Syllogisms	Season	02
	Episode	01
	Time frame	3 periods

Objectives :
- Discover and understand syllogisms.
- Write original syllogisms.
- See different types of syllogisms.

Materials :
- *Fact sheet about syllogisms.*
- *Twelve different syllogisms with the premises and conclusion written on different cards.*
- *Answer sheet for each team to write the syllogisms.*
- *Beamer with different types of syllogisms.*

1 – Matching game 20 mins

The teacher explains quickly what is a syllogism. Students are then handed out cards with one sentence, part of a syllogism, on each. They have to commit it to memory, then hide the paper and mingle to find the two other parts of the same syllogism. Once the team is made up, they must order the sentences correctly and read the complete syllogism to the class.

2 – Devising syllogisms in teams, checking their validity 35 mins

Every team of three must devise three original syllogisms and read them to the class. The concept of validity of a syllogism is introduced and checked for each new one.

3 – Construction of a syllogism 55 mins

The different types of syllogisms are shown, including the universal or particular, the positive or negative and the four different figures. Students have to fill their answer sheets with the subject, middle term, predicate, figure, types of proposition and type of syllogism.

4 – Recognise and repair invalid syllogisms (test) 55 mins

Students, working in pairs, are handed out a page with some syllogisms, most of them invalid. They have to find out which syllogisms are incorrect and repair them. At the end of the 55 minutes, they hand back their answer sheet to be graded.

One of the main methods of proof in mathematics is the syllogism. Here are two examples :

> All multiples of 12 are multiples of 4.
> All multiples of 4 are even.
> Therefore, all multiples of 6 are even.

> No reptiles have fur.
> All snakes are reptiles.
> Therefore, no snakes have fur.

Definition 1

A syllogism is a logical argument in which one proposition, the conclusion, is implied by two other propositions, the premises.

Truth and validity

While studying syllogism, and logic more generally, it's important to separate clearly the notions of truth and validity. Truth is about the real world, the one we're living in, and the way we perceive it. A statement is true if it corresponds to what we see in the world around us. Validity is strictly related to the form of the statement, to the correctness of the logical deductions involved. Below are two examples.

> All penguins have pink stripes. All math teachers are penguins. Therefore, all math teachers have pink stripes.

This syllogism is valid but none of the three statements involved is true.

> All equilateral triangles have angles of $60°$. The triangle ABC has an angle of $60°$. Therefore, the triangle ABC is equilateral.

This syllogism is not valid even if the three statements involved can be true. The problem here resides in the deduction, which doesn't respect the conditions of the first premise.

Different types of syllogisms

In each proposition (the premises and the conclusion), the quantifier can be universal or particular, and the sentence can be affirmative or negative. Since the medieval times, letters are used to represent each type of proposition :

					Type	Example
A	All	S	are	P	universal affirmative	All humans are mortal.
E	All	S	are not	P	universal negative	No humans are perfect.
I	Some	S	are	P	particular affirmative	Some humans are healthy.
O	Some	S	are not	P	particular negative	Some humans are not clever.

By definition, S is the subject of the conclusion, P is the predicate of the conclusion, M is the middle term, the major premise links M with P and the minor premise links M with S. However, the middle term can be either the subject or the predicate of each premise that it appears in. This gives rise to another classification of syllogisms known as the figure. The four figures are :

	Figure 1	Figure 2	Figure 3	Figure 4
Major premise	M-P	P-M	M-P	P-M
Minor premise	S-M	S-M	M-S	M-S
Conclusion	S-P	S-P	S-P	S-P

So the total number of possible types of syllogism is $4 \times 4 \times 4 \times 4 = 256$, as there are four different types of proposition for each of the three propositions and four different figures. But most of these forms are invalid (the conclusion does not follow logically from the premises). There are only 19 valid forms of syllogisms, each one having a mnemonic name used since the medieval times, where only the vowels are relevant.

