Subject: Leaving Certificate Maths
Teacher: Mr Murphy
Lesson 8: Geometry II

8.1 Learning Intentions

After this week's lesson you will be able to;

- Use ratio to identify unknown sides in similar triangles
- Apply the properties of a circle to problem solve in geometry

8.2 Specification

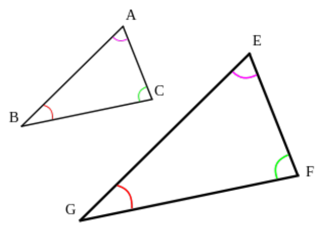
Students learn about	Students working at OL should be able to	In addition, students working at HL should be able to
2.1 Synthetic geometry	– perform constructions **16-21** (see *Geometry for Post-primary School Mathematics*) – use the following terms related to logic and deductive reasoning: theorem, proof, axiom, corollary, converse, implies – investigate theorems 7, 8, 11, 12, 13, 16, 17, 18, 20, 21 and corollary 6 (see Geometry for Post-primary School Mathematics) and use them to solve problems	– perform construction **22** (see *Geometry for Post-primary School Mathematics*) – use the following terms related to logic and deductive reasoning: is equivalent to, if and only if, proof by contradiction – prove theorems 11,12,13, concerning ratios (see Geometry for Post-primary School Mathematics), which lay the proper foundation for the proof of the theorem of Pythagoras studied at junior cycle

8.2 Specification

Student should practise different ways of solving problems, building up their arsenal of techniques on familiar problems will help them to tackle unfamiliar ones. Studnets at Higher level and Ordinary level should pay particular attention to algebraic method of solving problems, as such methods are directly examinable at these levels.

8.4 Similar Trianlges

Similar triangles are triangles that have the exact same angles but different side lengths,



This allows us to create the ratios such as the example below:

$$\frac{|AB|}{|EG|} = \frac{|AC|}{|EF|}$$

This ratio allows us to find a n unknown side length just like the below eample:

$$\frac{|x|}{|6|} = \frac{|2|}{|4|}$$

$$\frac{|x|}{|6|} = 0.5$$

$$x = 3$$

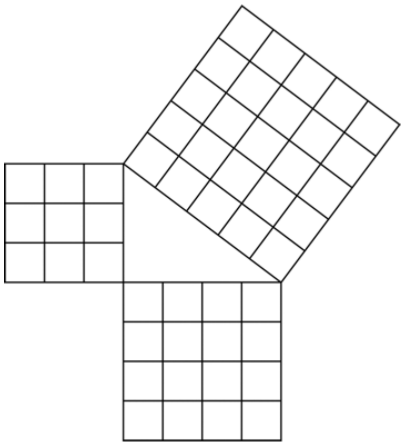
8.5 Pythagoras' Theorem

This was a theorem found in the school of mathematics run by Pythagoras.' It found that the square of the longest side, is equal to the sum of the square of the other two sides. This only applies in a right angled triangle.

The longest side of a right angled triangle is referred to as the **hypotenuse**.

In mathematical language we have:

$Hypotenuse^2 = a^2 + b^2$



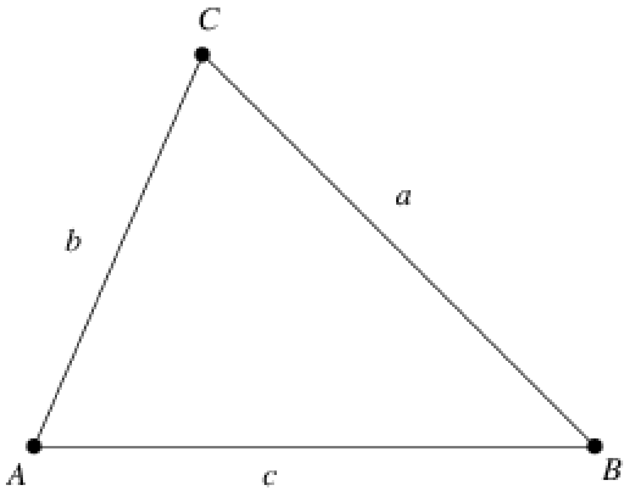
Where a and b are either of the other two sides (The choice of a and b is not important, once the hypotenuse is correct).

