1) Title of the lesson:

Parallel lines and alternate interior angles.

2) Brief description of the lesson:

Enable students to use their prior knowledge to solve problems relating parallel lines and their interior angles.

3) Aims of the lesson:

- For students to use their knowledge of the sum of interior angles of a triangle to find an unknown exterior angle.
- For students to become more creative when devising approaches and methods to solve problems.

4) Learning outcomes:

By the end of the lesson the students should be able:
- Apply their understanding of the relationship between angles to solve unknown interior and exterior angles.
- Apply a variety of methods to solve more complex and unseen problems.

5) Background and rationale

(a) Relationship to the Syllabus:
- Straight lines
- Parallel lines
- Intersecting lines
- Triangles
- Interior and exterior angles in a triangle.
- Sum of the interior angles in a triangle.
- Opposite angles.

(b) Difficulties students have had in the past with the subject matter.
- Not being able to calculate unknown angles.
- Not applying their previous knowledge to complete more complicated questions
- Not constructing lines to solve a geometrical problem

(c) The thematic focus of this lesson study i.e. larger goals the team will try to address and why.
- Problem solving
- More than one way to complete a question.
- Not waiting for teacher instructions: Foster independent learning

6) Research:

The text book which the students use is Téacs agus Trialacha 2, Ardléibheal agus Gnáthléibheal. Other books used in conjunction with the teaching of this topic is: Active maths 1 and 2 and Maths in Action 3.

7) About the unit and the lesson:

This lesson is designed to get students to draw on prior knowledge to attempt more challenging questions. Students will have participated in multiple lessons thus far in synthetic geometry and so we hope to guide them in understanding how to calculate unknown angles from information presented in a given problem and recognising steps that can be taken. From the diagram and their previous knowledge of triangles and parallel lines they will visually become more creative in finding an unknown angle.

It follows the Junior Certificate Mathematics Syllabus 2016, strand 2, section 2.1 Synthetic geometry, page 17-19.

8) Flow of the unit:

Lesson		# of lesson periods
	Title: Geometry 1 – Triangles and quadrilaterals	
1	Lines, angles and parallel lines.	2 x 40 min.
2	Angles of a triangle including interior and exterior angles.	2 x 40 min.
3	Quadrilaterals	1 x 40 min.
4	Parallel lines and triangles	3 x 40 min. (#3 = research lesson)
5	Congruent triangles	2 x 40 min.

9) Flow of the lesson:

