

Crash Course on Logic

INTRODUCTION

In this lesson you'll learn:

1. Why do we need to learn logic?
2. Review the 4 laws of logic
3. Argument components and structure
4. Learn two laws and two fallacies: *modus ponens* and *modus tollens*.
5. Three different types of arguments
6. Argument validity and soundness
7. Learn more informal logical fallacies

INTRODUCTION TO LOGIC: WHY DO WE NEED TO THINK LOGICALLY?

Why do we need logic? Simple: so you can come to true conclusions. So you can spot bad arguments. So you can do apologetics effectively and so you can benefit from thinking clearly. Here are some examples of bad arguments because of poor logic. Can you see where the arguments go wrong?

Bad Argument 1: You're better off not knowing anything on multiple choice tests.

1. On a multiple-choice test with four possible answers, I have a 25% chance of being wrong.
2. But if I can narrow the correct choices down to two options, then I have a 50% chance of being wrong.
3. A 25% chance of error is better than a 50% chance of error.
4. Therefore, the less I know about a question, the better off I am in guessing correctly.

Bad Argument 2: Math is stupid.

$$\begin{aligned}
 a &= 1 \\
 b &= 1 \\
 a &= b \\
 a^2 &= b^2 \\
 a^2 - b^2 &= b^2 - b^2 \\
 (a + b)(a - b) &= b(a - b) \\
 a + b &= b \\
 2 &= 1
 \end{aligned}$$

Bad Argument 3: No such thing as a pop quiz.

1. My teacher said that she will surprise us with a pop quiz someday this week.
2. But if we finish class on Thursday and haven't taken the quiz yet, then we know the pop quiz will be on Friday.
3. But if we know the quiz is on Friday, we won't be surprised.
4. Therefore, the quiz can't be on Friday.

5. If the quiz can't be on Friday, then after class ends on Wednesday, we'll know the quiz is on Thursday.
6. But if we know the quiz is on Thursday, we won't be surprised.
7. Therefore, the quiz can't be on Thursday.
8. By the same reasoning, the quiz can't be on Wednesday, Tuesday, or Monday.
9. Therefore it's not possible to surprise the class with a pop quiz.

Did you find the logical errors in the above arguments? If yes, good! If not, it's OK. Thinking logically is not natural. We tend to think illogically by nature, so be patient, and let's learn about logic.

REVIEW THE 4 LAWS OF LOGIC

1. The law of non-contradiction – Two contradictory statements cannot both be true at the same time in the same way. (It cannot be A and ~A)
2. The law of identity. (A is A)
3. The law of excluded middle. A statement about reality (or a *proposition*) is either true or not true. (It is either A or ~A)
4. The law of rational inference.

THE ARGUMENT: COMPONENTS, STRUCTURE

By *argument* we don't mean an emotional fight, as when we say "I had an argument with my parents." In logic, in argument has nothing to do with emotion. In fact, we discourage emotion in logical arguments, and we encourage making arguments!

An argument is made up of two types of propositions: the premises and the conclusion. A **proposition** is a declarative statement that affirms or denies something. It's made up of a subject, predicate, and a form of the verb "to be." A **premise** is a proposition in an argument that sets forth a reason or evidence for a conclusion.

TWO FORMAL LAWS AND FALLACIES

The Law of Modus Ponens

If P, then Q. P. Therefore, Q	If it rains, the ground is wet. It rains. Therefore, the ground is wet.
-------------------------------------	---

The Law of Modus Tollens

If P, then Q. ~Q. Therefore, ~P.	If it rains, the ground is wet. The ground is not wet. Therefore, it did not rain.
--	--

The Fallacy of Affirming the Antecedent

If P, then Q. Q. Therefore P.	If Chinatown café is open, I'll get fried rice. I'll get fried rice. Therefore, Chinatown café is open.
-------------------------------------	---

The Fallacy of Denying the Consequent

If P, then Q. ~P. Therefore ~Q	If Chinatown café is open, I'm getting fried rice. Chinatown café isn't open. Therefore, I'm not getting friend rice.
--------------------------------------	---

THE ARGUMENT: DIFFERENT TYPES

We will learn three different types of deductive arguments:

1. Hypothetical syllogism
2. Disjunctive syllogism
3. Reductio ad Absurdum

A **hypothetical syllogism** is set up by a hypothetical proposition. A hypothetical proposition is a statement that supposes something to be true. For example, a hypothetical proposition is

If Enoch is sick today, he will miss Sunday School today.

Another hypothetical proposition is

If Enoch will miss Sunday School, Daniel will teach instead.

So, a hypothetical syllogism would be like this

If Enoch is sick today, he will miss Trellis today.
If Enoch will miss Trellis, Daniel will teach instead.
Enoch is sick today.
Therefore, Daniel will teach instead.

If we used the letters and symbols to write the above argument, it would be like this.

If E, then M.
If M, then D.
E.
Therefore, D.