8.6 Area of a Triangle

We know from the early stages of mathematics education that to get the area of a triangle we do the following:

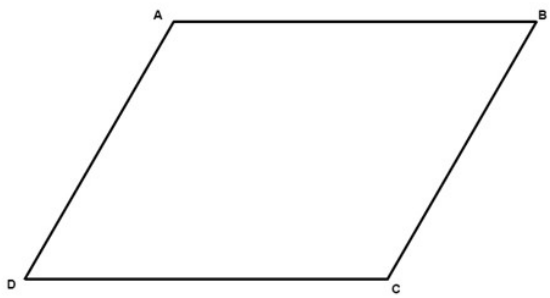
$\frac{1}{2} \times base \times perpendicular\ height$

Theorem 16: *States that the choice of base is not important once we know the perpendicular height from that base.*



8.7 Area of a Parallelogram

Firstly, a parallelogram has opposite sides of the same length and they are also parallel.

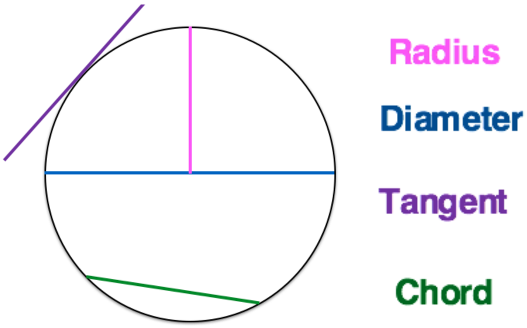


Theorem 17: A diagonal bisects the area of a parallelogram.

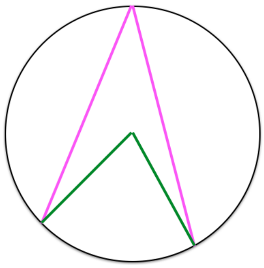
(Add in a diagonal to the above diagram to see this)

Theorem 18: The area of a parallelogram is the base x height (same as a rectangle).

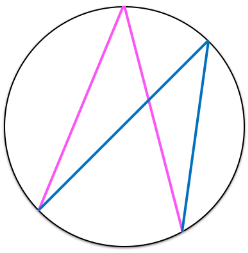
8.8 The Circle



Theorem 19: The angle at the centre of a circle is twice the size of one that is on the circumference, standing on the same arc.

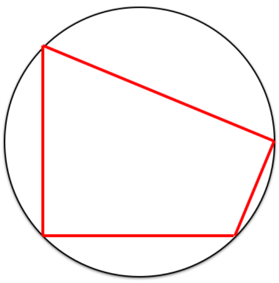


What follows on from this is that any two angles on the same arc on the circumference are equal.

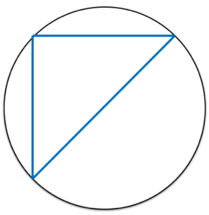


What is a cyclic quadrilateral?

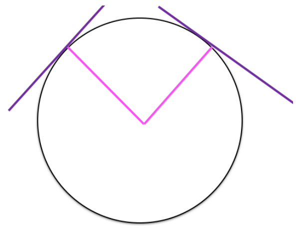
This is a four sided figure with each vertex on the circumference:



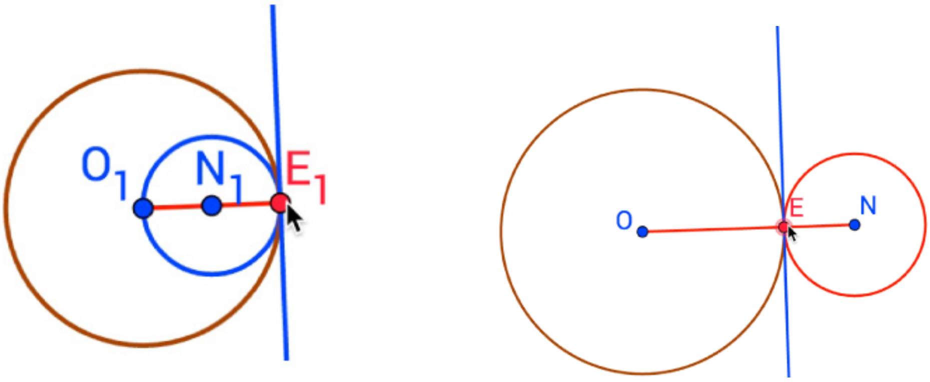
This gives us Corollary 5: Opposite angles in a cyclic quadrilateral sum to 180º.



