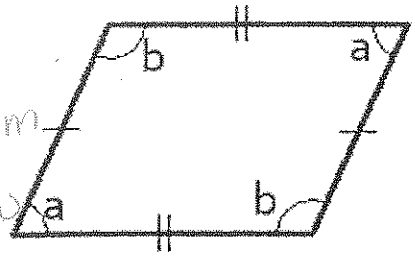
Kite

Trapezoid

Parallelogram

Rectangle Rhombus

Square



A parallelogram has opposite sides parallel and equal in length. Also opposite angles are equal (angles "a" are the same, and angles "b" are the same).

NOTE: Squares, Rectangles and Rhombuses are all Parallelograms!

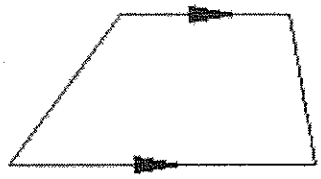
Example:

, **parallelogram** with:

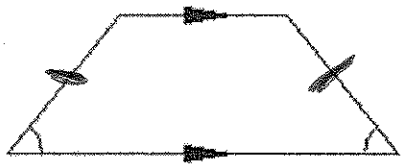
ll sides equal and
ngles "a" and "b" as right angles

a square!

The Trapezoid (UK: Trapezium)



Trapezoid



Isosceles Trapezoid

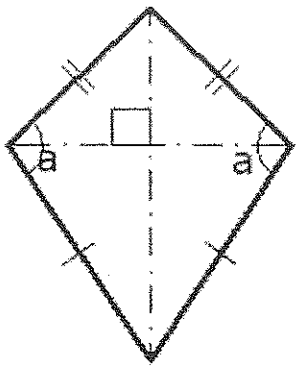
A trapezoid (called a trapezium in the UK) has a pair of opposite sides parallel.

It is called an **Isosceles** trapezoid if the sides that aren't parallel are equal in length and both angles coming from a parallel side are equal, as shown.

And a **trapezium** (UK: trapezoid) is a quadrilateral with NO parallel sides:

	Trapezoid	Trapezium
US:	a pair of parallel sides	NO parallel sides
UK:	NO parallel sides	a pair of parallel sides

The Kite



Hey, it looks like a kite. It has two pairs of sides. Each pair is made up of adjacent sides that are equal in length. The angles are equal where the pairs meet. Diagonals (dashed lines) meet at a right angle, and one of the diagonal bisects (cuts equally in half) the other.

... and that's it for the special quadrilaterals.

Irregular Quadrilaterals

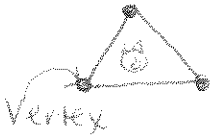
The only regular quadrilateral is a square. So all other quadrilaterals are **irregular**.

all sides =
all angles =

Triangle

From Latin: tri- "three" , angulus "corner, angle."

A closed figure consisting of three line segments linked end-to-end.
A 3-sided polygon.



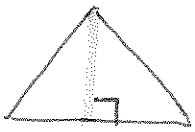
Triangle properties

Vertex The vertex (plural: vertices) is a corner of the triangle. Every triangle has three vertices.

Base

The base of a triangle can be any one of the three sides, usually the one drawn at the bottom. You can pick any side you like to be the base. Commonly used as a reference side for calculating the area of the triangle. In an isosceles triangle, the base is usually taken to be the unequal side.

Altitude



The altitude of a triangle is the perpendicular from the base to the opposite vertex. (The base may need to be extended). Since there are three possible bases, there are also three possible altitudes. The three altitudes intersect at a single point, called the orthocenter of the triangle. See Orthocenter of a Triangle.
In the figure above, you can see one possible base and its corresponding altitude displayed.

Median

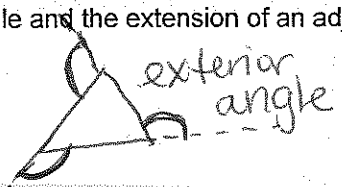
The median of a triangle is a line from a vertex to the midpoint of the opposite side. The three medians intersect at a single point, called the centroid of the triangle. See Centroid of a Triangle

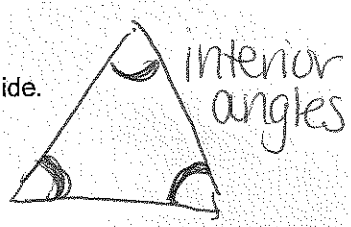
Area See area of the triangle and Heron's formula $A = \frac{bh}{2}$

Perimeter The distance around the triangle. The sum of its sides. See Perimeter of a Triangle

Interior angles The three angles on the inside of the triangle at each vertex. See Interior angles of a triangle

Exterior angles The angle between a side of a triangle and the extension of an adjacent side. SeeExterior angles of a triangle

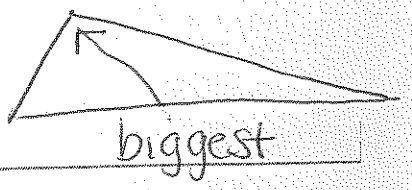




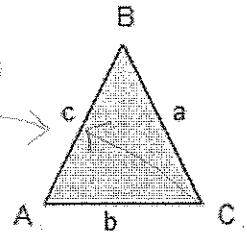
Also:

1. The shortest side is always opposite the smallest interior angle
2. The longest side is always opposite the largest interior angle

For more on this see Side / angle relationship in a triangle



Terminology



It is usual to name each vertex of a triangle with a single capital (upper-case) letter. The sides can be named with a single small (lower case) letter, and named after the opposite angle. So in the figure on the right, you can see that side b is opposite vertex B, side c is opposite vertex C and so on.

