

LESSON PLAN - APPENDIX - 1

CLASS : 9 SUBJECT : MATHEMATICS TEACHER'S NAME :

NAME OF THE UNIT	SUB-TOPICS	NO OF PERIODS REQUIRED			Time line for teaching	
		Teaching	Practice	TOTAL	From	To
PROOFS IN MATHEMATICS	A1.1 INTRODUCTION	1	0	1		
	A1.2 MATHEMATICALLY ACCEPTABLE STATEMENTS	1	1	2		
	A1.3 DEDUCTIVE REASONING	1	1	2		
	A1.4 THEOREMS, CONJECTURES AND AXIOMS	1	1	2		
	A1.5 WHAT IS A MATHEMATICAL PROOF ?	1	2	3		
	TOTAL		5	5	10	
PRE-REQUISITES & SKILLS	Every Pupil is expected to have basic knowledge and skills in # terminology and mathematical nomenclature. # basic geometrical shapes and objects, especially euclidian geometry and its other related axioms and postulates and their meaning # logical thinking and proving, drawing inferences, arriving at conclusions etc # four basic operations like +, -, x and ÷					

Learning Outcomes

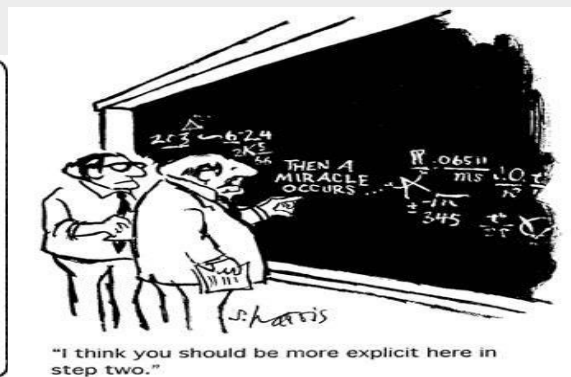
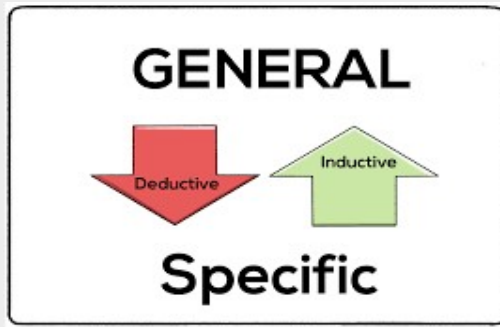
After Completion of this lesson every student will be able to

- # apprehend that statements, especially mathematical statements are needed to be proved through logical arguments
- # recognize the difference between a theorem, conjecture and an axiom
- # draw inferences basing on different statements and arrive at a valid conclusion.
- # prove different mathematical statements and will try to prove or disprove open conjectures.
- # appreciate the approach and enjoys the beauty in proving various mathematical statements or conjectures logically.

Teaching Learning Process

INTRODUCTION /INDUCTION

Teacher introduces the concept of proofs in mathematics with the help of different real life examples and situations where it is needed a logical proof to prove the authenticity of a statement or a result to make all agree with the argument. Through this, teacher draws and reroutes the attention of children towards the necessity of proving mathematical statements and conjectures as well and proceeds into the depth of the chapter.



Experience & Reflection

- # Pupils will recollect their knowledge on various mathematical statements, conjectures, axioms they have made use of in their previous chapters and will recognize the desperate need of proving them logically.
- # Students will experience the beauty and importance of proofs in mathematics and appreciate their uniqueness.

EXPLICIT TEACHING/TEACHER MODELLING (I DO)	GROUP WORK (WE DO)	INDEPENDENT WORK (YOU DO)	NOTES
<p>AI.1 INTRODUCTION</p> <p>Teacher introduces the concept of proofs in mathematics with the help of different real life examples and situations where it is needed a logical proof to prove the authenticity of a statement or a result to make all agree with the argument. Through this, teacher draws and reroutes the attention of children towards the necessity of proving mathematical statements and conjectures as well and proceeds into the depth of the chapter.</p>	<p>Pupils will work in groups and try to recall and recognize those situations where they really need to prove or disprove some real life statements & situations. For example we may need to disprove the claim of non payment of a bill from electricity department by producing the payment receipt. In the same fashion they will try to recall those mathematical statements which they made use of earlier without knowing their authenticity and will recognize the importance of proving them or knowing their proof now.</p>	<p>Every individual knows the importance and necessity of proving mathematical statements or conjectures logically.</p>	<div data-bbox="1247 846 1927 1260" style="border: 2px solid green; padding: 10px; background-color: #e0f0e0;"> <p style="text-align: center; background-color: #90ee90; margin: 0;">Nature & Importance of Proofs</p> <ul style="list-style-type: none"> • In mathematics, a <i>proof</i> is: <ul style="list-style-type: none"> – A sequence of statements that form an argument. – Must be <i>correct</i> (well-reasoned, logically valid) and <i>complete</i> (clear, detailed) that rigorously & undeniably establishes the truth of a mathematical statement. • Why must the argument be correct & complete? <ul style="list-style-type: none"> – <i>Correctness</i> prevents us from fooling ourselves. – <i>Completeness</i> allows anyone to verify the result. </div>