Teaching Activity	Points of Consideration
1. Introduction: Recap Prior Knowledge (4min) Using the information we have learned to date what can you tell me about each of the following? 1. Lines 2. Angles 3. Triangles 4. Parallel Lines 5. Parallel lines, triangles and their angles 6. Exterior angles	Teacher draws relevant images on the board to help extract required information.
2. Posing of task (4 Minutes) Today's task will involve understanding and using all the information we have been taught to date to solve this task. You are all given A3 sheet with a problem that requires solving. The sheet is divided into 6 sections all of which have the same problem. Problem Posed: Find as many different ways as you can to find the value of x in the figure below. Lines l and m are parallel. 	Having received the problem, ensure that students are aware that each problem is the same and that there is more than one solution to this problem. Read out the given task and ensure that students are aware what is being required of them. Required: students will need set squares, ruler, and pencil.
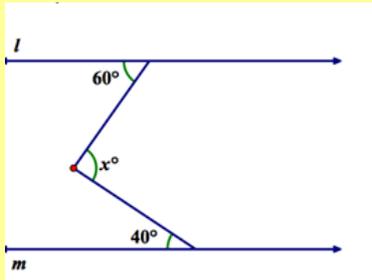
3. Individual Student Work (10 minutes) Instruct students that they have 10 minutes to solve the given problem as many ways as they can think of.	During this ten minutes circulate room to prepare and plan for Boardwork and Class Discussion. This in between desk assessment is crucial to the success of the class discussion to follow.
4. Class discussion (15min) Having walked around the room and observed all of your work I will now ask students to come up and show how they solved the problem. Student 1… solution	Instruct students that only those that have the right solutions have to approach the board and so they have nothing to fear.
  Student 2…..solution 	Bring students to the board starting with the most common approach to the most sophisticated. Summarise each solution after students have presented and explained how they got their answer.
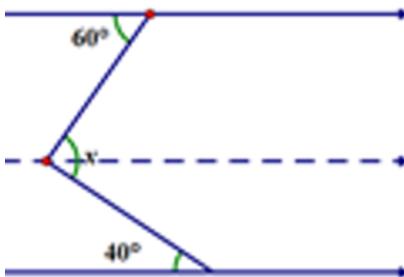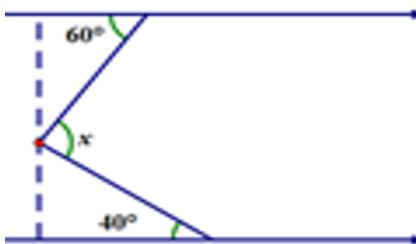
Student 3….solution
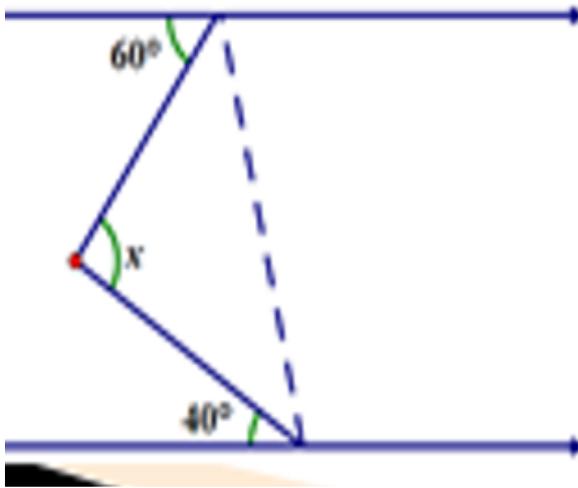
Student 4…solution
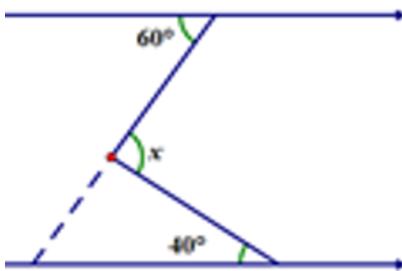
Student 5 …..solution
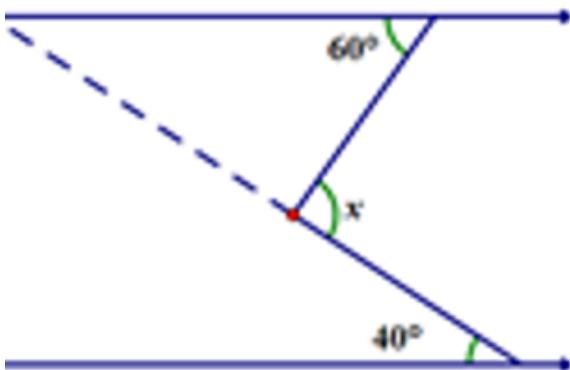
Student 6….solution
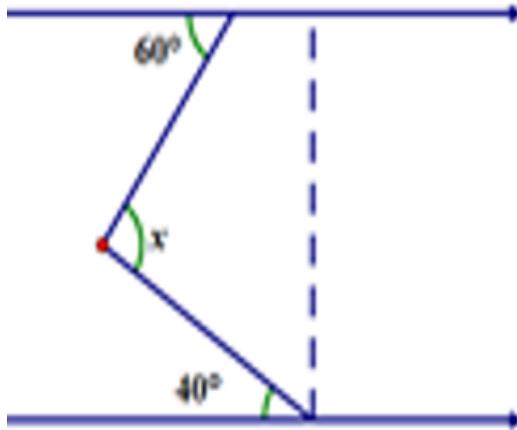
Student 7….solution
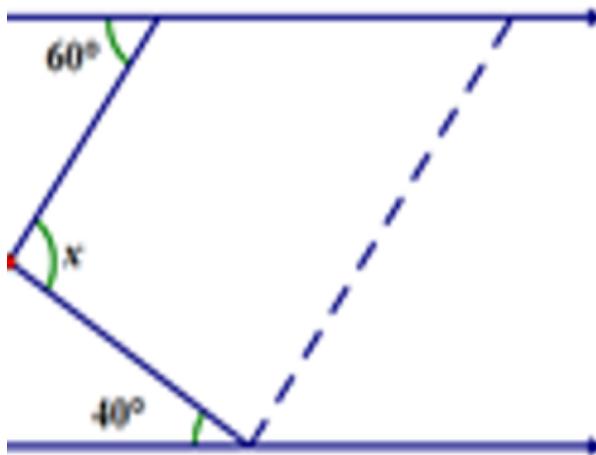
Student 8….solution
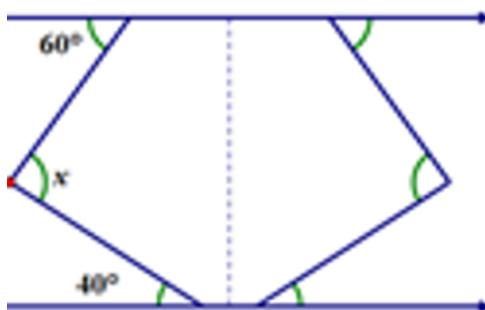
Guide students through any solutions that they have not got.

