

Topic: Calculating Perimeter of an irregular shape

Year group: First Year

Taught: 24 January, 2016 at Loreto Secondary School, Bray

Duration: 40 minutes

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Teacher: Mary Dignan

Title of the Lesson

Calculating the length of the perimeter of an irregular shape with known and unknown lengths.

Brief description of the lesson

Students will be given an irregular shape and be asked to write the length of the perimeter in its simplest form. The shape will be drawn on paper. They will be asked to work alone or in groups and asked to present and explain their solution to the class group.

Aims of the lesson

I. **Short term aim:**

- i. revise calculating perimeter with known and unknown lengths
- ii. describe length using variables
- iii. add like terms only in algebra: constant + constant, unknown + unknown
- iv. simplify problems of perimeter using an unknown and known value
- v. associate x with an unknown dimension
- vi. the value of this unknown can change from problem to problem and from group to group

II. **Long term aims:** We would like our students to:

- i. gain confidence in applying algebraic skills to topics not previously associated with algebra.
- ii. not all valid solutions are numerical.
- iii. recognise the value of using an unknown to reduce a problem to something more manageable.
- iv. To allow appreciation of the relevance of Mathematics in everyday life.
- v. That students will experience meaningful Mathematics.
- vi. That students will experience independent learning.
- vii. To build enthusiasm for the subject.
- viii. work with scale models.
- ix. developing their literacy and numeracy skills through discussing ideas.

Learning Outcomes

As a result of studying this topic, students will be able to:

- I. build on their knowledge of perimeter from primary school to solve problems of perimeter in irregular shapes
- II. build on their knowledge of algebra which some of them have already encountered in primary school
- III. use algebra to solve problems to do with length and perimeter
- IV. recognise that an unknown can be used to describe using a variable
- V. present logical ideas to their peers.

Background and Rationale

Many students find the idea of an unknown or variable hard to comprehend. The purpose of this lesson plan is to encourage them to work with length without knowing exactly the length of the side of the shape. Their answer will be an algebraic term which will describe the perimeter in its simplest term. It is a familiar shape and one which they might be familiar in their everyday lives, therefore, as First Years, is less daunting a first challenge. We endeavour to make the idea of an unknown more concrete. It also aims to encourage them to use fractions with the unknown. It will also demonstrate the strength of using algebra in scale models, i.e. the answer will be in general and not specific terms. By seeing the variety of different ways to approach and solve this problem we also hope to encourage the idea there are a variety of ways to approach problems of algebra and perimeter which are all valid.

It is also important to show that while we are not getting a definite value answer, e.g. Perimeter = 12cm, the answer written in algebraic terms is still a valid answer. Furthermore, we would like to encourage the students to use and their learning on regular shapes encountered in primary school to discover how to find the perimeter of irregular shapes.

Research

In preparation of this lesson plan the following materials have been used:

- a) Junior Certificate Mathematics Guidelines for Teachers (DES 2002)
- b) First and second year Teachers Handbooks (from the Project Maths website www.projectmaths.ie)
- c) Course text books for Junior Cert

About the Unit and the Lesson

- We have chosen a problem that represents a real-life shape to make the concept less abstract and more inviting.

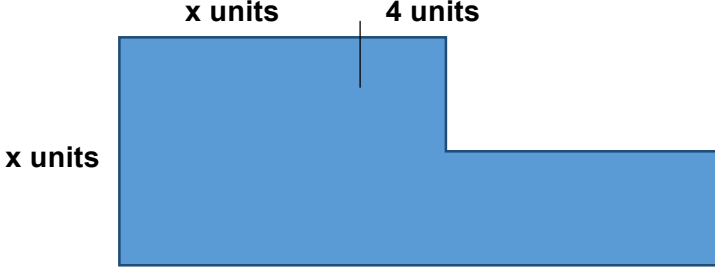
- The problem facilitates an investigative mode of learning where students are prompted to come up with various methods to simplify how to describe perimeter.
- The use of an everyday shape encourages discussion and comparisons and share ideas with each other students.
- We have chosen to use quantified and unquantified lengths to encourage the use of an unknown to simplify calculations, e.g. x is the same length on the other sides of the shape.
- The problem is designed to facilitate the use of fractions.

