

## THE ASSIGNMENT: MTH 151 CHAPTER ONE WRITTEN ASSIGNMENT PROBLEMS

Please answer problems on these assignment pages *unless otherwise indicated*. Problems one, two and three are all language and little math, and **must be typed** – please type your answers into this Word document, and upload it into the “Upload written assignments here!” section of the website. Please use the following convention to name your file (so I don’t have 50 assignments all called “Chapter One”!!): lastname\_151GR1.docx. [So, if I were turning in this assignment, I’d save it as ryan\_151GR1.docx.] Also, please don’t forget to put your name on the assignment itself!

Problems four and five are mathy, and may involve calculations, equations, or diagrams, depending on which problems you choose to solve. It’s up to you how to figure out how to get it to me. If you’re a Word master and can insert all your sketches, type all your math, and format the thing beautifully, then do that and send it all as one document. If you need to do some by-hand pencil and paper work, then you’ll need to scan those bits. If you can get it into your Word doc, great – if not, you can upload it as another attachment (or attachments). On campus, we have a scanner in the F building computer lab that you can use.

### Inductive and Deductive Reasoning

**Introduction:** Your textbook (and the lecture) gives a list of features that define inductive and deductive styles of reasoning; in particular we say that

#### **Deductive reasoning...**

- 1) moves from general to specific, applying general principles to specific cases or drawing a specific conclusion from a universal statement.
- 2) is a *valid* argument form; starting from true premises will result in a true conclusion. This does not imply all deductive arguments are true (arguing from false premises can yield a false conclusion as well).
- 3) includes formal logical structures and mathematical arguments that proceed in a series of logical steps.

#### **Inductive reasoning...**

- 1) moves from specific to general; on the basis of specific examples, it draws a general or universal conclusion.
- 2) is an *invalid* argument form; the truth of the premises does not guarantee the truth of the conclusion. An inductive argument may start from true premises and yield a false or ambiguous conclusion (it may also yield a true conclusion, if only by accident).
- 3) includes both generalizations from a series of examples, and also predictions based on a past pattern of examples.

In the questions that follow, you will be asked to *explain* how arguments fall into either the inductive or deductive type, and construct examples of your own.

**Problem one:** The first five terms of a sequence of numbers are given to be 1, 8, 27, 64, 125...

- a) Predict the next number in the sequence.
- b) What formula are you implicitly making use of to make that prediction (based on the pattern, what appears to be the formula being used to generate the sequence)?
- c) Are you making use of inductive or deductive reasoning when you answer the above?
- d) Support your choice of inductive or deductive by referring back to the list of characteristics at the beginning – in particular, discuss (two or three sentences) how each of the three things listed under the type of argument you identify this as being applies to this particular type of argument.

**Problem two:** Construct an example of an argument which uses inductive reasoning, and has an obviously false conclusion. Use the format

Premise A

Premise B

[Use many premises as you need. You might only have one.]

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Conclusion

Then, explain (two or three sentences) why your example works – address both why your example illustrates the characteristics of inductive reasoning, and also why the conclusion appears to you to be “obviously false.”

**Problem three:** Construct an example of an argument which uses deductive reasoning, and has an obviously true conclusion. Use the format

Premise A

Premise B

[Use many premises as you need. You might only have one.]

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Conclusion

Then, explain (two or three sentences) why your example works – address both why your example illustrates the characteristics of deductive reasoning, and also why the conclusion appears to you to be “obviously true.”

## Problem Solving and Polya’s Four Steps

**Introduction:** You might notice that this first written assignment involves a lot of writing (and not so much math)! The emphasis is on “explain” – don’t just answer the question, but explain why the answer you’re giving really does answer the question.

That’s the major theme of this chapter, and it culminates in section 1.3, which describes Polya’s four step process for problem solving. The idea here is not to just write down an answer, but to thoroughly analyze the thought process that went into getting that answer. In particular, ***you need to be able to explain your answer in such a way that somebody who was not familiar with the question or the answer would immediately understand what was going on.*** In other words, your audience isn’t ME (I already know what the problems are and how to solve them)...imagine you’re writing up your answer for somebody who has never seen the question before.

### Problems four and five:

Here is a listing of some textbook problems from section 1.3 (on pages 25 – 28)

#16, #26, #32, #40, #52, #62, #64

[Note to anyone considering this assignment: The textbook for this course is *Mathematical Ideas, 11e*, Miller, Heeren, and Hornsby. For copyright reasons, I won't reproduce the textbook problems here. However, if you're teaching a similar course in mathematical reasoning and problem solving for non-STEM majors, you've probably got a similar section in your own textbook. The problems are of the brain-teaser type – they don't require any complicated calculations, but require close reading and some thought to solve. Emphasis is on explaining the solution process, and fully answering the question being asked.]

Pick **ANY TWO** of the listed problems to work. Don't just give me the answer, but *explain your reasoning*; to receive credit you must do a writeup of each problem similar to what we were looking at in class, using Polya's problem solving strategy. **Your solution must show each of Polya's four steps explicitly.** No credit will be given for just an answer. Only partial credit will be given for something that's explained, but doesn't use Polya's four steps in the explanation. And note you've got a choice of problems to pick from – I don't want to see "this problem has no solution" as the solution! All problems have solutions, and if you can't figure out how to solve the one you picked initially, choose a different problem to solve.

**Depending on the nature of the problems you're solving, you may choose to (1) type your writeup here (inserting pictures as needed), (2) work by hand, scan, and insert the scans into the Word doc here, or (3) work by hand, scan, and upload as a separate attachment.**

*So there's no surprises here, this is how I'm going to grade problems four and five:*

Your score for each problem is...	If...
0 points	You omit the problem OR You write down a solution which is incorrect, with no explanation
1 point	You write down a solution which is correct, BUT provide no explanation of how you arrived at it
2 to 3 points	You give a correct solution to the problem, and provide some explanation as to how you arrived at it, BUT your explanation is not organized in the form of Polya's four steps
4 points	You give a correct solution to the problem, AND provide an explanation organized in the form of Polya's four steps, BUT your explanation is lacking in detail to the point where someone provided with the problem would not be able to tell from your solution how it related to the question or solved it.
5 points	You give a correct solution to the problem, AND provide an explanation organized in the form of Polya's four steps. Your explanation is reasonably detailed, and someone who was provided with a statement of the problem could follow your solution, and see how it addressed the question at hand.
6 points	You give a correct solution to the problem, AND provide an explanation organized in the form of Polya's four steps. Your explanation is extremely detailed (and might include figures, sketches, or some sort of supplementary visuals), and someone who had never even seen the problem would see immediately what the question was and how to solve it.

**Note that the above scale rates the *quality of your explanation*, and assumes you did correctly answer the question being asked. If your solution contains errors, or proceeds in the right direction but fails to completely address the question, points will be deducted from the above scale.**