Figure 1	Figure 2	Figure 3	Figure 4
Barbara	Cesare	Darapti	Bramantip
Celarent	Camestres	Disamis	Camenes
Darii	Festino	Datisi	Dimaris
Ferio	Baroco	Felapton	Fesapo
		Bocardo	Fresison
		Ferison	

Syllogisms	Season	02
	Episode	01
	Document	Answer sheet 1

Members of the team _____
_____
_____

First syllogism

Major premise _____ ☐
Minor premise _____ ☐
Conclusion _____ ☐

Subject ☐ Middle term ☐ Predicate ☐

Structure ☐☐☐ Figure ☐ **Type** ☐

Original syllogisms

Major premise _____ ☐
Minor premise _____ ☐
Conclusion _____ ☐

Subject ☐ Middle term ☐ Predicate ☐

Structure ☐☐☐ Figure ☐ **Type** ☐

Major premise _____ ☐

Minor premise _____ ☐

Conclusion _____ ☐

Subject ☐ Middle term ☐ Predicate ☐

Structure ☐☐☐ Figure ☐ **Type** ☐

Major premise _____ ☐

Minor premise _____ ☐

Conclusion _____ ☐

Subject ☐ Middle term ☐ Predicate ☐

Structure ☐☐☐ Figure ☐ **Type** ☐

Syllogisms	Season	02
	Episode	01
	Document	Answer sheet 2

Members of the team _____

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Syllogism 1 Valid □ Invalid □

Fish live in water.
Monkeys are not fish.
∴ Therefore, monkeys do not live in the water.

Valid revision _____

_____

_____

Syllogism 2 Valid □ Invalid □

No Frenchmen like plum pudding
All Englishmen like plum pudding
∴ Englishmen are not Frenchmen

Valid revision _____

_____

_____

Syllogism 3 Valid □ Invalid □

All lions are fierce
Some lions do not drink coffee
∴ Some creatures that drink coffee are not fierce

Valid revision _____

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_____

Syllogism 4 Valid □ Invalid □

No pigs can fly
All pigs are greedy
∴ Some greedy creatures cannot fly

Valid revision _____

_____

_____

Syllogism 5 Valid □ Invalid □

Some pillows are soft
No pokers are soft
∴ Some pokers are not pillows

Valid revision _____

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Syllogism 6 Valid □ Invalid □

No emperors are dentists
All dentists are dreaded by children
∴ No emperors are dreaded by children

Valid revision _____

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Syllogism 7 Valid □ Invalid □

Nothing intelligible ever puzzles me
Logic puzzles me
∴ Logic is unintelligible

Valid revision _____

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Syllogism 8 Valid □ Invalid □

If war is declared, the enemy country will be invaded
War is not declared
∴ The enemy country will not be invaded

Valid revision _____

_____

_____

Syllogism 9 Valid □ Invalid □

Ninety-nine Cretans in a hundred are liars
Epimenides is a Cretan
∴ Epimenides is a liar

Valid revision _____

_____

_____

Syllogism 10 Valid □ Invalid □

No bald creatures need a hairbrush
No lizards have hair
∴ No lizards need a hairbrush

Valid revision _____

_____

_____

Document 1 Cards with parts of syllogisms

All men are mortal.
Socrates is a man.
Socrates is mortal.
No mammal has feathers.
All horses are mammals.
No horse has feathers.
No lazy people pass exams.
Some students pass exams.
Some students are not lazy.
All cats are black.
Victoria is a white cat.
Victoria is a black cat.
All fruit is nutritious.
All fruit is tasty.
Some tasty things are nutritious.
Some cats have no tails.
All cats are mammals.
Some mammals have no tails.
Some small birds live on honey.
All birds that live on honey are colourful.
Some colourful birds are small.

No homework is fun.
Some reading is homework.
Some reading is not fun.
All kittens are playful.
Some pets are kittens.
Some pets are playful.
No healthy food is fattening.
All cakes are fattening.
No cakes are healthy.
All informative things are useful.
Some websites are not useful.
Some websites are not informative.
All the industrious boys in this school have red hair.
Some of the industrious boys in this school are boarders.
Some boarders in this school have red hair.
All wicked persons will face judgment
Some humans are wicked
Some humans will face judgment