# Introduction to logic	Season	01
	Episode	AP07
	Time frame	1 period

Prerequisites : None.

Objectives :
- Discover the concepts of implication, converse and contrapositive.

Materials :
- *Implications on cards.*
- *Answer sheet.*
- *Exercise sheet.*
- *Slideshow.*

1 – Matching game — 10 mins

Each student in the class is given a card with an implication on it. Students mingle to find :

1. first, the converse of their implication ;
2. second, the contrapositive of their implication.

Using a slideshow, the teacher introduces the vocabulary of logic.

2 – True or not — 10 mins

Students gather in groups of 4 : an implication, its converse, its contrapositive and the converse of the contrapositive. Together, they discuss which ones of the four sentences are true.

3 – Exercises — Remaining time

Still working in groups, students have to solve a few exercises about implication.

Surname		First name		Form	

Introduction to logic	Season	01
	Episode	AP07
	Document	Answer sheet

Your four implications

Type	Sentence	True ?
Implication		
Contrapositive		
Converse		
Contrapositive of the converse		

Exercises

Exercise 1

For each of the following implications, write its converse then decide if the inital implication is true and if the converse is true.

Type	Sentence	True ?
Implication	If a triangle ABC is inscribed in a circle of diameter $[AB]$, then it's right-angled in C.	
Converse		
Implication	If a line passes through the midpoints of two sides of a triangle, then it's parallel to the third side.	
Converse		

Type	Sentence	True ?
Implication	If a triangle has an altitude that is also a median, then it's isosceles.	
Converse		
Implication	If two altitudes of a triangle meet in a point H, then the third altitude also passes through H.	
Converse		
Implication	If a product is equal to 0, then at least one of the terms is equal to 0.	
Converse		

Exercise 2

For each pair of statements p and q, tick the propositions that are true.

p **:** I live in France. ***q*** **:** I live in Europe.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** I am overage. ***q*** **:** I'm 19.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** $CDEF$ is a parallelogram. ***q*** **:** $CDEF$ is a square.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** $x \in \mathbf{N}$. ***q*** **:** $x \in \mathbf{Z}$.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** MNP is right-angled in M. ***q*** **:** $MP^2 + MN^2 = NP^2$.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** $x \geq -2$. ***q*** **:** $x \geq -1$.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** $a + b = 5$. ***q*** **:** $a = 2$ and $b = 3$.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** $4x - (x + 5) = 7$. ***q*** **:** $x = 4$.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** n is prime. ***q*** **:** n is not a multiple of 3.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

p **:** $(ax + b)(cx + d) = 0$. ***q*** **:** $ax + b = 0$ or $cx + d = 0$.
☐ $p \Rightarrow q$ ☐ $q \Rightarrow p$ ☐ $p \Leftrightarrow q$ ☐ $\neg p \Rightarrow \neg q$ ☐ $\neg q \Rightarrow \neg p$

Document 1 Implications

If the triangle ABC is right-angled in A, then $BC^2 = AB^2 + AC^2$.

If $BC^2 = AB^2 + AC^2$, then the triangle ABC is right-angled in A.

If the triangle ABC is not right-angled in A, then $BC^2 \neq AB^2 + AC^2$.

If $BC^2 \neq AB^2 + AC^2$, then the triangle ABC is not right-angled in A.

If a quadrilateral is a square,
then its diagonals have the same length.

If the diagonals of a quadrilateral have the same length,
then it's a square.

If a quadrilateral is not a square,
then its diagonals don't have the same length.

If the diagonals of a quadrilateral don't have the same length,
then it's not a square.

If x is a real number such that $x^2 = 9$, then $x = 3$.

If x is a real number such that $x = 3$, then $x^2 = 9$.

If x is a real number such that $x^2 \neq 9$, then $x \neq 3$.

If x is a real number such that $x \neq 3$, then $x^2 \neq 9$.

If the median of a statistical set of data is 12,
then at least 50% of the values are greater than or equal to 12.

If at least 50% of the values are greater than or equal to 12,
then the median of a statistical set of data is 12.

If the median of a statistical set of data is not equal to 12,
then less than 50% of the values are greater than or equal to 12.

If less than 50% of the values are greater than or equal to 12,
then the median of a statistical set of data is not equal to 12.

If a triangle is equilateral, then it's right-angled.

If a triangle is right-angled, then it's equilateral.

If a triangle is not equilateral, then it's not right-angled.

If a triangle is not right-angled, then it's not equilateral.