Disjunctive syllogism is set up by a disjunctive proposition. A disjunctive proposition is made up of two alternate terms in opposition to each other, written in the form of "either/or." For example, a disjunctive proposition is

Either Enoch will teach, or Daniel will teach.

In this case, the "or" is exclusive, which means for the above example that only one of the two will teach. Either Enoch will teach and Daniel will not, OR Daniel will teach and Enoch will not.

So, an argument in disjunctive syllogism form looks like this

<p>Either Enoch will teach or Daniel will teach. Daniel will not teach. Therefore, Enoch will teach.</p>	<p>Either E or D. $\sim D$ Therefore, E.</p>
--	---

For the **Reductio ad Absurdum**, to prove a proposition P, you begin by assuming $\sim P$. Then you show that if $\sim P$, then Q. Then you show that Q is absurd, so that it must be the case that $\sim Q$ is true. But if $\sim P$, then Q. So $\sim Q$ means $\sim(\sim P)$, or simply P. This is a special form of modus tollens, but it's so important that we'll mention it anyway. Understand? Here's an example.

Let's say you're trying to prove that BCEC has a College Ministry. To prove this you begin by assuming that it's not the case that BCEC has a College Ministry. If that's true, then there must not be any College counselors, staff, or teachers. But that's absurd because we all know that Enoch is a Trellis (College Class) teacher. So that means it's not true that it's not the case that BCEC has a College Ministry. Therefore, BCEC has a College Ministry. Get it? Good!

You may be a bit confused by these different arguments. But when we consider different arguments, you'll see how these are common logical arguments we all use everyday. So hang in there and you'll get it eventually!

THE ARGUMENT: VALIDITY AND SOUNDNESS

An argument is *valid* if the conclusions follow from the premises. In other words, if the conclusion can be logically inferred from the premises, the argument is valid. For example, consider this valid argument:

If Enoch is sick, then Kian is the cutest toddler in the whole wide world.
 Enoch is sick.
 Therefore Kian is the cutest toddler in the whole wide world.

This argument is *valid* in that the conclusion follows logically from the premises. In other words, if the premises are true, and the conclusion follows logically, then the argument is valid.

But of course, the conclusion is not true. As cute as Evan is, he's not the cutest baby in the whole wide world. So we say this argument is not *sound*. An argument that is sound is an argument that has a conclusion that follows from the premises (valid) *and* the premises must all be true. For example...

If Jesus rose from the dead, then resurrection is possible.
 Jesus rose from the dead.
 Therefore resurrection is possible.

The above argument is both valid and sound.

INFORMAL LOGICAL FALLACIES

Sometimes arguments will not be valid because of errors or *fallacies* in the logic. Besides the fallacies we learned about above, below is a list of the most common you'll see.

1. Ad Hominem – the fallacy of attacking the person making the argument instead of the argument itself. Example: Enoch can't show that abortion is wrong because as a man, he doesn't know what it's like to be pregnant and couldn't understand. This is a fallacy because that means it attacks Enoch rather than the argument Enoch makes. Does this mean that if a woman used the exact same argument against abortion it would somehow be more true? Of course not.

2. Straw man – describing an opposing view in such weak a way that it's easy to refute and attack. Example: We should not have any policemen because there are some cops who are corrupt and so police will never help. This is a straw man fallacy. Just because some cops are corrupt doesn't mean that we should do away with all police.

3. Begging the question – this is the fallacy of the circular argument. One of the premises assumes that the conclusion is true, like this:

The Bible is true because God wrote it.
The Bible says that God exists.
Therefore, God exists.

4. Complex question – this is a fallacy in which the wording of the question makes it so you can't agree or disagree without admitting something that you don't want. For example,

Do you still have a crush on that girl?

If you say "yes" you're admitting that you like that girl. But if you say "no", you're admitting that you used to have a crush on that girl, and that could be false.

5. Equivocation – this fallacy changes the definition of a key term to arrive at a conclusion. For example,

It's wrong to lie.
But when I sleep, I lie on a bed.
Therefore, I should not sleep.

That's an obvious example where we used the word "lie" in different ways. In the first premise, we talked about a lie in the sense of dishonesty. In the second premise the word "lie" means "lying down." Because we used two different senses of the same word, we made a logical error.

Here's a less obvious example.

Men and women are equally loved by God.
The sexes are equal, then, and therefore the men and women should both be able to do the same things in life!

This is an equivocation on the word “equal” where the same word “equal” is used in two different ways. In the first sentence, “equal” refers to equality in love and value before God. In the second sentence, “equal” refers to equality of physical abilities, emotional tendencies, and spiritual roles. Just because men and women are “equally” important to God, it doesn’t necessarily mean that men and women are “equal” in every way such as physically.

NEXT WEEK: ARGUMENTS FOR THE EXISTENCE OF GOD ~ COSMOLOGICAL

Consider this: why is there anything existing at all? Why isn’t there just nothing?

References for logic:

Come, Let Us Reason by Norman Geisler, Ronald Brooks.

Introduction to Symbolic Logic by Kalish & Montague.

A Rulebook for Arguments by Anthony Weston.