Flow of the Unit

Angles and Algebra, Area and Perimeter - First Year Teacher Handbook based on 2016 syllabus

Topic	# of lesson periods
Revision of what they have covered on lines from primary school	1
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Finding the measure of angles using unknowns – x , y , $2x$, $3y$, etc	3
Parallel lines, Vertically Opposite angles, Alternate and Interior angles, including use of unknowns, e.g. x , $2x$, y , $3y$...	3
Adding like terms in Algebra Adding unknown terms and constants to simplify an expression	1

Flow of the Lesson

Teaching Activities and Students' Anticipated Responses	Points of Consideration
<p>1. Introduction (5 minutes)</p> <p>What do we mean when we ask about perimeter of shapes?</p> <p>What regular shapes do we know?</p> <p>If we don't know how big or long something is, what can we call it?</p> <p>When we encounter sides that have the same lengths, but we do not know exactly how long the sides are, what length can we give them?</p> <p>2. Posing the Task (5 minutes)</p> <p>Show the shape to the class. Can they identify where there might have seen this shape anywhere in real-life?</p> <p>On the worksheet, you are given an irregular shape. Your task is to find a way to describe how long the perimeter of this shape is in as many ways as you can. You can use whatever instruments you like. But the drawing is not to scale. That means you do not know exactly how long each side is. There are many possible ways to answer this.</p> 	<p>Teacher shows figures (square, rectangles)</p> <p>Teachers shows the formulae of how to find the perimeter of these shapes.</p> <p>Rule = add like terms in algebra</p> <p>Encourage students to label sides of equal length with the same unknown</p> <p>Students use a ruler, scissors</p>

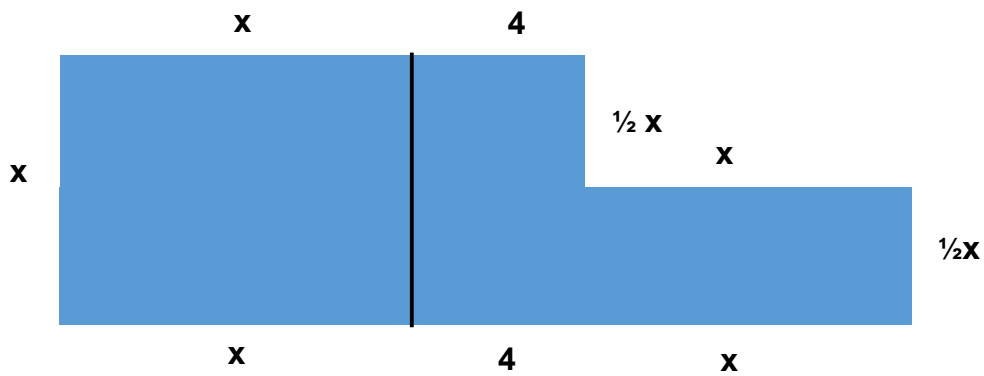
3. Students individual work (10 minutes)

Teacher circulates the room assessing students' work to plan how to orchestrate the presentation of students' work on the board and class discussion.

4. Class discussion (15 minutes)

Let's discuss now how you decided to find the length of the perimeter of this shape

Student 1

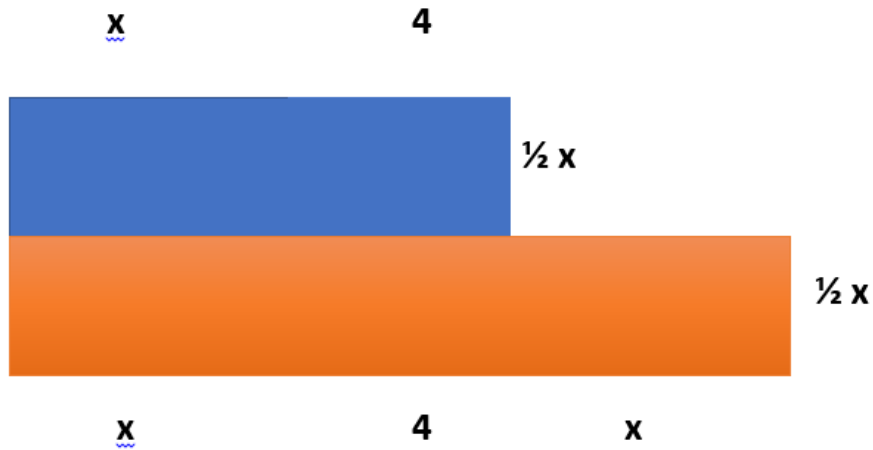


Add variable and natural numbers

$$x+x+x+x+x+ x+ x+ +x = x+$$

Teacher picks a student who... When the student has presented his/her reason, the teacher places a poster on the board.