EXPLICIT TEACHING/TEACHER MODELLING (I DO)	GROUP WORK (WE DO)	INDEPENDENT WORK (YOU DO)	NOTES
<p>A1.2 . MATHEMATICALLY ACCEPTABLE STATEMENTS</p> <p>Teacher first introduces what a statement is and which type of sentences are acceptable as statements and will explore different types of sentences which can be accepted as statements and which are not.</p>	<p>Teacher conducts a group activity involving children to segregate the given set of sentences into statements and non-statements</p>	<p>Every pupil is focused to get a comprehensive idea about which type of sentences turn into statements and which are not.</p>	

A1.2 Mathematically Acceptable Statements

In this section, we shall try to explain the meaning of a mathematically acceptable statement. A 'statement' is a sentence which is not an order or an exclamatory sentence. And, of course, a statement is not a question! For example,

"What is the colour of your hair?" is not a statement, it is a question.

"Please go and bring me some water." is a request or an order, not a statement.

"What a marvellous sunset!" is an exclamatory remark, not a statement.

However, "The colour of your hair is black" is a statement.

In general, statements can be one of the following:

- always true*
- always false*
- ambiguous*

The word 'ambiguous' needs some explanation. There are two situations which make a statement ambiguous. The first situation is when we cannot decide if the statement is always true or always false. For example, "Tomorrow is Thursday" is ambiguous, since enough of a context is not given to us to decide if the statement is true or false.

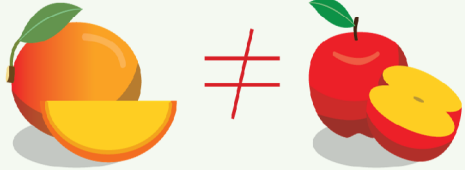
The second situation leading to ambiguity is when the statement is subjective, that is, it is true for some people and not true for others. For example, "Dogs are intelligent" is ambiguous, because some people believe this is true and others do not.

