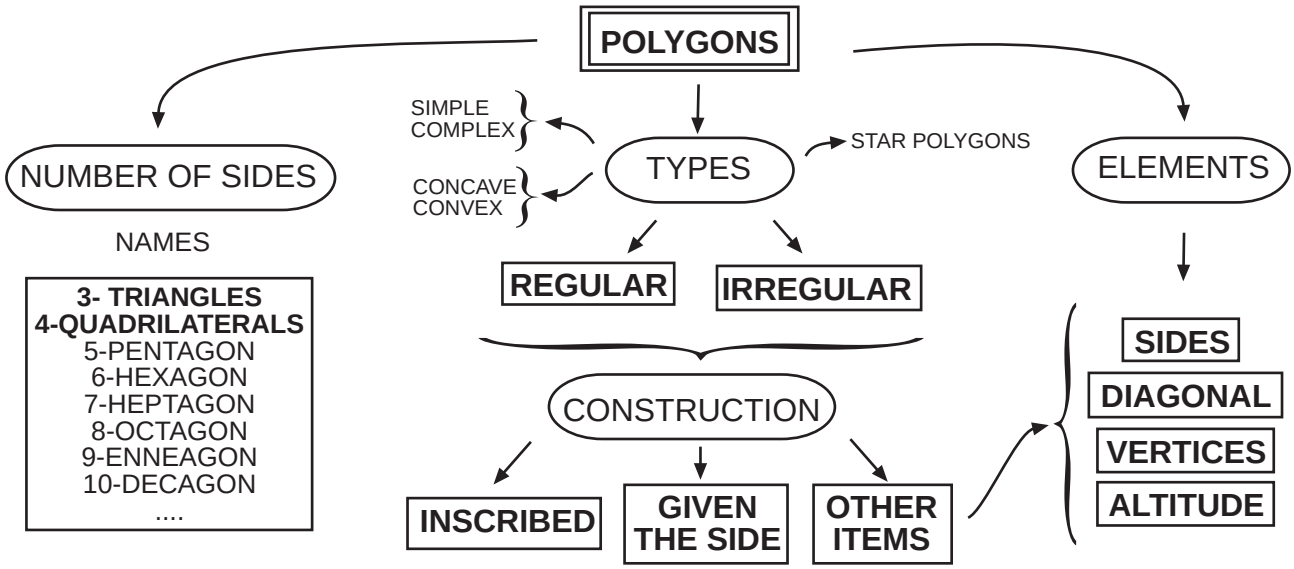
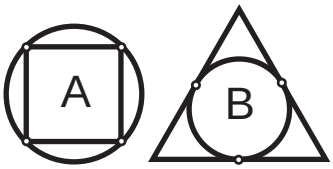


Star polygons: It is a particular polygon case with a star shape, created out of linking together non consecutive vertices of a regular polygon.

INSCRIBED VERSUS CIRCUMSCRIBED:

Inscribed Polygons: They are polygons placed inside circles so all the vertices of the polygon are placed on the circle.
Circumscribed polygons: They are polygons surrounding a circle, being its sides tangent to the circle inside.



A- The square is inscribed in the circle while the circle is circunscribed to the square.

B- The circle is inscribed in the triangle while the triangle is circumscribed to the triangle.

Watch this short **Youtube video** that introduces you the polygons definition and some names

http://youtu.be/LfPDFGvGbqk

FLATLAND - Edwin A. Abbott 1838-1926

3. CONCERNING THE INHABITANTS OF FLATLAND

The greatest length or breadth of a full grown inhabitant of Flatland may be estimated at about eleven of your inches. Twelve inches may be regarded as a maximum.

Our Women are Straight Lines.

Our Soldiers and Lowest Class of Workmen are Triangles with two equal sides, each about eleven inches long, and a base or third side so short (often not exceeding half an inch) that they form at their vertices a very sharp and formidable angle. Indeed when their bases are of the most degraded type (not more than the eighth part of an inch in size), they can hardly be distinguished from Straight lines or Women; so extremely pointed are their vertices. With us, as with you, these Triangles are distinguished from others by being called Isosceles; and by this name I shall refer to them in the following pages.

Our Middle Class consists of Equilateral or Equal-Sided Triangles.

Our Professional Men and Gentlemen are Squares (to which class I myself belong) and Five-Sided Figures or Pentagons.

