

Tips on Writing Exams

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- List the topics to be covered.
- You need to distinguish several groups of students:
 - **Top students** – learned material well, can apply to a new problem; can use skills in class, learned breadth of material.
 - **Middle students** – generally learned material, can apply to problems of a type they have seen before, may have missed a topic or pieces of several topics, generally can apply skills but may miss an occasional trick.
 - **Weaker but acceptable students** – has worked on material but either not enough or just isn't quite up to understanding harder topics, can do easier problems well, has memorized answers to some old test questions or review problems, has some sense of what is being looked for and what goes into a solution but can't quite get through harder problems in multiple areas, can do some of medium problems.
 - **Unacceptable student performance** – didn't learn much of the material, either didn't spend time on course and so missed many topics or spent time but didn't really understand the material, generally just guesses with some jargon flopping around in answers, can't explain, can't do even simple problems that require course content rather than logic or preexisting knowledge.
- If you make an exam too easier you can't tell the top students from the middle students. You will be testing accuracy and recall of details rather than critical thinking skills and deep understanding of the content.
- If you only give hard problems you will be able to identify the top students but won't be able to do a good job separating middle, weak and unsuccessful students. A large curve lifts all of the bottom including the students who don't really know any of the material. It takes including enough straight forward problems to separate those who studied and learned but not real well from those who really know almost nothing about the material.
- Your exam should include about a half straight forward problems that require course content (not just logic or prior knowledge), about 1/4 problems that are similar to problems they have seen before but require understanding and content knowledge to work well and about 1/4 problems that test deeper understanding. This can be whole problems if there are quite a few problems. If there only only 4-6 problems it is probably better to use parts so that the types of problems are spread across the range of material. Start each problem with some easy parts so that students can collect some points if they know something about the content, then add a harder middle part that requires haven't worked with the material in homework, and finally a hard part to distinguish the really strong students. You don't need a hard part on every problem or the test may get too long. Don't put the hardest problem too early in the test. Generally save the hardest or the most time consuming (or potentially most time consuming with common errors) problems for late in the test. Grades will be very skewed if students get sidetracked on problem 1 and don't get to later easier problems with a clear head.
- Come up with problem ideas and break into parts if appropriate. Write questions. Work the problem carefully to make sure it is doable and has all the necessary information. Look over the solution carefully and see if you made any assumptions that the students wouldn't be expected to know. Is the answer reasonable by the checks you have been teaching? Then look at the directions. Are they unambiguous?

- To make grading easier: Is it clear what you are asking? Is there enough space to write answers or will students be cramming things in funny places? For large classes, sometimes it helps to include a specific space for the answer or a part of the answer. Then you can quickly see if that is correct and either spot check work or look for certain types of mistakes based on specific wrong answers. There will always be some you have to spend longer figuring out, but it helps if you can get through $\frac{3}{4}$ of the papers efficiently without missing what the student was doing.
- Now, sit down and time yourself take the whole exam straight through. Note the start time and the stop time for each problem as you go. When you are done look at your overall time. Your students should have 3x (Cornell, more if weaker students) your time in which to take the exam. If the exam is too long (almost always the case when you apply the multiplier) you will need to shorten it. If it is way over you will have to cut 1 or more problems (look for ones that test similar skills or ideas). If you are still somewhat too long look at the following places to shorten the exam without hurting content:
 1. Wordiness in problem descriptions. Lack of clarity in directions that require doing extra work or time spent thinking about the directions.
 2. Can you simplify the numbers so that less time is spent copying multi-digit numbers? 3. Can you ask for the set up of the problem or an earlier step that takes less algebraic manipulation?
 3. Is there a part of the calculation that takes time but is redundant with another part or doesn't add much value? If so, try giving that piece as a known value. You will probably want to familiarize your students with this possibility so they don't spend more time trying to create what you have given them.
 4. You may have to change a problem for an easier one if it still too long or drop some parts of a problem
- If the exam is too short there is the problem that there are too many points on each problem. If a student was sick one day or missed one idea are they going to be penalized by a full letter grade or more? Are there any problems that are purely "tricky" and on something only covered very briefly?
- Make sure the problems aren't all tricky. You want to separate students who know the basic material from students who don't have a clue.