Having observed all of the students solutions, probe the class to see if anyone has thought of any other way since finishing the task.	
5. Reflection : (7minutes) What did you learn today? Which solution did you find to be the best? How will what you have learned today help you in the future?	Reinforce with the class that this one problem had many solutions and this can be the case with so many problems in mathematics. For homework they are to try and get another solution if not all of the eight solutions are achieved in class.

1. **What are the major patterns and tendencies in the evidence? Discuss.**
    From the evidence of the lesson the major patterns observed was that the students did not begin with the solutions that we had anticipated.
    Students had a strong reliance on prior knowledge, referring to the board material to help them in finding suitable methods to solving the unknown angle. This was a valuable resource, as it helped guide the students when they felt unsure about what direction to take.

2. **What are the key observations or representative examples of student learning and thinking?**

    The key observations was found were;
    Students were capable of being very flexible in the approach to the problem.
    Once the students found at least one method to solve the problem, they became more confident and more ambitious in their attempts.
    When given time to problem solve they became more comfortable and less cautious in their attempts.

3. **What does the evidence suggest about student thinking such as their misconceptions, difficulties, confusion, insights, surprising ideas, etc.?**
    *   Once misconception that the students had was because the question had two known angles they assumed that adding the third angle would equate to 180 degrees. This caused problems because they carried this incorrect answer forward to the other solutions.
    *   No confusion was experienced as the lessons task and instructions were very clear from the beginning.
    *   The surprising findings were that when the students were given the time they came up with 6 possible solutions to the one problem. See below:

60°
x°
40°
40°
M
x = 100

$$\begin{array}{cc} 90° & 180° \\ +60° & -150° \\ \hline 150° & 30° \end{array}$$

l
60°
A
30
x° 100°
50
B
L
m
40°

$$\begin{array}{cc} 40° & 180° \\ +90° & -130° \\ \hline 130° & 50° \end{array} \quad \begin{array}{cc} 30° & 180° \\ +50° & -80° \\ \hline 80° & 100° \end{array}$$