Next above these come the Nobility, of whom there are several degrees, beginning at Six-Sided Figures, or Hexagons, and from thence rising in the number of their sides till they receive the honorable title of Polygonal, or many-Sided. Finally when the number of the sides becomes so numerous, and the sides themselves so small, that the figure cannot be distinguished from a circle, he is included in the Circular or Priestly order; and this is the highest class of all...

5. OF OUR METHODS OF RECOGNIZING ONE ANOTHER

You, who are blessed with shade as well as light. You, who are gifted with two eyes, endowed with a knowledge of perspective, and charmed with the enjoyment of various colors. You, who can actually SEE an angle, and contemplate the complete circumference of a Circle in the happy region of the Three Dimensions--how shall I make it clear to you the extreme difficulty which we in Flatland experience in recognizing one another's configuration?

Recall what I told you above. All beings in Flatland, animate and inanimate, no matter what their form, present TO OUR VIEW the same, or nearly the same, appearance, viz. that of a straight Line. How then can one be distinguished from another, where all appear the same?...

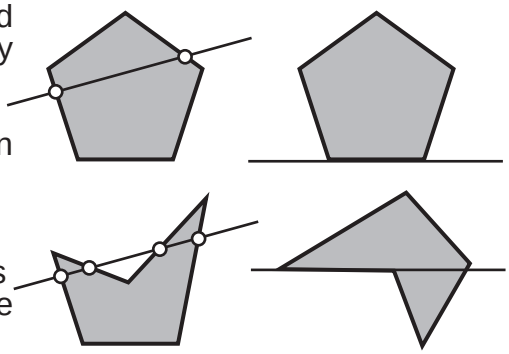
POLYGONS

A polygon is a number of coplanar line segments (called **edges** or **sides**), each connected end to end (**Vertex**/**vertices**)to form a closed shape. The word "polygon" derives from the Greek (polús) "several" and (gonía) "angle".

CLASSIFICATIONS

Convex polygon: Any line drawn through the polygon (and not tangent to an edge or corner) meets its boundary exactly twice. As a consequence, all its interior angles are less than 180°. Equivalently, any line segment with endpoints on the boundary passes through only interior points between its endpoints.

Non-Convex polygon (concave): a line may be found which meets its boundary more than twice. Equivalently, there exists a line segment between two boundary points that passes outside the polygon. There is an interior angle greater than 180°.



Equiangular: all their corner, angles or vertices are equal.
Equilateral: all edges or sides are of the same length.
Regular: All their vertices angles and sides are equal.
Irregular: Show different angles and lengths for their sides.

Play with the polygon vertices in **this website** to observe how the type name changes.

http://www.mathopenref.com/polygon.html

NAME OF POLYGONS ACCORDING TO THE NUMBER OF SIDES

3	Triangle	12	Dodecagon
4	Quadrilateral	13	Triskaidecagon
5	Pentagon	14	Tetradecagon
6	Hexagon	15	Pentadecagon
7	Heptagon	16	Hexadecagon
8	Octagono	17	Heptadecagon
9	Enneagon / Nonagon	18	Octadecagon
10	Decagon	19	Eneadecagon
11	Hendecagon		

TENS		AND	ONES			OTHER	
20	Icosa-	kay	1	-hena-	-gon	100	Hectgon / Hectagon
30	Triaconta-		2	-di-		1000	Chiliagon
40	Tetraconta-		3	-tri-		10000	Myriagon
50	Pentaconta-		4	-tetra-			
60	Hexaconta-		5	-penta-			
70	Heptaconta-		6	-hexa-			
80	Octaconta-		7	-hepta-			
90	Enneaconta- or Nonaconta-		8	-octa-			
			9	-ennea- / -nona-			

POLYGONS PARTS

SIDE OR **EDGE**: Each of the line segments that form a polygon.

VERTEX (**vertices**, plural): The point in which two sides or edges meet.

