

HW #1

- Read syllabus, add Khan Academy coach code, and fill out survey
- Read Ch 1.

Note that you are responsible for knowing all definitions, theorems, and formulas in your text, even if not explicitly gone over in class.

Key words are highlighted in your textbook in red.

HW #2

- Ch 1 Review Problems pp. 36-38 - all problems from sets I, II, & III
Due Friday. Show all of your own work!

HW #3

- Ch 2 Review pp.71-74 #1-50 due Wednesday, 14 Nov

TEST #1 on Ch 1-2 - Wednesday, 14 Nov

2.4 – Indirect Proof

In an indirect proof, an assumption is made at the beginning that leads to a contradiction. The contradiction indicates that the assumption is false and the desired conclusion is true.

Direct versus Indirect proof of the theorem “If a, then d.”

Direct Proof:

If a, then b.

If b, then c.

If c, then d.

Therefore, if a, then d.

Indirect Proof:

Suppose not d is true.

If not d, then e.

If e, then f,

And so on until we come to a contradiction.

Therefore, not d is false; so d is true.

In a book written in the 13th century on the shape of the earth, the author reasoned: “If the earth were flat, the stars would rise at the same time for everyone, which they do not.”

11. What is the author trying to prove?

The earth is not flat.

12. With what assumption does the author begin?

The earth is flat

13. What is the contradiction?

the stars rise at the same time for everyone

14. What does the contradiction prove about the author's beginning assumption?

*It is not true that the earth is flat.
Therefore the earth is not flat.*

Write the missing statements in the indirect proof:

16. The ammonia molecule consists of three hydrogen atoms bonded to a nitrogen atom as shown in this figure.

The fact that chemists have found that each bond angle is 107° can be used to prove the following theorem.

Theorem: The atoms of an ammonia molecule are not coplanar.

Proof:

> *Suppose the atoms are coplanar.*

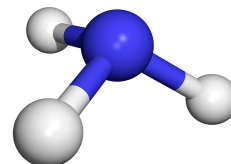
If the atoms are coplanar, then the sum of the three bond angles is 360° .

If the sum of the three bond angles is 360° , then each angle is 120° .

> *This contradicts the known bond angle of 107° .*

Therefore, our assumption is false and

> *the atoms are not coplanar.*



19. A particular puzzle involves separating a set of twelve weights into two sets so that one set will exactly balance the other on a scale with two pans.

Consider this argument:

If a puzzle of this type has a solution, then the weights of the two sets will be equal.

If the weights of the two sets are equal, then each set will weigh half the total weight.

What conclusion follows from these two premises?

If a puzzle of this type has a solution,
then each set will weigh half the total weight.

(syllogism)

20. Write in the missing statements in the indirect proof about this puzzle:

Theorem: If the sum of all of the weights is odd, then there is no solution.

Proof:

> Suppose there is a solution.

If there is a solution, let the weights in one set add up to S .

If the weights in each set add up to S , then the weights in both sets add up to $S+S=2S$, an even number.

> This contradicts that the sum of the weights is odd.

Therefore, our assumption is false and

> there is no solution.

21. At a sports banquet there are 100 famous athletes. Each one is either a football player or a basketball player. At least one is a football player. Given any two of the athletes, at least one is a basketball player. **How many of the athletes are football players, and how many are basketball players? Construct an indirect argument to explain your reasoning.**