Lesson Research Proposal for 3rd Year HL Geometyr

Date of lesson: 06/03/19
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1. **Title of the Lesson:** What's your Angle?

2. **Brief description of the lesson**

Pupils will be presented with 2 parallel lines and 5 points (A, B, C, D and E). Angle ABC is 110˚ and CDE is 50˚. Pupils must find the measure of angle BCD, they can do this by creating exterior angles, right angles, triangles, vertically opposite angles and alternate angles and applying properties of these to find the angle.

3. **Research Theme**

Our school is looking to improve pupil wellbeing as part of School self-evaluation. The mathematics department will implement this initiative by increasing pupil's motivation and interest by completing a problem that has many methods to a correct solution.

Pupils may work collaboratively to increase connectedness as well as respect for each pupils' contribution and make them responsible for their own learning in the classroom.

4. **Background & Rationale**

The geometry topic will be taught to 3rd year higher level pupils, it will encompass right angles, parallel lines, alternate angles, corresponding angles, exterior angles, straight angle, angles in a triangle and properties of quadrilaterals.

From the most recent PISA study it is evident that Irish students are lacking in understanding of shape and space. We as a maths department have identified similar difficulties in our classrooms. It is hoped that by using a structured problem-solving question will aid to improve pupils' understanding and comprehension in this area.

We see most pupils are reluctant to extend lines or create triangles to aid them in finding solutions. As this is at the core of the problem it is hoped pupils will gain confidence in this skill for future problems.

5. **Relationship of the Unit to the Syllabus**

Describe how this unit relates to the syllabus/learning outcomes from prior years, for this year and for future learning.

Primary School Mathematics Curriculum
Strand- Shape and Space
Third and Fourth class
- o Explore, describe and compare the properties (sides, angles, parallel and non-parallel lines) of 2-D shapes
- o Construct and draw 2-D shapes
- o Identify, describe and classify vertical, horizontal and parallel lines discuss and describe

lines in the environment draw and label lines
- o Recognise an angle in terms of a rotation
- o Draw, discuss and describe intersecting lines and their angles perpendicular and oblique lines Acute, obtuse and right angles
- o Classify angles as greater than, less than or equal to a right angle
- o Solve problems involving lines and angles.

Fifth and Sixth Class
- o use angle and line properties to classify and describe triangles and quadrilaterals
- o recognise, classify and describe angles and relate angles to shape
- o estimate, measure and construct angles in degrees
- o explore the sum of the angles in a triangle
- o explore the sum of the angles in a quadrilateral

Junior Certificate Mathematics
Strand 2- Geometry and Trigonometry
2.1 Synthetic geometry
- o Vertically opposite angles are equal in measure.
- o The angles in any triangle add to 180˚
- o Two lines are parallel if and only if, for any transversal, the corresponding angles are equal.
- o Each exterior angle of a triangle is equal to the sum of the interior opposite angles.
2.5 Synthesis and problem-solving skills
- o explore patterns and formulate conjectures
- o explain findings
- o justify conclusions
- o communicate mathematics verbally and in written form
- o apply their knowledge and skills to solve problems in familiar and unfamiliar contexts
- o analyse information presented verbally and translate it into mathematical form
- o devise, select and use appropriate mathematical models, formulae or techniques to process information and to draw relevant conclusions.

Geometry for Post-primary School Mathematics
- o 6.3 Degrees
- o 6.5 Parallels
- o 6.7 Quadrilaterals and Parallelograms

Leaving Certificate Mathematics
Strand 2- Geometry and Trigonometry
2.1 Synthetic geometry
- o 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

Geometry for Post-primary School Mathematics
- o 6.3 Degrees
- o 6.5 Parallels
- o 6.7 Quadrilaterals and Parallelograms

Related prior learning Outcomes	Learning outcomes for this unit	Related later learning outcomes
Pupils will know properties of Corresponding angles • Exterior angles • Right angles • Straight angles and full rotation • Triangles • Quadrilaterals and parallelograms	Students will draw lines to create exterior angles, right angles, triangles, quadrilaterals and apply properties of these to solve the problem in as many ways as possible	Pupils will see there are many methods to a correct solution

6. Goals of the Unit

Describe the cognitive or emotional changes within the student. What students need to know or understand in order to….

To consolidate student learning of angles and improve resilience in coming to many methods to fond a correct answer

Pupils will discover that

7. Unit Plan

How the research lesson fits into the larger unit plan, helping to show the bigger picture of the whole unit and the progression of learning. Clarify where the research lesson will be taught.

