

SHORT RULES FOR RUSSIANS TEACHING CALCULUS AND LOWER-LEVEL CLASSES IN USA

VLADIMIR SOLOMONOV

From the Editor: This paper was intended to be a joke; but some advice, if taken with a pinch of salt, could be very useful to all teachers (and not only to Russian ones) in university level mathematics education in any country of the world. The paper has been widely and virally circulated on the Internet; publication here is authorised by the Author writing under *nom de plume* Vladimir Solomonov.

1. *Generalities*

- (1) For most of your students studying Mathematics is “cruel and unusual punishment.” Show your students that you are on their side.
- (2) Make your students comfortable in your class. It is suicidal to say:

“What? You do not know it?”

or

“In Moscow every seventh grader must know it.”

It is also suicidal to criticize American education.

Always say:

“It is simple, let me remind you. . .”

- (3) Encourage students’ questions. Use the rule:

“Be brave, ask questions.”

Start your every class with

“Any questions?”

and then continue with

“Let me remind you that last time we discussed . . .”

- (4) Say a joke every twenty-twenty five minutes. The joke must be short and simple. Like

“This is an easy theorem. In my opinion, parallel parking (or baseball rules) is much harder.”

- (5) Smile and be friendly. It is dangerous show your students that you are wasting your precious time teaching those ignorant fools. Repeat to your students, superiors, colleagues, and yourself that you like to teach.

However, it will not hurt to tell your students before a break:

“Have a good time in Florida. And I hope to finish my research paper before the classes start.”

- (6) Give partial credit whenever is possible. Give extra points for a good question or comment, or even for attendance in bad weather.

- (7) Often repeat:

“See, *we* are making good progress.”

- (8) After writing a couple of sentences on a blackboard always look at your class.

- (9) Avoid long discussions. A standard answer to the question:

“Why do we need all this stuff?”

is

“To avoid outsourcing”

or

“It is a requirement.”

- (10) Never go overtime. It is the second crime after sexual harassment.

2. *Classes, Blackboard, etc*

- (1) Prepare your lectures on horizontal sheets to imitate a blackboard (I learned it from Yuri Manin).
- (2) At the beginning write a short plan of your lesson in the upper-left corner of your blackboard. From time to time point out where you are on the plan.
- (3)
 - Write almost everything on a blackboard (you may skip articles and use abbreviations).
 - Use arrows to explain logical connections.
 - Remember: your blackboard writing is faster than your students' writing (you are using your elbows and students are using their wrists only — I learned it from Israel Gelfand). Use this extra time to look at your class.
 - Keep a pattern on your blackboard. Display similar sentences in a symmetric way.
 - Keep only necessary information on the blackboard. Erase in order: what came first must be erased first (if you do not need it). But first ask you students if you may erase it.
- (4) Speak in short sequences and avoid long statements. Box main formulas. Teach everything in a TV format:

HERE IS THE MAIN FORMULA
(some restrictions apply)

You may skip the restrictions afterwards.

- (5) If you are teaching an early class, spend twenty minutes to warm up your students before presenting the main material. If you are teaching a late class, spend five minutes to wake up the students and then present the main material (it is likely that students will fall asleep after the first fifteen minutes).

3. *Mathematics*

- (1) Never miss a step: you cannot write

$$\frac{2}{4} + \frac{1}{2} = 1,$$

write

$$\frac{2}{4} + \frac{1}{2} = \frac{1}{2} + \frac{1}{2} = 1.$$

- (2) You cannot say:

“By using the formula for $(a - b)^2 \dots$ ”

Say:

“Since $(a - b)^2 = a^2 - 2ab + b^2$ we have \dots ”

- (3) Demonstrate students’ mistakes by using simple examples like this:

“Remember,

$$\sqrt{a + b} \neq \sqrt{a} + \sqrt{b}.$$

Check with $a = 4$ and $b = 36$.

Or,

$(uv)' \neq u'v'$. Check with $u = x^2, v = x^3$.”

- (4) Forget the word “proof.” Use

“Let me demonstrate (convince you),”

etc. Use a lot of simple examples.

- (5) Do not say: “This formula is very important.” Say:

”This formula is very important in electrical engineering”

or,

“Pay attention: Google technology is based on the theory of eigenvectors”

or, better,

“This formula will be very useful for your final.”