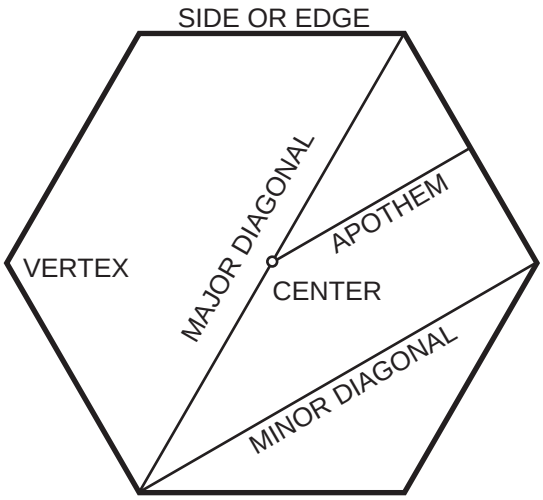
DIAGONAL: Segment line that connects non consecutive vertices. Some polygons have a major diagonal and a minor diagonal.

PERIMETER: The path around a polygon, the addition of all its sides.

In a regular polygon we can also find:

CENTER: A point equidistant from all the vertices. It is the center for the inscribed and circunscribed circle (only in regular polygons) .

APOTHEM: line segment from the center to the midpoint of one of its sides..



Play with the polygon vertices and take a look to **this website** to learn more about regular polygons.

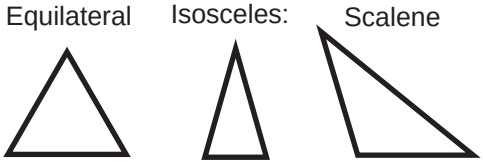
http://www.mathopenref.com/polygonregular.html

IMPORTANT DEFINITIONS AND CLASSIFICATIONS ABOUT TRIANGLES:

Triangle: It is a flat figure with three sides and three angles.

ACCORDING TO THE SIDES:

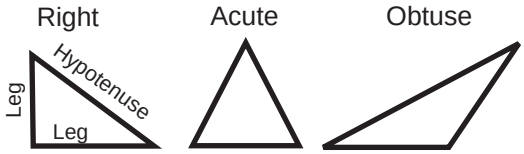
Equilateral Isosceles: Scalene



Equilateral triangle: It is a triangle which sides and vertices are the same.
Isosceles triangle: It is a triangle which has two equal sides and angles.
Scalene triangle: It is a triangle which has three different sides and angles.

ACCORDING TO THE ANGLES:

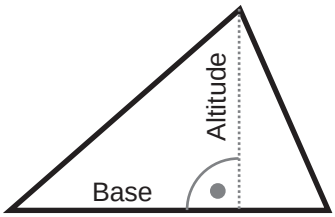
Right Acute Obtuse



Right triangle: It is a triangle which has one right angle. The side opposite to the right angle is called **hypotenuse** and the sides adjacent to it are called **legs**. .
Obtuse: Obtuse triangles have one angle which is more than 90º .
Acute: All their vertices are acute.

Watch this **Youtube video** to listen an explanations of triangles classifications.

http://youtu.be/Bb8e3ZkU3Sw



To learn more about triangles check **this animated and interactive website** which tells us more definitions and constructions.

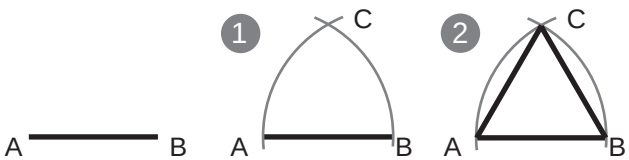
http://www.mathopenref.com/triangle.html

COMPLETE THE GAPS WITH THE GIVEN WORDS BELOW:

Segments-Polygon- Closed-Base-Vertices- Altitude

A triangle is a _____ shape consisting in three line_____ linked end-to-end, so it has three _____. It is a 3 sided _____. The _____ can be any of its three sides, but it is ususally drawn at the bottom. The _____ of a triangle is the distance from the base to the opposite vertex.

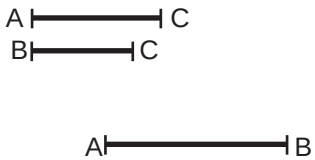
Regular triangle construction known its side



1st- Trace two arcs centered in the end points of the given segment with radius equal to the side. The point where the arcs intersect is the vertex C.

2nd- Connect the points A and B with C to obtain the equilateral triangle.