Lesson	Brief overview of lessons in unit
1	Angles in a triangle and straight line and full rotation
2	Theorems associated with angles in a triangle & types of triangles
3	Identifying angles/relationships present in a problem
4	Choosing the appropriate relationships to link together
5	**RESEARCH LESSON!!!**

8. Goals of the Research Lesson:

Mathematical Goals

Consolidating learning on angles created with parallel lines, triangles and extended lines.

Gain confidence in creating angles and lines with known properties to find new angles

To appreciate that there are many equally valid methods to a correct solution

To present their own work and verbalize their own mathematically thinking

Key Skills:

Problem solving- Devises and evaluates strategies for investigating and solving problems using mathematical knowledge, reasoning and skills

Making connections- Describes, illustrates, interprets, predicts and explains patterns and relationships

Managing myself- Observes and evaluates empirical events and processes and draws valid deductions and conclusions

Literacy- The student communicates effectively using a variety of means in a range of contexts
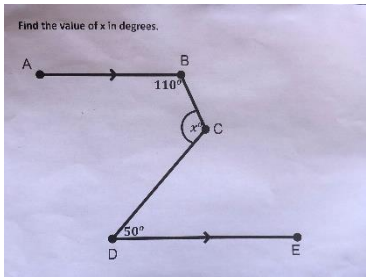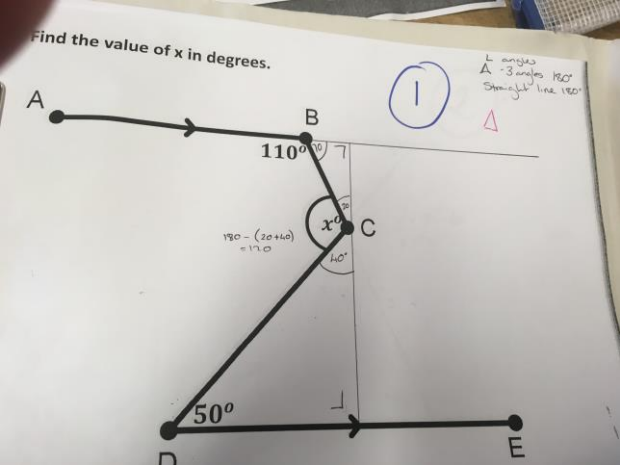
Numeracy- Recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning
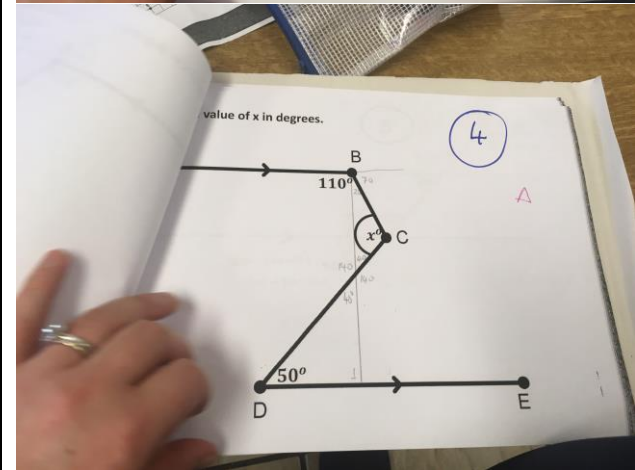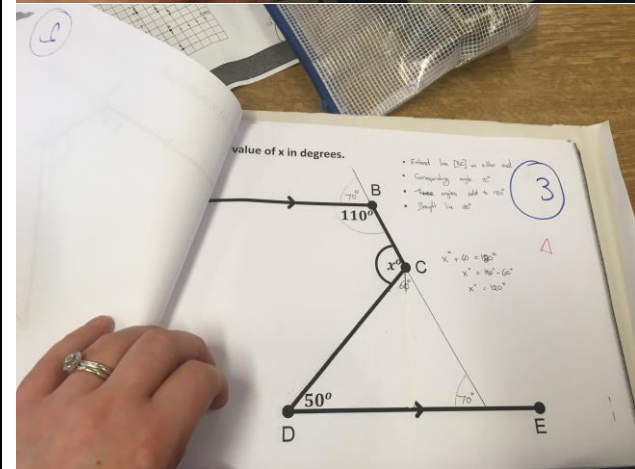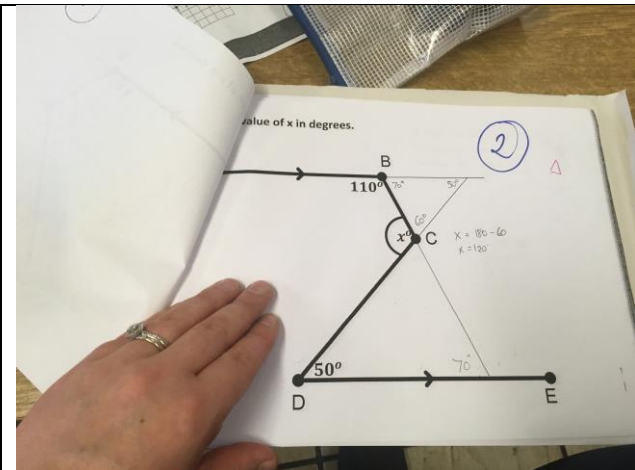
Staying well- Takes action to safeguard and promote her/his wellbeing and that of others