3

60°
120°
+140° −30°
260° 100°

70°
170

l
60° 30 30 60
x=100°
x°
40° 80 50 40

$$\begin{array}{c} 50 \\ +30 \\ \hline 80 \end{array}$$

$$\begin{array}{c} 180 \\ -80 \\ \hline 100 \end{array}$$

$$\begin{array}{c} 60° \\ +40° \\ \hline 100° \end{array}$$

l
∠ 60°
x°
A°+B°=X°
X°=100°
B° 40°
m

l
60° 120
x°
40° 140
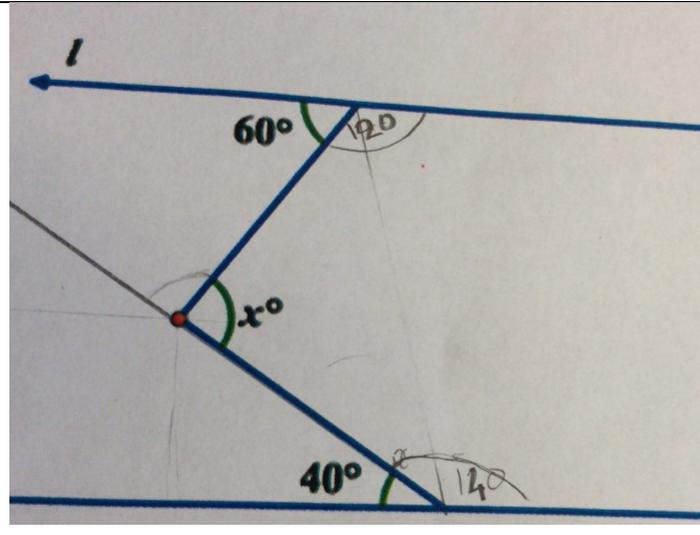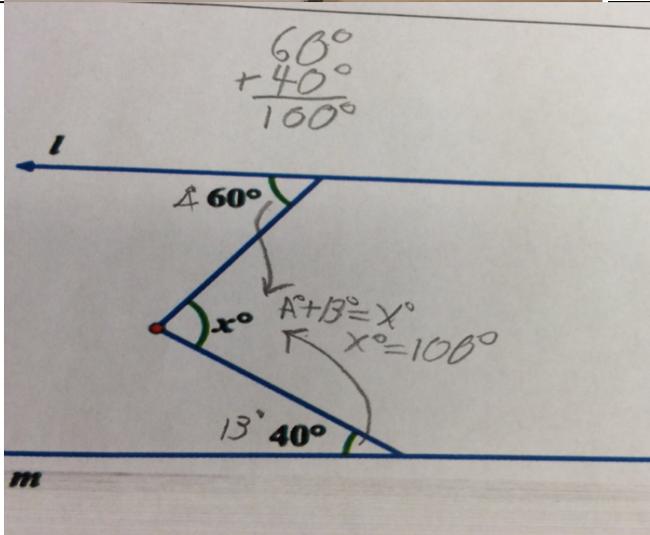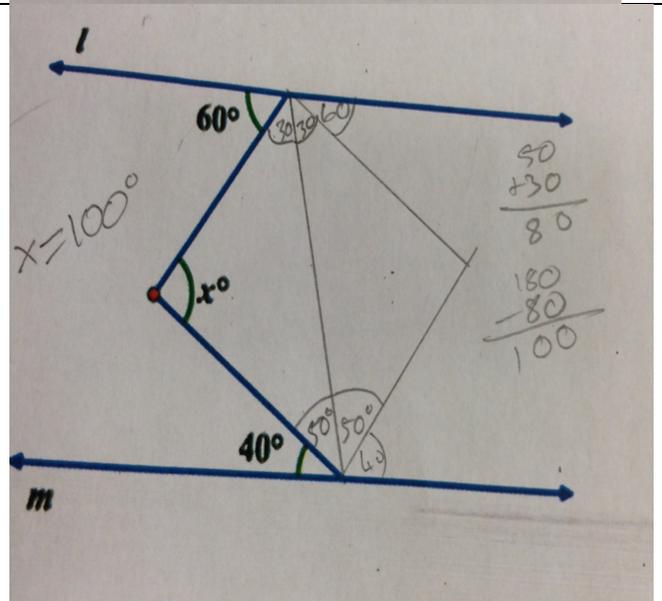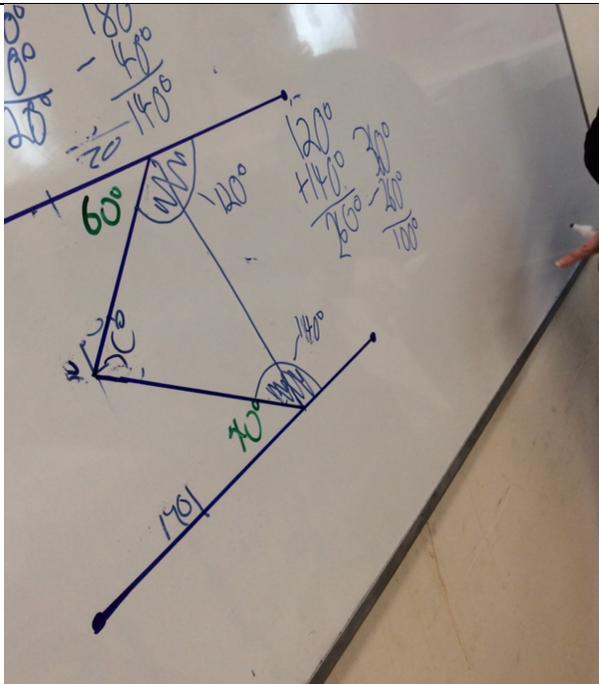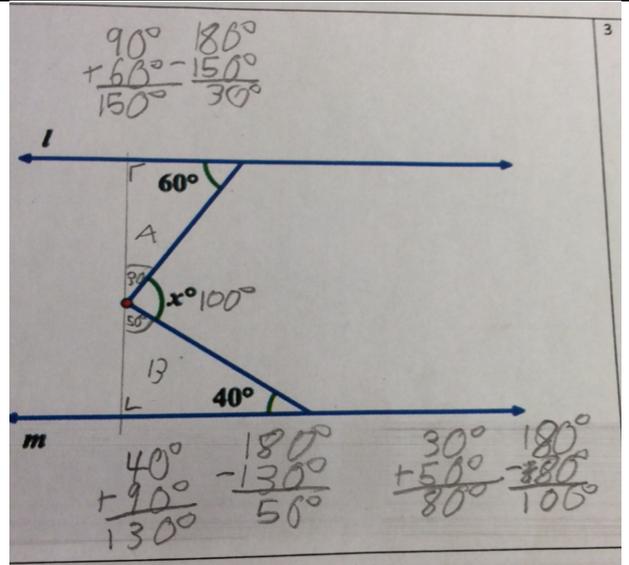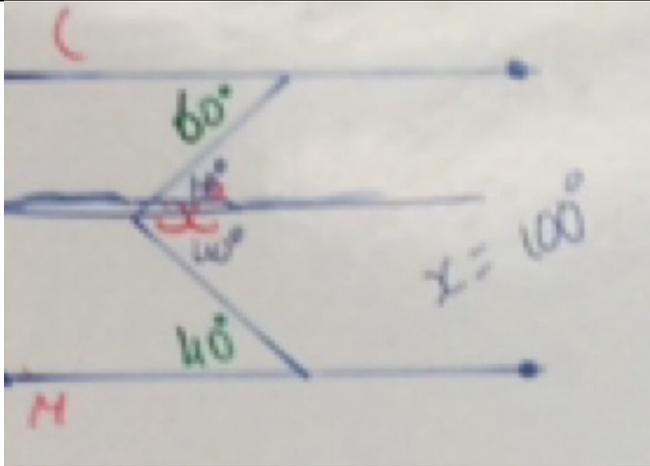
4. **In what way did the students achieve or not achieve the learning goals.**
    - The students did achieve their goals because they came up with 6 possible solutions out of the possible 8 and peer learning was the main method of the students achieving the learning aims.
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5. **Based on your analysis, how would you change or revise the lesson**.

- We feel that this lesson ran very smoothly and that any alterations would not benefit the lesson in any way

6. **What are the implications for teaching in your field?**

- Implications towards my teaching, this course helped me understand the importance of asking the right question and exhausting this as a learning resource as opposed to doing many similar questions which would not get the students to apply their prior learning to its maximum potential.