

This document is a list of all the common mistakes made by you (the students) that were seen too many times in answer scripts of the last written exam for MA101, ie the Final Exam, December 2014 at MEC.

Some of these remarks were already there in the previous document we made about mistakes in the two first Mid Term Exams. We expect all of you to take note of these recurring mistakes and weaknesses, and work on them to fix those definitively.

The first and more serious issue we could point out is the following: **in any case, even in an exam when the time is limited, never start to solve a question without reading it carefully, entirely, at least twice.**

1 Common mistakes done in problem 1

- TODO.
- Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
- Remarks (and grading) for this problem was done by Prof. Arya.

2 Common mistakes done in problem 2.

- TODO.
- Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
- Remarks (and grading) for this problem was done by Prof. Vijay.

3 Common mistakes done in problem 3 part A.

- TODO.
- Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
- Remarks (and grading) for this problem was done by Prof. Satya.

4 Common mistakes done in problem 3 part B.

- TODO.

- Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
- Remarks (and grading) for this problem was done by Prof. Jai.

5 Common mistakes done in problem 4 part A.

The goal of that part A was to define the sequence $(S_n(p))_{n \in \mathbb{N}}$, prove that its series (sum of the sequence $S(p)$) is convergent if and only if $p \geq 2$, and then define the function $z(p) = \sum_{k=1}^{+\infty} S_k(p)$ for $p \geq 2$. The part B focuses on computing one value of that function, for $p = 2$, $z(2) = \sum_{k=1}^{+\infty} \frac{1}{k^2}$.

- TODO.
- Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.
- Remarks (and grading) for this problem was done by Prof. Vijay.

6 Common mistakes done in problem 4 part B.

The goal of that part B focuses on computing one value of that function, for $p = 2$, $z(2) = \sum_{k=1}^{+\infty} \frac{1}{k^2}$. It was a long and quite delicate problem, with many intermediate steps.

-
- Q4.B.2) makes the link between $\frac{1}{k^2}$ and an integral $(\int_0^\pi h(t) \cos(kt) dt)$.
- Q4.B.3) links the partial sum of that integral $(\sum_{k=1}^n \int_0^\pi h(t) \cos(kt) dt)$ with two integrals, one moving with n $(\int_0^\pi \phi_0(t) \sin((n+1/2)t) dt)$, one constant $(-\lambda \int_0^\pi h(t) dt)$. $\lambda = 1/2$ was not so hard to find (Q4.B.3.c).
- Q4.B.1) and Q4.B.4) proved that this integral (for ϕ_0 , varying with n) will tend to 0 when $n \rightarrow +\infty$.
- Q4.B.5) asked to use all this, and conclude that $z(2) = -\lambda \int_0^\pi h(t) dt = \dots = \frac{\pi^2}{6}$.
- Q4.B.6) was given (2 marks).
- Q4.B.7) was a guess, but it was more natural to say irrational, as π is irrational.

- The marking schema was really generous, the maximum possible grade could have been 29/20.
- Many “free” points were given on easy things, e.g. writing EULER’s identity for cos and sin in Q4.B.3.a) and Q4.B.3.b) was one point each.
- A lot of points were given for the hardest questions. Only one of you managed to conclude the Q4.B.5, and he has been nicely rewarded.
- TODO
- Many of you spend too much time on integration by parts. It is quick to do, e.g. for Q4.B.2 we gave you which functions to use, it should have been two lines for the first one, two lines for the other one.
- For Q4.B.2, almost all of you proved two results, that $\int_0^\pi h(t) \cos(kt) dt = \frac{1}{k^2}$ and $-\frac{1}{k} \int_0^\pi (\frac{t}{\pi} - 1) \sin(kt) dt = \frac{1}{k^2}$ (this requires three integration by parts). What was asked is simpler, only two integration by parts: first you prove that $\int_0^\pi h(t) \cos(kt) dt = -\frac{1}{k} \int_0^\pi (\frac{t}{\pi} - 1) \sin(kt) dt$ with $f(t) = h(t)$ and $g'(t) = \cos(kt)$; and then to prove that $-\frac{1}{k} \int_0^\pi (\frac{t}{\pi} - 1) \sin(kt) dt = \frac{1}{k^2}$ with $f(t) = h'(t)$ and $g'(t) = \sin(kt)$.
- For Q4.B.3, between Q4.B.3.a and Q4.B.3.c, the sum index changes from $k = 0$ to $k = 1$. A lot of you misread. . .
- For Q4.B.3.a, it is required to write that the ratios $e^{it} \neq 0$ and $e^{-it} \neq 0$ before using the formula for the sum of a geometrical progression.
- Remarks (and grading) for this problem was done by Prof. Lilian.

7 Common mistakes in the whole exam.

- In English, a new sentence starts with a capital letter (even in a Mathematics exam!).
- Avoid all abbreviations in an exam (especially the symbol &).
- Try to keep your answer script *clean* and *readable*.
- Try to *highlight* or *underline* every result.
- Always specify which question you are solving (5.a), 1.b) etc).
- Try to “talk more”, by explaining just a little bit more what you are doing and how you proceed. An answer to an entire question cannot be just maths equations, and the symbols \therefore or \therefore are not enough. However, this does not mean that one has to give long and unnecessary explanation. Just suffices to make all equations etc as part of sentences.
- Whenever new variables (not used in the question) are used, please introduce them carefully (by using statements like where $x \in \mathbb{R}$ or let x be such that...).
- Do not be confused about the difference between proving: an equality (“stuff = ... = one other thing”), an implication (“If we have P then ... then we have the result”, or $P \implies \dots \implies$ result), and an equivalence (“ P is true if and only if ... iff Q ”, or $P \Leftrightarrow \dots \Leftrightarrow Q$).

- English again: in written English, one do not use abbreviation, e.g. “we can’t” will be written “we cannot”.
- When we use binary operators ($=, \in, \subset, <, >, \leq, \geq$ etc), we try to never mix them with text: we do not write “So the minimum is > 0 ”, but “So the minimum is greater than 0” or “So $\min(E) > 0$ ”.
- Usually, it is useless and time-consuming to *write again what was the question before you start answering it*. If you start (5.a), do not loose time by writing “We have to show that $(f(x))^2 + (g(x))^2 = 1, \forall x \in \mathbb{R}$ ”. Just start. We know what is the question, and you also know because you have the question paper just in front in you.
- English again: try to not forget to add a “n” at the end of the pronoun “a” before another word starting with a vowel. We write “Let a be an element of E ”, “an upper bound”, “an even function” etc.