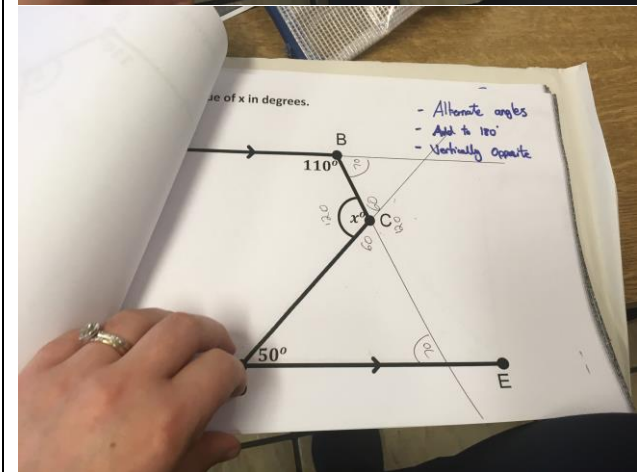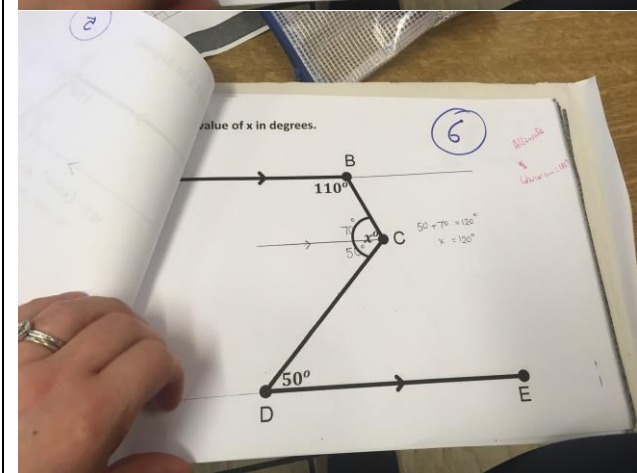Builds resilience by attempting to solve the problem and defend their reasoning when questioned
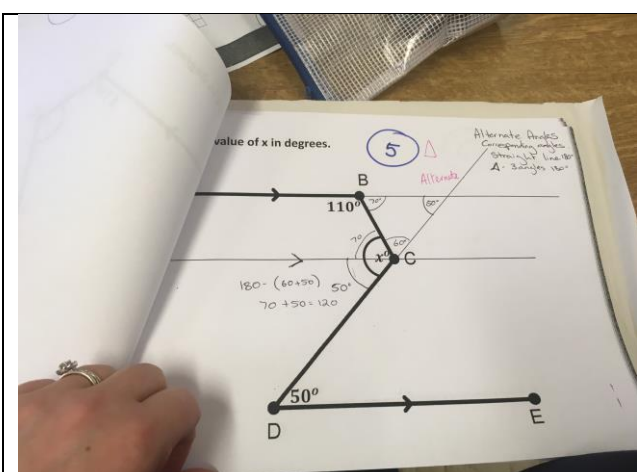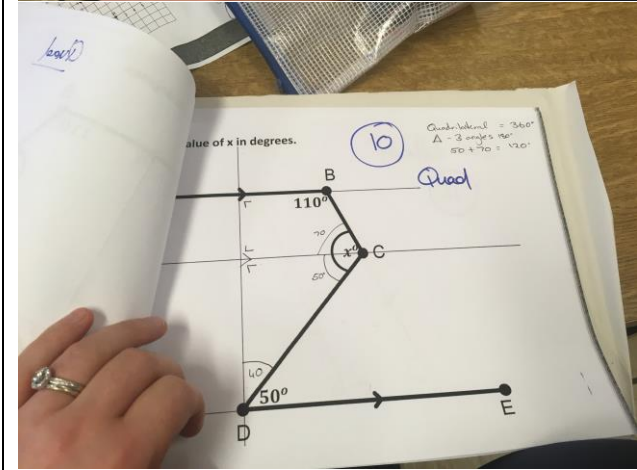