Student 2



Cut out from paper or cardboard and add

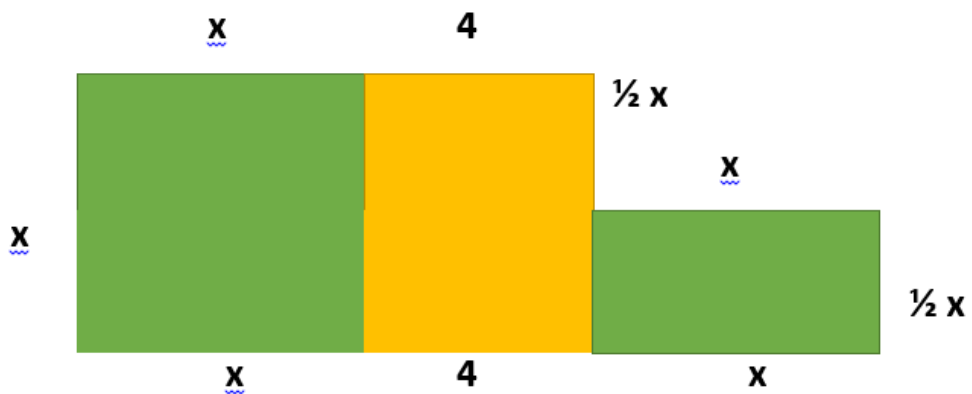
$$x + \quad + \quad x + \quad = \quad x +$$