Alternatively, the side of a triangle can be thought of as a line segment joining two vertices. So then side b would be called

AC—
. This is the form used on this site because it is consistent across all shapes, not just triangles.

Properties of all triangles

These are some well known properties of all triangles. See the section below for a complete list

- The interior angles of a triangle always add up to 180°
- The exterior angles of a triangle always add up to 360°

Types of Triangle

There are seven types of triangle, listed below. Note that a given triangle can be more than one type at the same time. For example, a scalene triangle (no sides the same length) can have one interior angle 90°, making it also a right triangle. This would be called a "right scalene triangle".

Isosceles		Two sides equal See Isosceles triangle definition
Equilateral		All sides equal See Equilateral triangle definition
Scalene		No sides equal See Scalene triangle definition
Right Triangle		One angle 90°. See Right triangle definition

based on angles

Obtuse		One angle greater than 90° See Obtuse triangle definition
Acute		All angles less than 90° See Acute triangle definition
Equiangular		All interior angles equal See Equiangular triangle definition

Classifying triangles

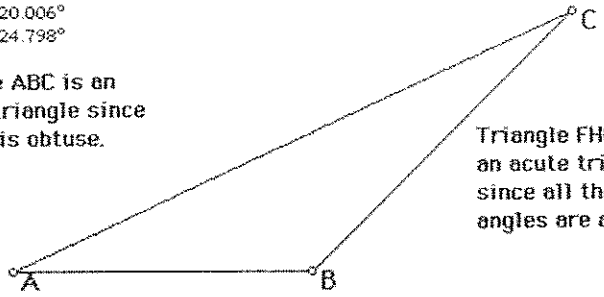
The seven types of triangle can be classified two ways: by sides and by interior angles. For more on this see Classifying triangles.

Constructing triangles

Many types of triangle can be constructed using a a compass and straightedge using the traditionalEuclidean construction methods. For more on this see Constructions using Compass and straightedge.

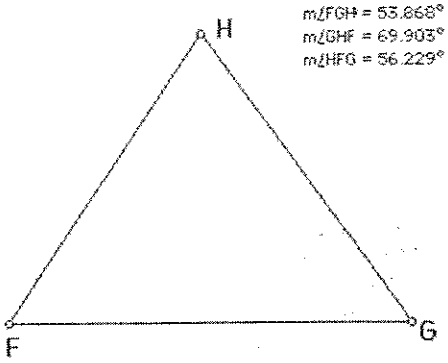
m∠ABC = 135.196°
m∠BCA = 20.006°
m∠CAB = 24.798°

Triangle ABC is an obtuse triangle since angle B is obtuse.



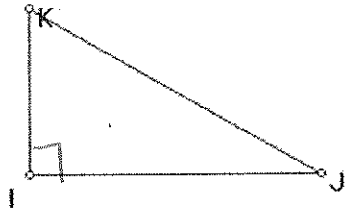
Triangle FHG is an acute triangle since all the angles are acute.

m∠FGH = 53.868°
m∠GHF = 69.903°
m∠HFG = 56.229°



m∠KIJ = 90.000°
m∠IJK = 29.571°
m∠JKI = 60.429°

Triangle KIJ is a right triangle since angle I is a right angle.

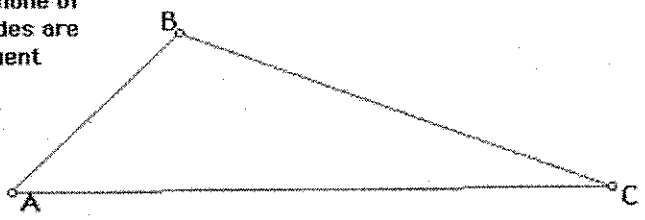


CLASSIFICATION OF TRIANGLES BY THEIR ANGLES:
1. acute triangle--a triangle with 3 acute angles
2. obtuse triangle--a triangle with one obtuse angle (and two acute angles)
3. right triangle--a triangle with one right angle (and 2 acute angles)

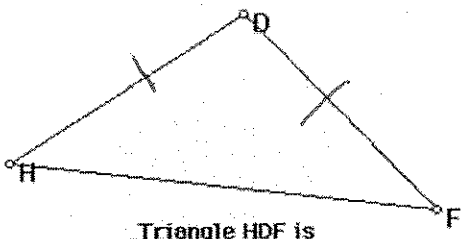
SPECIAL CASE:
4. equiangular triangle--a triangle with all congruent angles.

AB = 4.515 cm
BC = 8.733 cm
CA = 11.324 cm

Triangle ABC is scalene since none of the sides are congruent



HD = 5.380 cm
DF = 5.380 cm
FH = 8.152 cm



Triangle HDF is isosceles since at least 2 of the sides are congruent

JK = 4.490 cm
KI = 4.490 cm
IJ = 4.490 cm

Triangle JIK is equilateral since all three sides are congruent. Technically, it can also be classified as an isosceles triangle since at least 2 sides are congruent. What did we discover about the sides of an equiangular triangle? What do we know about the angles in this equilateral triangle?