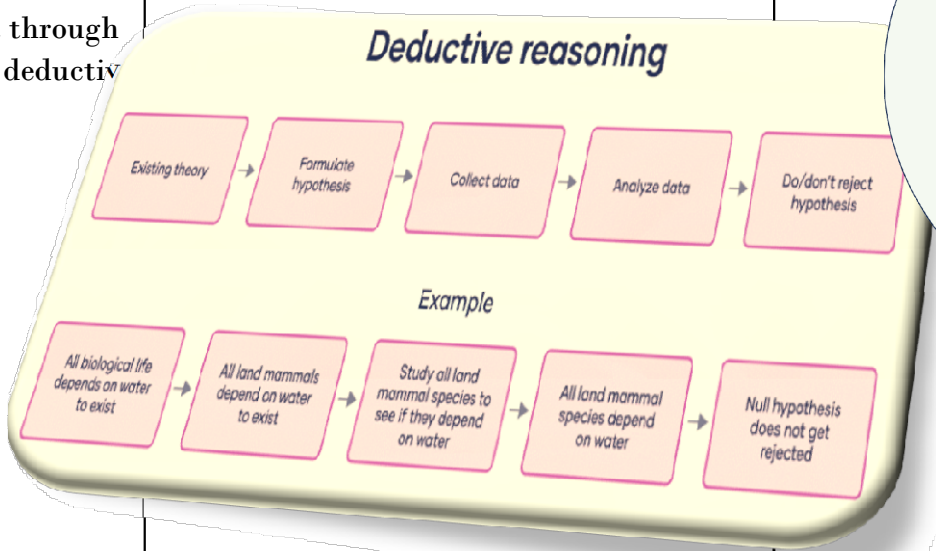
MATHEMATICALLY ACCEPTABLE STATEMENTS

An order or an exclamatory sentence or a question can not be a statement

In general statement can be

- (i) Always true
- (ii) Always false
- (iii) Ambiguous

EXPLICIT TEACHING/TEACHER MODELLING (I DO)	GROUP WORK (WE DO)	INDEPENDENT WORK (YOU DO)	NOTES
<p>A1.3. DEDUCTIVE REASONING Teacher describes children how an unambiguous statement can be proved through different logical arguments and analysis and concludes that the process of proving the truth of an unambiguous statement through logical analysis is called deductive reasoning</p>	<p>Pupils groups are made familiar with the deductive reasoning and how the truth of a statement.</p>	<p>Every individual is made familiar with deductive reasoning</p>	<div data-bbox="1297 613 1990 1084" style="border: 1px solid black; border-radius: 50%; padding: 10px; text-align: center;"> <p>If a food is a fruit, then it is an Apple → Statement</p> <p>Condition Conclusion</p>  <p>Condition is true but conclusion is false. Mango is a counter example. Mango is a fruit but not an Apple.</p> </div>



EXPLICIT TEACHING/TEACHER MODELLING (I DO)	GROUP WORK (WE DO)	INDEPENDENT WORK (YOU DO)	NOTES
A1.4. THEOREMS, CONJECTURES AND AXIOMS teacher explains the classification of statements into Theorems, Conjectures and Axioms basing on their provability	Pupils groups will be engaged in an activity of identifying some statements into Theorems, Conjectures and Axioms basing on their provability with the help of their previous knowledge in Euclidian Geometry where they were made familiar with Axioms and postulates and Conejctures like Goldbach Conjecture etc.,	Every individual is focussed so that each one understands and are able to distinguish among Theorem, Conjecture and Axiom	Some example sums along with exercise sums

Theorem	Statement that can be proved and has been shown to be true.
Proposition	Less important theorems, sometimes called facts
Axioms	Statements , sometimes called postulates, that we assume to be true.
Lemma	Minor or helper theorem. With complicated proofs, we use a series of lemmas, each proved separately, to help display reasoning
Corollary	Proposition or an easily drawn conclusion
Conjecture	Statement that is being proposed to be true, based on partial evidence or intuition.

EXPLICIT TEACHING/TEACHER MODELLING (I DO)	GROUP WORK (WE DO)	INDEPENDENT WORK (YOU DO)	NOTES
<p>A1.5 WHAT IS A MATHEMATICAL PROOF</p> <p>Teacher draws the attention of pupils towards how we prove a statement mathematically and at this juncture teacher makes children familiar with different types of mathematical proofs like</p> <ol style="list-style-type: none"> 1) Proving by contradiction 2) Proving Directly 3) Proving by construction 4) proving by exhaustion etc., 	<p>Pupils groups will be made familiar with different types of mathematical proofs and are engaged in proving some mathematical statements by selecting appropriate method of proving.</p>	<p>Teacher focuses on each individual and also throws some special attention towards the brilliants by stating some open conjectures and asks them to try to prove them.</p>	<p>different proofs of theorems.</p>

Mathematical Proof

Proof in maths is using knowledge of mathematics to prove a mathematical statement is true. There are two main types of proof that you may need for GCSE Mathematics.

***Algebraic proof** is where we use algebraic manipulation, such as expanding and factorising expressions, to prove a statement involving integers, a problem involving algebraic terms or an identity.*

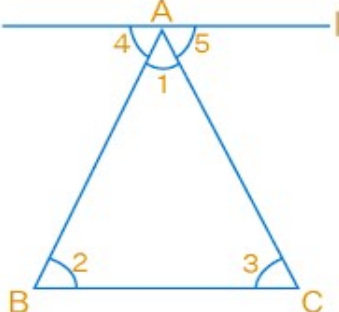
***Geometric proof** is where we use geometrical reasoning to prove a statement or theorem about a geometry problem. This may involve problems including congruent shapes, congruent triangles, circle theorems and vectors.*

THIRD SPACE LEARNING

A mathematical proof

is a series of logical statements supported by theorems and definitions that prove the truth of another mathematical statement

CHECK FOR UNDERSTANDING QUESTIONS

1. Factual	1) What are the differences between axiom, conjecture and theorem? 2) Define a Statement?
2. Open Ended/Critical Thinking	1. What type of method will you select in proving an irrational number as irrational? 2. What has been tried to prove in the adjacent diagram? <div style="text-align: center; margin-top: 20px;">  </div>
3. Student Practice questions & Activities	1. Prove that the product of two even natural numbers is even. 2) Prove that infinitely many points lie on the line $y=2x$
4. Assessment	Exercise sums and worksheet on Lines and Angles