- (6) Speak both formally and informally. Something like:
- (a) “This map is bijective. In other words, it is one-to-one and onto.”
 - (b) “ X has one million dollars and his income is growing by a logarithmic curve. Y has only a hundred dollars but his income grows exponentially. Whom would you prefer to marry?”
 - (c) “Areas are invariant under rotations and parallel shifts. This is the map of Oregon (draw it). You may turn this map upside-down, or move it but the area remains the same.”
 - (d) “Human bones containing such and such percentage of C^{14} were found in your backyard. Prove that you did not kill the guy”.

- (7) Try to relate your math with the students’ world. Refer to famous TV characters (Superman, Spiderman, etc).

Like:

“The idea behind parametric equations is very simple. Suppose, Spiderman is moving along a wall and at every moment he is sending to you his horizontal and vertical coordinates. . . .”

Or:

“To save the Earth, Superman must battle a cosmic fleet from planet SASNAK. Each enemy cosmic ship has a tag containing three distinct letters from the name of the planet. Help Superman: estimate the number of enemy ships.”

Explain that so-called *Squeeze Theorem* is known in Russia as the “*Theorem about Two Policemen*.”

- (8) Use students’ common sense in explaining their mistakes.

For example, while solving the problem:

“You put 1000 dollars in your bank. The rate is 2.5. How much you will get after one year?”

your students may come up with an answer of $1000^{2.5}$. Before explaining the mistake say:

“Thank you. I had no idea that it is so easy to become rich in this country.”

- (9) Forget “ ϵ - δ ” definitions and proofs. (If you are teaching honors students, you can give them a very, very light dose of proofs.)
- (10) Tell dramatic stories in class about Galois, Abel, Ramanujan, etc.

4. *Textbook, etc.*

- (1) Do not criticize the textbook. Better say:

“There is a one-page explanation of this fact in your textbook. I will explain this in two lines.”

- (2) Always refer to the textbook. Say:

“Your book has a good example”,

or

“Your book is using such and such notations. We will use other notations in class.”

- (3) If you want to add something that is not in the textbook, write

“Comment: Each trig function such as $\sin x$ and $\cos x$ can be expressed by simple formulas containing $\tan x/2$. This process is called uniformization.”

Make all such comments very short and say that it will not be on their test. If you want to make more additions (not too long, please), start with a sentence:

“Students of a great school like ours are entitled to a stereoscopic view”.

5. *Calculators*

Calculators for your students are like Teddy-bears for their younger siblings. If you want to ban calculators you need a strong support from your bosses and your department. I prefer to show that calculators do not always work (compare $\sqrt{1.00000000001}$ and $\sqrt{1.000000000001}$) and introduce the following three-step rule.

“If you are going to use your calculators, you have to

- (1) Think.
- (2) Push buttons.
- (3) Think again. If it is too hard you are allowed to skip the second step.”

6. *Students and their evaluations*

- (1) USA is a country of poison ivy, poison oak, and student evaluations. You cannot change it but you may protect yourself. Here are some recipes.
- (2) Follow necessary formalities and traditions. Answer students’ e-mails ASAP. Keep all of your records (homework, points, etc.) in order. Start and finish your office hours on time. If you have students waiting it will not hurt to extend your office hours. If you want to cut something short, say:

“Sorry, I have a meeting with my Chair.”

If your colleagues give students sheets of formulas with their exam, do it also. (But you may cut the list in half).

- (3) Try to call your students by their first names. It is useful to schedule a five-minute interview with each of your students (you will learn a lot of things about USA).
- (4) If you have a student with erratic behavior, talk to your colleagues. Quite often they may have the same problems with the student. Then his or her complaints are unlikely carry a lot of weight.
- (5) If you do not understand a question, say

“Repeat it louder”

or

“Slow down and repeat it louder”

instead of just “Repeat, please”. If you still do not understand the question, say

“We do not have time right now. Could you e-mail the question, I will answer next time.”

- (6) How to say “No.”
 - (a) I understand but it would be unfair to other students.
 - (b) I understand but university regulations do not allow it.
 - (c) I have to talk to my bosses (you may talk to your supervisor, or to your spouse, or to your cat and then say NO).
- (7) If you are concerned about your students evaluations, do something pleasant for them in the end of your class. (Schedule an extra review session, for example).
- (8) Read your students evaluations and their comments whenever is possible including

www.RateMyProfessors.com

Some of their remarks might be very reasonable. Even a nasty and obnoxious comment may contain useful information.

7. *About the Author*

Vladimir Solomonov is *nom de plume* of a mathematician.

Address: Raritan University, New Birmingham, New Cornwall 13666, USA