$$x + x + x + x + x = x$$

$$x + + x = x +$$

Student 3

sing Algebra tiles – $x =$ Green and $4 =$ Yellow



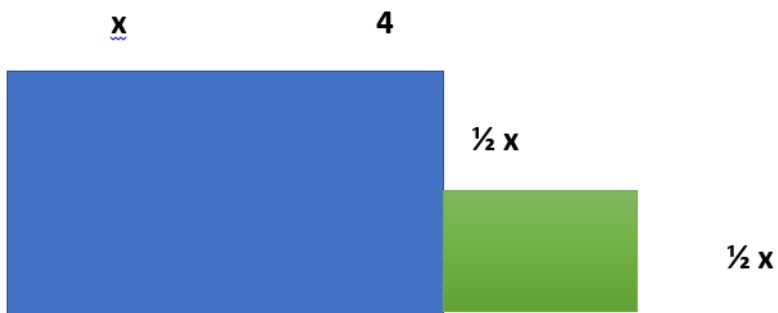
Green = $x+x+x+x+ x+x+ x = x$

Yellow = $+ =$

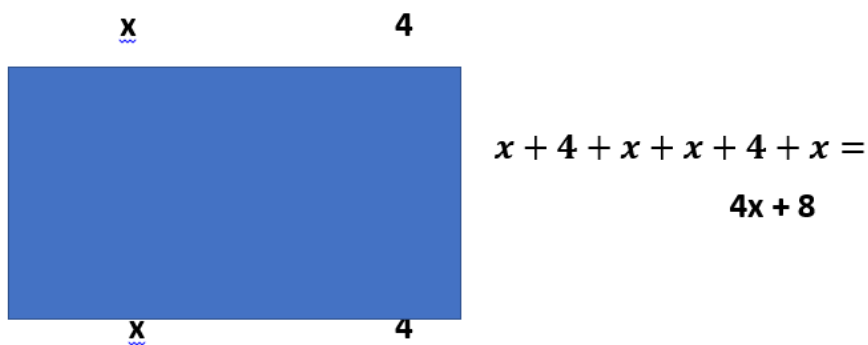
Total = $x+$

Student 4

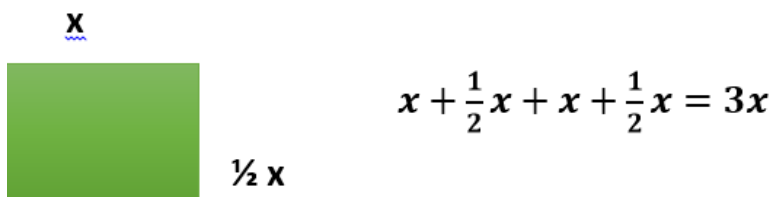
10 rectangles



1st Rectangle



2nd Rectangle



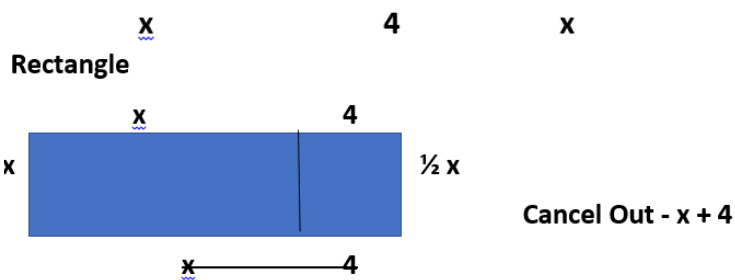
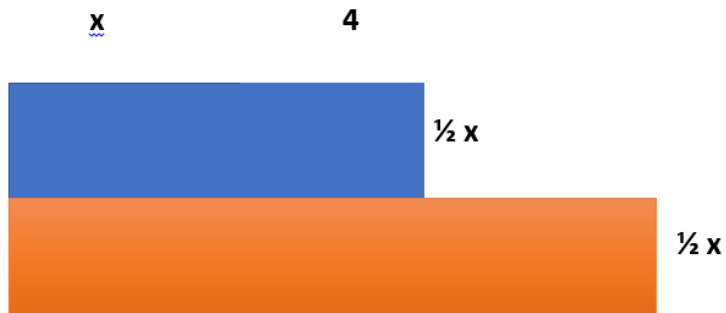
cancel out as no length in side shape

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$$\begin{aligned} \text{Perimeter of total shape} &= 4x + 8 + 3x \\ &= 7x + 8 - 1x = 6x + 8 \end{aligned}$$

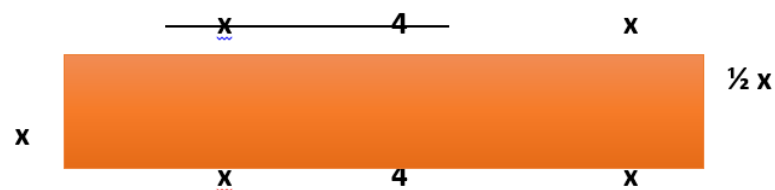
Student 5

Two rectangles



$$x + 4 + \frac{1}{2}x + \frac{1}{2}x = 2x + 4$$

Rectangle



Cancel out - $x + 4$

$$x + \frac{1}{2}x + x + 4 + x + \frac{1}{2}x = 4x + 4$$

$$\text{Total} - 2x + 4 + 4x + 4 = 6x + 8$$

<p>Student 6:</p> <p>The total perimeter = 2(total length) + 2(total width) Perimeter = $2(x + 4 + x) + 2(x) = 6x + 8$ units</p>	
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<p>5. Summing up (5 minutes)</p> <p>Now I would like you to write down in your copies two sentences about what you learned in today's lesson.</p> <p>We would also like you to try a similar perimeter problem of your own. You must write the problem as well as any possible solutions into your copy and tomorrow you will pose your problem on your whiteboard and we will ask another student to try and solve. You will then assess her solution.</p>	<p>Students copy homework down from the board into journal and as any questions if unclear</p>
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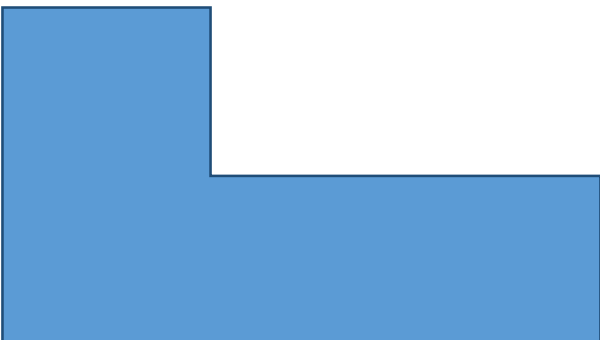
Evaluation: Plan for observing students

- A seating plan provided by the teacher
- Three observers, 8 students per observer, one observer uses the app LessonNote, the other two pen and paper using the Lesson Plan
- Types of student thinking and behaviour observers will focus on:

Introduction, posing the task	Can students recall the how to calculate the perimeter? Was wording of the task clear? Questions asked by students
Individual work	Are prompts required? What strategies do they employ when calculating perimeter? Can students see the use of algebra here? Are they able to employ algebra to make the task easier? How long do students spend on the task?
	What kind of questions do students ask? Do they persist with the task?
Discussion	Are students attentive to what is happening on the board? Are clarifications needed to presenters' board work? Did the discussion promote student learning?