Scalene triangle construction known its three sides:

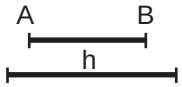


1st- With your compass take a radius equal to the segment AC, and centered in the A end point of AB trace an arc

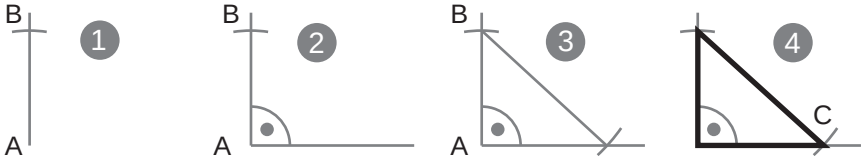
2nd- With your compass take ta radius equal to the segment BC, and centered in the B end point of AB trace another arc that intersects the first one in a point C.

3rd- Conect A and B with C to get the scalene triangle drawn.

Right triangle construction known one of its legs AB and its hypotenuse h



1st- Copy the segment line AB, which is the given leg's length.



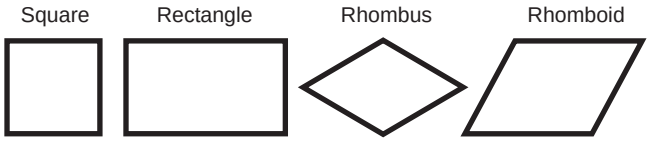
2nd- With the set squares or triangles, trace a perpendicular to AB segment from the A end point.
3rd- With radius equal to the hypotenuse and centered in B end point, trace an arc which intersects the perpendicular to AB in a C point.
4th-Conect the three points: A, B and C to obtain the right triangle.

IMPORTANT DEFINITIONS ABOUT QUADRILATERALS:

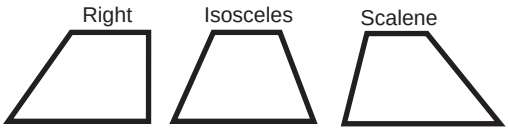
Quadrilateral: They are polygons with four sides and four vertices.

PARALLELOGRAMS: They are quadrilaterals with two pairs of parallel opposite equal sides and and two pairs of opposite equal angles. Their diagonals bisect each other.

Square: Quadrilateral with the same dimensions for all their four sides and with four right angles.
Rectangle: It is a parallelogram with two pairs of equal sides and four right angles.
Rhombus: It is a parallelogram with four equal sides and two pairs of equal angles.
Rhomboid: It is a parallelogram with two pairs of equal sides and two pairs of equal angles.

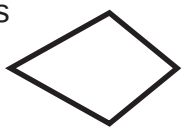


TRAPEZIUMS: Only one pair of sides are paralel.

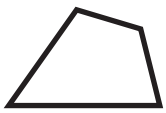


Right trapezium: It is a trapezium which has a right angle.
Isosceles trapezium: It is a trapezium which has two equal sides and two pairs of equal angles.
Scalene trapezium: It is a trapezium which has three different sides and vertices.

KITES: Two pairs of equal sides which are adyacent, one pair of equal angles,but no sides are parallel.



TRAPEZOIDS OR IRREGULAR QUADRILATERALS: No sides are parallel and have no equal sides.



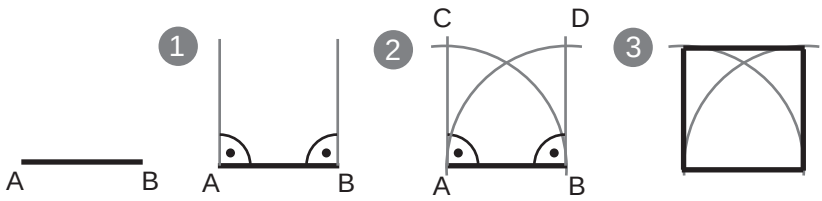
!! **LANGUAGE WARNING**: **These are the names for British English**. In American English Quadrilaterals with one pair of parallel sides are called "Trapezoids", while the Quadrilaterals with no parallel sides are called "Trapeziums". British names are more similar to the names in Spanish

So we chose to explain in this notes the British way because its names are more similar to our Spanish names. That's what you have to study and learn. However, on the right you can see a serious American website that explains both way and a funny American song which is not even totally correct with its classsifications names.