Inclusive- all solutions are equally valid and valued as appropriate methods to a solution
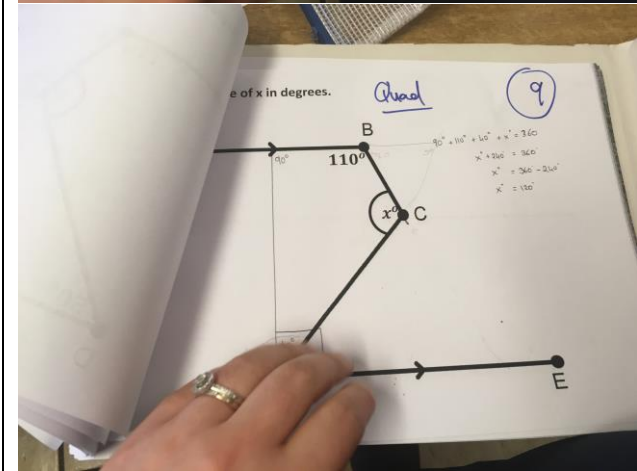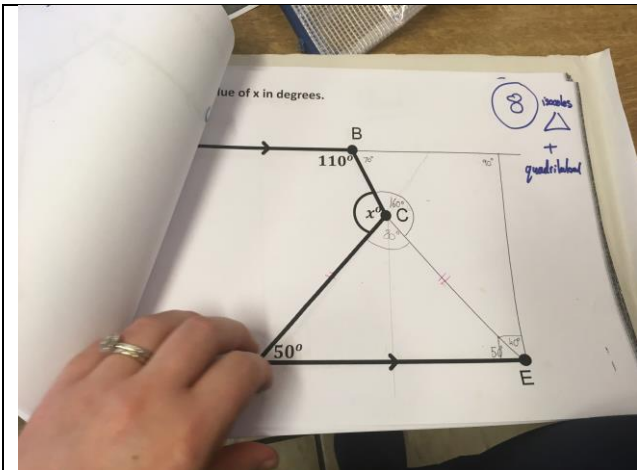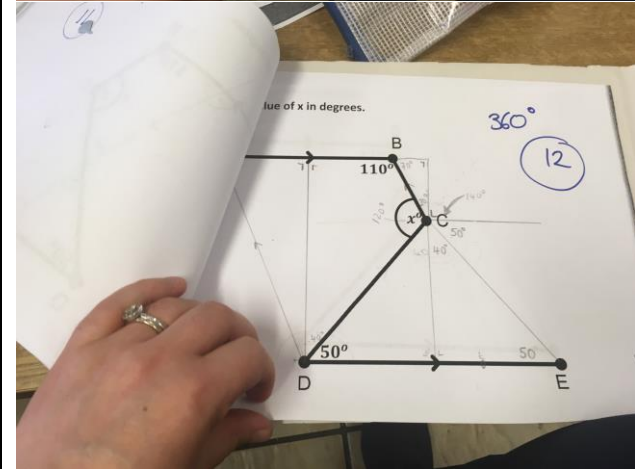
9. Flow of the Research Lesson:

Steps, Learning Activities Teacher's Questions and Expected Student Reactions	Teacher Support	Assessment
Introduction Students will discuss some of the theorems they have been working with for the past number of lessons.	Teacher will ask probing questions to ensure that the students are correctly identifying the theorems	
Posing the Task 	Students will be given out the problem on 6 copies of the worksheet and asked to estimate the number of ways they think there is to solve the problem.	
Student Individual Work Students will be given 15 minutes to work on their own to try and find as many solutions to the problem as possible.	The teacher will circulate the room asking the students questions to explain their thinking but also to try and prompt them to alter the diagram through adding in line segments or shapes if the student cannot see this.	Based on the student responses and work the teacher will choose which students to come to the board for ceardaiocht
Ceardaíocht /Comparing and Discussing In this section at least six students will be chosen to come up to the board to present their work and engage in a discussion with the whole class and teacher to fully explain their thought process 	During this session the teacher will ask questions of the students at the board in order to gain a fuller explanation of the approach that the student(s) took. Some of these questions will include: "Why did you do that?" "What made you start with that approach?" "Could you explain that to the rest of the class?" Directing some of these at the class "Could you rephrase what that student just explained?"	

"Does anyone like/dislike this way?"

⑤

Alternate Angles
Corresponding angles
Straight line 180°
Δ - 3 angles 180°

Alternate

B
110°
70°
60°
70°
60°
x° **C**
180 - (60+50) 50°
70 + 50 = 120
50° **D** → **E**

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② ⑥

Alternate
Solution = 120°

B
110°
70°
x° **C**   50 + 70 = 120°
50°   x = 120°
50° **D** → **E**

- Alternate angles
- Add to 180°
- Vertically Opposite

B
110° 70°
120°
x° **C** 120°
60°
50° **D** → z **E**

8 isoceles △ + quadrilateral

B
110°   x°
x° C 160°
50°   50° 40°
E

Quad   9

e of x in degrees.

B
90°   110°
x° C

E

$90° + 110° + 40° + x° = 360$
$x° + 240 = 360$
$x° = 360 - 240$
$x° = 120°$

Quad

alue of x in degrees.   10

Quadrilateral = 360°
△ - 3 angles 180°
50 + 70 = 120°

B
110°
70
x° C
50

40
50°   E
D

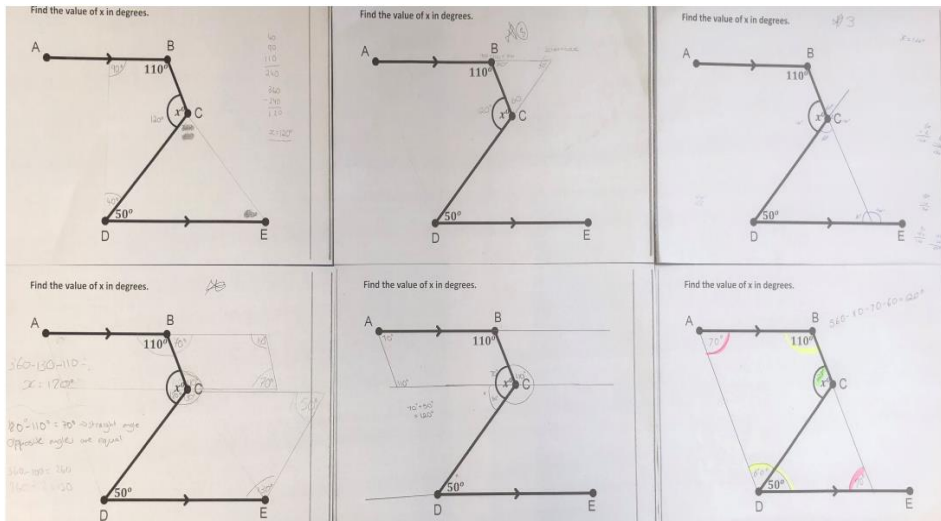| **Summing up & Reflection**		
At the end of the lesson we will try to summarize the new approach learned today	The teacher will ask the students to describe one new skill they learned today and discuss how that might help them in future situations.	

10. Board Plan

11. Evaluation

For the purpose of evaluating the lesson the will be hoping to answer the following questions

- Do the students look for the obvious theorems only and are unsure about how to progress?
- Can the students visualize other shapes present in the diagram?
- Does the explanation from the student at the board aid in understanding towards the goal of learning the new skill?

12. Reflection

Overall the lesson went as planned despite some minor deviations from students and unforeseen misconceptions.

Unforeseen errors:

- Students drew the line segment CE and treated that as being part of the same line as the segment BC which led to an incorrect identification of a straight angle and thus further incorrect values for the angles. An issue which the teacher can focus on in the next lesson using this same problem.
- It was felt that due to the benefit the students got from the Ceardaiocht session, that the idea of introducing some pair work into the section before the Ceardaiocht may help with the students understanding of the new methods. Some students really struggled with starting the question so pair work may have helped with this also.
- The group also discussing the possibility of estimating the value for x before the problem to allow the students to discuss the type of angle we have to avoid students getting answers that are way off.
- As a class the students were very fond of using right angles in their solutions.