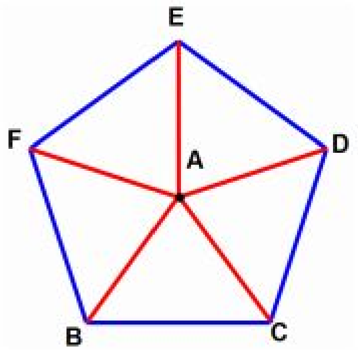
Special Lines and Constructions of Regular Polygons

Centre of a Regular Polygon

A regular polygon with a center A is made up of congruent isosceles triangles with a principal angle A.



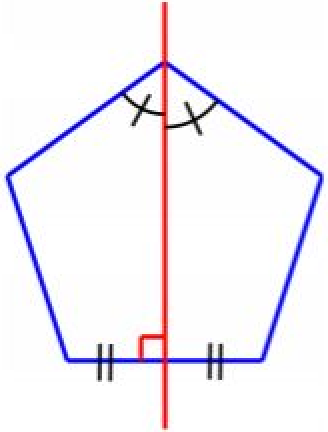
Note that point A is at the center of the regular pentagon.

To locate the center of a regular polygon, we will use the **axis of symmetry** that can be drawn from each vertex of the regular polygon.

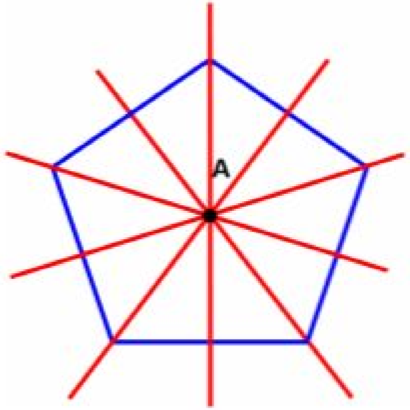
We can think of the axis of symmetry in two ways:

1. The **right bisector** of each side of a regular polygon is an **axis of symmetry** of the regular polygon.
2. The **angle bisector** of each side of each interior angle of a regular polygon is an **axis of symmetry** of the regular polygon.

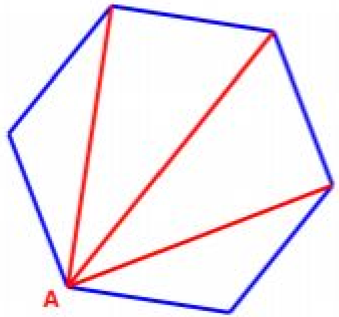
The **red line** in the regular pentagon below is an **axis of symmetry**.



We will draw the five axes of symmetry to locate the center (A) of the regular pentagon.



A regular polygon's diagonal is a line segment joining two non-consecutive vertices of a regular polygon.



These are the 3 diagonals from point A in a regular hexagon.

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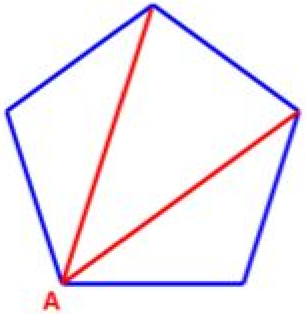
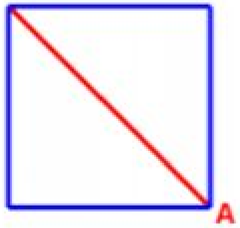




This is the 1 diagonal from point A in a square.

The number of diagonals from a vertex depends on the number of sides (n).

$$\# \text{ of diagonals} = n - 3$$

where "n" is the number of sides of the regular polygon

So, for a regular hexagon with **n = 6**,

$$\begin{aligned} \# \text{ of diagonals} &= n - 3 \\ &= 6 - 3 \\ &= 3 \end{aligned}$$

All regular polygons are made up of congruent isosceles triangles.

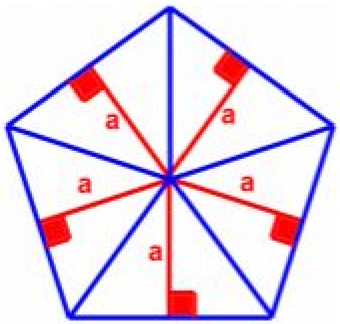
The number of congruent isosceles triangles are the same as the number of sides that make the regular polygon.

So, for example, a regular pentagon is made up of 5 congruent isosceles triangles, since a regular pentagon has 5 congruent sides.

Altitude & Apothem

The altitude from each isosceles triangle from the central angle (vertex) is called the apothem.

The 5 **apothems** for the regular pentagon from above are drawn in **red** below.



Drawing a Polygon

Finally, we will look at how to properly draw a regular polygon.

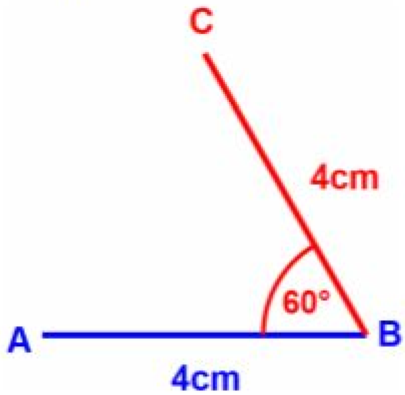
To do this, we will use a ruler and a protractor, and our knowledge of the internal angles of a regular polygon.

Example: Draw an Equilateral Triangle (4cm)

First, we use a ruler to draw a line 4cm long.

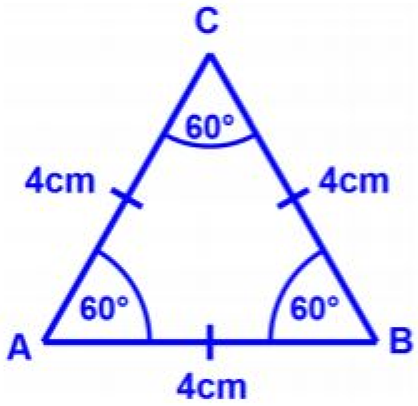
Next, we remember that the interior angles of an equilateral triangle measures 60° each.

Now, we use a protractor and a ruler to draw a side that connects to vertex B at an angle of 60° and a length of 4cm.



Example: continued

Finally, we connect vertices A and C to complete the drawing of the equilateral triangle.



Homework:

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Assignment on MHS