To learn more about quadrilaterals check **this animated and interactive website** which tells us more definitions and constructions.
http://www.mathopenref.com/quadrilateral.html

Listen to this **youtube videoclip** telling us about quadrilaterals AND FIND THE WRONG NAME for one of the polygons they explain.
http://youtu.be/k7oLm94kQEE

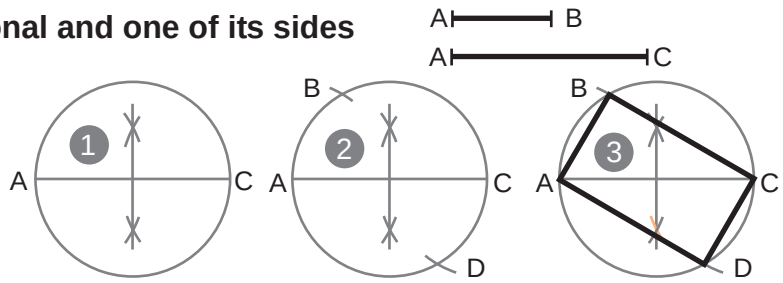
Square construction known its side dimension



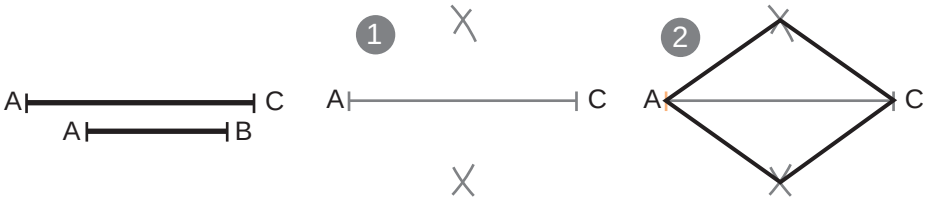
1st- Trace two perpendicular segments from both endpoints A and B.
2nd- Centered in A and B endpoints, trace two arcs which radius is equal AB. On both perpendicular segments you will obtain vertices C and D.
3rd- Connect the four points A, B, C and D together to obtain the square.

Rectangle construction known the diagonal and one of its sides

1st- Trace the diagonal AC and centered in it's midpoint O, draw a circle with an O-C radius.
2nd- Centered in A and C, trace two arcs with a radius equal to the given side. They will intersect the circle in B and D
3rd- Connect the four points A, B, C and D to obtain the rectangle.



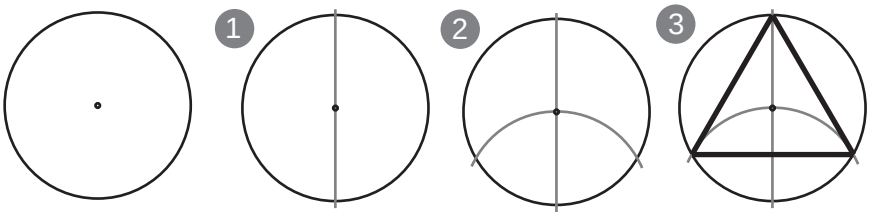
Rhombus construction known the diagonal and the sides



1st- With an AB radius, centered on the AC endpoints trace two arcs above and below the segment . The two points where the arcs intersect are the points B and D
2nd- Connect the four points A, B, C and D together to obtain the rhombus.

Given the circunscribed circles, Regular polygons constructions:

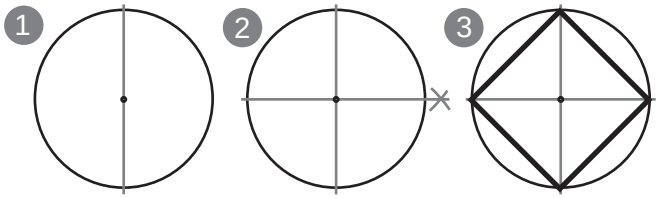
Equilateral triangle:



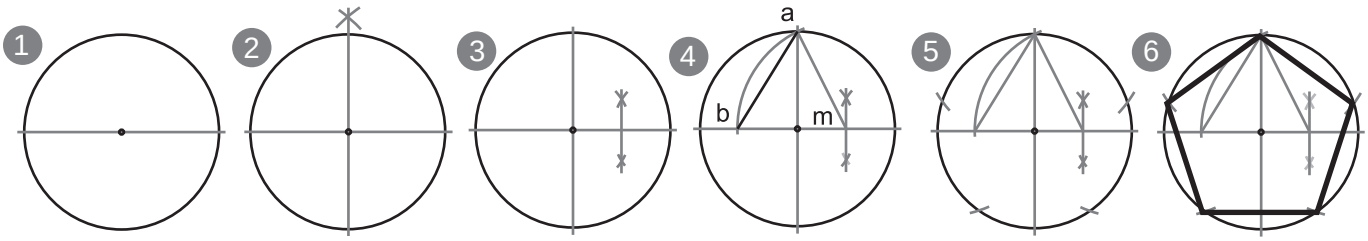
1st- Trace a vertical diameter
2nd- Centered in one of the diameter's endpoints and with a radius equal to it draw an arc that intersects the circle in two points.
3º- Connect the two points together and with the other diameter's endpoint.