Theorem 20: Each tangent to a circle is perpendicular to the radius at that point of intersection.



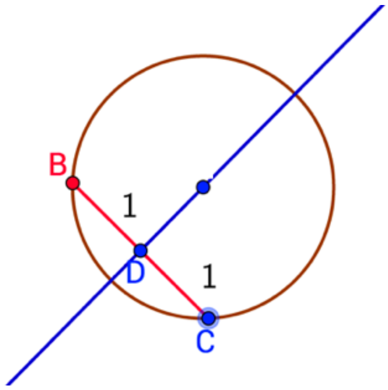
This allows us to see corollary 6: If two circles touch at one point only, then the two centres and the P.O.I. are collinear



External Contact

Internal Contact

Theorem 21: A perpendicular from the centre to a chord, bisects chord.



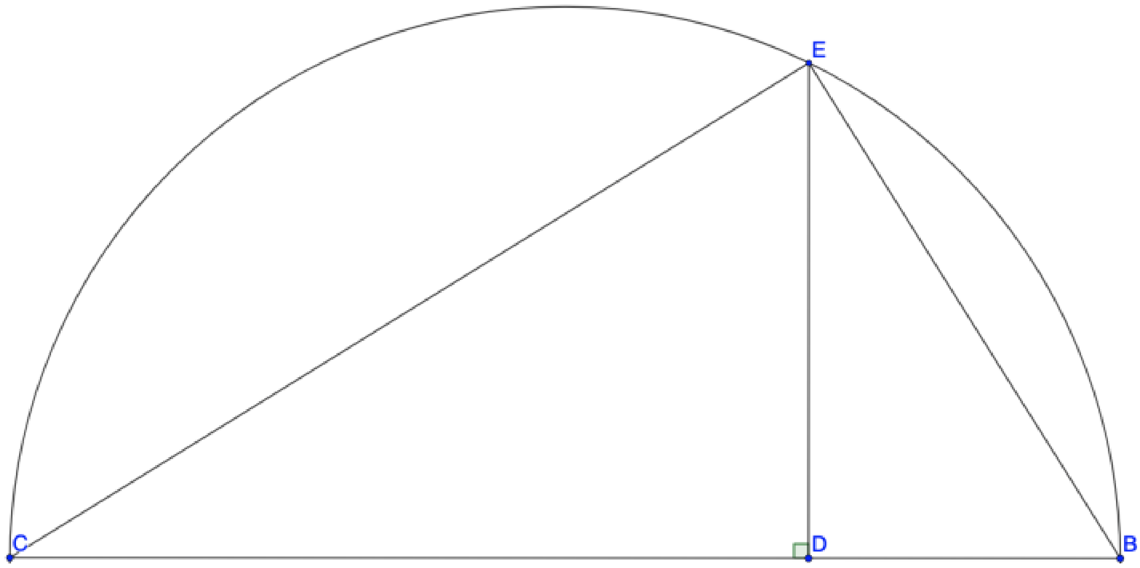
8.9 Recap of the Learning Intentions

After this week's lesson you will be able to;

- Use ratio to identify unknown sides in similar triangles
- Apply the properties of a circle to problem solve in geometry

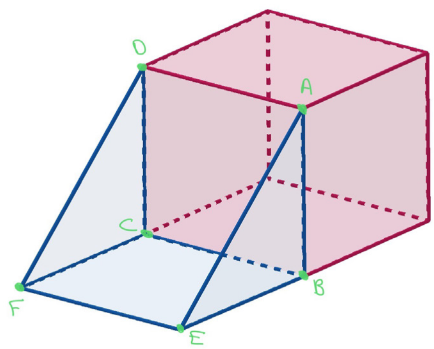
8.10 Homework Task

The diagram shows a semi-circle standing on a diameter [CB], and [ED] ⊥[CB]. Prove that the triangles ABD and DBC are similar



8.11 Solutions to 7.8

Using what you have learned this week, label the below diagram correctly and prove that the two blue triangles are congruent. The blue surface is a drop-down replica of the front face of the cube



$[AB] = [DC]$...*equal side of a square face*

$[BE] = [CF]$...*copies of the sides* $[AB]$ *and* $[DC]$

$[AE] = [DF]$...*Pythagoras' Theorem using the sides mentioned in steps 1 and 2.*
Congruent by S.S.S.