- Additional kinds of evidence collected (exemplars of students' work, photographs, end of lesson reflection)

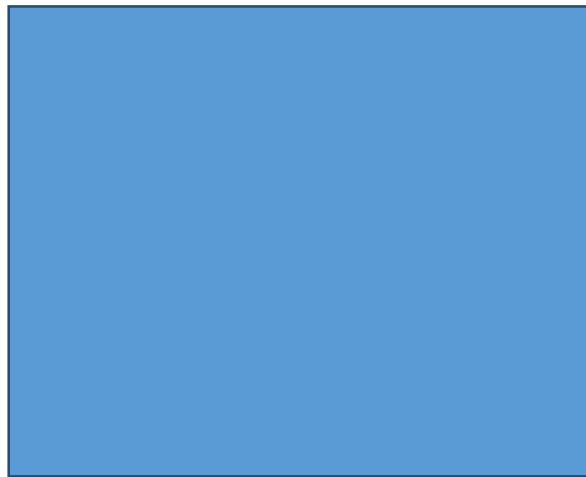
Board Plan

Known Shapes Finding Perimeter	Adding like terms in Algebra	Task Poster
<p><i>Student 1</i></p> <p>Square = all equal sides</p> <p>Rectangle = opposite sides are equal in length</p> <p><i>Student 2</i></p> <p>Perimeter = Add all four side</p>	<p><i>Student 3</i></p> <p>In Algebra all like terms can be added</p>	

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Board Posters

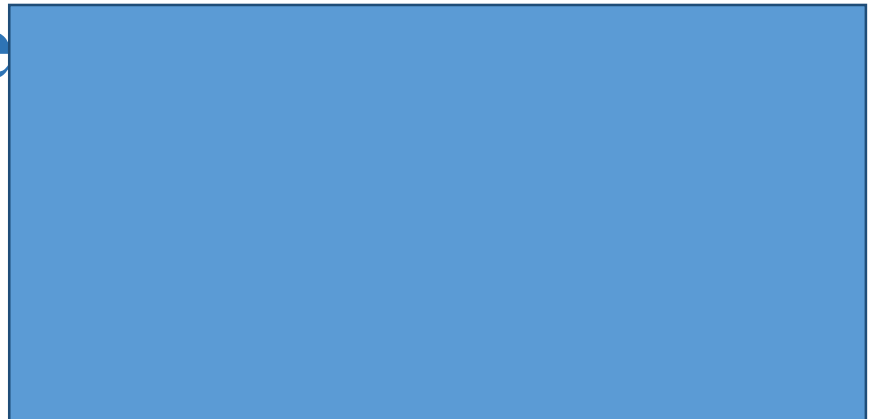
Square



length

length

Rectangle



width

length

Perimeter = Add all four
side

Rule of Algebra: All like
terms can be added

Post Lesson Discussion
To complete lesson proposal

12. Post-lesson reflection

- What are the major patterns and tendencies in the evidence? Discuss
 - Students understood the task which was clearly given and were comfortable finding the perimeter and adding the terms.
 - Some students were uncomfortable working with unknowns – changed x to a number and calculated perimeter using knowns.
 - Used their rulers to measure in centimetres in some cases.
 - Most groups divided the irregular shaped into known shapes
- What are the key observations or representative examples of student learning and thinking?
 - *See the attached photos on page 14*
- What does the evidence suggest about student thinking such as their misconceptions, difficulties, confusion, insights, surprising ideas, etc.?
 - Some students didn't realise it was possible to get x as a fraction.
 - Some students didn't realise that x couldn't be changed into a known value.
 - Some students are uncomfortable using a problem based approach to learning.
 - Some students enquired about what was the right way to approach the problem.
 - One group did solve the problem using 3 shapes and one that wasn't envisaged by the teachers prior to the lesson.
- In what ways did students achieve or not achieve the learning goals?
 - Students were clear in finding the perimeter of rectangle, square and irregular shape given
 - Associated x with an unknown
 - Adding like terms correctly
- Based on your analysis, how would you change or revise the lesson?
 - Perhaps a longer time for this particular lesson
 - Make sure everyone has the problem and then make clear the instructions
- What are the implications for teaching in your field?
 - Linking previous knowledge to summarise new material
 - A valid methodology
 - Suggest feedback from students is vital

Observations of students work