Square

1st- Trace a diameter.
2nd- Trace a perpendicular diameter to the first one.
3rd- Conect the four diameters' endppoints.

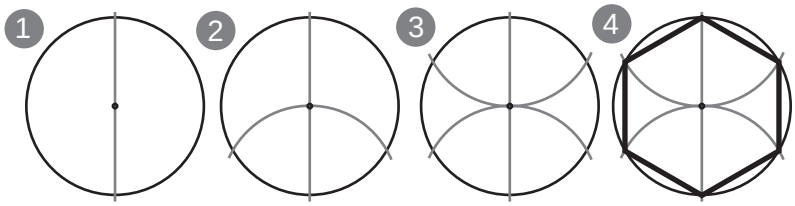


Pentagon



1st- Trace a diameter. 2nd- Traze a perpendicular diameter to the first one. 3rd- Draw the perpendicular segment bisector toone of the radii shown by the two diameters, obtaining point m. 4th- Centered in m and a radius radio m-a traze an arc to obtain b => a-b is the dimension of the side for the inscribed pentagon. 5th- With a radius a-b, starting by "a", traze five arcs intersecting the circle 6th- Conect the points on the circle.

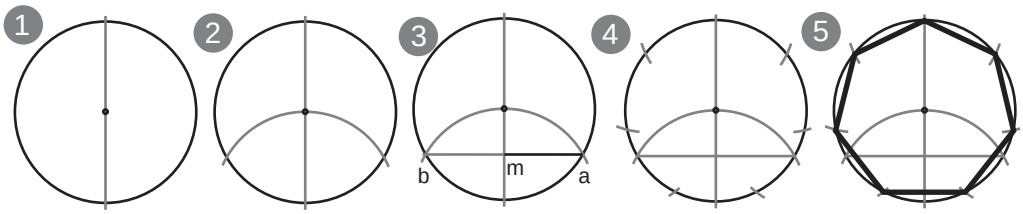
Hexagon



1st- Trace a vertical diameter.
2nd- Centered in adiameter's endpoint draw an arc, with a radius equal to the circle's, intersecting it in two points.
3th- Centered in the other endpoint repeat the last step.
4º- Connect the six points on the circle.

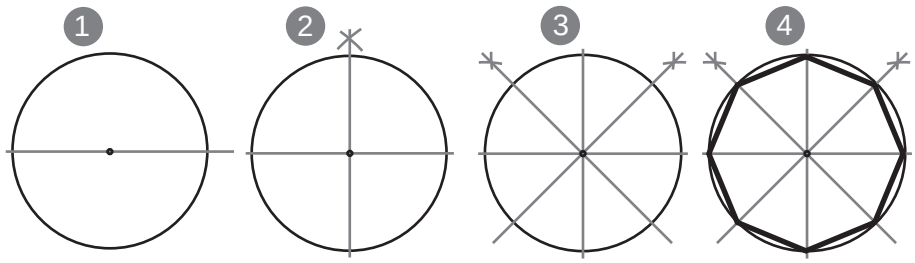
Heptagon

1st- Trace a vertical diameter.
2nd- Centered in adiameter's endpoint draw an arc, with a radius equal to the circle's, intersecting it in two points, a and b.
3rd- Connect a with b obtaining m. a-m is the dimension of the side for the inscribed heptagon.



4th- Trace arcs, centered on the circle and with a radius a-m, to obtain the circle division.
5th- Connect the points on the circle.

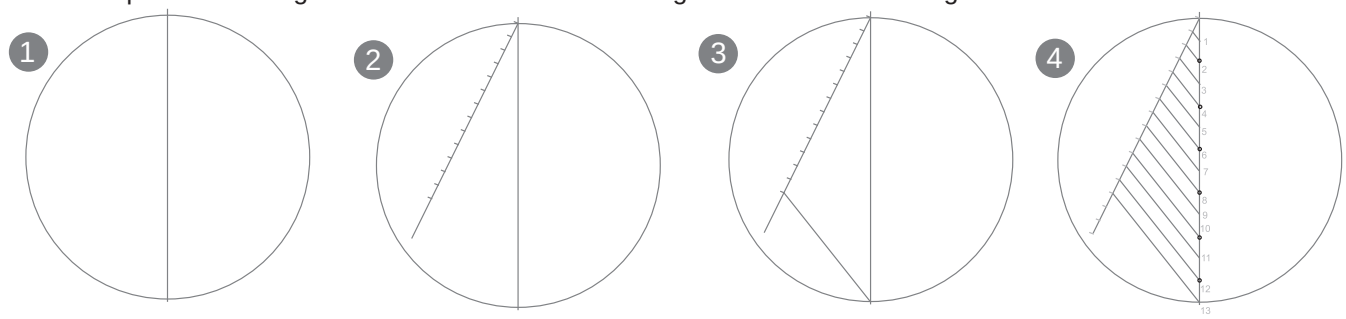
Octagon



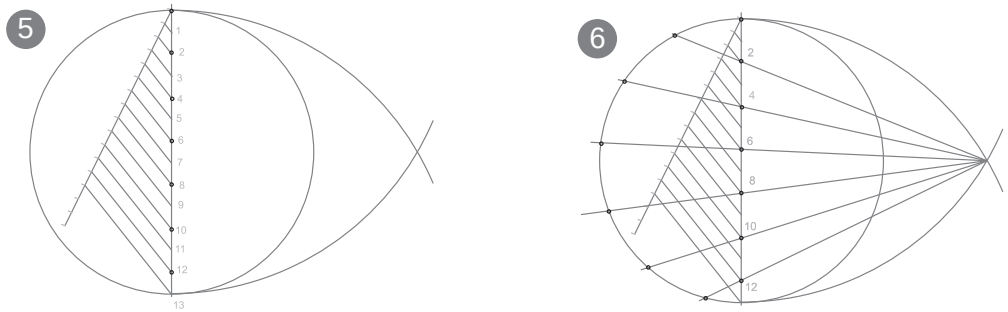
1st- Trace a horizontal diameter.
2nd- Trace a perpendicular diameter to the first one .
3rd- Trace angle bisectors (2 are enough) to the four quadrants.
4th- Connect the eight points on the circle.

Given the circumscribed circle radius a: Draw a n sided (13) regular polygon: _____

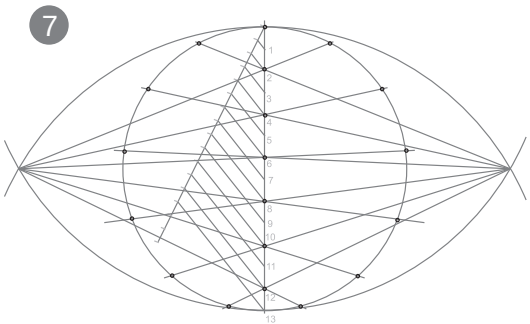
1th- Trace a circle with the given radius lengh, Trace a vertical diameter:
DIVIDE THE DIAMETER INTO AS MANY PORTIONS AS AIMED SIDES FOR THE POLYGON WANTED
2nd- Trace an auxiliary segment forming any angle with the vertex in the top diameter's endpoint and divide it into as many portions as wanted portions for the diameter (you can use either a ruler or the compas)
3rd- Connect the last auxiliary segment's mark with the bottom diameter's endpoint.
4th- Trace parallels through the division marks intersecting the diameter obtaining the divisions wanted on it.



5th- Centered in the diameter's endpoints and radius equal to it trace two arcs in which both intersections we will find two focii (one focus in each intersection).
6th- From one focus we trace rays through the even divisions on the diameter to intersect the circle in two points every ray. These rays project on the circle half of the divisions in their outgoing intersections with the circumference. Division 0, on the diameter also must be included, even though we did't need to project a ray due to its position on the circle.



7th- Repeat the last step, this time in the opposite side.



8th- Conect all the points obtained on the circle. Remember to conect also number 0 on the top of the diameter.